LVGL Documentation 9.0

LVGL community

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PDF version: `LVGL.pdf`

CHAPTER

ONE

INTRODUCTION

LVGL (Light and Versatile Graphics Library) is a free and open-source graphics library providing everything you need to create an embedded GUI with easy-to-use graphical elements, beautiful visual effects and a low memory footprint.

1.1 Key features

- Powerful building blocks such as buttons, charts, lists, sliders, images, etc.
- Advanced graphics with animations, anti-aliasing, opacity, smooth scrolling
- Various input devices such as touchpad, mouse, keyboard, encoder, etc.
- Multi-language support with UTF-8 encoding
- Multi-display support, i.e. use multiple TFT, monochrome displays simultaneously
- Fully customizable graphic elements with CSS-like styles
- Hardware independent: use with any microcontroller or display
- Scalable: able to operate with little memory (64 kB Flash, 16 kB RAM)
- OS, external memory and GPU are supported but not required
- Single frame buffer operation even with advanced graphic effects
- Written in C for maximal compatibility (C++ compatible)
- Simulator to start embedded GUI design on a PC without embedded hardware
- Binding to MicroPython
- Tutorials, examples, themes for rapid GUI design
- Documentation is available online and as PDF
- Free and open-source under MIT license

1.2 Requirements

Basically, every modern controller which is able to drive a display is suitable to run LVGL. The minimal requirements are:

1.3 License

The LVGL project (including all repositories) is licensed under MIT license. This means you can use it even in commercial projects.

It's not mandatory, but we highly appreciate it if you write a few words about your project in the My projects category of the forum or a private message to lvgl.io.

Although you can get LVGL for free there is a massive amount of work behind it. It's created by a group of volunteers who made it available for you in their free time.

To make the LVGL project sustainable, please consider *contributing* to the project. You can choose from *many different ways of contributing* such as simply writing a tweet about you using LVGL, fixing bugs, translating the documentation, or even becoming a maintainer.

1.4 Repository layout

All repositories of the LVGL project are hosted on GitHub: https://github.com/lvgl

You will find these repositories there:

- lvgl The library itself with many examples and demos.
- lv_drivers Display and input device drivers
- blog Source of the blog's site (https://blog.lvgl.io)
- sim Source of the online simulator's site (https://sim.lvgl.io)
- lv_port_... LVGL ports to development boards or environments
- lv_binding_.. Bindings to other languages

1.5 Release policy

The core repositories follow the rules of Semantic versioning:

- Major versions for incompatible API changes. E.g. v5.0.0, v6.0.0
- Minor version for new but backward-compatible functionalities. E.g. v6.1.0, v6.2.0
- Patch version for backward-compatible bug fixes. E.g. v6.1.1, v6.1.2

Tags like `vX.Y.Z` are created for every release.

1.5.1 Release cycle

- Bug fixes: Released on demand even weekly
- Minor releases: Every 3-4 months
- Major releases: Approximately yearly

1.5.2 Branches

The core repositories have at least the following branches:

- `master` latest version, patches are merged directly here.
- `release/vX.Y` stable versions of the minor releases
- `fix/some-description` temporary branches for bug fixes
- `feat/some-description` temporary branches for features

1.5.3 Changelog

The changes are recorded in *CHANGELOG.md*.

1.5.4 Version support

Before v8 the last minor release of each major series was supported for 1 year. Starting from v8, every minor release is supported for 1 year.

1.6 FAQ

1.6.1 Where can I ask questions?

You can ask questions in the forum: https://forum.lvgl.io/.

We use GitHub issues for development related discussion. You should use them only if your question or issue is tightly related to the development of the library.

Before posting a question, please ready this FAQ section as you might find answer to your issue here too.

1.6.2 Is my MCU/hardware supported?

Every MCU which is capable of driving a display via parallel port, SPI, RGB interface or anything else and fulfills the *Requirements* is supported by LVGL.

This includes:

- "Common" MCUs like STM32F, STM32H, NXP Kinetis, LPC, iMX, dsPIC33, PIC32, SWM341 etc.
- Bluetooth, GSM, Wi-Fi modules like Nordic NRF, Espressif ESP32 and Raspberry Pi Pico W
- Linux with frame buffer device such as /dev/fb0. This includes Single-board computers like the Raspberry Pi
- Anything else with a strong enough MCU and a peripheral to drive a display

1.6.3 Is my display supported?

LVGL needs just one simple driver function to copy an array of pixels into a given area of the display. If you can do this with your display then you can use it with LVGL.

Some examples of the supported display types:

- TFTs with 16 or 24 bit color depth
- Monitors with an HDMI port
- Small monochrome displays
- Gray-scale displays
- even LED matrices
- or any other display where you can control the color/state of the pixels

See the *Porting* section to learn more.

1.6.4 LVGL doesn't start, randomly crashes or nothing is drawn on the display. What can be the problem?

- Try increasing `LV_MEM_SIZE`.
- Be sure `lv_disp_t`, `lv_indev_t` and `lv_fs_drv_t` are global or `static`.
- Be sure your display works without LVGL. E.g. paint it to red on start up.
- Enable *Logging*
- Enable asserts in `lv_conf.h` (`LV_USE_ASSERT_...`)
- If you use an RTOS
  - increase the stack size of the task which calls `lv_timer_handler()`
  - Be sure you used a mutex as *described here*

1.6.5 My display driver is not called. What have I missed?

Be sure you are calling `lv_tick_inc(x)` in an interrupt and `lv_timer_handler()` in your main `while(1)`.

Learn more in the *Tick* and *Timer handler* sections.

1.6.6 Why is the display driver called only once? Only the upper part of the display is refreshed.

Be sure you are calling `lv_disp_flush_ready(drv)` at the end of your "*display flush callback*".

1.6.7 Why do I see only garbage on the screen?

Probably there a bug in your display driver. Try the following code without using LVGL. You should see a square with red-blue gradient.

```
#define BUF_W 20
#define BUF_H 10

lv_color_t buf[BUF_W * BUF_H];
lv_color_t * buf_p = buf;
uint16_t x, y;
for(y = 0; y < BUF_H; y++) {
    lv_color_t c = lv_color_mix(LV_COLOR_BLUE, LV_COLOR_RED, (y * 255) / BUF_H);
    for(x = 0; x < BUF_W; x++){
        (*buf_p) =  c;
        buf_p++;
    }
}

lv_area_t a;
a.x1 = 10;
a.y1 = 40;
a.x2 = a.x1 + BUF_W - 1;
a.y2 = a.y1 + BUF_H - 1;
my_flush_cb(NULL, &a, buf);
```

1.6.8 Why do I see nonsense colors on the screen?

Probably LVGL's color format is not compatible with your display's color format. Check `LV_COLOR_DEPTH` in *lv_conf.h*.

1.6.9 How to speed up my UI?

- Turn on compiler optimization and enable cache if your MCU has it
- Increase the size of the display buffer
- Use two display buffers and flush the buffer with DMA (or similar peripheral) in the background
- Increase the clock speed of the SPI or parallel port if you use them to drive the display
- If your display has an SPI port consider changing to a model with a parallel interface because it has much higher throughput
- Keep the display buffer in internal RAM (not in external SRAM) because LVGL uses it a lot and it should have a fast access time

1.6.10 How to reduce flash/ROM usage?

You can disable all the unused features (such as animations, file system, GPU etc.) and object types in *lv_conf.h*.

If you are using GCC/CLANG you can add `-fdata-sections -ffunction-sections` compiler flags and `--gc-sections` linker flag to remove unused functions and variables from the final binary. If possible, add the `-flto` compiler flag to enable link-time-optimisation together with `-Os` for GCC or `-Oz` for CLANG.

1.6.11 How to reduce the RAM usage

- Lower the size of the *Display buffer*
- Reduce `LV_MEM_SIZE` in *lv_conf.h*. This memory is used when you create objects like buttons, labels, etc.
- To work with lower `LV_MEM_SIZE` you can create objects only when required and delete them when they are not needed anymore

1.6.12 How to work with an operating system?

To work with an operating system where tasks can interrupt each other (preemptively) you should protect LVGL related function calls with a mutex. See the *Operating system and interrupts* section to learn more.

CHAPTER

TWO

EXAMPLES

2.1 Get started

2.1.1 A very simple "hello world" label

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LABEL

/**
 * Basic example to create a "Hello world" label
 */
void lv_example_get_started_1(void)
{
    /*Change the active screen's background color*/
    lv_obj_set_style_bg_color(lv_scr_act(), lv_color_hex(0x003a57), LV_PART_MAIN);

    /*Create a white label, set its text and align it to the center*/
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Hello world");
    lv_obj_set_style_text_color(lv_scr_act(), lv_color_hex(0xffffff), LV_PART_MAIN);
    lv_obj_align(label, LV_ALIGN_CENTER, 0, 0);
}

#endif
```

```
# Change the active screen's background color
scr = lv.scr_act()
scr.set_style_bg_color(lv.color_hex(0x003a57), lv.PART.MAIN)

# Create a white label, set its text and align it to the center
label = lv.label(lv.scr_act())
label.set_text("Hello world")
label.set_style_text_color(lv.color_hex(0xffffff), lv.PART.MAIN)
label.align(lv.ALIGN.CENTER, 0, 0)
```

2.1.2 A button with a label and react on click event

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_BTN

static void btn_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * btn = lv_event_get_target(e);
    if(code == LV_EVENT_CLICKED) {
        static uint8_t cnt = 0;
        cnt++;

        /*Get the first child of the button which is the label and change its text*/
        lv_obj_t * label = lv_obj_get_child(btn, 0);
        lv_label_set_text_fmt(label, "Button: %d", cnt);
    }
}

/**
 * Create a button with a label and react on click event.
 */
void lv_example_get_started_2(void)
{
    lv_obj_t * btn = lv_btn_create(lv_scr_act());     /*Add a button the current␣
↪screen*/
    lv_obj_set_pos(btn, 10, 10);                            /*Set its position*/
    lv_obj_set_size(btn, 120, 50);                          /*Set its size*/
    lv_obj_add_event(btn, btn_event_cb, LV_EVENT_ALL, NULL);           /*Assign a␣
↪callback to the button*/

    lv_obj_t * label = lv_label_create(btn);          /*Add a label to the button*/
    lv_label_set_text(label, "Button");                     /*Set the labels text*/
    lv_obj_center(label);
}

#endif
```

```
class CounterBtn():
    def __init__(self):
        self.cnt = 0
        #
        # Create a button with a label and react on click event.
        #

        btn = lv.btn(lv.scr_act())                               # Add a button the␣
↪current screen
        btn.set_pos(10, 10)                                      # Set its position
        btn.set_size(120, 50)                                    # Set its size
        btn.align(lv.ALIGN.CENTER,0,0)
        btn.add_event(self.btn_event_cb, lv.EVENT.ALL, None)  # Assign a callback to␣
↪the button
        label = lv.label(btn)                                    # Add a label to the␣
↪button
        label.set_text("Button")                                 # Set the labels text
        label.center()
```

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```
    def btn_event_cb(self,e):
        code = e.get_code()
        btn = e.get_target_obj()
        if code == lv.EVENT.CLICKED:
            self.cnt += 1

        # Get the first child of the button which is the label and change its text
        label = btn.get_child(0)
        label.set_text("Button: " + str(self.cnt))


counterBtn = CounterBtn()
```

2.1.3 Create styles from scratch for buttons

```
#include "../lv_examples.h"
#if LV_USE_BTN && LV_BUILD_EXAMPLES

static lv_style_t style_btn;
static lv_style_t style_btn_pressed;
static lv_style_t style_btn_red;

static lv_color_t darken(const lv_color_filter_dsc_t * dsc, lv_color_t color, lv_opa_
↪t opa)
{
    LV_UNUSED(dsc);
    return lv_color_darken(color, opa);
}

static void style_init(void)
{
    /*Create a simple button style*/
    lv_style_init(&style_btn);
    lv_style_set_radius(&style_btn, 10);
    lv_style_set_bg_opa(&style_btn, LV_OPA_COVER);
    lv_style_set_bg_color(&style_btn, lv_palette_lighten(LV_PALETTE_GREY, 3));
    lv_style_set_bg_grad_color(&style_btn, lv_palette_main(LV_PALETTE_GREY));
    lv_style_set_bg_grad_dir(&style_btn, LV_GRAD_DIR_VER);

    lv_style_set_border_color(&style_btn, lv_color_black());
    lv_style_set_border_opa(&style_btn, LV_OPA_20);
    lv_style_set_border_width(&style_btn, 2);

    lv_style_set_text_color(&style_btn, lv_color_black());

    /*Create a style for the pressed state.
     *Use a color filter to simply modify all colors in this state*/
    static lv_color_filter_dsc_t color_filter;
    lv_color_filter_dsc_init(&color_filter, darken);
    lv_style_init(&style_btn_pressed);
    lv_style_set_color_filter_dsc(&style_btn_pressed, &color_filter);
    lv_style_set_color_filter_opa(&style_btn_pressed, LV_OPA_20);
```

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```
    /*Create a red style. Change only some colors.*/
    lv_style_init(&style_btn_red);
    lv_style_set_bg_color(&style_btn_red, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_bg_grad_color(&style_btn_red, lv_palette_lighten(LV_PALETTE_RED, 3));
}

/**
 * Create styles from scratch for buttons.
 */
void lv_example_get_started_3(void)
{
    /*Initialize the style*/
    style_init();

    /*Create a button and use the new styles*/
    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    /* Remove the styles coming from the theme
     * Note that size and position are also stored as style properties
     * so lv_obj_remove_style_all will remove the set size and position too */
    lv_obj_remove_style_all(btn);
    lv_obj_set_pos(btn, 10, 10);
    lv_obj_set_size(btn, 120, 50);
    lv_obj_add_style(btn, &style_btn, 0);
    lv_obj_add_style(btn, &style_btn_pressed, LV_STATE_PRESSED);

    /*Add a label to the button*/
    lv_obj_t * label = lv_label_create(btn);
    lv_label_set_text(label, "Button");
    lv_obj_center(label);

    /*Create another button and use the red style too*/
    lv_obj_t * btn2 = lv_btn_create(lv_scr_act());
    lv_obj_remove_style_all(btn2);                      /*Remove the styles coming␣
↪from the theme*/
    lv_obj_set_pos(btn2, 10, 80);
    lv_obj_set_size(btn2, 120, 50);
    lv_obj_add_style(btn2, &style_btn, 0);
    lv_obj_add_style(btn2, &style_btn_red, 0);
    lv_obj_add_style(btn2, &style_btn_pressed, LV_STATE_PRESSED);
    lv_obj_set_style_radius(btn2, LV_RADIUS_CIRCLE, 0); /*Add a local style too*/

    label = lv_label_create(btn2);
    lv_label_set_text(label, "Button 2");
    lv_obj_center(label);
}

#endif
```

```
#
# Create styles from scratch for buttons.
#
style_btn =  lv.style_t()
style_btn_red = lv.style_t()
style_btn_pressed = lv.style_t()
```

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```
# Create a simple button style
style_btn.init()
style_btn.set_radius(10)
style_btn.set_bg_opa(lv.OPA.COVER)
style_btn.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 3))
style_btn.set_bg_grad_color(lv.palette_main(lv.PALETTE.GREY))
style_btn.set_bg_grad_dir(lv.GRAD_DIR.VER)

# Add a border
style_btn.set_border_color(lv.color_white())
style_btn.set_border_opa(lv.OPA._70)
style_btn.set_border_width(2)

# Set the text style
style_btn.set_text_color(lv.color_white())

# Create a red style. Change only some colors.
style_btn_red.init()
style_btn_red.set_bg_color(lv.palette_main(lv.PALETTE.RED))
style_btn_red.set_bg_grad_color(lv.palette_lighten(lv.PALETTE.RED, 2))

# Create a style for the pressed state.
style_btn_pressed.init()
style_btn_pressed.set_bg_color(lv.palette_main(lv.PALETTE.BLUE))
style_btn_pressed.set_bg_grad_color(lv.palette_darken(lv.PALETTE.RED, 3))

# Create a button and use the new styles
btn = lv.btn(lv.scr_act())                  # Add a button the current screen
# Remove the styles coming from the theme
# Note that size and position are also stored as style properties
# so lv_obj_remove_style_all will remove the set size and position too
btn.remove_style_all()                      # Remove the styles coming from the theme
btn.set_pos(10, 10)                         # Set its position
btn.set_size(120, 50)                       # Set its size
btn.add_style(style_btn, 0)
btn.add_style(style_btn_pressed, lv.STATE.PRESSED)

label = lv.label(btn)                       # Add a label to the button
label.set_text("Button")                    # Set the labels text
label.center()

# Create a slider in the center of the display
slider = lv.slider(lv.scr_act())
slider.set_width(200)                                           # Set the width
slider.center()                                                 # Align to the␣
↪center of the parent (screen)

# Create another button and use the red style too
btn2 = lv.btn(lv.scr_act())
btn2.remove_style_all()                     # Remove the styles coming from the theme
btn2.set_pos(10, 80)                        # Set its position
btn2.set_size(120, 50)                      # Set its size
btn2.add_style(style_btn, 0)
btn2.add_style(style_btn_red, 0)
btn2.add_style(style_btn_pressed, lv.STATE.PRESSED)
btn2.set_style_radius(lv.RADIUS_CIRCLE, 0)  # Add a local style
```

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```
label = lv.label(btn2)                          # Add a label to the button
label.set_text("Button 2")                      # Set the labels text
label.center()
```

2.1.4 Create a slider and write its value on a label

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SLIDER

static lv_obj_t * label;

static void slider_event_cb(lv_event_t * e)
{
    lv_obj_t * slider = lv_event_get_target(e);

    /*Refresh the text*/
    lv_label_set_text_fmt(label, "%"LV_PRId32, lv_slider_get_value(slider));
    lv_obj_align_to(label, slider, LV_ALIGN_OUT_TOP_MID, 0, -15);    /*Align top of␣
↪the slider*/
}

/**
 * Create a slider and write its value on a label.
 */
void lv_example_get_started_4(void)
{
    /*Create a slider in the center of the display*/
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_obj_set_width(slider, 200);                          /*Set the width*/
    lv_obj_center(slider);                                  /*Align to the center of␣
↪the parent (screen)*/
    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_VALUE_CHANGED, NULL);     /
↪*Assign an event function*/

    /*Create a label above the slider*/
    label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "0");
    lv_obj_align_to(label, slider, LV_ALIGN_OUT_TOP_MID, 0, -15);    /*Align top of␣
↪the slider*/
}

#endif
```

```
def slider_event_cb(e):
    slider = e.get_target_obj()

    # Refresh the text
    label.set_text(str(slider.get_value()))

#
# Create a slider and write its value on a label.
#
```

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```
# Create a slider in the center of the display
slider = lv.slider(lv.scr_act())
slider.set_width(200)                                               # Set the width
slider.center()                                                     # Align to the␣
↪center of the parent (screen)
slider.add_event(slider_event_cb, lv.EVENT.VALUE_CHANGED, None) # Assign an event␣
↪function

# Create a label above the slider
label = lv.label(lv.scr_act())
label.set_text("0")
label.align_to(slider, lv.ALIGN.OUT_TOP_MID, 0, -15)                # Align below the␣
↪slider
```

2.2 Styles

2.2.1 Size styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Using the Size, Position and Padding style properties
 */
void lv_example_style_1(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_radius(&style, 5);

    /*Make a gradient*/
    lv_style_set_width(&style, 150);
    lv_style_set_height(&style, LV_SIZE_CONTENT);

    lv_style_set_pad_ver(&style, 20);
    lv_style_set_pad_left(&style, 5);

    lv_style_set_x(&style, lv_pct(50));
    lv_style_set_y(&style, 80);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);

    lv_obj_t * label = lv_label_create(obj);
    lv_label_set_text(label, "Hello");
}

#endif
```

```
#
# Using the Size, Position and Padding style properties
#
style = lv.style_t()
style.init()
style.set_radius(5)

# Make a gradient
style.set_width(150)
style.set_height(lv.SIZE_CONTENT)

style.set_pad_ver(20)
style.set_pad_left(5)

style.set_x(lv.pct(50))
style.set_y(80)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)

label = lv.label(obj)
label.set_text("Hello")
```

2.2.2 Background styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Using the background style properties
 */
void lv_example_style_2(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_radius(&style, 5);

    /*Make a gradient*/
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    static lv_grad_dsc_t grad;
    grad.dir = LV_GRAD_DIR_VER;
    grad.stops_count = 2;
    grad.stops[0].color = lv_palette_lighten(LV_PALETTE_GREY, 1);
    grad.stops[1].color = lv_palette_main(LV_PALETTE_BLUE);

    /*Shift the gradient to the bottom*/
    grad.stops[0].frac  = 128;
    grad.stops[1].frac  = 192;

    lv_style_set_bg_grad(&style, &grad);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
```

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```
    lv_obj_add_style(obj, &style, 0);
    lv_obj_center(obj);
}

#endif
```

```
#
# Using the background style properties
#
style = lv.style_t()
style.init()
style.set_radius(5)

# Make a gradient
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 1))
style.set_bg_grad_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_bg_grad_dir(lv.GRAD_DIR.VER)

# Shift the gradient to the bottom
style.set_bg_main_stop(128)
style.set_bg_grad_stop(192)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)
obj.center()
```

2.2.3 Border styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Using the border style properties
 */
void lv_example_style_3(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    /*Set a background color and a radius*/
    lv_style_set_radius(&style, 10);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 1));

    /*Add border to the bottom+right*/
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_border_width(&style, 5);
    lv_style_set_border_opa(&style, LV_OPA_50);
    lv_style_set_border_side(&style, LV_BORDER_SIDE_BOTTOM | LV_BORDER_SIDE_RIGHT);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
```

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```
    lv_obj_add_style(obj, &style, 0);
    lv_obj_center(obj);
}

#endif
```

```
#
# Using the border style properties
#
style = lv.style_t()
style.init()

# Set a background color and a radius
style.set_radius(10)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 1))

# Add border to the bottom+right
style.set_border_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_border_width(5)
style.set_border_opa(lv.OPA._50)
style.set_border_side(lv.BORDER_SIDE.BOTTOM | lv.BORDER_SIDE.RIGHT)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)
obj.center()
```

2.2.4 Outline styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Using the outline style properties
 */
void lv_example_style_4(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    /*Set a background color and a radius*/
    lv_style_set_radius(&style, 5);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 1));

    /*Add outline*/
    lv_style_set_outline_width(&style, 2);
    lv_style_set_outline_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_outline_pad(&style, 8);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);
```

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```
    lv_obj_center(obj);
}

#endif
```

```
#
# Using the outline style properties
#

style = lv.style_t()
style.init()

# Set a background color and a radius
style.set_radius(5)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 1))

# Add outline
style.set_outline_width(2)
style.set_outline_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_outline_pad(8)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)
obj.center()
```

2.2.5 Shadow styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Using the Shadow style properties
 */
void lv_example_style_5(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    /*Set a background color and a radius*/
    lv_style_set_radius(&style, 5);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 1));

    /*Add a shadow*/
    lv_style_set_shadow_width(&style, 55);
    lv_style_set_shadow_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    //    lv_style_set_shadow_ofs_x(&style, 10);
    //    lv_style_set_shadow_ofs_y(&style, 20);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
```

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```
    lv_obj_add_style(obj, &style, 0);
    lv_obj_center(obj);
}

#endif
```

```
#
# Using the Shadow style properties
#

style = lv.style_t()
style.init()

# Set a background color and a radius
style.set_radius(5)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 1))

# Add a shadow
style.set_shadow_width(8)
style.set_shadow_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_shadow_ofs_x(10)
style.set_shadow_ofs_y(20)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)
obj.center()
```

2.2.6 Image styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Using the Image style properties
 */
void lv_example_style_6(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    /*Set a background color and a radius*/
    lv_style_set_radius(&style, 5);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 3));
    lv_style_set_border_width(&style, 2);
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_BLUE));

    lv_style_set_img_recolor(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_img_recolor_opa(&style, LV_OPA_50);
    lv_style_set_transform_angle(&style, 300);

    /*Create an object with the new style*/
```

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```
    lv_obj_t * obj = lv_img_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);

    LV_IMG_DECLARE(img_cogwheel_argb);
    lv_img_set_src(obj, &img_cogwheel_argb);

    lv_obj_center(obj);
}

#endif
```

```
# Create an image from the png file
try:
    with open('../assets/img_cogwheel_argb.png', 'rb') as f:
        png_data = f.read()
except:
    print("Could not find img_cogwheel_argb.png")
    sys.exit()

img_cogwheel_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

#
# Using the Image style properties
#
style = lv.style_t()
style.init()

# Set a background color and a radius
style.set_radius(5)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 3))
style.set_border_width(2)
style.set_border_color(lv.palette_main(lv.PALETTE.BLUE))

style.set_img_recolor(lv.palette_main(lv.PALETTE.BLUE))
style.set_img_recolor_opa(lv.OPA._50)
# style.set_transform_angle(300)

# Create an object with the new style
obj = lv.img(lv.scr_act())
obj.add_style(style, 0)

obj.set_src(img_cogwheel_argb)

obj.center()
```

2.2.7 Text styles

```c
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LABEL

/**
 * Using the text style properties
 */
void lv_example_style_8(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    lv_style_set_radius(&style, 5);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 2));
    lv_style_set_border_width(&style, 2);
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_pad_all(&style, 10);

    lv_style_set_text_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_text_letter_space(&style, 5);
    lv_style_set_text_line_space(&style, 20);
    lv_style_set_text_decor(&style, LV_TEXT_DECOR_UNDERLINE);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_label_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);
    lv_label_set_text(obj, "Text of\n"
                      "a label");

    lv_obj_center(obj);
}

#endif
```

```python
#
# Using the text style properties
#

style = lv.style_t()
style.init()

style.set_radius(5)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 3))
style.set_border_width(2)
style.set_border_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_pad_all(10)

style.set_text_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_text_letter_space(5)
style.set_text_line_space(20)
style.set_text_decor(lv.TEXT_DECOR.UNDERLINE)

# Create an object with the new style
obj = lv.label(lv.scr_act())
```

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```
obj.add_style(style, 0)
obj.set_text("Text of\n"
             "a label")

obj.center()
```

2.2.8 Line styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LINE

/**
 * Using the line style properties
 */
void lv_example_style_9(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    lv_style_set_line_color(&style, lv_palette_main(LV_PALETTE_GREY));
    lv_style_set_line_width(&style, 6);
    lv_style_set_line_rounded(&style, true);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_line_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);

    static lv_point_t p[] = {{10, 30}, {30, 50}, {100, 0}};
    lv_line_set_points(obj, p, 3);

    lv_obj_center(obj);
}

#endif
```

```
#
# Using the line style properties
#

style = lv.style_t()
style.init()

style.set_line_color(lv.palette_main(lv.PALETTE.GREY))
style.set_line_width(6)
style.set_line_rounded(True)

# Create an object with the new style
obj = lv.line(lv.scr_act())
obj.add_style(style, 0)
p =  [ {"x":10, "y":30},
       {"x":30, "y":50},
       {"x":100, "y":0}]
```

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```
obj.set_points(p, 3)

obj.center()
```

2.2.9 Transition

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Creating a transition
 */
void lv_example_style_10(void)
{
    static const lv_style_prop_t props[] = {LV_STYLE_BG_COLOR, LV_STYLE_BORDER_COLOR,␣
↪LV_STYLE_BORDER_WIDTH, 0};

    /* A default transition
     * Make it fast (100ms) and start with some delay (200 ms)*/
    static lv_style_transition_dsc_t trans_def;
    lv_style_transition_dsc_init(&trans_def, props, lv_anim_path_linear, 100, 200,␣
↪NULL);

    /* A special transition when going to pressed state
     * Make it slow (500 ms) but start  without delay*/
    static lv_style_transition_dsc_t trans_pr;
    lv_style_transition_dsc_init(&trans_pr, props, lv_anim_path_linear, 500, 0, NULL);

    static lv_style_t style_def;
    lv_style_init(&style_def);
    lv_style_set_transition(&style_def, &trans_def);

    static lv_style_t style_pr;
    lv_style_init(&style_pr);
    lv_style_set_bg_color(&style_pr, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_border_width(&style_pr, 6);
    lv_style_set_border_color(&style_pr, lv_palette_darken(LV_PALETTE_RED, 3));
    lv_style_set_transition(&style_pr, &trans_pr);

    /*Create an object with the new style_pr*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style_def, 0);
    lv_obj_add_style(obj, &style_pr, LV_STATE_PRESSED);

    lv_obj_center(obj);
}

#endif
```

```
#
# Creating a transition
#

props = [lv.STYLE.BG_COLOR, lv.STYLE.BORDER_COLOR, lv.STYLE.BORDER_WIDTH, 0]
```

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```
# A default transition
# Make it fast (100ms) and start with some delay (200 ms)

trans_def = lv.style_transition_dsc_t()
trans_def.init(props, lv.anim_t.path_linear, 100, 200, None)

# A special transition when going to pressed state
# Make it slow (500 ms) but start  without delay

trans_pr = lv.style_transition_dsc_t()
trans_pr.init(props, lv.anim_t.path_linear, 500, 0, None)

style_def = lv.style_t()
style_def.init()
style_def.set_transition(trans_def)

style_pr = lv.style_t()
style_pr.init()
style_pr.set_bg_color(lv.palette_main(lv.PALETTE.RED))
style_pr.set_border_width(6)
style_pr.set_border_color(lv.palette_darken(lv.PALETTE.RED, 3))
style_pr.set_transition(trans_pr)

# Create an object with the new style_pr
obj = lv.obj(lv.scr_act())
obj.add_style(style_def, 0)
obj.add_style(style_pr, lv.STATE.PRESSED)

obj.center()
```

2.2.10 Using multiple styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Using multiple styles
 */
void lv_example_style_11(void)
{
    /*A base style*/
    static lv_style_t style_base;
    lv_style_init(&style_base);
    lv_style_set_bg_color(&style_base, lv_palette_main(LV_PALETTE_LIGHT_BLUE));
    lv_style_set_border_color(&style_base, lv_palette_darken(LV_PALETTE_LIGHT_BLUE,␣
↪3));
    lv_style_set_border_width(&style_base, 2);
    lv_style_set_radius(&style_base, 10);
    lv_style_set_shadow_width(&style_base, 10);
    lv_style_set_shadow_ofs_y(&style_base, 5);
    lv_style_set_shadow_opa(&style_base, LV_OPA_50);
    lv_style_set_text_color(&style_base, lv_color_white());
    lv_style_set_width(&style_base, 100);
```

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```
    lv_style_set_height(&style_base, LV_SIZE_CONTENT);

    /*Set only the properties that should be different*/
    static lv_style_t style_warning;
    lv_style_init(&style_warning);
    lv_style_set_bg_color(&style_warning, lv_palette_main(LV_PALETTE_YELLOW));
    lv_style_set_border_color(&style_warning, lv_palette_darken(LV_PALETTE_YELLOW,␣
↪3));
    lv_style_set_text_color(&style_warning, lv_palette_darken(LV_PALETTE_YELLOW, 4));

    /*Create an object with the base style only*/
    lv_obj_t * obj_base = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj_base, &style_base, 0);
    lv_obj_align(obj_base, LV_ALIGN_LEFT_MID, 20, 0);

    lv_obj_t * label = lv_label_create(obj_base);
    lv_label_set_text(label, "Base");
    lv_obj_center(label);

    /*Create another object with the base style and earnings style too*/
    lv_obj_t * obj_warning = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj_warning, &style_base, 0);
    lv_obj_add_style(obj_warning, &style_warning, 0);
    lv_obj_align(obj_warning, LV_ALIGN_RIGHT_MID, -20, 0);

    label = lv_label_create(obj_warning);
    lv_label_set_text(label, "Warning");
    lv_obj_center(label);
}

#endif
```

```
#
# Using multiple styles
#
# A base style

style_base = lv.style_t()
style_base.init()
style_base.set_bg_color(lv.palette_main(lv.PALETTE.LIGHT_BLUE))
style_base.set_border_color(lv.palette_darken(lv.PALETTE.LIGHT_BLUE, 3))
style_base.set_border_width(2)
style_base.set_radius(10)
style_base.set_shadow_width(10)
style_base.set_shadow_ofs_y(5)
style_base.set_shadow_opa(lv.OPA._50)
style_base.set_text_color(lv.color_white())
style_base.set_width(100)
style_base.set_height(lv.SIZE_CONTENT)

# Set only the properties that should be different
style_warning = lv.style_t()
style_warning.init()
style_warning.set_bg_color(lv.palette_main(lv.PALETTE.YELLOW))
style_warning.set_border_color(lv.palette_darken(lv.PALETTE.YELLOW, 3))
style_warning.set_text_color(lv.palette_darken(lv.PALETTE.YELLOW, 4))
```

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```
# Create an object with the base style only
obj_base = lv.obj(lv.scr_act())
obj_base.add_style(style_base, 0)
obj_base.align(lv.ALIGN.LEFT_MID, 20, 0)

label = lv.label(obj_base)
label.set_text("Base")
label.center()

# Create another object with the base style and earnings style too
obj_warning = lv.obj(lv.scr_act())
obj_warning.add_style(style_base, 0)
obj_warning.add_style(style_warning, 0)
obj_warning.align(lv.ALIGN.RIGHT_MID, -20, 0)

label = lv.label(obj_warning)
label.set_text("Warning")
label.center()
```

2.2.11 Local styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Local styles
 */
void lv_example_style_12(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_bg_color(&style, lv_palette_main(LV_PALETTE_GREEN));
    lv_style_set_border_color(&style, lv_palette_lighten(LV_PALETTE_GREEN, 3));
    lv_style_set_border_width(&style, 3);

    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);

    /*Overwrite the background color locally*/
    lv_obj_set_style_bg_color(obj, lv_palette_main(LV_PALETTE_ORANGE), LV_PART_MAIN);

    lv_obj_center(obj);
}

#endif
```

```
#
# Local styles
#

style = lv.style_t()
style.init()
style.set_bg_color(lv.palette_main(lv.PALETTE.GREEN))
```

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```
style.set_border_color(lv.palette_lighten(lv.PALETTE.GREEN, 3))
style.set_border_width(3)

obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)

# Overwrite the background color locally
obj.set_style_bg_color(lv.palette_main(lv.PALETTE.ORANGE), lv.PART.MAIN)

obj.center()
```

2.2.12 Add styles to parts and states

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Add styles to parts and states
 */
void lv_example_style_13(void)
{
    static lv_style_t style_indic;
    lv_style_init(&style_indic);
    lv_style_set_bg_color(&style_indic, lv_palette_lighten(LV_PALETTE_RED, 3));
    lv_style_set_bg_grad_color(&style_indic, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_bg_grad_dir(&style_indic, LV_GRAD_DIR_HOR);

    static lv_style_t style_indic_pr;
    lv_style_init(&style_indic_pr);
    lv_style_set_shadow_color(&style_indic_pr, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_shadow_width(&style_indic_pr, 10);
    lv_style_set_shadow_spread(&style_indic_pr, 3);

    /*Create an object with the new style_pr*/
    lv_obj_t * obj = lv_slider_create(lv_scr_act());
    lv_obj_add_style(obj, &style_indic, LV_PART_INDICATOR);
    lv_obj_add_style(obj, &style_indic_pr, LV_PART_INDICATOR | LV_STATE_PRESSED);
    lv_slider_set_value(obj, 70, LV_ANIM_OFF);
    lv_obj_center(obj);
}

#endif
```

```
#
# Add styles to parts and states
#

style_indic = lv.style_t()
style_indic.init()
style_indic.set_bg_color(lv.palette_lighten(lv.PALETTE.RED, 3))
style_indic.set_bg_grad_color(lv.palette_main(lv.PALETTE.RED))
style_indic.set_bg_grad_dir(lv.GRAD_DIR.HOR)

style_indic_pr = lv.style_t()
```

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```
style_indic_pr.init()
style_indic_pr.set_shadow_color(lv.palette_main(lv.PALETTE.RED))
style_indic_pr.set_shadow_width(10)
style_indic_pr.set_shadow_spread(3)

# Create an object with the new style_pr
obj = lv.slider(lv.scr_act())
obj.add_style(style_indic, lv.PART.INDICATOR)
obj.add_style(style_indic_pr, lv.PART.INDICATOR | lv.STATE.PRESSED)
obj.set_value(70, lv.ANIM.OFF)
obj.center()
```

2.2.13 Extending the current theme

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG


static lv_style_t style_btn;

/*Will be called when the styles of the base theme are already added
  to add new styles*/
static void new_theme_apply_cb(lv_theme_t * th, lv_obj_t * obj)
{
    LV_UNUSED(th);

    if(lv_obj_check_type(obj, &lv_btn_class)) {
        lv_obj_add_style(obj, &style_btn, 0);
    }
}

static void new_theme_init_and_set(void)
{
    /*Initialize the styles*/
    lv_style_init(&style_btn);
    lv_style_set_bg_color(&style_btn, lv_palette_main(LV_PALETTE_GREEN));
    lv_style_set_border_color(&style_btn, lv_palette_darken(LV_PALETTE_GREEN, 3));
    lv_style_set_border_width(&style_btn, 3);

    /*Initialize the new theme from the current theme*/
    lv_theme_t * th_act = lv_disp_get_theme(NULL);
    static lv_theme_t th_new;
    th_new = *th_act;

    /*Set the parent theme and the style apply callback for the new theme*/
    lv_theme_set_parent(&th_new, th_act);
    lv_theme_set_apply_cb(&th_new, new_theme_apply_cb);

    /*Assign the new theme to the current display*/
    lv_disp_set_theme(NULL, &th_new);
}
```

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```c
/**
 * Extending the current theme
 */
void lv_example_style_14(void)
{
    lv_obj_t * btn;
    lv_obj_t * label;

    btn = lv_btn_create(lv_scr_act());
    lv_obj_align(btn, LV_ALIGN_TOP_MID, 0, 20);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Original theme");

    new_theme_init_and_set();

    btn = lv_btn_create(lv_scr_act());
    lv_obj_align(btn, LV_ALIGN_BOTTOM_MID, 0, -20);

    label = lv_label_create(btn);
    lv_label_set_text(label, "New theme");
}

#endif
```

```python
# Will be called when the styles of the base theme are already added
# to add new styles


class NewTheme(lv.theme_t):
    def __init__(self):
        super().__init__()
        # Initialize the styles
        self.style_btn = lv.style_t()
        self.style_btn.init()
        self.style_btn.set_bg_color(lv.palette_main(lv.PALETTE.GREEN))
        self.style_btn.set_border_color(lv.palette_darken(lv.PALETTE.GREEN, 3))
        self.style_btn.set_border_width(3)

        # This theme is based on active theme
        th_act = lv.theme_get_from_obj(lv.scr_act())
        # This theme will be applied only after base theme is applied
        self.set_parent(th_act)


class ExampleStyle_14:

    def __init__(self):
        #
        # Extending the current theme
        #

        btn = lv.btn(lv.scr_act())
        btn.align(lv.ALIGN.TOP_MID, 0, 20)

        label = lv.label(btn)
```

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```
        label.set_text("Original theme")

        self.new_theme_init_and_set()

        btn = lv.btn(lv.scr_act())
        btn.align(lv.ALIGN.BOTTOM_MID, 0, -20)

        label = lv.label(btn)
        label.set_text("New theme")

    def new_theme_apply_cb(self, th, obj):
        print(th,obj)
        if obj.get_class() == lv.btn_class:
            obj.add_style(self.th_new.style_btn, 0)

    def new_theme_init_and_set(self):
        print("new_theme_init_and_set")
        # Initialize the new theme from the current theme
        self.th_new = NewTheme()
        self.th_new.set_apply_cb(self.new_theme_apply_cb)
        lv.disp_get_default().set_theme(self.th_new)


exampleStyle_14 = ExampleStyle_14()
```

2.2.14 Opacity and Transformations

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_BTN && LV_USE_LABEL



/**
 * Opacity and Transformations
 */
void lv_example_style_15(void)
{
    lv_obj_t * btn;
    lv_obj_t * label;

    /*Normal button*/
    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 40);
    lv_obj_align(btn, LV_ALIGN_CENTER, 0, -70);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Normal");
    lv_obj_center(label);

    /*Set opacity
     *The button and the label is rendered to a layer first and that layer is␣
↪blended*/
    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 40);
```

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```
    lv_obj_set_style_opa(btn, LV_OPA_50, 0);
    lv_obj_align(btn, LV_ALIGN_CENTER, 0, 0);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Opa:50%");
    lv_obj_center(label);

    /*Set transformations
     *The button and the label is rendered to a layer first and that layer is␣
↪transformed*/
    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 40);
    lv_obj_set_style_transform_angle(btn, 150, 0);        /*15 deg*/
    lv_obj_set_style_transform_zoom(btn, 256 + 64, 0);   /*1.25x*/
    lv_obj_set_style_transform_pivot_x(btn, 50, 0);
    lv_obj_set_style_transform_pivot_y(btn, 20, 0);
    lv_obj_set_style_opa(btn, LV_OPA_50, 0);
    lv_obj_align(btn, LV_ALIGN_CENTER, 0, 70);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Transf.");
    lv_obj_center(label);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/styles/lv_
↪example_style_15.py
```

2.3 Animations

2.3.1 Start animation on an event

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SWITCH

static void anim_x_cb(void * var, int32_t v)
{
    lv_obj_set_x(var, v);
}

static void sw_event_cb(lv_event_t * e)
{
    lv_obj_t * sw = lv_event_get_target(e);
    lv_obj_t * label = lv_event_get_user_data(e);

    if(lv_obj_has_state(sw, LV_STATE_CHECKED)) {
        lv_anim_t a;
        lv_anim_init(&a);
        lv_anim_set_var(&a, label);
        lv_anim_set_values(&a, lv_obj_get_x(label), 100);
        lv_anim_set_time(&a, 500);
        lv_anim_set_exec_cb(&a, anim_x_cb);
```

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```
        lv_anim_set_path_cb(&a, lv_anim_path_overshoot);
        lv_anim_start(&a);
    }
    else {
        lv_anim_t a;
        lv_anim_init(&a);
        lv_anim_set_var(&a, label);
        lv_anim_set_values(&a, lv_obj_get_x(label), -lv_obj_get_width(label));
        lv_anim_set_time(&a, 500);
        lv_anim_set_exec_cb(&a, anim_x_cb);
        lv_anim_set_path_cb(&a, lv_anim_path_ease_in);
        lv_anim_start(&a);
    }

}

/**
 * Start animation on an event
 */
void lv_example_anim_1(void)
{
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Hello animations!");
    lv_obj_set_pos(label, 100, 10);


    lv_obj_t * sw = lv_switch_create(lv_scr_act());
    lv_obj_center(sw);
    lv_obj_add_state(sw, LV_STATE_CHECKED);
    lv_obj_add_event(sw, sw_event_cb, LV_EVENT_VALUE_CHANGED, label);
}

#endif
```

```
def anim_x_cb(label, v):
    label.set_x(v)

def sw_event_cb(e,label):
    sw = e.get_target_obj()

    if sw.has_state(lv.STATE.CHECKED):
        a = lv.anim_t()
        a.init()
        a.set_var(label)
        a.set_values(label.get_x(), 100)
        a.set_time(500)
        a.set_path_cb(lv.anim_t.path_overshoot)
        a.set_custom_exec_cb(lambda a,val: anim_x_cb(label,val))
        lv.anim_t.start(a)
    else:
        a = lv.anim_t()
        a.init()
        a.set_var(label)
        a.set_values(label.get_x(), -label.get_width())
        a.set_time(500)
        a.set_path_cb(lv.anim_t.path_ease_in)
```

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```
        a.set_custom_exec_cb(lambda a,val: anim_x_cb(label,val))
        lv.anim_t.start(a)

#
# Start animation on an event
#

label = lv.label(lv.scr_act())
label.set_text("Hello animations!")
label.set_pos(100, 10)


sw = lv.switch(lv.scr_act())
sw.center()
sw.add_state(lv.STATE.CHECKED)
sw.add_event(lambda e: sw_event_cb(e,label), lv.EVENT.VALUE_CHANGED, None)
```

2.3.2 Playback animation

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SWITCH


static void anim_x_cb(void * var, int32_t v)
{
    lv_obj_set_x(var, v);
}

static void anim_size_cb(void * var, int32_t v)
{
    lv_obj_set_size(var, v, v);
}

/**
 * Create a playback animation
 */
void lv_example_anim_2(void)
{

    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_set_style_bg_color(obj, lv_palette_main(LV_PALETTE_RED), 0);
    lv_obj_set_style_radius(obj, LV_RADIUS_CIRCLE, 0);

    lv_obj_align(obj, LV_ALIGN_LEFT_MID, 10, 0);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, obj);
    lv_anim_set_values(&a, 10, 50);
    lv_anim_set_time(&a, 1000);
    lv_anim_set_playback_delay(&a, 100);
```

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```
    lv_anim_set_playback_time(&a, 300);
    lv_anim_set_repeat_delay(&a, 500);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_set_path_cb(&a, lv_anim_path_ease_in_out);

    lv_anim_set_exec_cb(&a, anim_size_cb);
    lv_anim_start(&a);
    lv_anim_set_exec_cb(&a, anim_x_cb);
    lv_anim_set_values(&a, 10, 240);
    lv_anim_start(&a);
}

#endif
```

```
def anim_x_cb(obj, v):
    obj.set_x(v)

def anim_size_cb(obj, v):
    obj.set_size(v, v)


#
# Create a playback animation
#
obj = lv.obj(lv.scr_act())
obj.set_style_bg_color(lv.palette_main(lv.PALETTE.RED), 0)
obj.set_style_radius(lv.RADIUS_CIRCLE, 0)

obj.align(lv.ALIGN.LEFT_MID, 10, 0)

a1 = lv.anim_t()
a1.init()
a1.set_var(obj)
a1.set_values(10, 50)
a1.set_time(1000)
a1.set_playback_delay(100)
a1.set_playback_time(300)
a1.set_repeat_delay(500)
a1.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a1.set_path_cb(lv.anim_t.path_ease_in_out)
a1.set_custom_exec_cb(lambda a1,val: anim_size_cb(obj,val))
lv.anim_t.start(a1)

a2 = lv.anim_t()
a2.init()
a2.set_var(obj)
a2.set_values(10, 240)
a2.set_time(1000)
a2.set_playback_delay(100)
a2.set_playback_time(300)
a2.set_repeat_delay(500)
a2.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a2.set_path_cb(lv.anim_t.path_ease_in_out)
a2.set_custom_exec_cb(lambda a1,val: anim_x_cb(obj,val))
lv.anim_t.start(a2)
```

2.3.3 Animation timeline

```
#include "../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

static lv_anim_timeline_t * anim_timeline = NULL;

static lv_obj_t * obj1 = NULL;
static lv_obj_t * obj2 = NULL;
static lv_obj_t * obj3 = NULL;

static const lv_coord_t obj_width = 90;
static const lv_coord_t obj_height = 70;

static void set_width(void * var, int32_t v)
{
    lv_obj_set_width((lv_obj_t *)var, v);
}

static void set_height(void * var, int32_t v)
{
    lv_obj_set_height((lv_obj_t *)var, v);
}

static void anim_timeline_create(void)
{
    /* obj1 */
    lv_anim_t a1;
    lv_anim_init(&a1);
    lv_anim_set_var(&a1, obj1);
    lv_anim_set_values(&a1, 0, obj_width);
    lv_anim_set_early_apply(&a1, false);
    lv_anim_set_exec_cb(&a1, (lv_anim_exec_xcb_t)set_width);
    lv_anim_set_path_cb(&a1, lv_anim_path_overshoot);
    lv_anim_set_time(&a1, 300);

    lv_anim_t a2;
    lv_anim_init(&a2);
    lv_anim_set_var(&a2, obj1);
    lv_anim_set_values(&a2, 0, obj_height);
    lv_anim_set_early_apply(&a2, false);
    lv_anim_set_exec_cb(&a2, (lv_anim_exec_xcb_t)set_height);
    lv_anim_set_path_cb(&a2, lv_anim_path_ease_out);
    lv_anim_set_time(&a2, 300);

    /* obj2 */
    lv_anim_t a3;
    lv_anim_init(&a3);
    lv_anim_set_var(&a3, obj2);
    lv_anim_set_values(&a3, 0, obj_width);
    lv_anim_set_early_apply(&a3, false);
    lv_anim_set_exec_cb(&a3, (lv_anim_exec_xcb_t)set_width);
    lv_anim_set_path_cb(&a3, lv_anim_path_overshoot);
    lv_anim_set_time(&a3, 300);

    lv_anim_t a4;
    lv_anim_init(&a4);
```

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```
    lv_anim_set_var(&a4, obj2);
    lv_anim_set_values(&a4, 0, obj_height);
    lv_anim_set_early_apply(&a4, false);
    lv_anim_set_exec_cb(&a4, (lv_anim_exec_xcb_t)set_height);
    lv_anim_set_path_cb(&a4, lv_anim_path_ease_out);
    lv_anim_set_time(&a4, 300);

    /* obj3 */
    lv_anim_t a5;
    lv_anim_init(&a5);
    lv_anim_set_var(&a5, obj3);
    lv_anim_set_values(&a5, 0, obj_width);
    lv_anim_set_early_apply(&a5, false);
    lv_anim_set_exec_cb(&a5, (lv_anim_exec_xcb_t)set_width);
    lv_anim_set_path_cb(&a5, lv_anim_path_overshoot);
    lv_anim_set_time(&a5, 300);

    lv_anim_t a6;
    lv_anim_init(&a6);
    lv_anim_set_var(&a6, obj3);
    lv_anim_set_values(&a6, 0, obj_height);
    lv_anim_set_early_apply(&a6, false);
    lv_anim_set_exec_cb(&a6, (lv_anim_exec_xcb_t)set_height);
    lv_anim_set_path_cb(&a6, lv_anim_path_ease_out);
    lv_anim_set_time(&a6, 300);

    /* Create anim timeline */
    anim_timeline = lv_anim_timeline_create();
    lv_anim_timeline_add(anim_timeline, 0, &a1);
    lv_anim_timeline_add(anim_timeline, 0, &a2);
    lv_anim_timeline_add(anim_timeline, 200, &a3);
    lv_anim_timeline_add(anim_timeline, 200, &a4);
    lv_anim_timeline_add(anim_timeline, 400, &a5);
    lv_anim_timeline_add(anim_timeline, 400, &a6);
}

static void btn_start_event_handler(lv_event_t * e)
{
    lv_obj_t * btn = lv_event_get_target(e);

    if(!anim_timeline) {
        anim_timeline_create();
    }

    bool reverse = lv_obj_has_state(btn, LV_STATE_CHECKED);
    lv_anim_timeline_set_reverse(anim_timeline, reverse);
    lv_anim_timeline_start(anim_timeline);
}

static void btn_del_event_handler(lv_event_t * e)
{
    LV_UNUSED(e);
    if(anim_timeline) {
        lv_anim_timeline_del(anim_timeline);
        anim_timeline = NULL;
    }
}
```

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```
static void btn_stop_event_handler(lv_event_t * e)
{
    LV_UNUSED(e);
    if(anim_timeline) {
        lv_anim_timeline_stop(anim_timeline);
    }
}

static void slider_prg_event_handler(lv_event_t * e)
{
    lv_obj_t * slider = lv_event_get_target(e);

    if(!anim_timeline) {
        anim_timeline_create();
    }

    int32_t progress = lv_slider_get_value(slider);
    lv_anim_timeline_set_progress(anim_timeline, progress);
}

/**
 * Create an animation timeline
 */
void lv_example_anim_timeline_1(void)
{
    lv_obj_t * par = lv_scr_act();
    lv_obj_set_flex_flow(par, LV_FLEX_FLOW_ROW);
    lv_obj_set_flex_align(par, LV_FLEX_ALIGN_SPACE_AROUND, LV_FLEX_ALIGN_CENTER, LV_
↪FLEX_ALIGN_CENTER);

    /* create btn_start */
    lv_obj_t * btn_start = lv_btn_create(par);
    lv_obj_add_event(btn_start, btn_start_event_handler, LV_EVENT_VALUE_CHANGED,␣
↪NULL);
    lv_obj_add_flag(btn_start, LV_OBJ_FLAG_IGNORE_LAYOUT);
    lv_obj_add_flag(btn_start, LV_OBJ_FLAG_CHECKABLE);
    lv_obj_align(btn_start, LV_ALIGN_TOP_MID, -100, 20);

    lv_obj_t * label_start = lv_label_create(btn_start);
    lv_label_set_text(label_start, "Start");
    lv_obj_center(label_start);

    /* create btn_del */
    lv_obj_t * btn_del = lv_btn_create(par);
    lv_obj_add_event(btn_del, btn_del_event_handler, LV_EVENT_CLICKED, NULL);
    lv_obj_add_flag(btn_del, LV_OBJ_FLAG_IGNORE_LAYOUT);
    lv_obj_align(btn_del, LV_ALIGN_TOP_MID, 0, 20);

    lv_obj_t * label_del = lv_label_create(btn_del);
    lv_label_set_text(label_del, "Delete");
    lv_obj_center(label_del);

    /* create btn_stop */
    lv_obj_t * btn_stop = lv_btn_create(par);
    lv_obj_add_event(btn_stop, btn_stop_event_handler, LV_EVENT_CLICKED, NULL);
    lv_obj_add_flag(btn_stop, LV_OBJ_FLAG_IGNORE_LAYOUT);
```

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```
    lv_obj_align(btn_stop, LV_ALIGN_TOP_MID, 100, 20);

    lv_obj_t * label_stop = lv_label_create(btn_stop);
    lv_label_set_text(label_stop, "Stop");
    lv_obj_center(label_stop);

    /* create slider_prg */
    lv_obj_t * slider_prg = lv_slider_create(par);
    lv_obj_add_event(slider_prg, slider_prg_event_handler, LV_EVENT_VALUE_CHANGED,␣
↪NULL);
    lv_obj_add_flag(slider_prg, LV_OBJ_FLAG_IGNORE_LAYOUT);
    lv_obj_align(slider_prg, LV_ALIGN_BOTTOM_MID, 0, -20);
    lv_slider_set_range(slider_prg, 0, 65535);

    /* create 3 objects */
    obj1 = lv_obj_create(par);
    lv_obj_set_size(obj1, obj_width, obj_height);

    obj2 = lv_obj_create(par);
    lv_obj_set_size(obj2, obj_width, obj_height);

    obj3 = lv_obj_create(par);
    lv_obj_set_size(obj3, obj_width, obj_height);
}

#endif
```

```
class LV_ExampleAnimTimeline_1(object):

    def __init__(self):
        self.obj_width = 120
        self.obj_height = 150
        #
        # Create an animation timeline
        #

        self.par = lv.scr_act()
        self.par.set_flex_flow(lv.FLEX_FLOW.ROW)
        self.par.set_flex_align(lv.FLEX_ALIGN.SPACE_AROUND, lv.FLEX_ALIGN.CENTER, lv.
↪FLEX_ALIGN.CENTER)

        self.btn_run = lv.btn(self.par)
        self.btn_run.add_event(self.btn_run_event_handler, lv.EVENT.VALUE_CHANGED,␣
↪None)
        self.btn_run.add_flag(lv.obj.FLAG.IGNORE_LAYOUT)
        self.btn_run.add_flag(lv.obj.FLAG.CHECKABLE)
        self.btn_run.align(lv.ALIGN.TOP_MID, -50, 20)

        self.label_run = lv.label(self.btn_run)
        self.label_run.set_text("Run")
        self.label_run.center()

        self.btn_del = lv.btn(self.par)
        self.btn_del.add_event(self.btn_del_event_handler, lv.EVENT.CLICKED, None)
        self.btn_del.add_flag(lv.obj.FLAG.IGNORE_LAYOUT)
        self.btn_del.align(lv.ALIGN.TOP_MID, 50, 20)
```

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```
        self.label_del = lv.label(self.btn_del)
        self.label_del.set_text("Stop")
        self.label_del.center()

        self.slider = lv.slider(self.par)
        self.slider.add_event(self.slider_prg_event_handler, lv.EVENT.VALUE_CHANGED,␣
↪None)
        self.slider.add_flag(lv.obj.FLAG.IGNORE_LAYOUT)
        self.slider.align(lv.ALIGN.BOTTOM_RIGHT, -20, -20)
        self.slider.set_range(0, 65535)

        self.obj1 = lv.obj(self.par)
        self.obj1.set_size(self.obj_width, self.obj_height)

        self.obj2 = lv.obj(self.par)
        self.obj2.set_size(self.obj_width, self.obj_height)

        self.obj3 = lv.obj(self.par)
        self.obj3.set_size(self.obj_width, self.obj_height)

        self.anim_timeline = None

    def set_width(self,obj, v):
        obj.set_width(v)

    def set_height(self,obj, v):
        obj.set_height(v)

    def anim_timeline_create(self):
        # obj1
        self.a1 = lv.anim_t()
        self.a1.init()
        self.a1.set_values(0, self.obj_width)
        self.a1.set_early_apply(False)
        self.a1.set_custom_exec_cb(lambda a,v: self.set_width(self.obj1,v))
        self.a1.set_path_cb(lv.anim_t.path_overshoot)
        self.a1.set_time(300)

        self.a2 = lv.anim_t()
        self.a2.init()
        self.a2.set_values(0, self.obj_height)
        self.a2.set_early_apply(False)
        self.a2.set_custom_exec_cb(lambda a,v: self.set_height(self.obj1,v))
        self.a2.set_path_cb(lv.anim_t.path_ease_out)
        self.a2.set_time(300)

        # obj2
        self.a3=lv.anim_t()
        self.a3.init()
        self.a3.set_values(0, self.obj_width)
        self.a3.set_early_apply(False)
        self.a3.set_custom_exec_cb(lambda a,v: self.set_width(self.obj2,v))
        self.a3.set_path_cb(lv.anim_t.path_overshoot)
        self.a3.set_time(300)

        self.a4 = lv.anim_t()
```

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```
        self.a4.init()
        self.a4.set_values(0, self.obj_height)
        self.a4.set_early_apply(False)
        self.a4.set_custom_exec_cb(lambda a,v: self.set_height(self.obj2,v))
        self.a4.set_path_cb(lv.anim_t.path_ease_out)
        self.a4.set_time(300)

        # obj3
        self.a5 = lv.anim_t()
        self.a5.init()
        self.a5.set_values(0, self.obj_width)
        self.a5.set_early_apply(False)
        self.a5.set_custom_exec_cb(lambda a,v: self.set_width(self.obj3,v))
        self.a5.set_path_cb(lv.anim_t.path_overshoot)
        self.a5.set_time(300)

        self.a6 = lv.anim_t()
        self.a6.init()
        self.a6.set_values(0, self.obj_height)
        self.a6.set_early_apply(False)
        self.a6.set_custom_exec_cb(lambda a,v: self.set_height(self.obj3,v))
        self.a6.set_path_cb(lv.anim_t.path_ease_out)
        self.a6.set_time(300)

        # Create anim timeline
        print("Create new anim_timeline")
        self.anim_timeline = lv.anim_timeline_create()
        self.anim_timeline.add(0, self.a1)
        self.anim_timeline.add(0, self.a2)
        self.anim_timeline.add(200, self.a3)
        self.anim_timeline.add(200, self.a4)
        self.anim_timeline.add(400, self.a5)
        self.anim_timeline.add(400, self.a6)

    def slider_prg_event_handler(self,e):
        slider = e.get_target_obj()

        if  not self.anim_timeline:
            self.anim_timeline_create()

        progress = slider.get_value()
        self.anim_timeline.set_progress(progress)


    def btn_run_event_handler(self,e):
        btn = e.get_target_obj()
        if not self.anim_timeline:
            self.anim_timeline_create()

        reverse = btn.has_state(lv.STATE.CHECKED)
        self.anim_timeline.set_reverse(reverse)
        self.anim_timeline.start()

    def btn_del_event_handler(self,e):
        if self.anim_timeline:
            self.anim_timeline._del()
        self.anim_timeline = None
```

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```
lv_example_anim_timeline_1 = LV_ExampleAnimTimeline_1()
```

2.4 Events

2.4.1 Button click event

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SWITCH

static void event_cb(lv_event_t * e)
{
    LV_LOG_USER("Clicked");

    static uint32_t cnt = 1;
    lv_obj_t * btn = lv_event_get_target(e);
    lv_obj_t * label = lv_obj_get_child(btn, 0);
    lv_label_set_text_fmt(label, "%"LV_PRIu32, cnt);
    cnt++;
}

/**
 * Add click event to a button
 */
void lv_example_event_1(void)
{
    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 50);
    lv_obj_center(btn);
    lv_obj_add_event(btn, event_cb, LV_EVENT_CLICKED, NULL);

    lv_obj_t * label = lv_label_create(btn);
    lv_label_set_text(label, "Click me!");
    lv_obj_center(label);
}

#endif
```

```
class Event_1():
    def __init__(self):
        self.cnt = 1
        #
        # Add click event to a button
        #

        btn = lv.btn(lv.scr_act())
        btn.set_size(100, 50)
        btn.center()
        btn.add_event(self.event_cb, lv.EVENT.CLICKED, None)

        label = lv.label(btn)
        label.set_text("Click me!")
```

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```
        label.center()

    def event_cb(self,e):
        print("Clicked")

        btn = e.get_target_obj()
        label = btn.get_child(0)
        label.set_text(str(self.cnt))
        self.cnt += 1

evt1 = Event_1()
```

2.4.2 Handle multiple events

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SWITCH

static void event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * label = lv_event_get_user_data(e);

    switch(code) {
        case LV_EVENT_PRESSED:
            lv_label_set_text(label, "The last button event:\nLV_EVENT_PRESSED");
            break;
        case LV_EVENT_CLICKED:
            lv_label_set_text(label, "The last button event:\nLV_EVENT_CLICKED");
            break;
        case LV_EVENT_LONG_PRESSED:
            lv_label_set_text(label, "The last button event:\nLV_EVENT_LONG_PRESSED");
            break;
        case LV_EVENT_LONG_PRESSED_REPEAT:
            lv_label_set_text(label, "The last button event:\nLV_EVENT_LONG_PRESSED_
↪REPEAT");
            break;
        default:
            break;
    }
}

/**
 * Handle multiple events
 */
void lv_example_event_2(void)
{
    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 50);
    lv_obj_center(btn);

    lv_obj_t * btn_label = lv_label_create(btn);
    lv_label_set_text(btn_label, "Click me!");
    lv_obj_center(btn_label);
```

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```
    lv_obj_t * info_label = lv_label_create(lv_scr_act());
    lv_label_set_text(info_label, "The last button event:\nNone");

    lv_obj_add_event(btn, event_cb, LV_EVENT_ALL, info_label);
}

#endif
```

```
def event_cb(e,label):
    code = e.get_code()
    if code == lv.EVENT.PRESSED:
        label.set_text("The last button event:\nLV_EVENT_PRESSED")
    elif code == lv.EVENT.CLICKED:
        label.set_text("The last button event:\nLV_EVENT_CLICKED")
    elif code == lv.EVENT.LONG_PRESSED:
        label.set_text("The last button event:\nLV_EVENT_LONG_PRESSED")
    elif code == lv.EVENT.LONG_PRESSED_REPEAT:
        label.set_text("The last button event:\nLV_EVENT_LONG_PRESSED_REPEAT")
btn = lv.btn(lv.scr_act())
btn.set_size(100, 50)
btn.center()

btn_label = lv.label(btn)
btn_label.set_text("Click me!")
btn_label.center()

info_label = lv.label(lv.scr_act())
info_label.set_text("The last button event:\nNone")

btn.add_event(lambda e: event_cb(e,info_label), lv.EVENT.ALL, None)
```

2.4.3 Event bubbling

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_FLEX

static void event_cb(lv_event_t * e)
{
    /*The original target of the event. Can be the buttons or the container*/
    lv_obj_t * target = lv_event_get_target(e);

    /*The current target is always the container as the event is added to it*/
    lv_obj_t * cont = lv_event_get_current_target(e);

    /*If container was clicked do nothing*/
    if(target == cont) return;

    /*Make the clicked buttons red*/
    lv_obj_set_style_bg_color(target, lv_palette_main(LV_PALETTE_RED), 0);
}

/**
 * Demonstrate event bubbling
 */
```

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```c
void lv_example_event_3(void)
{

    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 290, 200);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_ROW_WRAP);

    uint32_t i;
    for(i = 0; i < 30; i++) {
        lv_obj_t * btn = lv_btn_create(cont);
        lv_obj_set_size(btn, 80, 50);
        lv_obj_add_flag(btn, LV_OBJ_FLAG_EVENT_BUBBLE);

        lv_obj_t * label = lv_label_create(btn);
        lv_label_set_text_fmt(label, "%"LV_PRIu32, i);
        lv_obj_center(label);
    }

    lv_obj_add_event(cont, event_cb, LV_EVENT_CLICKED, NULL);
}

#endif
```

```python
def event_cb(e):

    # The original target of the event. Can be the buttons or the container
    target = e.get_target_obj()
    # print(type(target))

    # If container was clicked do nothing
    if type(target) != type(lv.btn()):
        return

    # Make the clicked buttons red
    target.set_style_bg_color(lv.palette_main(lv.PALETTE.RED), 0)

#
# Demonstrate event bubbling
#

cont = lv.obj(lv.scr_act())
cont.set_size(320, 200)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)

for i in range(30):
    btn = lv.btn(cont)
    btn.set_size(80, 50)
    btn.add_flag(lv.obj.FLAG.EVENT_BUBBLE)

    label = lv.label(btn)
    label.set_text(str(i))
    label.center()

cont.add_event(event_cb, lv.EVENT.CLICKED, None)
```

2.4.4 Draw event

```c
#include "../lv_examples.h"

#if LV_BUILD_EXAMPLES

static uint32_t size = 0;
static bool size_dec = false;

static void timer_cb(lv_timer_t * timer)
{
    lv_obj_invalidate(timer->user_data);
    if(size_dec) size--;
    else size++;

    if(size == 50) size_dec = true;
    else if(size == 0) size_dec = false;
}

static void event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->class_p == &lv_obj_class && dsc->part == LV_PART_MAIN) {
        lv_draw_rect_dsc_t draw_dsc;
        lv_draw_rect_dsc_init(&draw_dsc);
        draw_dsc.bg_color = lv_color_hex(0xffaaaa);
        draw_dsc.radius = LV_RADIUS_CIRCLE;
        draw_dsc.border_color = lv_color_hex(0xff5555);
        draw_dsc.border_width = 2;
        draw_dsc.outline_color = lv_color_hex(0xff0000);
        draw_dsc.outline_pad = 3;
        draw_dsc.outline_width = 2;

        lv_area_t a;
        a.x1 = 0;
        a.y1 = 0;
        a.x2 = size;
        a.y2 = size;
        lv_area_align(&obj->coords, &a, LV_ALIGN_CENTER, 0, 0);

        lv_draw_rect(dsc->draw_ctx, &draw_dsc, &a);
    }
}

/**
 * Demonstrate the usage of draw event
 */
void lv_example_event_4(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 200, 200);
    lv_obj_center(cont);
    lv_obj_add_event(cont, event_cb, LV_EVENT_DRAW_PART_END, NULL);
    lv_timer_create(timer_cb, 30, cont);
}

#endif
```

```
class LV_Example_Event_4:

    def __init__(self):
        #
        # Demonstrate the usage of draw event
        #
        self.size = 0
        self.size_dec = False
        self.cont = lv.obj(lv.scr_act())
        self.cont.set_size(200, 200)
        self.cont.center()
        self.cont.add_event(self.event_cb, lv.EVENT.DRAW_PART_END, None)
        lv.timer_create(self.timer_cb, 30, None)

    def timer_cb(self,timer) :
        self.cont.invalidate()
        if self.size_dec :
            self.size -= 1
        else :
            self.size += 1

        if self.size == 50 :
            self.size_dec = True
        elif self.size == 0:
            self.size_dec = False

    def event_cb(self,e) :
        obj = e.get_target_obj()
        dsc = e.get_draw_part_dsc()
        if dsc.class_p == lv.obj_class and dsc.part == lv.PART.MAIN :
            draw_dsc = lv.draw_rect_dsc_t()
            draw_dsc.init()
            draw_dsc.bg_color = lv.color_hex(0xffaaaa)
            draw_dsc.radius = lv.RADIUS_CIRCLE
            draw_dsc.border_color = lv.color_hex(0xff5555)
            draw_dsc.border_width = 2
            draw_dsc.outline_color = lv.color_hex(0xff0000)
            draw_dsc.outline_pad = 3
            draw_dsc.outline_width = 2

            a = lv.area_t()
            a.x1 = 0
            a.y1 = 0
            a.x2 = self.size
            a.y2 = self.size
            coords = lv.area_t()
            obj.get_coords(coords)
            coords.align(a, lv.ALIGN.CENTER, 0, 0)

            dsc.draw_ctx.rect(draw_dsc, a)

lv_example_event_4 = LV_Example_Event_4()
```

2.5 Layouts

2.5.1 Flex

A simple row and a column layout with flexbox

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * A simple row and a column layout with flexbox
 */
void lv_example_flex_1(void)
{
    /*Create a container with ROW flex direction*/
    lv_obj_t * cont_row = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont_row, 300, 75);
    lv_obj_align(cont_row, LV_ALIGN_TOP_MID, 0, 5);
    lv_obj_set_flex_flow(cont_row, LV_FLEX_FLOW_ROW);

    /*Create a container with COLUMN flex direction*/
    lv_obj_t * cont_col = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont_col, 200, 150);
    lv_obj_align_to(cont_col, cont_row, LV_ALIGN_OUT_BOTTOM_MID, 0, 5);
    lv_obj_set_flex_flow(cont_col, LV_FLEX_FLOW_COLUMN);

    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_obj_t * obj;
        lv_obj_t * label;

        /*Add items to the row*/
        obj = lv_btn_create(cont_row);
        lv_obj_set_size(obj, 100, LV_PCT(100));

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "Item: %"LV_PRIu32"", i);
        lv_obj_center(label);

        /*Add items to the column*/
        obj = lv_btn_create(cont_col);
        lv_obj_set_size(obj, LV_PCT(100), LV_SIZE_CONTENT);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "Item: %"LV_PRIu32, i);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# A simple row and a column layout with flexbox
#
```

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```
# Create a container with ROW flex direction
cont_row = lv.obj(lv.scr_act())
cont_row.set_size(300, 75)
cont_row.align(lv.ALIGN.TOP_MID, 0, 5)
cont_row.set_flex_flow(lv.FLEX_FLOW.ROW)

# Create a container with COLUMN flex direction
cont_col = lv.obj(lv.scr_act())
cont_col.set_size(200, 150)
cont_col.align_to(cont_row, lv.ALIGN.OUT_BOTTOM_MID, 0, 5)
cont_col.set_flex_flow(lv.FLEX_FLOW.COLUMN)

for i in range(10):
    # Add items to the row
    obj = lv.btn(cont_row)
    obj.set_size(100, lv.pct(100))

    label = lv.label(obj)
    label.set_text("Item: {:d}".format(i))
    label.center()

    # Add items to the column
    obj = lv.btn(cont_col)
    obj.set_size(lv.pct(100), lv.SIZE_CONTENT)

    label = lv.label(obj)
    label.set_text("Item: {:d}".format(i))
    label.center()
```

Arrange items in rows with wrap and even spacing

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * Arrange items in rows with wrap and place the items to get even space around them.
 */
void lv_example_flex_2(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_flex_flow(&style, LV_FLEX_FLOW_ROW_WRAP);
    lv_style_set_flex_main_place(&style, LV_FLEX_ALIGN_SPACE_EVENLY);
    lv_style_set_layout(&style, LV_LAYOUT_FLEX);

    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_add_style(cont, &style, 0);

    uint32_t i;
    for(i = 0; i < 8; i++) {
        lv_obj_t * obj = lv_obj_create(cont);
        lv_obj_set_size(obj, 70, LV_SIZE_CONTENT);
```

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```
        lv_obj_add_flag(obj, LV_OBJ_FLAG_CHECKABLE);

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%"LV_PRIu32, i);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Arrange items in rows with wrap and place the items to get even space around them.
#
style = lv.style_t()
style.init()
style.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)
style.set_flex_main_place(lv.FLEX_ALIGN.SPACE_EVENLY)
style.set_layout(lv.LAYOUT_FLEX.value)

cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.add_style(style, 0)

for i in range(8):
    obj = lv.obj(cont)
    obj.set_size(70, lv.SIZE_CONTENT)

    label = lv.label(obj)
    label.set_text("{:d}".format(i))
    label.center()
```

Demonstrate flex grow

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * Demonstrate flex grow.
 */
void lv_example_flex_3(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_ROW);

    lv_obj_t * obj;
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, 40, 40);           /*Fix size*/

    obj = lv_obj_create(cont);
    lv_obj_set_height(obj, 40);
```

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```
    lv_obj_set_flex_grow(obj, 1);           /*1 portion from the free space*/

    obj = lv_obj_create(cont);
    lv_obj_set_height(obj, 40);
    lv_obj_set_flex_grow(obj, 2);           /*2 portion from the free space*/

    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, 40, 40);           /*Fix size. It is flushed to the right by␣
↪the "grow" items*/
}

#endif
```

```
#
# Demonstrate flex grow.
#

cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.ROW)

obj = lv.obj(cont)
obj.set_size(40, 40)            # Fix size

obj = lv.obj(cont)
obj.set_height(40)
obj.set_flex_grow(1)            # 1 portion from the free space

obj = lv.obj(cont)
obj.set_height(40)
obj.set_flex_grow(2)            # 2 portion from the free space

obj = lv.obj(cont)
obj.set_size(40, 40)            # Fix size. It is flushed to the right by the "grow"␣
↪items
```

Demonstrate flex grow.

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * Reverse the order of flex items
 */
void lv_example_flex_4(void)
{

    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_COLUMN_REVERSE);
```

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```
    uint32_t i;
    for(i = 0; i < 6; i++) {
        lv_obj_t * obj = lv_obj_create(cont);
        lv_obj_set_size(obj, 100, 50);

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "Item: %"LV_PRIu32, i);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Reverse the order of flex items
#
cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.COLUMN_REVERSE)

for i  in range(6):
    obj = lv.obj(cont)
    obj.set_size(100, 50)

    label = lv.label(obj)
    label.set_text("Item: " + str(i))
    label.center()
```

Demonstrate column and row gap style properties

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

static void row_gap_anim(void * obj, int32_t v)
{
    lv_obj_set_style_pad_row(obj, v, 0);
}

static void column_gap_anim(void * obj, int32_t v)
{
    lv_obj_set_style_pad_column(obj, v, 0);
}

/**
 * Demonstrate the effect of column and row gap style properties
 */
void lv_example_flex_5(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_ROW_WRAP);
```

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```
    uint32_t i;
    for(i = 0; i < 9; i++) {
        lv_obj_t * obj = lv_obj_create(cont);
        lv_obj_set_size(obj, 70, LV_SIZE_CONTENT);

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%"LV_PRIu32, i);
        lv_obj_center(label);
    }

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, cont);
    lv_anim_set_values(&a, 0, 10);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);

    lv_anim_set_exec_cb(&a, row_gap_anim);
    lv_anim_set_time(&a, 500);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_start(&a);

    lv_anim_set_exec_cb(&a, column_gap_anim);
    lv_anim_set_time(&a, 3000);
    lv_anim_set_playback_time(&a, 3000);
    lv_anim_start(&a);
}

#endif
```

```
def row_gap_anim(obj, v):
    obj.set_style_pad_row(v, 0)


def column_gap_anim(obj, v):
    obj.set_style_pad_column(v, 0)

#
# Demonstrate the effect of column and row gap style properties
#

cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)

for i in range(9):
    obj = lv.obj(cont)
    obj.set_size(70, lv.SIZE_CONTENT)

    label = lv.label(obj)
    label.set_text(str(i))
    label.center()

a_row = lv.anim_t()
a_row.init()
```

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```
a_row.set_var(cont)
a_row.set_values(0, 10)
a_row.set_repeat_count(lv.ANIM_REPEAT_INFINITE)

a_row.set_time(500)
a_row.set_playback_time(500)
a_row.set_custom_exec_cb(lambda a,val: row_gap_anim(cont,val))
lv.anim_t.start(a_row)

a_col = lv.anim_t()
a_col.init()
a_col.set_var(cont)
a_col.set_values(0, 10)
a_col.set_repeat_count(lv.ANIM_REPEAT_INFINITE)

a_col.set_time(3000)
a_col.set_playback_time(3000)
a_col.set_custom_exec_cb(lambda a,val: column_gap_anim(cont,val))

lv.anim_t.start(a_col)
```

RTL base direction changes order of the items

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * RTL base direction changes order of the items.
 * Also demonstrate how horizontal scrolling works with RTL.
 */
void lv_example_flex_6(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_style_base_dir(cont, LV_BASE_DIR_RTL, 0);
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_ROW_WRAP);

    uint32_t i;
    for(i = 0; i < 20; i++) {
        lv_obj_t * obj = lv_obj_create(cont);
        lv_obj_set_size(obj, 70, LV_SIZE_CONTENT);

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%"LV_PRIu32, i);
        lv_obj_center(label);
    }
}
#endif
```

```
#
# RTL base direction changes order of the items.
# Also demonstrate how horizontal scrolling works with RTL.
```

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```
#

cont = lv.obj(lv.scr_act())
cont.set_style_base_dir(lv.BASE_DIR.RTL,0)
cont.set_size(300, 220)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)

for i in range(20):
    obj = lv.obj(cont)
    obj.set_size(70, lv.SIZE_CONTENT)

    label = lv.label(obj)
    label.set_text(str(i))
    label.center()
```

2.5.2 Grid

A simple grid

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

/**
 * A simple grid
 */
void lv_example_grid_1(void)
{
    static lv_coord_t col_dsc[] = {70, 70, 70, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {50, 50, 50, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_style_grid_column_dsc_array(cont, col_dsc, 0);
    lv_obj_set_style_grid_row_dsc_array(cont, row_dsc, 0);
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_layout(cont, LV_LAYOUT_GRID);

    lv_obj_t * label;
    lv_obj_t * obj;

    uint32_t i;
    for(i = 0; i < 9; i++) {
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_btn_create(cont);
        /*Stretch the cell horizontally and vertically too
         *Set span to 1 to make the cell 1 column/row sized*/
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                                  LV_GRID_ALIGN_STRETCH, row, 1);
```

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```
        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "c%d, r%d", col, row);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# A simple grid
#

col_dsc = [70, 70, 70, lv.GRID_TEMPLATE_LAST]
row_dsc = [50, 50, 50, lv.GRID_TEMPLATE_LAST]

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_style_grid_column_dsc_array(col_dsc, 0)
cont.set_style_grid_row_dsc_array(row_dsc, 0)
cont.set_size(300, 220)
cont.center()
cont.set_layout(lv.LAYOUT_GRID.value)

for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.btn(cont)
    # Stretch the cell horizontally and vertically too
    # Set span to 1 to make the cell 1 column/row sized
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)

    label = lv.label(obj)
    label.set_text("c" +str(col) +  "r" +str(row))
    label.center()
```

Demonstrate cell placement and span

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES


/**
 * Demonstrate cell placement and span
 */
void lv_example_grid_2(void)
{
    static lv_coord_t col_dsc[] = {70, 70, 70, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {50, 50, 50, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
```

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```
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);

    lv_obj_t * label;
    lv_obj_t * obj;

    /*Cell to 0;0 and align to to the start (left/top) horizontally and vertically␣
↪too*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_START, 0, 1,
                         LV_GRID_ALIGN_START, 0, 1);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c0, r0");

    /*Cell to 1;0 and align to to the start (left) horizontally and center vertically␣
↪too*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_START, 1, 1,
                         LV_GRID_ALIGN_CENTER, 0, 1);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c1, r0");

    /*Cell to 2;0 and align to to the start (left) horizontally and end (bottom)␣
↪vertically too*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_START, 2, 1,
                         LV_GRID_ALIGN_END, 0, 1);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c2, r0");

    /*Cell to 1;1 but 2 column wide (span = 2).Set width and height to stretched.*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, 1, 2,
                         LV_GRID_ALIGN_STRETCH, 1, 1);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c1-2, r1");

    /*Cell to 0;1 but 2 rows tall (span = 2).Set width and height to stretched.*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, 0, 1,
                         LV_GRID_ALIGN_STRETCH, 1, 2);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c0\nr1-2");
}

#endif
```

```
#
# Demonstrate cell placement and span
#
```

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```
col_dsc = [70, 70, 70, lv.GRID_TEMPLATE_LAST]
row_dsc = [50, 50, 50, lv.GRID_TEMPLATE_LAST]

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_grid_dsc_array(col_dsc, row_dsc)
cont.set_size(300, 220)
cont.center()

# Cell to 0;0 and align to the start (left/top) horizontally and vertically too
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.START, 0, 1,
                  lv.GRID_ALIGN.START, 0, 1)
label = lv.label(obj)
label.set_text("c0, r0")

# Cell to 1;0 and align to the start (left) horizontally and center vertically too
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.START, 1, 1,
                  lv.GRID_ALIGN.CENTER, 0, 1)
label = lv.label(obj)
label.set_text("c1, r0")

# Cell to 2;0 and align to the start (left) horizontally and end (bottom) vertically␣
↪too
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.START, 2, 1,
                  lv.GRID_ALIGN.END, 0, 1)
label = lv.label(obj)
label.set_text("c2, r0")

# Cell to 1;1 but 2 column wide (span = 2).Set width and height to stretched.
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, 1, 2,
                  lv.GRID_ALIGN.STRETCH, 1, 1)
label = lv.label(obj)
label.set_text("c1-2, r1")

# Cell to 0;1 but 2 rows tall (span = 2).Set width and height to stretched.
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, 0, 1,
                  lv.GRID_ALIGN.STRETCH, 1, 2)
label = lv.label(obj)
label.set_text("c0\nr1-2")
```

Demonstrate grid's "free unit"

```c
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

/**
 * Demonstrate grid's "free unit"
 */
void lv_example_grid_3(void)
{
    /*Column 1: fix width 60 px
     *Column 2: 1 unit from the remaining free space
     *Column 3: 2 unit from the remaining free space*/
    static lv_coord_t col_dsc[] = {60, LV_GRID_FR(1), LV_GRID_FR(2), LV_GRID_TEMPLATE_
↪LAST};

    /*Row 1: fix width 50 px
     *Row 2: 1 unit from the remaining free space
     *Row 3: fix width 50 px*/
    static lv_coord_t row_dsc[] = {50, LV_GRID_FR(1), 50, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);

    lv_obj_t * label;
    lv_obj_t * obj;
    uint32_t i;
    for(i = 0; i < 9; i++) {
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_obj_create(cont);
        /*Stretch the cell horizontally and vertically too
         *Set span to 1 to make the cell 1 column/row sized*/
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%d,%d", col, row);
        lv_obj_center(label);
    }
}

#endif
```

```python
#
# Demonstrate grid's "free unit"
#

# Column 1: fix width 60 px
# Column 2: 1 unit from the remaining free space
# Column 3: 2 unit from the remaining free space

col_dsc = [60, lv.grid_fr(1), lv.grid_fr(2), lv.GRID_TEMPLATE_LAST]
```

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```
# Row 1: fix width 60 px
# Row 2: 1 unit from the remaining free space
# Row 3: fix width 60 px

row_dsc = [40, lv.grid_fr(1), 40, lv.GRID_TEMPLATE_LAST]

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_grid_dsc_array(col_dsc, row_dsc)

for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.obj(cont)
    # Stretch the cell horizontally and vertically too
    # Set span to 1 to make the cell 1 column/row sized
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)

    label = lv.label(obj)
    label.set_text("%d,%d"%(col, row))
    label.center()
```

Demonstrate track placement

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

/**
 * Demonstrate track placement
 */
void lv_example_grid_4(void)
{
    static lv_coord_t col_dsc[] = {60, 60, 60, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {45, 45, 45, LV_GRID_TEMPLATE_LAST};


    /*Add space between the columns and move the rows to the bottom (end)*/

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_grid_align(cont, LV_GRID_ALIGN_SPACE_BETWEEN, LV_GRID_ALIGN_END);
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);

    lv_obj_t * label;
    lv_obj_t * obj;
    uint32_t i;
    for(i = 0; i < 9; i++) {
```

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```
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_obj_create(cont);
        /*Stretch the cell horizontally and vertically too
         *Set span to 1 to make the cell 1 column/row sized*/
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%d,%d", col, row);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Demonstrate track placement
#

col_dsc = [60, 60, 60, lv.GRID_TEMPLATE_LAST]
row_dsc = [40, 40, 40, lv.GRID_TEMPLATE_LAST]


# Add space between the columns and move the rows to the bottom (end)

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_grid_align(lv.GRID_ALIGN.SPACE_BETWEEN, lv.GRID_ALIGN.END)
cont.set_grid_dsc_array(col_dsc, row_dsc)
cont.set_size(300, 220)
cont.center()


for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.obj(cont)
    # Stretch the cell horizontally and vertically too
    # Set span to 1 to make the cell 1 column/row sized
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)

    label = lv.label(obj)
    label.set_text("{:d}{:d}".format(col, row))
    label.center()
```

Demonstrate column and row gap

```c
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

static void row_gap_anim(void * obj, int32_t v)
{
    lv_obj_set_style_pad_row(obj, v, 0);
}

static void column_gap_anim(void * obj, int32_t v)
{
    lv_obj_set_style_pad_column(obj, v, 0);
}

/**
 * Demonstrate column and row gap
 */
void lv_example_grid_5(void)
{

    /*60x60 cells*/
    static lv_coord_t col_dsc[] = {60, 60, 60, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {45, 45, 45, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);

    lv_obj_t * label;
    lv_obj_t * obj;
    uint32_t i;
    for(i = 0; i < 9; i++) {
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_obj_create(cont);
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);
        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%d,%d", col, row);
        lv_obj_center(label);
    }

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, cont);
    lv_anim_set_values(&a, 0, 10);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);

    lv_anim_set_exec_cb(&a, row_gap_anim);
    lv_anim_set_time(&a, 500);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_start(&a);
```

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```
    lv_anim_set_exec_cb(&a, column_gap_anim);
    lv_anim_set_time(&a, 3000);
    lv_anim_set_playback_time(&a, 3000);
    lv_anim_start(&a);
}

#endif
```

```
def row_gap_anim(obj, v):
    obj.set_style_pad_row(v, 0)

def column_gap_anim(obj, v):
    obj.set_style_pad_column(v, 0)

#
# Demonstrate column and row gap
#

# 60x60 cells
col_dsc = [60, 60, 60, lv.GRID_TEMPLATE_LAST]
row_dsc = [40, 40, 40, lv.GRID_TEMPLATE_LAST]

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_grid_dsc_array(col_dsc, row_dsc)

for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.obj(cont)
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)
    label = lv.label(obj)
    label.set_text("{:d},{:d}".format(col, row))
    label.center()

    a_row = lv.anim_t()
    a_row.init()
    a_row.set_var(cont)
    a_row.set_values(0, 10)
    a_row.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
    a_row.set_time(500)
    a_row.set_playback_time(500)
    a_row. set_custom_exec_cb(lambda a,val: row_gap_anim(cont,val))
    lv.anim_t.start(a_row)

    a_col = lv.anim_t()
    a_col.init()
    a_col.set_var(cont)
    a_col.set_values(0, 10)
    a_col.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
    a_col.set_time(500)
```

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```
    a_col.set_playback_time(500)
    a_col. set_custom_exec_cb(lambda a,val: column_gap_anim(cont,val))
    lv.anim_t.start(a_col)
```

Demonstrate RTL direction on grid

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

/**
 * Demonstrate RTL direction on grid
 */
void lv_example_grid_6(void)
{

    static lv_coord_t col_dsc[] = {60, 60, 60, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {45, 45, 45, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_style_base_dir(cont, LV_BASE_DIR_RTL, 0);
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);

    lv_obj_t * label;
    lv_obj_t * obj;
    uint32_t i;
    for(i = 0; i < 9; i++) {
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_obj_create(cont);
        /*Stretch the cell horizontally and vertically too
         *Set span to 1 to make the cell 1 column/row sized*/
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%d,%d", col, row);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Demonstrate RTL direction on grid
#
col_dsc = [60, 60, 60, lv.GRID_TEMPLATE_LAST]
row_dsc = [40, 40, 40, lv.GRID_TEMPLATE_LAST]
```

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```
# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_style_base_dir(lv.BASE_DIR.RTL,0)
cont.set_grid_dsc_array(col_dsc, row_dsc)

for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.obj(cont)
    # Stretch the cell horizontally and vertically too
    # Set span to 1 to make the cell 1 column/row sized
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)

    label = lv.label(obj)
    label.set_text("{:d},{:d}".format(col, row))
    label.center()
```

2.6 Scrolling

2.6.1 Nested scrolling

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Demonstrate how scrolling appears automatically
 */
void lv_example_scroll_1(void)
{
    /*Create an object with the new style*/
    lv_obj_t * panel = lv_obj_create(lv_scr_act());
    lv_obj_set_size(panel, 200, 200);
    lv_obj_center(panel);

    lv_obj_t * child;
    lv_obj_t * label;

    child = lv_obj_create(panel);
    lv_obj_set_pos(child, 0, 0);
    lv_obj_set_size(child, 70, 70);
    label = lv_label_create(child);
    lv_label_set_text(label, "Zero");
    lv_obj_center(label);

    child = lv_obj_create(panel);
    lv_obj_set_pos(child, 160, 80);
    lv_obj_set_size(child, 80, 80);
```

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```
    lv_obj_t * child2 = lv_btn_create(child);
    lv_obj_set_size(child2, 100, 50);

    label = lv_label_create(child2);
    lv_label_set_text(label, "Right");
    lv_obj_center(label);

    child = lv_obj_create(panel);
    lv_obj_set_pos(child, 40, 160);
    lv_obj_set_size(child, 100, 70);
    label = lv_label_create(child);
    lv_label_set_text(label, "Bottom");
    lv_obj_center(label);
}

#endif
```

```
#
# Demonstrate how scrolling appears automatically
#
# Create an object with the new style
panel = lv.obj(lv.scr_act())
panel.set_size(200, 200)
panel.center()

child = lv.obj(panel)
child.set_pos(0, 0)
label = lv.label(child)
label.set_text("Zero")
label.center()

child = lv.obj(panel)
child.set_pos(-40, 100)
label = lv.label(child)
label.set_text("Left")
label.center()

child = lv.obj(panel)
child.set_pos(90, -30)
label = lv.label(child)
label.set_text("Top")
label.center()

child = lv.obj(panel)
child.set_pos(150, 80)
label = lv.label(child)
label.set_text("Right")
label.center()

child = lv.obj(panel)
child.set_pos(60, 170)
label = lv.label(child)
label.set_text("Bottom")
label.center()
```

2.6.2 Snapping

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_FLEX

static void sw_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * sw = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        lv_obj_t * list = lv_event_get_user_data(e);

        if(lv_obj_has_state(sw, LV_STATE_CHECKED)) lv_obj_add_flag(list, LV_OBJ_FLAG_
↪SCROLL_ONE);
        else lv_obj_clear_flag(list, LV_OBJ_FLAG_SCROLL_ONE);
    }
}

/**
 * Show an example to scroll snap
 */
void lv_example_scroll_2(void)
{
    lv_obj_t * panel = lv_obj_create(lv_scr_act());
    lv_obj_set_size(panel, 280, 120);
    lv_obj_set_scroll_snap_x(panel, LV_SCROLL_SNAP_CENTER);
    lv_obj_set_flex_flow(panel, LV_FLEX_FLOW_ROW);
    lv_obj_align(panel, LV_ALIGN_CENTER, 0, 20);

    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_obj_t * btn = lv_btn_create(panel);
        lv_obj_set_size(btn, 150, lv_pct(100));

        lv_obj_t * label = lv_label_create(btn);
        if(i == 3) {
            lv_label_set_text_fmt(label, "Panel %"LV_PRIu32"\nno snap", i);
            lv_obj_clear_flag(btn, LV_OBJ_FLAG_SNAPPABLE);
        }
        else {
            lv_label_set_text_fmt(label, "Panel %"LV_PRIu32, i);
        }

        lv_obj_center(label);
    }
    lv_obj_update_snap(panel, LV_ANIM_ON);

#if LV_USE_SWITCH
    /*Switch between "One scroll" and "Normal scroll" mode*/
    lv_obj_t * sw = lv_switch_create(lv_scr_act());
    lv_obj_align(sw, LV_ALIGN_TOP_RIGHT, -20, 10);
    lv_obj_add_event(sw, sw_event_cb, LV_EVENT_ALL, panel);
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "One scroll");
    lv_obj_align_to(label, sw, LV_ALIGN_OUT_BOTTOM_MID, 0, 5);
#endif
```

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```
}

#endif
```

```python
def sw_event_cb(e,panel):

    code = e.get_code()
    sw = e.get_target_obj()

    if code == lv.EVENT.VALUE_CHANGED:

        if sw.has_state(lv.STATE.CHECKED):
            panel.add_flag(lv.obj.FLAG.SCROLL_ONE)
        else:
            panel.clear_flag(lv.obj.FLAG.SCROLL_ONE)


#
# Show an example to scroll snap
#

panel = lv.obj(lv.scr_act())
panel.set_size(280, 150)
panel.set_scroll_snap_x(lv.SCROLL_SNAP.CENTER)
panel.set_flex_flow(lv.FLEX_FLOW.ROW)
panel.center()

for i in range(10):
    btn = lv.btn(panel)
    btn.set_size(150, 100)

    label = lv.label(btn)
    if i == 3:
        label.set_text("Panel {:d}\nno snap".format(i))
        btn.clear_flag(lv.obj.FLAG.SNAPPABLE)
    else:
        label.set_text("Panel {:d}".format(i))
    label.center()

panel.update_snap(lv.ANIM.ON)


# Switch between "One scroll" and "Normal scroll" mode
sw = lv.switch(lv.scr_act())
sw.align(lv.ALIGN.TOP_RIGHT, -20, 10)
sw.add_event(lambda evt:  sw_event_cb(evt,panel), lv.EVENT.ALL, None)
label = lv.label(lv.scr_act())
label.set_text("One scroll")
label.align_to(sw, lv.ALIGN.OUT_BOTTOM_MID, 0, 5)
```

2.6.3 Floating button

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LIST

static uint32_t btn_cnt = 1;

static void float_btn_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * float_btn = lv_event_get_target(e);

    if(code == LV_EVENT_CLICKED) {
        lv_obj_t * list = lv_event_get_user_data(e);
        char buf[32];
        lv_snprintf(buf, sizeof(buf), "Track %d", (int)btn_cnt);
        lv_obj_t * list_btn = lv_list_add_btn(list, LV_SYMBOL_AUDIO, buf);
        btn_cnt++;

        lv_obj_move_foreground(float_btn);

        lv_obj_scroll_to_view(list_btn, LV_ANIM_ON);
    }
}

/**
 * Create a list with a floating button
 */
void lv_example_scroll_3(void)
{
    lv_obj_t * list = lv_list_create(lv_scr_act());
    lv_obj_set_size(list, 280, 220);
    lv_obj_center(list);

    for(btn_cnt = 1; btn_cnt <= 2; btn_cnt++) {
        char buf[32];
        lv_snprintf(buf, sizeof(buf), "Track %d", (int)btn_cnt);
        lv_list_add_btn(list, LV_SYMBOL_AUDIO, buf);
    }

    lv_obj_t * float_btn = lv_btn_create(list);
    lv_obj_set_size(float_btn, 50, 50);
    lv_obj_add_flag(float_btn, LV_OBJ_FLAG_FLOATING);
    lv_obj_align(float_btn, LV_ALIGN_BOTTOM_RIGHT, 0, -lv_obj_get_style_pad_
↪right(list, LV_PART_MAIN));
    lv_obj_add_event(float_btn, float_btn_event_cb, LV_EVENT_ALL, list);
    lv_obj_set_style_radius(float_btn, LV_RADIUS_CIRCLE, 0);
    lv_obj_set_style_bg_img_src(float_btn, LV_SYMBOL_PLUS, 0);
    lv_obj_set_style_text_font(float_btn, lv_theme_get_font_large(float_btn), 0);
}

#endif
```

```
class ScrollExample_3():
    def __init__(self):
        self.btn_cnt = 1
        #
```

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```
        # Create a list with a floating button
        #

        list = lv.list(lv.scr_act())
        list.set_size(280, 220)
        list.center()

        for btn_cnt in range(2):
            list.add_btn(lv.SYMBOL.AUDIO,"Track {:d}".format(btn_cnt))

        float_btn = lv.btn(list)
        float_btn.set_size(50, 50)
        float_btn.add_flag(lv.obj.FLAG.FLOATING)
        float_btn.align(lv.ALIGN.BOTTOM_RIGHT, 0, -list.get_style_pad_right(lv.PART.
↪MAIN))
        float_btn.add_event(lambda evt: self.float_btn_event_cb(evt,list), lv.EVENT.
↪ALL, None)
        float_btn.set_style_radius(lv.RADIUS_CIRCLE, 0)
        float_btn.set_style_bg_img_src(lv.SYMBOL.PLUS, 0)
        float_btn.set_style_text_font(lv.theme_get_font_large(float_btn), 0)

    def float_btn_event_cb(self,e,list):
        code = e.get_code()
        float_btn = e.get_target_obj()

        if code == lv.EVENT.CLICKED:
            list_btn = list.add_btn(lv.SYMBOL.AUDIO, "Track {:d}".format(self.btn_
↪cnt))
            self.btn_cnt += 1

            float_btn.move_foreground()

            list_btn.scroll_to_view(lv.ANIM.ON)

scroll_example_3 = ScrollExample_3()
```

2.6.4 Styling the scrollbars

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LIST


/**
 * Styling the scrollbars
 */
void lv_example_scroll_4(void)
{
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_set_size(obj, 200, 100);
    lv_obj_center(obj);

    lv_obj_t * label = lv_label_create(obj);
```

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```
    lv_label_set_text(label,
                      "Lorem ipsum dolor sit amet, consectetur adipiscing elit.\n"
                      "Etiam dictum, tortor vestibulum lacinia laoreet, mi neque␣
↪consectetur neque, vel mattis odio dolor egestas ligula. \n"
                      "Sed vestibulum sapien nulla, id convallis ex porttitor nec. \n"
                      "Duis et massa eu libero accumsan faucibus a in arcu. \n"
                      "Ut pulvinar odio lorem, vel tempus turpis condimentum quis.␣
↪Nam consectetur condimentum sem in auctor. \n"
                      "Sed nisl augue, venenatis in blandit et, gravida ac tortor. \n"
                      "Etiam dapibus elementum suscipit. \n"
                      "Proin mollis sollicitudin convallis. \n"
                      "Integer dapibus tempus arcu nec viverra. \n"
                      "Donec molestie nulla enim, eu interdum velit placerat quis. \n"
                      "Donec id efficitur risus, at molestie turpis. \n"
                      "Suspendisse vestibulum consectetur nunc ut commodo. \n"
                      "Fusce molestie rhoncus nisi sit amet tincidunt. \n"
                      "Suspendisse a nunc ut magna ornare volutpat.");


    /*Remove the style of scrollbar to have clean start*/
    lv_obj_remove_style(obj, NULL, LV_PART_SCROLLBAR | LV_STATE_ANY);

    /*Create a transition the animate the some properties on state change*/
    static const lv_style_prop_t props[] = {LV_STYLE_BG_OPA, LV_STYLE_WIDTH, 0};
    static lv_style_transition_dsc_t trans;
    lv_style_transition_dsc_init(&trans, props, lv_anim_path_linear, 200, 0, NULL);

    /*Create a style for the scrollbars*/
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_width(&style, 4);      /*Width of the scrollbar*/
    lv_style_set_pad_right(&style, 5);  /*Space from the parallel side*/
    lv_style_set_pad_top(&style, 5);    /*Space from the perpendicular side*/

    lv_style_set_radius(&style, 2);
    lv_style_set_bg_opa(&style, LV_OPA_70);
    lv_style_set_bg_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_border_color(&style, lv_palette_darken(LV_PALETTE_BLUE, 3));
    lv_style_set_border_width(&style, 2);
    lv_style_set_shadow_width(&style, 8);
    lv_style_set_shadow_spread(&style, 2);
    lv_style_set_shadow_color(&style, lv_palette_darken(LV_PALETTE_BLUE, 1));

    lv_style_set_transition(&style, &trans);

    /*Make the scrollbars wider and use 100% opacity when scrolled*/
    static lv_style_t style_scrolled;
    lv_style_init(&style_scrolled);
    lv_style_set_width(&style_scrolled, 8);
    lv_style_set_bg_opa(&style_scrolled, LV_OPA_COVER);

    lv_obj_add_style(obj, &style, LV_PART_SCROLLBAR);
    lv_obj_add_style(obj, &style_scrolled, LV_PART_SCROLLBAR | LV_STATE_SCROLLED);
}

#endif
```

```
#
# Styling the scrollbars
#
obj = lv.obj(lv.scr_act())
obj.set_size(200, 100)
obj.center()

label = lv.label(obj)
label.set_text(
"""
Lorem ipsum dolor sit amet, consectetur adipiscing elit.
Etiam dictum, tortor vestibulum lacinia laoreet, mi neque consectetur neque, vel␣
↪mattis odio dolor egestas ligula.
Sed vestibulum sapien nulla, id convallis ex porttitor nec.
Duis et massa eu libero accumsan faucibus a in arcu.
Ut pulvinar odio lorem, vel tempus turpis condimentum quis. Nam consectetur␣
↪condimentum sem in auctor.
Sed nisl augue, venenatis in blandit et, gravida ac tortor.
Etiam dapibus elementum suscipit.
Proin mollis sollicitudin convallis.
Integer dapibus tempus arcu nec viverra.
Donec molestie nulla enim, eu interdum velit placerat quis.
Donec id efficitur risus, at molestie turpis.
Suspendisse vestibulum consectetur nunc ut commodo.
Fusce molestie rhoncus nisi sit amet tincidunt.
Suspendisse a nunc ut magna ornare volutpat.
""")


# Remove the style of scrollbar to have clean start
obj.remove_style(None, lv.PART.SCROLLBAR | lv.STATE.ANY)

# Create a transition the animate the some properties on state change
props = [lv.STYLE.BG_OPA, lv.STYLE.WIDTH, 0]
trans = lv.style_transition_dsc_t()
trans.init(props, lv.anim_t.path_linear, 200, 0, None)

# Create a style for the scrollbars
style = lv.style_t()
style.init()
style.set_width(4)                # Width of the scrollbar
style.set_pad_right(5)            # Space from the parallel side
style.set_pad_top(5)              # Space from the perpendicular side

style.set_radius(2)
style.set_bg_opa(lv.OPA._70)
style.set_bg_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_border_color(lv.palette_darken(lv.PALETTE.BLUE, 3))
style.set_border_width(2)
style.set_shadow_width(8)
style.set_shadow_spread(2)
style.set_shadow_color(lv.palette_darken(lv.PALETTE.BLUE, 1))

style.set_transition(trans)

# Make the scrollbars wider and use 100% opacity when scrolled
style_scrolled = lv.style_t()
```

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```
style_scrolled.init()
style_scrolled.set_width(8)
style_scrolled.set_bg_opa(lv.OPA.COVER)

obj.add_style(style, lv.PART.SCROLLBAR)
obj.add_style(style_scrolled, lv.PART.SCROLLBAR | lv.STATE.SCROLLED)
```

2.6.5 Right to left scrolling

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_FONT_DEJAVU_16_PERSIAN_HEBREW


/**
 * Scrolling with Right To Left base direction
 */
void lv_example_scroll_5(void)
{
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_set_style_base_dir(obj, LV_BASE_DIR_RTL, 0);
    lv_obj_set_size(obj, 200, 100);
    lv_obj_center(obj);

    lv_obj_t * label = lv_label_create(obj);
    lv_label_set_text(label,
                      "میکروکُنترولر (به انگلیسی: Microcontroller) گونه‌ای ریزپردازنده␣
↪است که دارای حافظهٔ دسترسی تصادفی (RAM) و حافظهٔ فقط‌خواندنی (ROM)، تایمر، پورت‌های␣
↪ورودی و خروجی (I/O) و درگاه ترتیبی (Serial Port پورت سریال)، درون خود تراشه است، و␣
↪می‌تواند به تنهایی ابزارهای دیگر را کنترل کند. به عبارت دیگر یک میکروکنترلر، مدار␣
↪مجتمع کوچکی است که از یک CPU کوچک و اجزای دیگری مانند تایمر، درگاه‌های ورودی و خروجی␣
↪آنالوگ و دیجیتال و حافظه تشکیل شده‌است.");
    lv_obj_set_width(label, 400);
    lv_obj_set_style_text_font(label, &lv_font_dejavu_16_persian_hebrew, 0);

}

#endif
```

```
#
# Scrolling with Right To Left base direction
#
obj = lv.obj(lv.scr_act())
obj.set_style_base_dir(lv.BASE_DIR.RTL, 0)
obj.set_size(200, 100)
obj.center()

label = lv.label(obj)
label.set_text("میکروکُنترولر (به انگلیسی: Microcontroller) گونه‌ای ریزپردازنده است که␣
↪دارای حافظهٔ دسترسی تصادفی (RAM) و حافظهٔ فقط‌خواندنی (ROM)، تایمر، پورت‌های ورودی و␣
↪خروجی (I/O) و درگاه ترتیبی (Serial Port پورت سریال)، درون خود تراشه است، و می‌تواند␣
↪به تنهایی ابزارهای دیگر را کنترل کند. به عبارت دیگر یک میکروکنترلر، مدار مجتمع␣
↪کوچکی است که از یک CPU کوچک و اجزای دیگری مانند تایمر، درگاه‌های ورودی و خروجی␣
↪آنالوگ و دیجیتال و حافظه تشکیل شده‌است.")
```

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```
label.set_width(400)
label.set_style_text_font(lv.font_dejavu_16_persian_hebrew, 0)
```

2.6.6 Translate on scroll

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_FLEX

static void scroll_event_cb(lv_event_t * e)
{
    lv_obj_t * cont = lv_event_get_target(e);

    lv_area_t cont_a;
    lv_obj_get_coords(cont, &cont_a);
    lv_coord_t cont_y_center = cont_a.y1 + lv_area_get_height(&cont_a) / 2;

    lv_coord_t r = lv_obj_get_height(cont) * 7 / 10;
    uint32_t i;
    uint32_t child_cnt = lv_obj_get_child_cnt(cont);
    for(i = 0; i < child_cnt; i++) {
        lv_obj_t * child = lv_obj_get_child(cont, i);
        lv_area_t child_a;
        lv_obj_get_coords(child, &child_a);

        lv_coord_t child_y_center = child_a.y1 + lv_area_get_height(&child_a) / 2;

        lv_coord_t diff_y = child_y_center - cont_y_center;
        diff_y = LV_ABS(diff_y);

        /*Get the x of diff_y on a circle.*/
        lv_coord_t x;
        /*If diff_y is out of the circle use the last point of the circle (the␣
↪radius)*/
        if(diff_y >= r) {
            x = r;
        }
        else {
            /*Use Pythagoras theorem to get x from radius and y*/
            uint32_t x_sqr = r * r - diff_y * diff_y;
            lv_sqrt_res_t res;
            lv_sqrt(x_sqr, &res, 0x8000);   /*Use lvgl's built in sqrt root function*/
            x = r - res.i;
        }

        /*Translate the item by the calculated X coordinate*/
        lv_obj_set_style_translate_x(child, x, 0);

        /*Use some opacity with larger translations*/
        lv_opa_t opa = lv_map(x, 0, r, LV_OPA_TRANSP, LV_OPA_COVER);
        lv_obj_set_style_opa(child, LV_OPA_COVER - opa, 0);
    }
}
```

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```
/**
 * Translate the object as they scroll
 */
void lv_example_scroll_6(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 200, 200);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_COLUMN);
    lv_obj_add_event(cont, scroll_event_cb, LV_EVENT_SCROLL, NULL);
    lv_obj_set_style_radius(cont, LV_RADIUS_CIRCLE, 0);
    lv_obj_set_style_clip_corner(cont, true, 0);
    lv_obj_set_scroll_dir(cont, LV_DIR_VER);
    lv_obj_set_scroll_snap_y(cont, LV_SCROLL_SNAP_CENTER);
    lv_obj_set_scrollbar_mode(cont, LV_SCROLLBAR_MODE_OFF);

    uint32_t i;
    for(i = 0; i < 20; i++) {
        lv_obj_t * btn = lv_btn_create(cont);
        lv_obj_set_width(btn, lv_pct(100));

        lv_obj_t * label = lv_label_create(btn);
        lv_label_set_text_fmt(label, "Button %"LV_PRIu32, i);
    }

    /*Update the buttons position manually for first*/
    lv_obj_send_event(cont, LV_EVENT_SCROLL, NULL);

    /*Be sure the fist button is in the middle*/
    lv_obj_scroll_to_view(lv_obj_get_child(cont, 0), LV_ANIM_OFF);
}

#endif
```

```
def scroll_event_cb(e):

    cont = e.get_target_obj()

    cont_a = lv.area_t()
    cont.get_coords(cont_a)
    cont_y_center = cont_a.y1 + cont_a.get_height() // 2

    r = cont.get_height() * 7 // 10

    child_cnt = cont.get_child_cnt()
    for i in range(child_cnt):
        child = cont.get_child(i)
        child_a = lv.area_t()
        child.get_coords(child_a)

        child_y_center = child_a.y1 + child_a.get_height() // 2

        diff_y = child_y_center - cont_y_center
        diff_y = abs(diff_y)

        # Get the x of diff_y on a circle.
```

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```
        # If diff_y is out of the circle use the last point of the circle (the radius)
        if diff_y >= r:
            x = r
        else:
            # Use Pythagoras theorem to get x from radius and y
            x_sqr = r * r - diff_y * diff_y
            res = lv.sqrt_res_t()
            lv.sqrt(x_sqr, res, 0x8000)   # Use lvgl's built in sqrt root function
            x = r - res.i

        # Translate the item by the calculated X coordinate
        child.set_style_translate_x(x, 0)

        # Use some opacity with larger translations
        opa = lv.map(x, 0, r, lv.OPA.TRANSP, lv.OPA.COVER)
        child.set_style_opa(lv.OPA.COVER - opa, 0)

#
# Translate the object as they scroll
#

cont = lv.obj(lv.scr_act())
cont.set_size(200, 200)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.COLUMN)
cont.add_event(scroll_event_cb, lv.EVENT.SCROLL, None)
cont.set_style_radius(lv.RADIUS_CIRCLE, 0)
cont.set_style_clip_corner(True, 0)
cont.set_scroll_dir(lv.DIR.VER)
cont.set_scroll_snap_y(lv.SCROLL_SNAP.CENTER)
cont.set_scrollbar_mode(lv.SCROLLBAR_MODE.OFF)

for i in range(20):
    btn = lv.btn(cont)
    btn.set_width(lv.pct(100))

    label = lv.label(btn)
    label.set_text("Button " + str(i))

    # Update the buttons position manually for first*
    cont.send_event(lv.EVENT.SCROLL, None)

    # Be sure the fist button is in the middle
    #lv.obj.scroll_to_view(cont.get_child(0), lv.ANIM.OFF)
    cont.get_child(0).scroll_to_view(lv.ANIM.OFF)
```

2.7 Widgets

2.7.1 Base object

Base objects with custom styles

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES

void lv_example_obj_1(void)
{
    lv_obj_t * obj1;
    obj1 = lv_obj_create(lv_scr_act());
    lv_obj_set_size(obj1, 100, 50);
    lv_obj_align(obj1, LV_ALIGN_CENTER, -60, -30);

    static lv_style_t style_shadow;
    lv_style_init(&style_shadow);
    lv_style_set_shadow_width(&style_shadow, 10);
    lv_style_set_shadow_spread(&style_shadow, 5);
    lv_style_set_shadow_color(&style_shadow, lv_palette_main(LV_PALETTE_BLUE));

    lv_obj_t * obj2;
    obj2 = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj2, &style_shadow, 0);
    lv_obj_align(obj2, LV_ALIGN_CENTER, 60, 30);
}
#endif
```

```
obj1 = lv.obj(lv.scr_act())
obj1.set_size(100, 50)
obj1.align(lv.ALIGN.CENTER, -60, -30)

style_shadow = lv.style_t()
style_shadow.init()
style_shadow.set_shadow_width(10)
style_shadow.set_shadow_spread(5)
style_shadow.set_shadow_color(lv.palette_main(lv.PALETTE.BLUE))

obj2 = lv.obj(lv.scr_act())
obj2.add_style(style_shadow, 0)
obj2.align(lv.ALIGN.CENTER, 60, 30)
```

Make an object draggable

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES

static void drag_event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
```

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```
    lv_indev_t * indev = lv_indev_get_act();
    if(indev == NULL)  return;

    lv_point_t vect;
    lv_indev_get_vect(indev, &vect);

    lv_coord_t x = lv_obj_get_x(obj) + vect.x;
    lv_coord_t y = lv_obj_get_y(obj) + vect.y;
    lv_obj_set_pos(obj, x, y);
}


/**
 * Make an object dragable.
 */
void lv_example_obj_2(void)
{
    lv_obj_t * obj;
    obj = lv_obj_create(lv_scr_act());
    lv_obj_set_size(obj, 150, 100);
    lv_obj_add_event(obj, drag_event_handler, LV_EVENT_PRESSING, NULL);

    lv_obj_t * label = lv_label_create(obj);
    lv_label_set_text(label, "Drag me");
    lv_obj_center(label);

}
#endif
```

```
def drag_event_handler(e):

    obj = e.get_target_obj()

    indev = lv.indev_get_act()

    vect = lv.point_t()
    indev.get_vect(vect)
    x = obj.get_x() + vect.x
    y = obj.get_y() + vect.y
    obj.set_pos(x, y)


#
# Make an object dragable.
#

obj = lv.obj(lv.scr_act())
obj.set_size(150, 100)
obj.add_event(drag_event_handler, lv.EVENT.PRESSING, None)

label = lv.label(obj)
label.set_text("Drag me")
label.center()
```

2.7.2 Arc

Simple Arc

```c
#include "../../lv_examples.h"

#if LV_USE_ARC && LV_BUILD_EXAMPLES

static void value_changed_event_cb(lv_event_t * e);

void lv_example_arc_1(void)
{
    lv_obj_t * label = lv_label_create(lv_scr_act());

    /*Create an Arc*/
    lv_obj_t * arc = lv_arc_create(lv_scr_act());
    lv_obj_set_size(arc, 150, 150);
    lv_arc_set_rotation(arc, 135);
    lv_arc_set_bg_angles(arc, 0, 270);
    lv_arc_set_value(arc, 10);
    lv_obj_center(arc);
    lv_obj_add_event(arc, value_changed_event_cb, LV_EVENT_VALUE_CHANGED, label);

    /*Manually update the label for the first time*/
    lv_obj_send_event(arc, LV_EVENT_VALUE_CHANGED, NULL);
}

static void value_changed_event_cb(lv_event_t * e)
{
    lv_obj_t * arc = lv_event_get_target(e);
    lv_obj_t * label = lv_event_get_user_data(e);

    lv_label_set_text_fmt(label, "%d%%", lv_arc_get_value(arc));

    /*Rotate the label to the current position of the arc*/
    lv_arc_rotate_obj_to_angle(arc, label, 25);
}

#endif
```

```python
# Create an Arc
arc = lv.arc(lv.scr_act())
arc.set_end_angle(200)
arc.set_size(150, 150)
arc.center()
```

Loader with Arc

```
#include "../../lv_examples.h"

#if LV_USE_ARC && LV_BUILD_EXAMPLES

static void set_angle(void * obj, int32_t v)
{
    lv_arc_set_value(obj, v);
}

/**
 * Create an arc which acts as a loader.
 */
void lv_example_arc_2(void)
{
    /*Create an Arc*/
    lv_obj_t * arc = lv_arc_create(lv_scr_act());
    lv_arc_set_rotation(arc, 270);
    lv_arc_set_bg_angles(arc, 0, 360);
    lv_obj_remove_style(arc, NULL, LV_PART_KNOB);   /*Be sure the knob is not␣
↪displayed*/
    lv_obj_clear_flag(arc, LV_OBJ_FLAG_CLICKABLE);  /*To not allow adjusting by␣
↪click*/
    lv_obj_center(arc);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, arc);
    lv_anim_set_exec_cb(&a, set_angle);
    lv_anim_set_time(&a, 1000);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);    /*Just for the demo*/
    lv_anim_set_repeat_delay(&a, 500);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_start(&a);



}

#endif
```

```
#
# An `lv_timer` to call periodically to set the angles of the arc
#
class ArcLoader():
    def __init__(self):
        self.a = 270

    def arc_loader_cb(self,tim,arc):
        # print(tim,arc)
        self.a += 5

        arc.set_end_angle(self.a)

        if self.a >= 270 + 360:
            tim._del()
```

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```
#
# Create an arc which acts as a loader.
#

# Create an Arc
arc = lv.arc(lv.scr_act())
arc.set_bg_angles(0, 360)
arc.set_angles(270, 270)
arc.center()

# create the loader
arc_loader = ArcLoader()

# Create an `lv_timer` to update the arc.

timer = lv.timer_create_basic()
timer.set_period(20)
timer.set_cb(lambda src: arc_loader.arc_loader_cb(timer,arc))
```

2.7.3 Bar

Simple Bar

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

void lv_example_bar_1(void)
{
    lv_obj_t * bar1 = lv_bar_create(lv_scr_act());
    lv_obj_set_size(bar1, 200, 20);
    lv_obj_center(bar1);
    lv_bar_set_value(bar1, 70, LV_ANIM_OFF);
}

#endif
```

```
bar1 = lv.bar(lv.scr_act())
bar1.set_size(200, 20)
bar1.center()
bar1.set_value(70, lv.ANIM.OFF)
```

Styling a bar

```c
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

/**
 * Example of styling the bar
 */
void lv_example_bar_2(void)
{
    static lv_style_t style_bg;
    static lv_style_t style_indic;

    lv_style_init(&style_bg);
    lv_style_set_border_color(&style_bg, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_border_width(&style_bg, 2);
    lv_style_set_pad_all(&style_bg, 6); /*To make the indicator smaller*/
    lv_style_set_radius(&style_bg, 6);
    lv_style_set_anim_time(&style_bg, 1000);

    lv_style_init(&style_indic);
    lv_style_set_bg_opa(&style_indic, LV_OPA_COVER);
    lv_style_set_bg_color(&style_indic, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_radius(&style_indic, 3);

    lv_obj_t * bar = lv_bar_create(lv_scr_act());
    lv_obj_remove_style_all(bar);  /*To have a clean start*/
    lv_obj_add_style(bar, &style_bg, 0);
    lv_obj_add_style(bar, &style_indic, LV_PART_INDICATOR);

    lv_obj_set_size(bar, 200, 20);
    lv_obj_center(bar);
    lv_bar_set_value(bar, 100, LV_ANIM_ON);
}

#endif
```

```python
#
# Example of styling the bar
#
style_bg = lv.style_t()
style_indic = lv.style_t()

style_bg.init()
style_bg.set_border_color(lv.palette_main(lv.PALETTE.BLUE))
style_bg.set_border_width(2)
style_bg.set_pad_all(6)            # To make the indicator smaller
style_bg.set_radius(6)
style_bg.set_anim_time(1000)

style_indic.init()
style_indic.set_bg_opa(lv.OPA.COVER)
style_indic.set_bg_color(lv.palette_main(lv.PALETTE.BLUE))
style_indic.set_radius(3)

bar = lv.bar(lv.scr_act())
bar.remove_style_all()   # To have a clean start
```

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```
bar.add_style(style_bg, 0)
bar.add_style(style_indic, lv.PART.INDICATOR)

bar.set_size(200, 20)
bar.center()
bar.set_value(100, lv.ANIM.ON)
```

Temperature meter

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

static void set_temp(void * bar, int32_t temp)
{
    lv_bar_set_value(bar, temp, LV_ANIM_ON);
}

/**
 * A temperature meter example
 */
void lv_example_bar_3(void)
{
    static lv_style_t style_indic;

    lv_style_init(&style_indic);
    lv_style_set_bg_opa(&style_indic, LV_OPA_COVER);
    lv_style_set_bg_color(&style_indic, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_bg_grad_color(&style_indic, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_bg_grad_dir(&style_indic, LV_GRAD_DIR_VER);

    lv_obj_t * bar = lv_bar_create(lv_scr_act());
    lv_obj_add_style(bar, &style_indic, LV_PART_INDICATOR);
    lv_obj_set_size(bar, 20, 200);
    lv_obj_center(bar);
    lv_bar_set_range(bar, -20, 40);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_exec_cb(&a, set_temp);
    lv_anim_set_time(&a, 3000);
    lv_anim_set_playback_time(&a, 3000);
    lv_anim_set_var(&a, bar);
    lv_anim_set_values(&a, -20, 40);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);
}


#endif
```

```
def set_temp(bar, temp):
    bar.set_value(temp, lv.ANIM.ON)
```

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```
#
# A temperature meter example
#


style_indic = lv.style_t()

style_indic.init()
style_indic.set_bg_opa(lv.OPA.COVER)
style_indic.set_bg_color(lv.palette_main(lv.PALETTE.RED))
style_indic.set_bg_grad_color(lv.palette_main(lv.PALETTE.BLUE))
style_indic.set_bg_grad_dir(lv.GRAD_DIR.VER)

bar = lv.bar(lv.scr_act())
bar.add_style(style_indic, lv.PART.INDICATOR)
bar.set_size(20, 200)
bar.center()
bar.set_range(-20, 40)

a = lv.anim_t()
a.init()
a.set_time(3000)
a.set_playback_time(3000)
a.set_var(bar)
a.set_values(-20, 40)
a.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a.set_custom_exec_cb(lambda a, val: set_temp(bar,val))
lv.anim_t.start(a)
```

Stripe pattern and range value

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

/**
 * Bar with stripe pattern and ranged value
 */
void lv_example_bar_4(void)
{
    LV_IMG_DECLARE(img_skew_strip);
    static lv_style_t style_indic;

    lv_style_init(&style_indic);
    lv_style_set_bg_img_src(&style_indic, &img_skew_strip);
    lv_style_set_bg_img_tiled(&style_indic, true);
    lv_style_set_bg_img_opa(&style_indic, LV_OPA_30);

    lv_obj_t * bar = lv_bar_create(lv_scr_act());
    lv_obj_add_style(bar, &style_indic, LV_PART_INDICATOR);

    lv_obj_set_size(bar, 260, 20);
    lv_obj_center(bar);
    lv_bar_set_mode(bar, LV_BAR_MODE_RANGE);
    lv_bar_set_value(bar, 90, LV_ANIM_OFF);
```

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```
    lv_bar_set_start_value(bar, 20, LV_ANIM_OFF);
}

#endif
```

```
#
# get an icon
#
def get_icon(filename,xres,yres):
    try:
        sdl_filename = "../../assets/" + filename + "_" + str(xres) + "x" + str(yres)␣
↪+ "_argb8888.fnt"
        print("file name: ", sdl_filename)
        with open(sdl_filename,'rb') as f:
            icon_data = f.read()
    except:
        print("Could not find image file: " + filename)
        return None

    icon_dsc = lv.img_dsc_t(
        {
            "header": {"always_zero": 0, "w": xres, "h": yres, "cf": lv.COLOR_FORMAT.
↪NATIVE_ALPHA},
            "data": icon_data,
            "data_size": len(icon_data),
        }
    )
    return icon_dsc

#
# Bar with stripe pattern and ranged value
#

img_skew_strip_dsc = get_icon("img_skew_strip",80,20)
style_indic = lv.style_t()

style_indic.init()
style_indic.set_bg_img_src(img_skew_strip_dsc)
style_indic.set_bg_img_tiled(True)
style_indic.set_bg_img_opa(lv.OPA._30)

bar = lv.bar(lv.scr_act())
bar.add_style(style_indic, lv.PART.INDICATOR)

bar.set_size(260, 20)
bar.center()
bar.set_mode(lv.bar.MODE.RANGE)
bar.set_value(90, lv.ANIM.OFF)
bar.set_start_value(20, lv.ANIM.OFF)
```

Bar with LTR and RTL base direction

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

/**
 * Bar with LTR and RTL base direction
 */
void lv_example_bar_5(void)
{
    lv_obj_t * label;


    lv_obj_t * bar_ltr = lv_bar_create(lv_scr_act());
    lv_obj_set_size(bar_ltr, 200, 20);
    lv_bar_set_value(bar_ltr, 70, LV_ANIM_OFF);
    lv_obj_align(bar_ltr, LV_ALIGN_CENTER, 0, -30);

    label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Left to Right base direction");
    lv_obj_align_to(label, bar_ltr, LV_ALIGN_OUT_TOP_MID, 0, -5);

    lv_obj_t * bar_rtl = lv_bar_create(lv_scr_act());
    lv_obj_set_style_base_dir(bar_rtl, LV_BASE_DIR_RTL, 0);
    lv_obj_set_size(bar_rtl, 200, 20);
    lv_bar_set_value(bar_rtl, 70, LV_ANIM_OFF);
    lv_obj_align(bar_rtl, LV_ALIGN_CENTER, 0, 30);

    label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Right to Left base direction");
    lv_obj_align_to(label, bar_rtl, LV_ALIGN_OUT_TOP_MID, 0, -5);
}

#endif
```

```
#
# Bar with LTR and RTL base direction
#

bar_ltr = lv.bar(lv.scr_act())
bar_ltr.set_size(200, 20)
bar_ltr.set_value(70, lv.ANIM.OFF)
bar_ltr.align(lv.ALIGN.CENTER, 0, -30)

label = lv.label(lv.scr_act())
label.set_text("Left to Right base direction")
label.align_to(bar_ltr, lv.ALIGN.OUT_TOP_MID, 0, -5)

bar_rtl = lv.bar(lv.scr_act())
bar_rtl.set_style_base_dir(lv.BASE_DIR.RTL,0)
bar_rtl.set_size(200, 20)
bar_rtl.set_value(70, lv.ANIM.OFF)
bar_rtl.align(lv.ALIGN.CENTER, 0, 30)

label = lv.label(lv.scr_act())
label.set_text("Right to Left base direction")
label.align_to(bar_rtl, lv.ALIGN.OUT_TOP_MID, 0, -5)
```

Custom drawer to show the current value

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

static void set_value(void * bar, int32_t v)
{
    lv_bar_set_value(bar, v, LV_ANIM_OFF);
}

static void event_cb(lv_event_t * e)
{
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->part != LV_PART_INDICATOR) return;

    lv_obj_t * obj = lv_event_get_target(e);

    lv_draw_label_dsc_t label_dsc;
    lv_draw_label_dsc_init(&label_dsc);
    label_dsc.font = LV_FONT_DEFAULT;

    char buf[8];
    lv_snprintf(buf, sizeof(buf), "%d", (int)lv_bar_get_value(obj));

    lv_point_t txt_size;
    lv_txt_get_size(&txt_size, buf, label_dsc.font, label_dsc.letter_space, label_dsc.
↪line_space, LV_COORD_MAX,
                    label_dsc.flag);

    lv_area_t txt_area;
    /*If the indicator is long enough put the text inside on the right*/
    if(lv_area_get_width(dsc->draw_area) > txt_size.x + 20) {
        txt_area.x2 = dsc->draw_area->x2 - 5;
        txt_area.x1 = txt_area.x2 - txt_size.x + 1;
        label_dsc.color = lv_color_white();
    }
    /*If the indicator is still short put the text out of it on the right*/
    else {
        txt_area.x1 = dsc->draw_area->x2 + 5;
        txt_area.x2 = txt_area.x1 + txt_size.x - 1;
        label_dsc.color = lv_color_black();
    }

    txt_area.y1 = dsc->draw_area->y1 + (lv_area_get_height(dsc->draw_area) - txt_size.
↪y) / 2;
    txt_area.y2 = txt_area.y1 + txt_size.y - 1;

    lv_draw_label(dsc->draw_ctx, &label_dsc, &txt_area, buf, NULL);
}

/**
 * Custom drawer on the bar to display the current value
 */
void lv_example_bar_6(void)
{
    lv_obj_t * bar = lv_bar_create(lv_scr_act());
    lv_obj_add_event(bar, event_cb, LV_EVENT_DRAW_PART_END, NULL);
```

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```
    lv_obj_set_size(bar, 200, 20);
    lv_obj_center(bar);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, bar);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_set_exec_cb(&a, set_value);
    lv_anim_set_time(&a, 2000);
    lv_anim_set_playback_time(&a, 2000);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);

}

#endif
```

```
def set_value(bar, v):
    bar.set_value(v, lv.ANIM.OFF)

def event_cb(e):
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    if dsc.part != lv.PART.INDICATOR:
        return

    obj= e.get_target_obj()

    label_dsc = lv.draw_label_dsc_t()
    label_dsc.init()
    # label_dsc.font = LV_FONT_DEFAULT;

    value_txt = str(obj.get_value())
    txt_size = lv.point_t()
    lv.txt_get_size(txt_size, value_txt, label_dsc.font, label_dsc.letter_space,␣
↪label_dsc.line_space, lv.COORD.MAX, label_dsc.flag)

    txt_area = lv.area_t()
    # If the indicator is long enough put the text inside on the right
    if dsc.draw_area.get_width() > txt_size.x + 20:
        txt_area.x2 = dsc.draw_area.x2 - 5
        txt_area.x1 = txt_area.x2 - txt_size.x + 1
        label_dsc.color = lv.color_white()
    # If the indicator is still short put the text out of it on the right*/
    else:
        txt_area.x1 = dsc.draw_area.x2 + 5
        txt_area.x2 = txt_area.x1 + txt_size.x - 1
        label_dsc.color = lv.color_black()

    txt_area.y1 = dsc.draw_area.y1 + (dsc.draw_area.get_height() - txt_size.y) // 2
    txt_area.y2 = txt_area.y1 + txt_size.y - 1

    dsc.draw_ctx.label(label_dsc, txt_area, value_txt, None)

#
# Custom drawer on the bar to display the current value
#
```

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```
bar = lv.bar(lv.scr_act())
bar.add_event(event_cb, lv.EVENT.DRAW_PART_END, None)
bar.set_size(200, 20)
bar.center()

a = lv.anim_t()
a.init()
a.set_var(bar)
a.set_values(0, 100)
a.set_custom_exec_cb(lambda a,val: set_value(bar,val))
a.set_time(2000)
a.set_playback_time(2000)
a.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
lv.anim_t.start(a)
```

2.7.4 Button

Simple Buttons

```
#include "../../lv_examples.h"
#if LV_USE_BTN && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);

    if(code == LV_EVENT_CLICKED) {
        LV_LOG_USER("Clicked");
    }
    else if(code == LV_EVENT_VALUE_CHANGED) {
        LV_LOG_USER("Toggled");
    }
}

void lv_example_btn_1(void)
{
    lv_obj_t * label;

    lv_obj_t * btn1 = lv_btn_create(lv_scr_act());
    lv_obj_add_event(btn1, event_handler, LV_EVENT_ALL, NULL);
    lv_obj_align(btn1, LV_ALIGN_CENTER, 0, -40);

    label = lv_label_create(btn1);
    lv_label_set_text(label, "Button");
    lv_obj_center(label);

    lv_obj_t * btn2 = lv_btn_create(lv_scr_act());
    lv_obj_add_event(btn2, event_handler, LV_EVENT_ALL, NULL);
    lv_obj_align(btn2, LV_ALIGN_CENTER, 0, 40);
    lv_obj_add_flag(btn2, LV_OBJ_FLAG_CHECKABLE);
    lv_obj_set_height(btn2, LV_SIZE_CONTENT);
```

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```
    label = lv_label_create(btn2);
    lv_label_set_text(label, "Toggle");
    lv_obj_center(label);
}
#endif
```

```
def event_handler(evt):
    code = evt.get_code()

    if code == lv.EVENT.CLICKED:
            print("Clicked event seen")
    elif code == lv.EVENT.VALUE_CHANGED:
        print("Value changed seen")

# create a simple button
btn1 = lv.btn(lv.scr_act())

# attach the callback
btn1.add_event(event_handler,lv.EVENT.ALL, None)

btn1.align(lv.ALIGN.CENTER,0,-40)
label=lv.label(btn1)
label.set_text("Button")

# create a toggle button
btn2 = lv.btn(lv.scr_act())

# attach the callback
#btn2.add_event(event_handler,lv.EVENT.VALUE_CHANGED,None)
btn2.add_event(event_handler,lv.EVENT.ALL, None)

btn2.align(lv.ALIGN.CENTER,0,40)
btn2.add_flag(lv.obj.FLAG.CHECKABLE)
btn2.set_height(lv.SIZE_CONTENT)

label=lv.label(btn2)
label.set_text("Toggle")
label.center()
```

Styling buttons

```
#include "../../lv_examples.h"
#if LV_USE_BTN && LV_BUILD_EXAMPLES

/**
 * Style a button from scratch
 */
void lv_example_btn_2(void)
{
    /*Init the style for the default state*/
    static lv_style_t style;
    lv_style_init(&style);

    lv_style_set_radius(&style, 3);
```

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```
    lv_style_set_bg_opa(&style, LV_OPA_100);
    lv_style_set_bg_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_bg_grad_color(&style, lv_palette_darken(LV_PALETTE_BLUE, 2));
    lv_style_set_bg_grad_dir(&style, LV_GRAD_DIR_VER);

    lv_style_set_border_opa(&style, LV_OPA_40);
    lv_style_set_border_width(&style, 2);
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_GREY));

    lv_style_set_shadow_width(&style, 8);
    lv_style_set_shadow_color(&style, lv_palette_main(LV_PALETTE_GREY));
    lv_style_set_shadow_ofs_y(&style, 8);

    lv_style_set_outline_opa(&style, LV_OPA_COVER);
    lv_style_set_outline_color(&style, lv_palette_main(LV_PALETTE_BLUE));

    lv_style_set_text_color(&style, lv_color_white());
    lv_style_set_pad_all(&style, 10);

    /*Init the pressed style*/
    static lv_style_t style_pr;
    lv_style_init(&style_pr);

    /*Add a large outline when pressed*/
    lv_style_set_outline_width(&style_pr, 30);
    lv_style_set_outline_opa(&style_pr, LV_OPA_TRANSP);

    lv_style_set_translate_y(&style_pr, 5);
    lv_style_set_shadow_ofs_y(&style_pr, 3);
    lv_style_set_bg_color(&style_pr, lv_palette_darken(LV_PALETTE_BLUE, 2));
    lv_style_set_bg_grad_color(&style_pr, lv_palette_darken(LV_PALETTE_BLUE, 4));

    /*Add a transition to the outline*/
    static lv_style_transition_dsc_t trans;
    static lv_style_prop_t props[] = {LV_STYLE_OUTLINE_WIDTH, LV_STYLE_OUTLINE_OPA, 0}
↪;
    lv_style_transition_dsc_init(&trans, props, lv_anim_path_linear, 300, 0, NULL);

    lv_style_set_transition(&style_pr, &trans);

    lv_obj_t * btn1 = lv_btn_create(lv_scr_act());
    lv_obj_remove_style_all(btn1);                          /*Remove the style coming␣
↪from the theme*/
    lv_obj_add_style(btn1, &style, 0);
    lv_obj_add_style(btn1, &style_pr, LV_STATE_PRESSED);
    lv_obj_set_size(btn1, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_center(btn1);

    lv_obj_t * label = lv_label_create(btn1);
    lv_label_set_text(label, "Button");
    lv_obj_center(label);
}
#endif
```

```
#
# Style a button from scratch
#

# Init the style for the default state
style = lv.style_t()
style.init()

style.set_radius(3)

style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_bg_grad_color(lv.palette_darken(lv.PALETTE.BLUE, 2))
style.set_bg_grad_dir(lv.GRAD_DIR.VER)

style.set_border_opa(lv.OPA._40)
style.set_border_width(2)
style.set_border_color(lv.palette_main(lv.PALETTE.GREY))

style.set_shadow_width(8)
style.set_shadow_color(lv.palette_main(lv.PALETTE.GREY))
style.set_shadow_ofs_y(8)

style.set_outline_opa(lv.OPA.COVER)
style.set_outline_color(lv.palette_main(lv.PALETTE.BLUE))

style.set_text_color(lv.color_white())
style.set_pad_all(10)

# Init the pressed style
style_pr = lv.style_t()
style_pr.init()

# Add a large outline when pressed
style_pr.set_outline_width(30)
style_pr.set_outline_opa(lv.OPA.TRANSP)

style_pr.set_translate_y(5)
style_pr.set_shadow_ofs_y(3)
style_pr.set_bg_color(lv.palette_darken(lv.PALETTE.BLUE, 2))
style_pr.set_bg_grad_color(lv.palette_darken(lv.PALETTE.BLUE, 4))

# Add a transition to the outline
trans = lv.style_transition_dsc_t()
props = [lv.STYLE.OUTLINE_WIDTH, lv.STYLE.OUTLINE_OPA, 0]
trans.init(props, lv.anim_t.path_linear, 300, 0, None)

style_pr.set_transition(trans)

btn1 = lv.btn(lv.scr_act())
btn1.remove_style_all()                          # Remove the style coming from the␣
↪theme
btn1.add_style(style, 0)
btn1.add_style(style_pr, lv.STATE.PRESSED)
btn1.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
btn1.center()
```

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```
label = lv.label(btn1)
label.set_text("Button")
label.center()
```

Gummy button

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_BTN

/**
 * Create a style transition on a button to act like a gum when clicked
 */
void lv_example_btn_3(void)
{
    /*Properties to transition*/
    static lv_style_prop_t props[] = {
        LV_STYLE_TRANSFORM_WIDTH, LV_STYLE_TRANSFORM_HEIGHT, LV_STYLE_TEXT_LETTER_
↪SPACE, 0
    };

    /*Transition descriptor when going back to the default state.
     *Add some delay to be sure the press transition is visible even if the press was␣
↪very short*/
    static lv_style_transition_dsc_t transition_dsc_def;
    lv_style_transition_dsc_init(&transition_dsc_def, props, lv_anim_path_overshoot,␣
↪250, 100, NULL);

    /*Transition descriptor when going to pressed state.
     *No delay, go to presses state immediately*/
    static lv_style_transition_dsc_t transition_dsc_pr;
    lv_style_transition_dsc_init(&transition_dsc_pr, props, lv_anim_path_ease_in_out,␣
↪250, 0, NULL);

    /*Add only the new transition to he default state*/
    static lv_style_t style_def;
    lv_style_init(&style_def);
    lv_style_set_transition(&style_def, &transition_dsc_def);

    /*Add the transition and some transformation to the presses state.*/
    static lv_style_t style_pr;
    lv_style_init(&style_pr);
    lv_style_set_transform_width(&style_pr, 10);
    lv_style_set_transform_height(&style_pr, -10);
    lv_style_set_text_letter_space(&style_pr, 10);
    lv_style_set_transition(&style_pr, &transition_dsc_pr);

    lv_obj_t * btn1 = lv_btn_create(lv_scr_act());
    lv_obj_align(btn1, LV_ALIGN_CENTER, 0, -80);
    lv_obj_add_style(btn1, &style_pr, LV_STATE_PRESSED);
    lv_obj_add_style(btn1, &style_def, 0);

    lv_obj_t * label = lv_label_create(btn1);
    lv_label_set_text(label, "Gum");
}
```

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```
#endif
```

```
#
# Create a style transition on a button to act like a gum when clicked
#

# Properties to transition
props = [lv.STYLE.TRANSFORM_WIDTH, lv.STYLE.TRANSFORM_HEIGHT, lv.STYLE.TEXT_LETTER_
↪SPACE, 0]

# Transition descriptor when going back to the default state.
# Add some delay to be sure the press transition is visible even if the press was␣
↪very short*/
transition_dsc_def = lv.style_transition_dsc_t()
transition_dsc_def.init(props, lv.anim_t.path_overshoot, 250, 100, None)

# Transition descriptor when going to pressed state.
# No delay, go to pressed state immediately
transition_dsc_pr = lv.style_transition_dsc_t()
transition_dsc_pr.init(props, lv.anim_t.path_ease_in_out, 250, 0, None)

# Add only the new transition to the default state
style_def = lv.style_t()
style_def.init()
style_def.set_transition(transition_dsc_def)

# Add the transition and some transformation to the presses state.
style_pr = lv.style_t()
style_pr.init()
style_pr.set_transform_width(10)
style_pr.set_transform_height(-10)
style_pr.set_text_letter_space(10)
style_pr.set_transition(transition_dsc_pr)

btn1 = lv.btn(lv.scr_act())
btn1.align(lv.ALIGN.CENTER, 0, -80)
btn1.add_style(style_pr, lv.STATE.PRESSED)
btn1.add_style(style_def, 0)

label = lv.label(btn1)
label.set_text("Gum")
```

2.7.5 Button matrix

Simple Button matrix

```
#include "../../lv_examples.h"
#if LV_USE_BTNMATRIX && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
```

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```
    if(code == LV_EVENT_VALUE_CHANGED) {
        uint32_t id = lv_btnmatrix_get_selected_btn(obj);
        const char * txt = lv_btnmatrix_get_btn_text(obj, id);
        LV_UNUSED(txt);
        LV_LOG_USER("%s was pressed\n", txt);
    }
}


static const char * btnm_map[] = {"1", "2", "3", "4", "5", "\n",
                                  "6", "7", "8", "9", "0", "\n",
                                  "Action1", "Action2", ""
                                 };

void lv_example_btnmatrix_1(void)
{
    lv_obj_t * btnm1 = lv_btnmatrix_create(lv_scr_act());
    lv_btnmatrix_set_map(btnm1, btnm_map);
    lv_btnmatrix_set_btn_width(btnm1, 10, 2);        /*Make "Action1" twice as wide␣
↪as "Action2"*/
    lv_btnmatrix_set_btn_ctrl(btnm1, 10, LV_BTNMATRIX_CTRL_CHECKABLE);
    lv_btnmatrix_set_btn_ctrl(btnm1, 11, LV_BTNMATRIX_CTRL_CHECKED);
    lv_obj_align(btnm1, LV_ALIGN_CENTER, 0, 0);
    lv_obj_add_event(btnm1, event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj  = e.get_target_obj()

    if code == lv.EVENT.VALUE_CHANGED :
        id = obj.get_selected_btn()
        txt = obj.get_btn_text(id)

        print("%s was pressed"%txt)

btnm_map = ["1", "2", "3", "4", "5", "\n",
            "6", "7", "8", "9", "0", "\n",
            "Action1", "Action2", ""]

btnm1 = lv.btnmatrix(lv.scr_act())
btnm1.set_map(btnm_map)
btnm1.set_btn_width(10, 2)        # Make "Action1" twice as wide as "Action2"
btnm1.set_btn_ctrl(10, lv.btnmatrix.CTRL.CHECKABLE)
btnm1.set_btn_ctrl(11, lv.btnmatrix.CTRL.CHECKED)
btnm1.align(lv.ALIGN.CENTER, 0, 0)
btnm1.add_event(event_handler, lv.EVENT.ALL, None)


#endif
```

Custom buttons

```
#include "../../lv_examples.h"
#if LV_USE_BTNMATRIX && LV_BUILD_EXAMPLES


static void event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_DRAW_PART_BEGIN) {
        lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);

        /*When the button matrix draws the buttons...*/
        if(dsc->class_p == &lv_btnmatrix_class && dsc->type == LV_BTNMATRIX_DRAW_PART_
↪BTN) {
            /*Change the draw descriptor of the 2nd button*/
            if(dsc->id == 1) {
                dsc->rect_dsc->radius = 0;
                if(lv_btnmatrix_get_selected_btn(obj) == dsc->id)  dsc->rect_dsc->bg_
↪color = lv_palette_darken(LV_PALETTE_BLUE, 3);
                else dsc->rect_dsc->bg_color = lv_palette_main(LV_PALETTE_BLUE);

                dsc->rect_dsc->shadow_width = 6;
                dsc->rect_dsc->shadow_ofs_x = 3;
                dsc->rect_dsc->shadow_ofs_y = 3;
                dsc->label_dsc->color = lv_color_white();
            }
            /*Change the draw descriptor of the 3rd button*/
            else if(dsc->id == 2) {
                dsc->rect_dsc->radius = LV_RADIUS_CIRCLE;
                if(lv_btnmatrix_get_selected_btn(obj) == dsc->id)  dsc->rect_dsc->bg_
↪color = lv_palette_darken(LV_PALETTE_RED, 3);
                else dsc->rect_dsc->bg_color = lv_palette_main(LV_PALETTE_RED);

                dsc->label_dsc->color = lv_color_white();
            }
            else if(dsc->id == 3) {
                dsc->label_dsc->opa = LV_OPA_TRANSP; /*Hide the text if any*/

            }
        }
    }
    if(code == LV_EVENT_DRAW_PART_END) {
        lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);

        /*When the button matrix draws the buttons...*/
        if(dsc->class_p == &lv_btnmatrix_class && dsc->type == LV_BTNMATRIX_DRAW_PART_
↪BTN) {
            /*Add custom content to the 4th button when the button itself was drawn*/
            if(dsc->id == 3) {
                LV_IMG_DECLARE(img_star);
                lv_img_header_t header;
                lv_res_t res = lv_img_decoder_get_info(&img_star, &header);
                if(res != LV_RES_OK) return;

                lv_area_t a;
```

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```
                a.x1 = dsc->draw_area->x1 + (lv_area_get_width(dsc->draw_area) -␣
↪header.w) / 2;
                a.x2 = a.x1 + header.w - 1;
                a.y1 = dsc->draw_area->y1 + (lv_area_get_height(dsc->draw_area) -␣
↪header.h) / 2;
                a.y2 = a.y1 + header.h - 1;

                lv_draw_img_dsc_t img_draw_dsc;
                lv_draw_img_dsc_init(&img_draw_dsc);
                img_draw_dsc.recolor = lv_color_black();
                if(lv_btnmatrix_get_selected_btn(obj) == dsc->id)  img_draw_dsc.
↪recolor_opa = LV_OPA_30;

                lv_draw_img(dsc->draw_ctx, &img_draw_dsc, &a, &img_star);
            }
        }
    }
}

/**
 * Add custom drawer to the button matrix to customize buttons one by one
 */
void lv_example_btnmatrix_2(void)
{
    lv_obj_t * btnm = lv_btnmatrix_create(lv_scr_act());
    lv_obj_add_event(btnm, event_cb, LV_EVENT_ALL, NULL);
    lv_obj_center(btnm);
}

#endif
```

```
# Create an image from the png file
try:
    with open('../../assets/img_star.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find star.png")
    sys.exit()

img_star_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def event_cb(e):
    code = e.get_code()
    obj = e.get_target_obj()
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    if code == lv.EVENT.DRAW_PART_BEGIN:
        # Change the draw descriptor the 2nd button
        if dsc.id == 1:
            dsc.rect_dsc.radius = 0
            if obj.get_selected_btn() == dsc.id:
                dsc.rect_dsc.bg_color = lv.palette_darken(lv.PALETTE.GREY, 3)
            else:
                dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.BLUE)
```

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```
            dsc.rect_dsc.shadow_width = 6
            dsc.rect_dsc.shadow_ofs_x = 3
            dsc.rect_dsc.shadow_ofs_y = 3
            dsc.label_dsc.color = lv.color_white()

        # Change the draw descriptor the 3rd button

        elif dsc.id == 2:
            dsc.rect_dsc.radius = lv.RADIUS_CIRCLE
            if obj.get_selected_btn() == dsc.id:
                dsc.rect_dsc.bg_color = lv.palette_darken(lv.PALETTE.RED, 3)
            else:
                dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.RED)

                dsc.label_dsc.color = lv.color_white()
        elif dsc.id == 3:
            dsc.label_dsc.opa = lv.OPA.TRANSP  # Hide the text if any

    if code == lv.EVENT.DRAW_PART_END:
        # Add custom content to the 4th button when the button itself was drawn
        if dsc.id == 3:
            # LV_IMG_DECLARE(img_star)
            header = lv.img_header_t()
            res = lv.img.decoder_get_info(img_star_argb, header)
            if res != lv.RES.OK:
                print("error when getting image header")
                return
            else:
                a = lv.area_t()
                a.x1 = dsc.draw_area.x1 + (dsc.draw_area.get_width() - header.w) // 2
                a.x2 = a.x1 + header.w - 1
                a.y1 = dsc.draw_area.y1 + (dsc.draw_area.get_height() - header.h) // 2
                a.y2 = a.y1 + header.h - 1
                img_draw_dsc = lv.draw_img_dsc_t()
                img_draw_dsc.init()
                img_draw_dsc.recolor = lv.color_black()
                if obj.get_selected_btn() == dsc.id:
                    img_draw_dsc.recolor_opa = lv.OPA._30

                dsc.draw_ctx.img(img_draw_dsc, a, img_star_argb)

#
# Add custom drawer to the button matrix to c
#
btnm = lv.btnmatrix(lv.scr_act())
btnm.add_event(event_cb, lv.EVENT.ALL, None)
btnm.center()
```

Pagination

```
#include "../../lv_examples.h"
#if LV_USE_BTNMATRIX  && LV_BUILD_EXAMPLES

static void event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    uint32_t id = lv_btnmatrix_get_selected_btn(obj);
    bool prev = id == 0 ? true : false;
    bool next = id == 6 ? true : false;
    if(prev || next) {
        /*Find the checked button*/
        uint32_t i;
        for(i = 1; i < 7; i++) {
            if(lv_btnmatrix_has_btn_ctrl(obj, i, LV_BTNMATRIX_CTRL_CHECKED)) break;
        }

        if(prev && i > 1) i--;
        else if(next && i < 5) i++;

        lv_btnmatrix_set_btn_ctrl(obj, i, LV_BTNMATRIX_CTRL_CHECKED);
    }
}

/**
 * Make a button group (pagination)
 */
void lv_example_btnmatrix_3(void)
{
    static lv_style_t style_bg;
    lv_style_init(&style_bg);
    lv_style_set_pad_all(&style_bg, 0);
    lv_style_set_pad_gap(&style_bg, 0);
    lv_style_set_clip_corner(&style_bg, true);
    lv_style_set_radius(&style_bg, LV_RADIUS_CIRCLE);
    lv_style_set_border_width(&style_bg, 0);


    static lv_style_t style_btn;
    lv_style_init(&style_btn);
    lv_style_set_radius(&style_btn, 0);
    lv_style_set_border_width(&style_btn, 1);
    lv_style_set_border_opa(&style_btn, LV_OPA_50);
    lv_style_set_border_color(&style_btn, lv_palette_main(LV_PALETTE_GREY));
    lv_style_set_border_side(&style_btn, LV_BORDER_SIDE_INTERNAL);
    lv_style_set_radius(&style_btn, 0);

    static const char * map[] = {LV_SYMBOL_LEFT, "1", "2", "3", "4", "5", LV_SYMBOL_
↪RIGHT, ""};

    lv_obj_t * btnm = lv_btnmatrix_create(lv_scr_act());
    lv_btnmatrix_set_map(btnm, map);
    lv_obj_add_style(btnm, &style_bg, 0);
    lv_obj_add_style(btnm, &style_btn, LV_PART_ITEMS);
    lv_obj_add_event(btnm, event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_obj_set_size(btnm, 225, 35);
```

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```
    /*Allow selecting on one number at time*/
    lv_btnmatrix_set_btn_ctrl_all(btnm, LV_BTNMATRIX_CTRL_CHECKABLE);
    lv_btnmatrix_clear_btn_ctrl(btnm, 0, LV_BTNMATRIX_CTRL_CHECKABLE);
    lv_btnmatrix_clear_btn_ctrl(btnm, 6, LV_BTNMATRIX_CTRL_CHECKABLE);

    lv_btnmatrix_set_one_checked(btnm, true);
    lv_btnmatrix_set_btn_ctrl(btnm, 1, LV_BTNMATRIX_CTRL_CHECKED);

    lv_obj_center(btnm);

}

#endif
```

```
def event_cb(e):
    obj = e.get_target_obj()
    id = obj.get_selected_btn()
    if id == 0:
        prev = True
    else:
        prev = False
    if id == 6:
        next = True
    else:
        next = False
    if prev or next:
        # Find the checked butto
        for i in range(7):
            if obj.has_btn_ctrl(i, lv.btnmatrix.CTRL.CHECKED):
                break
        if prev and i > 1:
            i-=1
        elif next and i < 5:
            i+=1

        obj.set_btn_ctrl(i, lv.btnmatrix.CTRL.CHECKED)

#
# Make a button group
#

style_bg = lv.style_t()
style_bg.init()
style_bg.set_pad_all(0)
style_bg.set_pad_gap(0)
style_bg.set_clip_corner(True)
style_bg.set_radius(lv.RADIUS_CIRCLE)
style_bg.set_border_width(0)


style_btn = lv.style_t()
style_btn.init()
style_btn.set_radius(0)
style_btn.set_border_width(1)
style_btn.set_border_opa(lv.OPA._50)
```

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```
style_btn.set_border_color(lv.palette_main(lv.PALETTE.GREY))
style_btn.set_border_side(lv.BORDER_SIDE.INTERNAL)
style_btn.set_radius(0)

map = [lv.SYMBOL.LEFT,"1","2", "3", "4", "5",lv.SYMBOL.RIGHT, ""]

btnm = lv.btnmatrix(lv.scr_act())
btnm.set_map(map)
btnm.add_style(style_bg, 0)
btnm.add_style(style_btn, lv.PART.ITEMS)
btnm.add_event(event_cb, lv.EVENT.VALUE_CHANGED, None)
btnm.set_size(225, 35)

# Allow selecting on one number at time
btnm.set_btn_ctrl_all(lv.btnmatrix.CTRL.CHECKABLE)
btnm.clear_btn_ctrl(0, lv.btnmatrix.CTRL.CHECKABLE)
btnm.clear_btn_ctrl(6, lv.btnmatrix.CTRL.CHECKABLE)

btnm.set_one_checked(True)
btnm.set_btn_ctrl(1, lv.btnmatrix.CTRL.CHECKED)

btnm.center()
```

2.7.6 Calendar

Calendar with header

```
#include "../../lv_examples.h"
#if LV_USE_CALENDAR && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_current_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        lv_calendar_date_t date;
        if(lv_calendar_get_pressed_date(obj, &date)) {
            LV_LOG_USER("Clicked date: %02d.%02d.%d", date.day, date.month, date.
↪year);
        }
    }
}

void lv_example_calendar_1(void)
{
    lv_obj_t  * calendar = lv_calendar_create(lv_scr_act());
    lv_obj_set_size(calendar, 185, 185);
    lv_obj_align(calendar, LV_ALIGN_CENTER, 0, 27);
    lv_obj_add_event(calendar, event_handler, LV_EVENT_ALL, NULL);

    lv_calendar_set_today_date(calendar, 2021, 02, 23);
    lv_calendar_set_showed_date(calendar, 2021, 02);
```

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```
    /*Highlight a few days*/
    static lv_calendar_date_t highlighted_days[3];       /*Only its pointer will be␣
↪saved so should be static*/
    highlighted_days[0].year = 2021;
    highlighted_days[0].month = 02;
    highlighted_days[0].day = 6;

    highlighted_days[1].year = 2021;
    highlighted_days[1].month = 02;
    highlighted_days[1].day = 11;

    highlighted_days[2].year = 2022;
    highlighted_days[2].month = 02;
    highlighted_days[2].day = 22;

    lv_calendar_set_highlighted_dates(calendar, highlighted_days, 3);

#if LV_USE_CALENDAR_HEADER_DROPDOWN
    lv_calendar_header_dropdown_create(calendar);
#elif LV_USE_CALENDAR_HEADER_ARROW
    lv_calendar_header_arrow_create(calendar);
#endif
    lv_calendar_set_showed_date(calendar, 2021, 10);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()

    if code == lv.EVENT.VALUE_CHANGED:
        source = e.get_current_target_obj()
        date = lv.calendar_date_t()
        if source.get_pressed_date(date) == lv.RES.OK:
            calendar.set_today_date(date.year, date.month, date.day)
            print("Clicked date: %02d.%02d.%02d"%(date.day, date.month, date.year))


calendar = lv.calendar(lv.scr_act())
calendar.set_size(200, 200)
calendar.align(lv.ALIGN.CENTER, 0, 20)
calendar.add_event(event_handler, lv.EVENT.ALL, None)

calendar.set_today_date(2021, 02, 23)
calendar.set_showed_date(2021, 02)

# Highlight a few days
highlighted_days=[
    lv.calendar_date_t({'year':2021, 'month':2, 'day':6}),
    lv.calendar_date_t({'year':2021, 'month':2, 'day':11}),
    lv.calendar_date_t({'year':2021, 'month':2, 'day':22})
]

calendar.set_highlighted_dates(highlighted_days, len(highlighted_days))
```

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```
lv.calendar_header_dropdown(calendar)
```

2.7.7 Canvas

Drawing on the Canvas and rotate

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES


#define CANVAS_WIDTH  200
#define CANVAS_HEIGHT  150

void lv_example_canvas_1(void)
{
    lv_draw_rect_dsc_t rect_dsc;
    lv_draw_rect_dsc_init(&rect_dsc);
    rect_dsc.radius = 10;
    rect_dsc.bg_opa = LV_OPA_COVER;
    rect_dsc.bg_grad.dir = LV_GRAD_DIR_HOR;
    rect_dsc.bg_grad.stops[0].color = lv_palette_main(LV_PALETTE_RED);
    rect_dsc.bg_grad.stops[1].color = lv_palette_main(LV_PALETTE_BLUE);
    rect_dsc.border_width = 2;
    rect_dsc.border_opa = LV_OPA_90;
    rect_dsc.border_color = lv_color_white();
    rect_dsc.shadow_width = 5;
    rect_dsc.shadow_ofs_x = 5;
    rect_dsc.shadow_ofs_y = 5;

    lv_draw_label_dsc_t label_dsc;
    lv_draw_label_dsc_init(&label_dsc);
    label_dsc.color = lv_palette_main(LV_PALETTE_ORANGE);

    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_obj_center(canvas);
    lv_canvas_fill_bg(canvas, lv_palette_lighten(LV_PALETTE_GREY, 3), LV_OPA_COVER);

    lv_canvas_draw_rect(canvas, 70, 60, 100, 70, &rect_dsc);

    lv_canvas_draw_text(canvas, 40, 20, 100, &label_dsc, "Some text on text canvas");

    /*Test the rotation. It requires another buffer where the original image is␣
↪stored.
     *So copy the current image to buffer and rotate it to the canvas*/
    static uint8_t cbuf_tmp[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_
↪HEIGHT)];
    memcpy(cbuf_tmp, cbuf, sizeof(cbuf_tmp));
    lv_img_dsc_t img;
    img.data = (void *)cbuf_tmp;
```

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```
    img.header.cf = LV_COLOR_FORMAT_NATIVE;
    img.header.w = CANVAS_WIDTH;
    img.header.h = CANVAS_HEIGHT;

    lv_canvas_fill_bg(canvas, lv_palette_lighten(LV_PALETTE_GREY, 3), LV_OPA_COVER);
    lv_canvas_transform(canvas, &img, 120, LV_ZOOM_NONE, 0, 0, CANVAS_WIDTH / 2,␣
↪CANVAS_HEIGHT / 2, true);
}

#endif
```

```
_CANVAS_WIDTH = 200
_CANVAS_HEIGHT = 150
LV_ZOOM_NONE = 256

rect_dsc = lv.draw_rect_dsc_t()
rect_dsc.init()
rect_dsc.radius = 10
rect_dsc.bg_opa = lv.OPA.COVER
rect_dsc.bg_grad.dir = lv.GRAD_DIR.HOR
rect_dsc.bg_grad.stops[0].color = lv.palette_main(lv.PALETTE.RED)
rect_dsc.bg_grad.stops[1].color = lv.palette_main(lv.PALETTE.BLUE)
rect_dsc.border_width = 2
rect_dsc.border_opa = lv.OPA._90
rect_dsc.border_color = lv.color_white()
rect_dsc.shadow_width = 5
rect_dsc.shadow_ofs_x = 5
rect_dsc.shadow_ofs_y = 5

label_dsc = lv.draw_label_dsc_t()
label_dsc.init()
label_dsc.color = lv.palette_main(lv.PALETTE.YELLOW)

cbuf = bytearray(_CANVAS_WIDTH * _CANVAS_HEIGHT * 4)

canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, _CANVAS_WIDTH, _CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.center()
canvas.fill_bg(lv.palette_lighten(lv.PALETTE.GREY, 3), lv.OPA.COVER)

canvas.draw_rect(70, 60, 100, 70, rect_dsc)
canvas.draw_text(40, 20, 100, label_dsc, "Some text on text canvas")

# Test the rotation. It requires another buffer where the original image is stored.
# So copy the current image to buffer and rotate it to the canvas

img = lv.img_dsc_t()
img.data = cbuf[:]
img.header.cf = lv.COLOR_FORMAT.NATIVE
img.header.w = _CANVAS_WIDTH
img.header.h = _CANVAS_HEIGHT

canvas.fill_bg(lv.palette_lighten(lv.PALETTE.GREY, 3), lv.OPA.COVER)
canvas.transform(img, 30, LV_ZOOM_NONE, 0, 0, _CANVAS_WIDTH // 2, _CANVAS_HEIGHT // 2,
↪ True)
```

Transparent Canvas with chroma keying

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Create a transparent canvas with Chroma keying and indexed color format (palette).
 */
void lv_example_canvas_2(void)
{
    /*Create a button to better see the transparency*/
    lv_btn_create(lv_scr_act());

    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_INDEXED_1BIT(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪I1);
    lv_canvas_set_palette(canvas, 0, lv_color_to32(LV_COLOR_CHROMA_KEY));
    lv_canvas_set_palette(canvas, 1, lv_color_to32(lv_palette_main(LV_PALETTE_RED)));

    /*Create colors with the indices of the palette*/
    lv_color_t c0;
    lv_color_t c1;

    lv_color_set_int(&c0, 0);
    lv_color_set_int(&c1, 1);

    /*Red background (There is no dedicated alpha channel in indexed images so LV_OPA_
↪COVER is ignored)*/
    lv_canvas_fill_bg(canvas, c1, LV_OPA_COVER);

    /*Create hole on the canvas*/
    uint32_t x;
    uint32_t y;
    for(y = 10; y < 30; y++) {
        for(x = 5; x < 20; x++) {
            lv_canvas_set_px(canvas, x, y, c0, LV_OPA_COVER);
        }
    }
}
#endif
```

```
import math

CANVAS_WIDTH   = 50
CANVAS_HEIGHT  = 50
LV_COLOR_CHROMA_KEY = lv.color_hex(0x00ff00)

def LV_IMG_BUF_SIZE_ALPHA_1BIT(w, h):
    return int(math.floor((w + 7) / 8 ) * h)
```

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```
def LV_IMG_BUF_SIZE_INDEXED_1BIT(w, h):
    return LV_IMG_BUF_SIZE_ALPHA_1BIT(w, h) + 4 * 2

def LV_CANVAS_BUF_SIZE_INDEXED_1BIT(w, h):
    return LV_IMG_BUF_SIZE_INDEXED_1BIT(w, h)

#
# Create a transparent canvas with Chroma keying and indexed color format (palette).
#

# Create a button to better see the transparency
btn=lv.btn(lv.scr_act())

# Create a buffer for the canvas
cbuf= bytearray(LV_CANVAS_BUF_SIZE_INDEXED_1BIT(CANVAS_WIDTH, CANVAS_HEIGHT))

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.I1)
canvas.set_palette(0, LV_COLOR_CHROMA_KEY)
canvas.set_palette(1, lv.palette_main(lv.PALETTE.RED))

# Create colors with the indices of the palette
c0 = lv.color_t()
c1 = lv.color_t()

c0.set_int(0)
c1.set_int(1)

# Red background (There is no dedicated alpha channel in indexed images so LV_OPA_
↪COVER is ignored)
canvas.fill_bg(c1, lv.OPA.COVER)

# Create hole on the canvas
for y in range(10,30):
    for x in range(5,20):
        canvas.set_px(x, y, c0, lv.OPA.COVER)
```

Draw a rectangle to the canvas

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw a rectangle to the canvas
 */
void lv_example_canvas_3(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
```

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```
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_rect_dsc_t dsc;
    lv_draw_rect_dsc_init(&dsc);
    dsc.bg_color = lv_palette_main(LV_PALETTE_RED);
    dsc.border_color = lv_palette_main(LV_PALETTE_BLUE);
    dsc.border_width = 3;
    dsc.outline_color = lv_palette_main(LV_PALETTE_GREEN);
    dsc.outline_width = 2;
    dsc.outline_pad = 2;
    dsc.outline_opa = LV_OPA_50;
    dsc.radius = 5;
    dsc.border_width = 3;
    lv_canvas_draw_rect(canvas, 10, 10, 30, 20, &dsc);


}
#endif
```

```
CANVAS_WIDTH  = 50
CANVAS_HEIGHT =  50

LV_COLOR_SIZE = 32
#
# Draw a rectangle to the canvas
#
# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette*/
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)

canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_rect_dsc_t()
dsc.init()

dsc.bg_color = lv.palette_main(lv.PALETTE.RED)
dsc.border_color = lv.palette_main(lv.PALETTE.BLUE)
dsc.border_width = 3
dsc.outline_color = lv.palette_main(lv.PALETTE.GREEN)
dsc.outline_width = 2
dsc.outline_pad = 2
dsc.outline_opa = lv.OPA._50
dsc.radius = 5
dsc.border_width = 3
canvas.draw_rect(10, 10, 30, 20, dsc)
```

Draw a label to the canvas

```c
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_FONT_MONTSERRAT_18 && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw a text to the canvas
 */
void lv_example_canvas_4(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_label_dsc_t dsc;
    lv_draw_label_dsc_init(&dsc);
    dsc.color = lv_palette_main(LV_PALETTE_RED);
    dsc.font = &lv_font_montserrat_18;
    dsc.decor = LV_TEXT_DECOR_UNDERLINE;

    lv_canvas_draw_text(canvas, 10, 10, 30, &dsc, "Hello");
}
#endif
```

```python
import fs_driver

CANVAS_WIDTH  = 50
CANVAS_HEIGHT = 50

LV_COLOR_SIZE = 32

#
# Draw a text to the canvas
#

# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_label_dsc_t()
dsc.init()

dsc.color = lv.palette_main(lv.PALETTE.RED)
```

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```python
try:
    dsc.font = lv_font_montserrat_18
except:
    # needed for dynamic font loading
    fs_drv = lv.fs_drv_t()
    fs_driver.fs_register(fs_drv, 'S')

    print("Loading font montserrat_18")
    font_montserrat_18 = lv.font_load("S:../../assets/font/montserrat-18.fnt")
    if not font_montserrat_18:
        print("Font loading failed")
    else:
        dsc.font = font_montserrat_18

dsc.decor = lv.TEXT_DECOR.UNDERLINE
print('Printing "Hello"')
canvas.draw_text(10, 10, 30, dsc, "Hello")
```

Draw an arc to the canvas

```c
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw an arc to the canvas
 */
void lv_example_canvas_5(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_arc_dsc_t dsc;
    lv_draw_arc_dsc_init(&dsc);
    dsc.color = lv_palette_main(LV_PALETTE_RED);
    dsc.width = 5;

    lv_canvas_draw_arc(canvas, 25, 25, 15, 0, 220, &dsc);
}
#endif
```

```
CANVAS_WIDTH  = 50
CANVAS_HEIGHT = 50

LV_COLOR_SIZE = 32

#
# Draw an arc to the canvas
#

# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_arc_dsc_t()
dsc.init()
dsc.color = lv.palette_main(lv.PALETTE.RED)
dsc.width = 5

canvas.draw_arc(25, 25, 15, 0, 220, dsc)
```

Draw an image to the canvas

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw an image to the canvas
 */
void lv_example_canvas_6(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_img_dsc_t dsc;
    lv_draw_img_dsc_init(&dsc);

    LV_IMG_DECLARE(img_star);
    lv_canvas_draw_img(canvas, 5, 5, &img_star, &dsc);
}
#endif
```

```
CANVAS_WIDTH  = 50
CANVAS_HEIGHT = 50

LV_COLOR_SIZE = 32

# Create an image from the png file
try:
    with open('../../assets/img_star.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find star.png")
    sys.exit()

img_star_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

#
# Draw an image to the canvas
#

# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_img_dsc_t()
dsc.init()

canvas.draw_img(5, 5, img_star_argb, dsc)
```

Draw a line to the canvas

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS&& LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw a line to the canvas
 */
void lv_example_canvas_7(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
```

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```
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_line_dsc_t dsc;
    lv_draw_line_dsc_init(&dsc);
    dsc.color = lv_palette_main(LV_PALETTE_RED);
    dsc.width = 4;
    dsc.round_end = 1;
    dsc.round_start = 1;

    lv_point_t p[] = {{15, 15}, {35, 10}, {10, 40}};
    lv_canvas_draw_line(canvas, p, 3, &dsc);
}
#endif
```

```
CANVAS_WIDTH  = 50
CANVAS_HEIGHT = 50

LV_COLOR_SIZE = 32

#
# Draw a line to the canvas
#

# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_line_dsc_t()
dsc.init()

dsc.color = lv.palette_main(lv.PALETTE.RED)
dsc.width = 4
dsc.round_end = 1
dsc.round_start = 1

p = [ {"x":15,"y":15},
      {"x":35,"y":10},
      {"x":10,"y":40} ]

canvas.draw_line(p, 3, dsc)
```

2.7.8 Chart

Line Chart

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES

void lv_example_chart_1(void)
{
    /*Create a chart*/
    lv_obj_t * chart;
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_center(chart);
    lv_chart_set_type(chart, LV_CHART_TYPE_LINE);   /*Show lines and points too*/

    /*Add two data series*/
    lv_chart_series_t * ser1 = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪RED), LV_CHART_AXIS_PRIMARY_Y);
    lv_chart_series_t * ser2 = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪GREEN), LV_CHART_AXIS_SECONDARY_Y);

    /*Set the next points on 'ser1'*/
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 30);
    lv_chart_set_next_value(chart, ser1, 70);
    lv_chart_set_next_value(chart, ser1, 90);

    /*Directly set points on 'ser2'*/
    ser2->y_points[0] = 90;
    ser2->y_points[1] = 70;
    ser2->y_points[2] = 65;
    ser2->y_points[3] = 65;
    ser2->y_points[4] = 65;
    ser2->y_points[5] = 65;
    ser2->y_points[6] = 65;
    ser2->y_points[7] = 65;
    ser2->y_points[8] = 65;
    ser2->y_points[9] = 65;

    lv_chart_refresh(chart); /*Required after direct set*/
}

#endif
```

```
# Create a chart
chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.center()
chart.set_type(lv.chart.TYPE.LINE)   # Show lines and points too

```

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```
# Add two data series
ser1 = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)
ser2 = chart.add_series(lv.palette_main(lv.PALETTE.GREEN), lv.chart.AXIS.SECONDARY_Y)
print(ser2)
# Set next points on ser1
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,30)
chart.set_next_value(ser1,70)
chart.set_next_value(ser1,90)

# Directly set points on 'ser2'
ser2.y_points = [90, 70, 65, 65, 65, 65, 65, 65, 65, 65]
chart.refresh()      #  Required after direct set
```

Faded area line chart with custom division lines

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_USE_DRAW_MASKS && LV_BUILD_EXAMPLES

static lv_obj_t * chart1;
static lv_chart_series_t * ser1;
static lv_chart_series_t * ser2;

static void draw_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);

    /*Add the faded area before the lines are drawn*/
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->part == LV_PART_ITEMS) {
        if(!dsc->p1 || !dsc->p2) return;

        /*Add a line mask that keeps the area below the line*/
        lv_draw_mask_line_param_t line_mask_param;
        lv_draw_mask_line_points_init(&line_mask_param, dsc->p1->x, dsc->p1->y, dsc->
↪p2->x, dsc->p2->y,
                                      LV_DRAW_MASK_LINE_SIDE_BOTTOM);
        int16_t line_mask_id = lv_draw_mask_add(&line_mask_param, NULL);

        /*Add a fade effect: transparent bottom covering top*/
        lv_coord_t h = lv_obj_get_height(obj);
        lv_draw_mask_fade_param_t fade_mask_param;
        lv_draw_mask_fade_init(&fade_mask_param, &obj->coords, LV_OPA_COVER, obj->
↪coords.y1 + h / 8, LV_OPA_TRANSP,
                               obj->coords.y2);
        int16_t fade_mask_id = lv_draw_mask_add(&fade_mask_param, NULL);

        /*Draw a rectangle that will be affected by the mask*/
```

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```
        lv_draw_rect_dsc_t draw_rect_dsc;
        lv_draw_rect_dsc_init(&draw_rect_dsc);
        draw_rect_dsc.bg_opa = LV_OPA_20;
        draw_rect_dsc.bg_color = dsc->line_dsc->color;

        lv_area_t a;
        a.x1 = dsc->p1->x;
        a.x2 = dsc->p2->x - 1;
        a.y1 = LV_MIN(dsc->p1->y, dsc->p2->y);
        a.y2 = obj->coords.y2;
        lv_draw_rect(dsc->draw_ctx, &draw_rect_dsc, &a);

        /*Remove the masks*/
        lv_draw_mask_free_param(&line_mask_param);
        lv_draw_mask_free_param(&fade_mask_param);
        lv_draw_mask_remove_id(line_mask_id);
        lv_draw_mask_remove_id(fade_mask_id);
    }
    /*Hook the division lines too*/
    else if(dsc->part == LV_PART_MAIN) {
        if(dsc->line_dsc == NULL || dsc->p1 == NULL || dsc->p2 == NULL) return;

        /*Vertical line*/
        if(dsc->p1->x == dsc->p2->x) {
            dsc->line_dsc->color  = lv_palette_lighten(LV_PALETTE_GREY, 1);
            if(dsc->id == 3) {
                dsc->line_dsc->width  = 2;
                dsc->line_dsc->dash_gap  = 0;
                dsc->line_dsc->dash_width  = 0;
            }
            else {
                dsc->line_dsc->width = 1;
                dsc->line_dsc->dash_gap  = 6;
                dsc->line_dsc->dash_width  = 6;
            }
        }
        /*Horizontal line*/
        else {
            if(dsc->id == 2) {
                dsc->line_dsc->width  = 2;
                dsc->line_dsc->dash_gap  = 0;
                dsc->line_dsc->dash_width  = 0;
            }
            else {
                dsc->line_dsc->width = 2;
                dsc->line_dsc->dash_gap  = 6;
                dsc->line_dsc->dash_width  = 6;
            }

            if(dsc->id == 1  || dsc->id == 3) {
                dsc->line_dsc->color  = lv_palette_main(LV_PALETTE_GREEN);
            }
            else {
                dsc->line_dsc->color  = lv_palette_lighten(LV_PALETTE_GREY, 1);
            }
        }
    }
```

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```
}

static void add_data(lv_timer_t * timer)
{
    LV_UNUSED(timer);
    static uint32_t cnt = 0;
    lv_chart_set_next_value(chart1, ser1, lv_rand(20, 90));

    if(cnt % 4 == 0) lv_chart_set_next_value(chart1, ser2, lv_rand(40, 60));

    cnt++;
}

/**
 * Add a faded area effect to the line chart and make some division lines ticker
 */
void lv_example_chart_2(void)
{
    /*Create a chart1*/
    chart1 = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart1, 200, 150);
    lv_obj_center(chart1);
    lv_chart_set_type(chart1, LV_CHART_TYPE_LINE);   /*Show lines and points too*/

    lv_chart_set_div_line_count(chart1, 5, 7);

    lv_obj_add_event(chart1, draw_event_cb, LV_EVENT_DRAW_PART_BEGIN, NULL);
    lv_chart_set_update_mode(chart1, LV_CHART_UPDATE_MODE_CIRCULAR);

    /*Add two data series*/
    ser1 = lv_chart_add_series(chart1, lv_palette_main(LV_PALETTE_RED), LV_CHART_AXIS_
↪PRIMARY_Y);
    ser2 = lv_chart_add_series(chart1, lv_palette_main(LV_PALETTE_BLUE), LV_CHART_
↪AXIS_SECONDARY_Y);

    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_chart_set_next_value(chart1, ser1, lv_rand(20, 90));
        lv_chart_set_next_value(chart1, ser2, lv_rand(30, 70));
    }

    lv_timer_create(add_data, 200, NULL);
}

#endif
```

```
def draw_event_cb(e):

    obj = e.get_target_obj()

    # Add the faded area before the lines are drawn
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    if dsc.part != lv.PART.ITEMS:
        return
    if not dsc.p1 or not dsc.p2:
        return
```

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```
    # Add a line mask that keeps the area below the line
    line_mask_param = lv.draw_mask_line_param_t()
    line_mask_param.points_init(dsc.p1.x, dsc.p1.y, dsc.p2.x, dsc.p2.y, lv.DRAW_MASK_
↪LINE_SIDE.BOTTOM)
    # line_mask_id = line_mask_param.draw_mask_add(None)
    line_mask_id = lv.draw_mask_add(line_mask_param, None)
    # Add a fade effect: transparent bottom covering top
    h = obj.get_height()
    fade_mask_param = lv.draw_mask_fade_param_t()
    coords = lv.area_t()
    obj.get_coords(coords)
    fade_mask_param.init(coords, lv.OPA.COVER, coords.y1 + h // 8, lv.OPA.TRANSP,
↪coords.y2)
    fade_mask_id = lv.draw_mask_add(fade_mask_param,None)

    # Draw a rectangle that will be affected by the mask
    draw_rect_dsc = lv.draw_rect_dsc_t()
    draw_rect_dsc.init()
    draw_rect_dsc.bg_opa = lv.OPA._20
    draw_rect_dsc.bg_color = dsc.line_dsc.color

    a = lv.area_t()
    a.x1 = dsc.p1.x
    a.x2 = dsc.p2.x - 1
    a.y1 = min(dsc.p1.y, dsc.p2.y)
    coords = lv.area_t()
    obj.get_coords(coords)
    a.y2 = coords.y2
    dsc.draw_ctx.rect(draw_rect_dsc, a)

    # Remove the masks
    lv.draw_mask_remove_id(line_mask_id)
    lv.draw_mask_remove_id(fade_mask_id)


def add_data(timer):
    # LV_UNUSED(timer);
    cnt = 0
    chart1.set_next_value(ser1, lv.rand(20, 90))

    if cnt % 4 == 0:
        chart1.set_next_value(ser2, lv.rand(40, 60))

    cnt +=1

#
# Add a faded area effect to the line chart
#

# Create a chart1
chart1 = lv.chart(lv.scr_act())
chart1.set_size(200, 150)
chart1.center()
chart1.set_type(lv.chart.TYPE.LINE)    # Show lines and points too

chart1.add_event(draw_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)
```

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```
chart1.set_update_mode(lv.chart.UPDATE_MODE.CIRCULAR)

# Add two data series
ser1 = chart1.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)
ser2 = chart1.add_series(lv.palette_main(lv.PALETTE.BLUE), lv.chart.AXIS.SECONDARY_Y)

for i in range(10):
    chart1.set_next_value(ser1, lv.rand(20, 90))
    chart1.set_next_value(ser2, lv.rand(30, 70))

timer = lv.timer_create(add_data, 200, None)
```

Axis ticks and labels with scrolling

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES

static void draw_event_cb(lv_event_t * e)
{
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(!lv_obj_draw_part_check_type(dsc, &lv_chart_class, LV_CHART_DRAW_PART_TICK_
↪LABEL)) return;

    if(dsc->id == LV_CHART_AXIS_PRIMARY_X && dsc->text) {
        const char * month[] = {"Jan", "Febr", "March", "Apr", "May", "Jun", "July",
↪"Aug", "Sept", "Oct", "Nov", "Dec"};
        lv_snprintf(dsc->text, dsc->text_length, "%s", month[dsc->value]);
    }
}

/**
 * Add ticks and labels to the axis and demonstrate scrolling
 */
void lv_example_chart_3(void)
{
    /*Create a chart*/
    lv_obj_t * chart;
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_center(chart);
    lv_chart_set_type(chart, LV_CHART_TYPE_BAR);
    lv_chart_set_range(chart, LV_CHART_AXIS_PRIMARY_Y, 0, 100);
    lv_chart_set_range(chart, LV_CHART_AXIS_SECONDARY_Y, 0, 400);
    lv_chart_set_point_count(chart, 12);
    lv_obj_add_event(chart, draw_event_cb, LV_EVENT_DRAW_PART_BEGIN, NULL);

    /*Add ticks and label to every axis*/
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_X, 10, 5, 12, 3, true, 40);
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_Y, 10, 5, 6, 2, true, 50);
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_SECONDARY_Y, 10, 5, 3, 4, true, 50);

    /*Zoom in a little in X*/
    lv_chart_set_zoom_x(chart, 800);

    /*Add two data series*/
```

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```
    lv_chart_series_t * ser1 = lv_chart_add_series(chart, lv_palette_lighten(LV_
↪PALETTE_GREEN, 2), LV_CHART_AXIS_PRIMARY_Y);
    lv_chart_series_t * ser2 = lv_chart_add_series(chart, lv_palette_darken(LV_
↪PALETTE_GREEN, 2),
                                                   LV_CHART_AXIS_SECONDARY_Y);

    /*Set the next points on 'ser1'*/
    lv_chart_set_next_value(chart, ser1, 31);
    lv_chart_set_next_value(chart, ser1, 66);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 89);
    lv_chart_set_next_value(chart, ser1, 63);
    lv_chart_set_next_value(chart, ser1, 56);
    lv_chart_set_next_value(chart, ser1, 32);
    lv_chart_set_next_value(chart, ser1, 35);
    lv_chart_set_next_value(chart, ser1, 57);
    lv_chart_set_next_value(chart, ser1, 85);
    lv_chart_set_next_value(chart, ser1, 22);
    lv_chart_set_next_value(chart, ser1, 58);

    lv_coord_t * ser2_array = lv_chart_get_y_array(chart, ser2);
    /*Directly set points on 'ser2'*/
    ser2_array[0] = 92;
    ser2_array[1] = 71;
    ser2_array[2] = 61;
    ser2_array[3] = 15;
    ser2_array[4] = 21;
    ser2_array[5] = 35;
    ser2_array[6] = 35;
    ser2_array[7] = 58;
    ser2_array[8] = 31;
    ser2_array[9] = 53;
    ser2_array[10] = 33;
    ser2_array[11] = 73;

    lv_chart_refresh(chart); /*Required after direct set*/
}

#endif
```

```
def draw_event_cb(e):

    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    if dsc.part == lv.PART.TICKS and dsc.id == lv.chart.AXIS.PRIMARY_X:
        month = ["Jan", "Febr", "March", "Apr", "May", "Jun", "July", "Aug", "Sept",
↪"Oct", "Nov", "Dec"]
        # dsc.text is defined char text[16], I must therefore convert the Python␣
↪string to a byte_array
        dsc.text = bytes(month[dsc.value],"ascii")
#
# Add ticks and labels to the axis and demonstrate scrolling
#

# Create a chart
chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
```

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```
chart.center()
chart.set_type(lv.chart.TYPE.BAR)
chart.set_range(lv.chart.AXIS.PRIMARY_Y, 0, 100)
chart.set_range(lv.chart.AXIS.SECONDARY_Y, 0, 400)
chart.set_point_count(12)
chart.add_event(draw_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)

# Add ticks and label to every axis
chart.set_axis_tick(lv.chart.AXIS.PRIMARY_X, 10, 5, 12, 3, True, 40)
chart.set_axis_tick(lv.chart.AXIS.PRIMARY_Y, 10, 5, 6, 2, True, 50)
chart.set_axis_tick(lv.chart.AXIS.SECONDARY_Y, 10, 5, 3, 4,True, 50)

# Zoom in a little in X
chart.set_zoom_x(800)

# Add two data series
ser1 = lv.chart.add_series(chart, lv.palette_lighten(lv.PALETTE.GREEN, 2), lv.chart.
↪AXIS.PRIMARY_Y)
ser2 = lv.chart.add_series(chart, lv.palette_darken(lv.PALETTE.GREEN, 2), lv.chart.
↪AXIS.SECONDARY_Y)

# Set the next points on 'ser1'
chart.set_next_value(ser1, 31)
chart.set_next_value(ser1, 66)
chart.set_next_value(ser1, 10)
chart.set_next_value(ser1, 89)
chart.set_next_value(ser1, 63)
chart.set_next_value(ser1, 56)
chart.set_next_value(ser1, 32)
chart.set_next_value(ser1, 35)
chart.set_next_value(ser1, 57)
chart.set_next_value(ser1, 85)
chart.set_next_value(ser1, 22)
chart.set_next_value(ser1, 58)

# Directly set points on 'ser2'
ser2.y_points = [92,71,61,15,21,35,35,58,31,53,33,73]

chart.refresh()  # Required after direct set
```

Show the value of the pressed points

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES


static void event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * chart = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        lv_obj_invalidate(chart);
    }
```

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```
    if(code == LV_EVENT_REFR_EXT_DRAW_SIZE) {
        lv_coord_t * s = lv_event_get_param(e);
        *s = LV_MAX(*s, 20);
    }
    else if(code == LV_EVENT_DRAW_POST_END) {
        int32_t id = lv_chart_get_pressed_point(chart);
        if(id == LV_CHART_POINT_NONE) return;

        LV_LOG_USER("Selected point %d", (int)id);

        lv_chart_series_t * ser = lv_chart_get_series_next(chart, NULL);
        while(ser) {
            lv_point_t p;
            lv_chart_get_point_pos_by_id(chart, ser, id, &p);

            lv_coord_t * y_array = lv_chart_get_y_array(chart, ser);
            lv_coord_t value = y_array[id];

            char buf[16];
            lv_snprintf(buf, sizeof(buf), LV_SYMBOL_DUMMY"$%d", value);

            lv_draw_rect_dsc_t draw_rect_dsc;
            lv_draw_rect_dsc_init(&draw_rect_dsc);
            draw_rect_dsc.bg_color = lv_color_black();
            draw_rect_dsc.bg_opa = LV_OPA_50;
            draw_rect_dsc.radius = 3;
            draw_rect_dsc.bg_img_src = buf;
            draw_rect_dsc.bg_img_recolor = lv_color_white();

            lv_area_t a;
            a.x1 = chart->coords.x1 + p.x - 20;
            a.x2 = chart->coords.x1 + p.x + 20;
            a.y1 = chart->coords.y1 + p.y - 30;
            a.y2 = chart->coords.y1 + p.y - 10;

            lv_draw_ctx_t * draw_ctx = lv_event_get_draw_ctx(e);
            lv_draw_rect(draw_ctx, &draw_rect_dsc, &a);

            ser = lv_chart_get_series_next(chart, ser);
        }
    }
    else if(code == LV_EVENT_RELEASED) {
        lv_obj_invalidate(chart);
    }
}

/**
 * Show the value of the pressed points
 */
void lv_example_chart_4(void)
{
    /*Create a chart*/
    lv_obj_t * chart;
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_center(chart);
```

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```
    lv_obj_add_event(chart, event_cb, LV_EVENT_ALL, NULL);
    lv_obj_refresh_ext_draw_size(chart);

    /*Zoom in a little in X*/
    lv_chart_set_zoom_x(chart, 800);

    /*Add two data series*/
    lv_chart_series_t * ser1 = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪RED), LV_CHART_AXIS_PRIMARY_Y);
    lv_chart_series_t * ser2 = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪GREEN), LV_CHART_AXIS_PRIMARY_Y);
    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_chart_set_next_value(chart, ser1, lv_rand(60, 90));
        lv_chart_set_next_value(chart, ser2, lv_rand(10, 40));
    }
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv

def event_cb(e):

    code = e.get_code()
    chart = e.get_target_obj()

    if code == lv.EVENT.VALUE_CHANGED:
        chart.invalidate()

    if code == lv.EVENT.REFR_EXT_DRAW_SIZE:
        # s = lv.coord_t.__cast__(e.get_param())
        # print("s: {:d}".format(s))
        e.set_ext_draw_size(20)

    elif code == lv.EVENT.DRAW_POST_END:
        id = chart.get_pressed_point()
        if id == lv.CHART_POINT_NONE :
            return

        # print("Selected point {:d}".format(id))

        ser = chart.get_series_next(None)

        while(ser) :
            p = lv.point_t()
            chart.get_point_pos_by_id(ser, id, p)
            # print("point coords: x: {:d}, y: {:d}".format(p.x,p.y))
            y_array = chart.get_y_array(ser)
            value = y_array[id]

            buf = lv.SYMBOL.DUMMY + "{:2d}".format(value)

            draw_rect_dsc = lv.draw_rect_dsc_t()
            draw_rect_dsc.init()
```

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```
            draw_rect_dsc.bg_color = lv.color_black()
            draw_rect_dsc.bg_opa = lv.OPA._50
            draw_rect_dsc.radius = 3
            draw_rect_dsc.bg_img_src = buf
            draw_rect_dsc.bg_img_recolor = lv.color_white()

            coords = lv.area_t()
            chart.get_coords(coords)
            # print("coords: x1: {:d}, y1: {:d}".format(coords.x1, coords.y1))
            a = lv.area_t()
            a.x1 = coords.x1 + p.x - 20
            a.x2 = coords.x1 + p.x + 20
            a.y1 = coords.y1 + p.y - 30
            a.y2 = coords.y1 + p.y - 10
            # print("a: x1: {:d}, x2: {:d}, y1: {:d}, y2: {:d}".format(a.x1,a.x2,a.y1,
↪a.y2))
            draw_ctx = e.get_draw_ctx()
            draw_ctx.rect(draw_rect_dsc, a)

            ser = chart.get_series_next(ser)

    elif code == lv.EVENT.RELEASED:
        chart.invalidate()


#
#  Show the value of the pressed points
#

# Create a chart
chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.center()

chart.add_event(event_cb, lv.EVENT.ALL, None)

chart.refresh_ext_draw_size()

# Zoom in a little in X
chart.set_zoom_x(800)

# Add two data series
ser1 = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)
ser2 = chart.add_series(lv.palette_main(lv.PALETTE.GREEN), lv.chart.AXIS.PRIMARY_Y)
for i in range(10):
    chart.set_next_value(ser1, lv.rand(60, 90))
    chart.set_next_value(ser2, lv.rand(10, 40))
```

Display 1000 data points with zooming and scrolling

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_USE_SLIDER && LV_BUILD_EXAMPLES

static lv_obj_t * chart;
/* Source: https://github.com/ankur219/ECG-Arrhythmia-classification/blob/
↪642230149583adfae1e4bd26c6f0e1fd8af2be0e/sample.csv*/
static const lv_coord_t ecg_sample[] = {
    -2, 2, 0, -15, -39, -63, -71, -68, -67, -69, -84, -95, -104, -107, -108, -107, -
↪107, -107, -107, -114, -118, -117,
        -112, -100, -89, -83, -71, -64, -58, -58, -62, -62, -58, -51, -46, -39, -27, -
↪10, 4, 7, 1, -3, 0, 14, 24, 30, 25, 19,
        13, 7, 12, 15, 18, 21, 13, 6, 9, 8, 17, 19, 13, 11, 11, 11, 23, 30, 37, 34,␣
↪25, 14, 15, 19, 28, 31, 26, 23, 25, 31,
        39, 37, 37, 34, 30, 32, 22, 29, 31, 33, 37, 23, 13, 7, 2, 4, -2, 2, 11, 22,␣
↪33, 19, -1, -27, -55, -67, -72, -71, -63,
        -49, -18, 35, 113, 230, 369, 525, 651, 722, 730, 667, 563, 454, 357, 305, 288,
↪ 274, 255, 212, 173, 143, 117, 82, 39,
        -13, -53, -78, -91, -101, -113, -124, -131, -131, -131, -129, -128, -129, -
↪125, -123, -123, -129, -139, -148, -153,
        -159, -166, -183, -205, -227, -243, -248, -246, -254, -280, -327, -381, -429,␣
↪-473, -517, -556, -592, -612, -620,
        -620, -614, -604, -591, -574, -540, -497, -441, -389, -358, -336, -313, -284,␣
↪-222, -167, -114, -70, -47, -28, -4, 12,
        38, 52, 58, 56, 56, 57, 68, 77, 86, 86, 80, 69, 67, 70, 82, 85, 89, 90, 89,␣
↪89, 88, 91, 96, 97, 91, 83, 78, 82, 88, 95,
        96, 105, 106, 110, 102, 100, 96, 98, 97, 101, 98, 99, 100, 107, 113, 119, 115,
↪ 110, 96, 85, 73, 64, 69, 76, 79,
        78, 75, 85, 100, 114, 113, 105, 96, 84, 74, 66, 60, 75, 85, 89, 83, 67, 61,␣
↪67, 73, 79, 74, 63, 57, 56, 58, 61, 55,
        48, 45, 46, 55, 62, 55, 49, 43, 50, 59, 63, 57, 40, 31, 23, 25, 27, 31, 35,␣
↪34, 30, 36, 34, 42, 38, 36, 40, 46, 50,
        47, 32, 30, 32, 52, 67, 73, 71, 63, 54, 53, 45, 41, 28, 13, 3, 1, 4, 4, -8, -
↪23, -32, -31, -19, -5, 3, 9, 13, 19,
        24, 27, 29, 25, 22, 26, 32, 42, 51, 56, 60, 57, 55, 53, 53, 54, 59, 54, 49,␣
↪26, -3, -11, -20, -47, -100, -194, -236,
        -212, -123, 8, 103, 142, 147, 120, 105, 98, 93, 81, 61, 40, 26, 28, 30, 30,␣
↪27, 19, 17, 21, 20, 19, 19, 22, 36, 40,
        35, 20, 7, 1, 10, 18, 27, 22, 6, -4, -2, 3, 6, -2, -13, -14, -10, -2, 3, 2, -
↪1, -5, -10, -19, -32, -42, -55, -60,
        -68, -77, -86, -101, -110, -117, -115, -104, -92, -84, -85, -84, -73, -65, -
↪52, -50, -45, -35, -20, -3, 12, 20, 25,
        26, 28, 28, 30, 28, 25, 28, 33, 42, 42, 36, 23, 9, 0, 1, -4, 1, -4, -4, 1, 5,␣
↪9, 9, -3, -1, -18, -50, -108, -190,
        -272, -340, -408, -446, -537, -643, -777, -894, -920, -853, -697, -461, -251,␣
↪-60, 58, 103, 129, 139, 155, 170, 173,
        178, 185, 190, 193, 200, 208, 215, 225, 224, 232, 234, 240, 240, 236, 229,␣
↪226, 224, 232, 233, 232, 224, 219, 219,
        223, 231, 226, 223, 219, 218, 223, 223, 223, 233, 245, 268, 286, 296, 295,␣
↪283, 271, 263, 252, 243, 226, 210, 197,
        186, 171, 152, 133, 117, 114, 110, 107, 96, 80, 63, 48, 40, 38, 34, 28, 15, 2,
↪ -7, -11, -14, -18, -29, -37, -44, -50,
        -58, -63, -61, -52, -50, -48, -61, -59, -58, -54, -47, -52, -62, -61, -64, -
↪54, -52, -59, -69, -76, -76, -69, -67,
        -74, -78, -81, -80, -73, -65, -57, -53, -51, -47, -35, -27, -22, -22, -24, -
↪21, -17, -13, -10, -11, -13, -20, -20,
```

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```
        -12, -2, 7, -1, -12, -16, -13, -2, 2, -4, -5, -2, 9, 19, 19, 14, 11, 13, 19,␣
↪21, 20, 18, 19, 19, 19, 16, 15, 13, 14,
        9, 3, -5, -9, -5, -3, -2, -3, -3, 2, 8, 9, 9, 5, 6, 8, 8, 7, 4, 3, 4, 5, 3, 5,
↪ 5, 13, 13, 12, 10, 10, 15, 22, 17,
        14, 7, 10, 15, 16, 11, 12, 10, 13, 9, -2, -4, -2, 7, 16, 16, 17, 16, 7, -1, -
↪16, -18, -16, -9, -4, -5, -10, -9, -8,
        -3, -4, -10, -19, -20, -16, -9, -9, -23, -40, -48, -43, -33, -19, -21, -26, -
↪31, -33, -19, 0, 17, 24, 9, -17, -47,
        -63, -67, -59, -52, -51, -50, -49, -42, -26, -21, -15, -20, -23, -22, -19, -
↪12, -8, 5, 18, 27, 32, 26, 25, 26, 22,
        23, 17, 14, 17, 21, 25, 2, -45, -121, -196, -226, -200, -118, -9, 73, 126,␣
↪131, 114, 87, 60, 42, 29, 26, 34, 35, 34,
        25, 12, 9, 7, 3, 2, -8, -11, 2, 23, 38, 41, 23, 9, 10, 13, 16, 8, -8, -17, -
↪23, -26, -25, -21, -15, -10, -13, -13,
        -19, -22, -29, -40, -48, -48, -54, -55, -66, -82, -85, -90, -92, -98, -114, -
↪119, -124, -129, -132, -146, -146, -138,
        -124, -99, -85, -72, -65, -65, -65, -66, -63, -64, -64, -58, -46, -26, -9, 2,␣
↪2, 4, 0, 1, 4, 3, 10, 11, 10, 2, -4,
        0, 10, 18, 20, 6, 2, -9, -7, -3, -3, -2, -7, -12, -5, 5, 24, 36, 31, 25, 6, 3,
↪ 7, 12, 17, 11, 0, -6, -9, -8, -7, -5,
        -6, -2, -2, -6, -2, 2, 14, 24, 22, 15, 8, 4, 6, 7, 12, 16, 25, 20, 7, -16, -
↪41, -60, -67, -65, -54, -35, -11, 30,
        84, 175, 302, 455, 603, 707, 743, 714, 625, 519, 414, 337, 300, 281, 263, 239,
↪ 197, 163, 136, 109, 77, 34, -18, -50,
        -66, -74, -79, -92, -107, -117, -127, -129, -135, -139, -141, -155, -159, -
↪167, -171, -169, -174, -175, -178, -191,
        -202, -223, -235, -243, -237, -240, -256, -298, -345, -393, -432, -475, -518,␣
↪-565, -596, -619, -623, -623, -614,
        -599, -583, -559, -524, -477, -425, -383, -357, -331, -301, -252, -198, -143,␣
↪-96, -57, -29, -8, 10, 31, 45, 60, 65,
        70, 74, 76, 79, 82, 79, 75, 62,
    };

static void slider_x_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    int32_t v = lv_slider_get_value(obj);
    lv_chart_set_zoom_x(chart, v);
}

static void slider_y_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    int32_t v = lv_slider_get_value(obj);
    lv_chart_set_zoom_y(chart, v);
}

/**
 * Display 1000 data points with zooming and scrolling.
 * See how the chart changes drawing mode (draw only vertical lines) when
 * the points get too crowded.
 */
void lv_example_chart_5(void)
{
    /*Create a chart*/
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
```

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```
    lv_obj_align(chart, LV_ALIGN_CENTER, -30, -30);
    lv_chart_set_range(chart, LV_CHART_AXIS_PRIMARY_Y, -1000, 1000);

    /*Do not display points on the data*/
    lv_obj_set_style_size(chart, 0, 0, LV_PART_INDICATOR);

    lv_chart_series_t * ser = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪RED), LV_CHART_AXIS_PRIMARY_Y);

    uint32_t pcnt = sizeof(ecg_sample) / sizeof(ecg_sample[0]);
    lv_chart_set_point_count(chart, pcnt);
    lv_chart_set_ext_y_array(chart, ser, (lv_coord_t *)ecg_sample);

    lv_obj_t * slider;
    slider = lv_slider_create(lv_scr_act());
    lv_slider_set_range(slider, LV_ZOOM_NONE, LV_ZOOM_NONE * 10);
    lv_obj_add_event(slider, slider_x_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_obj_set_size(slider, 200, 10);
    lv_obj_align_to(slider, chart, LV_ALIGN_OUT_BOTTOM_MID, 0, 20);

    slider = lv_slider_create(lv_scr_act());
    lv_slider_set_range(slider, LV_ZOOM_NONE, LV_ZOOM_NONE * 10);
    lv_obj_add_event(slider, slider_y_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_obj_set_size(slider, 10, 150);
    lv_obj_align_to(slider, chart, LV_ALIGN_OUT_RIGHT_MID, 20, 0);
}

#endif
```

```
# Source: https://github.com/ankur219/ECG-Arrhythmia-classification/blob/
↪642230149583adfae1e4bd26c6f0e1fd8af2be0e/sample.csv
ecg_sample = [
    -2, 2, 0, -15, -39, -63, -71, -68, -67, -69, -84, -95, -104, -107, -108, -107, -
↪107, -107, -107, -114, -118, -117,
    -112, -100, -89, -83, -71, -64, -58, -58, -62, -62, -58, -51, -46, -39, -27, -10,␣
↪4, 7, 1, -3, 0, 14, 24, 30, 25, 19,
    13, 7, 12, 15, 18, 21, 13, 6, 9, 8, 17, 19, 13, 11, 11, 11, 23, 30, 37, 34, 25,␣
↪14, 15, 19, 28, 31, 26, 23, 25, 31,
    39, 37, 37, 34, 30, 32, 22, 29, 31, 33, 37, 23, 13, 7, 2, 4, -2, 2, 11, 22, 33,␣
↪19, -1, -27, -55, -67, -72, -71, -63,
    -49, -18, 35, 113, 230, 369, 525, 651, 722, 730, 667, 563, 454, 357, 305, 288,␣
↪274, 255, 212, 173, 143, 117, 82, 39,
    -13, -53, -78, -91, -101, -113, -124, -131, -131, -131, -129, -128, -129, -125, -
↪123, -123, -129, -139, -148, -153,
    -159, -166, -183, -205, -227, -243, -248, -246, -254, -280, -327, -381, -429, -
↪473, -517, -556, -592, -612, -620,
    -620, -614, -604, -591, -574, -540, -497, -441, -389, -358, -336, -313, -284, -
↪222, -167, -114, -70, -47, -28, -4, 12,
    38, 52, 58, 56, 56, 57, 68, 77, 86, 86, 80, 69, 67, 70, 82, 85, 89, 90, 89, 89,␣
↪88, 91, 96, 97, 91, 83, 78, 82, 88, 95,
    96, 105, 106, 110, 102, 100, 96, 98, 97, 101, 98, 99, 100, 107, 113, 119, 115,␣
↪110, 96, 85, 73, 64, 69, 76, 79,
    78, 75, 85, 100, 114, 113, 105, 96, 84, 74, 66, 60, 75, 85, 89, 83, 67, 61, 67,␣
↪73, 79, 74, 63, 57, 56, 58, 61, 55,
    48, 45, 46, 55, 62, 55, 49, 43, 50, 59, 63, 57, 40, 31, 23, 25, 27, 31, 35, 34,␣
↪30, 36, 34, 42, 38, 36, 40, 46, 50,
```

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```
    47, 32, 30, 32, 52, 67, 73, 71, 63, 54, 53, 45, 41, 28, 13, 3, 1, 4, 4, -8, -23, -
↪32, -31, -19, -5, 3, 9, 13, 19,
    24, 27, 29, 25, 22, 26, 32, 42, 51, 56, 60, 57, 55, 53, 53, 54, 59, 54, 49, 26, -
↪3, -11, -20, -47, -100, -194, -236,
    -212, -123, 8, 103, 142, 147, 120, 105, 98, 93, 81, 61, 40, 26, 28, 30, 30, 27,␣
↪19, 17, 21, 20, 19, 19, 22, 36, 40,
    35, 20, 7, 1, 10, 18, 27, 22, 6, -4, -2, 3, 6, -2, -13, -14, -10, -2, 3, 2, -1, -
↪5, -10, -19, -32, -42, -55, -60,
    -68, -77, -86, -101, -110, -117, -115, -104, -92, -84, -85, -84, -73, -65, -52, -
↪50, -45, -35, -20, -3, 12, 20, 25,
    26, 28, 28, 30, 28, 25, 28, 33, 42, 42, 36, 23, 9, 0, 1, -4, 1, -4, -4, 1, 5, 9,␣
↪9, -3, -1, -18, -50, -108, -190,
    -272, -340, -408, -446, -537, -643, -777, -894, -920, -853, -697, -461, -251, -60,
↪ 58, 103, 129, 139, 155, 170, 173,
    178, 185, 190, 193, 200, 208, 215, 225, 224, 232, 234, 240, 240, 236, 229, 226,␣
↪224, 232, 233, 232, 224, 219, 219,
    223, 231, 226, 223, 219, 218, 223, 223, 223, 233, 245, 268, 286, 296, 295, 283,␣
↪271, 263, 252, 243, 226, 210, 197,
    186, 171, 152, 133, 117, 114, 110, 107, 96, 80, 63, 48, 40, 38, 34, 28, 15, 2, -7,
↪ -11, -14, -18, -29, -37, -44, -50,
    -58, -63, -61, -52, -50, -48, -61, -59, -58, -54, -47, -52, -62, -61, -64, -54, -
↪52, -59, -69, -76, -76, -69, -67,
    -74, -78, -81, -80, -73, -65, -57, -53, -51, -47, -35, -27, -22, -22, -24, -21, -
↪17, -13, -10, -11, -13, -20, -20,
    -12, -2, 7, -1, -12, -16, -13, -2, 2, -4, -5, -2, 9, 19, 19, 14, 11, 13, 19, 21,␣
↪20, 18, 19, 19, 19, 16, 15, 13, 14,
    9, 3, -5, -9, -5, -3, -2, -3, -3, 2, 8, 9, 9, 5, 6, 8, 8, 7, 4, 3, 4, 5, 3, 5, 5,␣
↪13, 13, 12, 10, 10, 15, 22, 17,
    14, 7, 10, 15, 16, 11, 12, 10, 13, 9, -2, -4, -2, 7, 16, 16, 17, 16, 7, -1, -16, -
↪18, -16, -9, -4, -5, -10, -9, -8,
    -3, -4, -10, -19, -20, -16, -9, -9, -23, -40, -48, -43, -33, -19, -21, -26, -31, -
↪33, -19, 0, 17, 24, 9, -17, -47,
    -63, -67, -59, -52, -51, -50, -49, -42, -26, -21, -15, -20, -23, -22, -19, -12, -
↪8, 5, 18, 27, 32, 26, 25, 26, 22,
    23, 17, 14, 17, 21, 25, 2, -45, -121, -196, -226, -200, -118, -9, 73, 126, 131,␣
↪114, 87, 60, 42, 29, 26, 34, 35, 34,
    25, 12, 9, 7, 3, 2, -8, -11, 2, 23, 38, 41, 23, 9, 10, 13, 16, 8, -8, -17, -23, -
↪26, -25, -21, -15, -10, -13, -13,
    -19, -22, -29, -40, -48, -48, -54, -55, -66, -82, -85, -90, -92, -98, -114, -119,␣
↪-124, -129, -132, -146, -146, -138,
    -124, -99, -85, -72, -65, -65, -65, -66, -63, -64, -64, -58, -46, -26, -9, 2, 2,␣
↪4, 0, 1, 4, 3, 10, 11, 10, 2, -4,
    0, 10, 18, 20, 6, 2, -9, -7, -3, -3, -2, -7, -12, -5, 5, 24, 36, 31, 25, 6, 3, 7,␣
↪12, 17, 11, 0, -6, -9, -8, -7, -5,
    -6, -2, -2, -6, -2, 2, 14, 24, 22, 15, 8, 4, 6, 7, 12, 16, 25, 20, 7, -16, -41, -
↪60, -67, -65, -54, -35, -11, 30,
    84, 175, 302, 455, 603, 707, 743, 714, 625, 519, 414, 337, 300, 281, 263, 239,␣
↪197, 163, 136, 109, 77, 34, -18, -50,
    -66, -74, -79, -92, -107, -117, -127, -129, -135, -139, -141, -155, -159, -167, -
↪171, -169, -174, -175, -178, -191,
    -202, -223, -235, -243, -237, -240, -256, -298, -345, -393, -432, -475, -518, -
↪565, -596, -619, -623, -623, -614,
    -599, -583, -559, -524, -477, -425, -383, -357, -331, -301, -252, -198, -143, -96,
↪ -57, -29, -8, 10, 31, 45, 60, 65,
    70, 74, 76, 79, 82, 79, 75, 62,
]
```

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```
def slider_x_event_cb(e):

    slider = e.get_target_obj()
    v = slider.get_value()
    chart.set_zoom_x(v)

def slider_y_event_cb(e):

    slider = e.get_target_obj()
    v = slider.get_value()
    chart.set_zoom_y(v)


#
# Display 1000 data points with zooming and scrolling.
# See how the chart changes drawing mode (draw only vertical lines) when
# the points get too crowded.

# Create a chart
chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.align(lv.ALIGN.CENTER, -30, -30)
chart.set_range(lv.chart.AXIS.PRIMARY_Y, -1000, 1000)

# Do not display points on the data
chart.set_style_size(0, 0, lv.PART.INDICATOR)

ser = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)

pcnt = len(ecg_sample)
chart.set_point_count(pcnt)
chart.set_ext_y_array(ser, ecg_sample)

slider = lv.slider(lv.scr_act())
slider.set_range(lv.ZOOM_NONE, lv.ZOOM_NONE * 10)
slider.add_event(slider_x_event_cb, lv.EVENT.VALUE_CHANGED, None)
slider.set_size(200,10)
slider.align_to(chart, lv.ALIGN.OUT_BOTTOM_MID, 0, 20)

slider = lv.slider(lv.scr_act())
slider.set_range(lv.ZOOM_NONE, lv.ZOOM_NONE * 10)
slider.add_event(slider_y_event_cb, lv.EVENT.VALUE_CHANGED, None)
slider.set_size(10, 150)
slider.align_to(chart, lv.ALIGN.OUT_RIGHT_MID, 20, 0)
```

Show cursor on the clicked point

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES

static lv_obj_t * chart;
static lv_chart_series_t * ser;
static lv_chart_cursor_t * cursor;

static void event_cb(lv_event_t * e)
{
    static int32_t last_id = -1;
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        last_id = lv_chart_get_pressed_point(obj);
        if(last_id != LV_CHART_POINT_NONE) {
            lv_chart_set_cursor_point(obj, cursor, NULL, last_id);
        }
    }
    else if(code == LV_EVENT_DRAW_PART_END) {
        lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
        if(!lv_obj_draw_part_check_type(dsc, &lv_chart_class, LV_CHART_DRAW_PART_
↪CURSOR)) return;
        if(dsc->p1 == NULL || dsc->p2 == NULL || dsc->p1->y != dsc->p2->y || last_id
↪< 0) return;

        lv_coord_t * data_array = lv_chart_get_y_array(chart, ser);
        lv_coord_t v = data_array[last_id];
        char buf[16];
        lv_snprintf(buf, sizeof(buf), "%d", v);

        lv_point_t size;
        lv_txt_get_size(&size, buf, LV_FONT_DEFAULT, 0, 0, LV_COORD_MAX, LV_TEXT_FLAG_
↪NONE);

        lv_area_t a;
        a.y2 = dsc->p1->y - 5;
        a.y1 = a.y2 - size.y - 10;
        a.x1 = dsc->p1->x + 10;
        a.x2 = a.x1 + size.x + 10;

        lv_draw_rect_dsc_t draw_rect_dsc;
        lv_draw_rect_dsc_init(&draw_rect_dsc);
        draw_rect_dsc.bg_color = lv_palette_main(LV_PALETTE_BLUE);
        draw_rect_dsc.radius = 3;

        lv_draw_rect(dsc->draw_ctx, &draw_rect_dsc, &a);

        lv_draw_label_dsc_t draw_label_dsc;
        lv_draw_label_dsc_init(&draw_label_dsc);
        draw_label_dsc.color = lv_color_white();
        a.x1 += 5;
        a.x2 -= 5;
        a.y1 += 5;
        a.y2 -= 5;
```

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```
        lv_draw_label(dsc->draw_ctx, &draw_label_dsc, &a, buf, NULL);
    }
}

/**
 * Show cursor on the clicked point
 */
void lv_example_chart_6(void)
{
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_align(chart, LV_ALIGN_CENTER, 0, -10);

    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_Y, 10, 5, 6, 5, true, 40);
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_X, 10, 5, 10, 1, true, 30);

    lv_obj_add_event(chart, event_cb, LV_EVENT_ALL, NULL);
    lv_obj_refresh_ext_draw_size(chart);

    cursor = lv_chart_add_cursor(chart, lv_palette_main(LV_PALETTE_BLUE), LV_DIR_LEFT␣
↪| LV_DIR_BOTTOM);

    ser = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_RED), LV_CHART_AXIS_
↪PRIMARY_Y);
    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_chart_set_next_value(chart, ser, lv_rand(10, 90));
    }

    lv_chart_set_zoom_x(chart, 500);

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Click on a point");
    lv_obj_align_to(label, chart, LV_ALIGN_OUT_TOP_MID, 0, -5);
}

#endif
```

```
class ExampleChart_6():

    def __init__(self):
        self.last_id = -1
        #
        # Show cursor on the clicked point
        #

        chart = lv.chart(lv.scr_act())
        chart.set_size(200, 150)
        chart.align(lv.ALIGN.CENTER, 0, -10)

        chart.set_axis_tick(lv.chart.AXIS.PRIMARY_Y, 10, 5, 6, 5, True, 40)
        chart.set_axis_tick(lv.chart.AXIS.PRIMARY_X, 10, 5, 10, 1, True, 30)

        chart.add_event(self.event_cb, lv.EVENT.ALL, None)
        chart.refresh_ext_draw_size()
```

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```
        self.cursor = chart.add_cursor(lv.palette_main(lv.PALETTE.BLUE), lv.DIR.LEFT␣
↪| lv.DIR.BOTTOM)

        self.ser = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.
↪PRIMARY_Y)

        self.ser_p = []
        for i in range(10):
            self.ser_p.append(lv.rand(10,90))
        self.ser.y_points = self.ser_p

        newser = chart.get_series_next(None)
        # print("length of data points: ",len(newser.points))
        chart.set_zoom_x(500)

        label = lv.label(lv.scr_act())
        label.set_text("Click on a point")
        label.align_to(chart, lv.ALIGN.OUT_TOP_MID, 0, -5)


    def event_cb(self,e):

        code = e.get_code()
        chart = e.get_target_obj()

        if code == lv.EVENT.VALUE_CHANGED:
            # print("last_id: ",self.last_id)
            self.last_id = chart.get_pressed_point()
            if self.last_id != lv.CHART_POINT_NONE:
                p = lv.point_t()
                chart.get_point_pos_by_id(self.ser, self.last_id, p)
                chart.set_cursor_point(self.cursor, None, self.last_id)

        elif code == lv.EVENT.DRAW_PART_END:
            # print("EVENT.DRAW_PART_END")
            dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
            # if dsc.p1 and dsc.p2:
                # print("p1, p2", dsc.p1,dsc.p2)
                # print("p1.y, p2.y", dsc.p1.y, dsc.p2.y)
                # print("last_id: ",self.last_id)
            if dsc.part == lv.PART.CURSOR and dsc.p1 and dsc.p2 and dsc.p1.y == dsc.
↪p2.y and self.last_id >= 0:

                v = self.ser_p[self.last_id]

                # print("value: ",v)
                value_txt = str(v)
                size = lv.point_t()
                lv.txt_get_size(size, value_txt, lv.font_default(), 0, 0, lv.COORD.
↪MAX, lv.TEXT_FLAG.NONE)

                a = lv.area_t()
                a.y2 = dsc.p1.y - 5
                a.y1 = a.y2 - size.y - 10
                a.x1 = dsc.p1.x + 10
                a.x2 = a.x1 + size.x + 10
```

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```
                draw_rect_dsc = lv.draw_rect_dsc_t()
                draw_rect_dsc.init()
                draw_rect_dsc.bg_color = lv.palette_main(lv.PALETTE.BLUE)
                draw_rect_dsc.radius = 3

                lv.draw_rect(a, dsc.clip_area, draw_rect_dsc)

                draw_label_dsc = lv.draw_label_dsc_t()
                draw_label_dsc.init()
                draw_label_dsc.color = lv.color_white()
                a.x1 += 5
                a.x2 -= 5
                a.y1 += 5
                a.y2 -= 5
                lv.draw_label(a, dsc.clip_area, draw_label_dsc, value_txt, None)

example_chart_6 = ExampleChart_6()
```

Scatter chart

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES

static void draw_event_cb(lv_event_t * e)
{
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->part == LV_PART_ITEMS) {
        lv_obj_t * obj = lv_event_get_target(e);
        lv_chart_series_t * ser = lv_chart_get_series_next(obj, NULL);
        uint32_t cnt = lv_chart_get_point_count(obj);
        /*Make older value more transparent*/
        dsc->rect_dsc->bg_opa = (LV_OPA_COVER *  dsc->id) / (cnt - 1);

        /*Make smaller values blue, higher values red*/
        lv_coord_t * x_array = lv_chart_get_x_array(obj, ser);
        lv_coord_t * y_array = lv_chart_get_y_array(obj, ser);
        /*dsc->id is the tells drawing order, but we need the ID of the point being␣
↪drawn.*/
        uint32_t start_point = lv_chart_get_x_start_point(obj, ser);
        uint32_t p_act = (start_point + dsc->id) % cnt; /*Consider start point to get␣
↪the index of the array*/
        lv_opa_t x_opa = (x_array[p_act] * LV_OPA_50) / 200;
        lv_opa_t y_opa = (y_array[p_act] * LV_OPA_50) / 1000;

        dsc->rect_dsc->bg_color = lv_color_mix(lv_palette_main(LV_PALETTE_RED),
                                               lv_palette_main(LV_PALETTE_BLUE),
                                               x_opa + y_opa);
    }
}

static void add_data(lv_timer_t * timer)
{
    LV_UNUSED(timer);
    lv_obj_t * chart = timer->user_data;
    lv_chart_set_next_value2(chart, lv_chart_get_series_next(chart, NULL), lv_rand(0,␣
↪200), lv_rand(0, 1000));
```

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```
}

/**
 * A scatter chart
 */
void lv_example_chart_7(void)
{
    lv_obj_t * chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_align(chart, LV_ALIGN_CENTER, 0, 0);
    lv_obj_add_event(chart, draw_event_cb, LV_EVENT_DRAW_PART_BEGIN, NULL);
    lv_obj_set_style_line_width(chart, 0, LV_PART_ITEMS);   /*Remove the lines*/

    lv_chart_set_type(chart, LV_CHART_TYPE_SCATTER);

    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_X, 5, 5, 5, 1, true, 30);
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_Y, 10, 5, 6, 5, true, 50);

    lv_chart_set_range(chart, LV_CHART_AXIS_PRIMARY_X, 0, 200);
    lv_chart_set_range(chart, LV_CHART_AXIS_PRIMARY_Y, 0, 1000);

    lv_chart_set_point_count(chart, 50);

    lv_chart_series_t * ser = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪RED), LV_CHART_AXIS_PRIMARY_Y);
    uint32_t i;
    for(i = 0; i < 50; i++) {
        lv_chart_set_next_value2(chart, ser, lv_rand(0, 200), lv_rand(0, 1000));
    }

    lv_timer_create(add_data, 100, chart);
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import utime as time
import lvgl as lv

def draw_event_cb(e):
    dsc = e.get_draw_part_dsc()
    if dsc.part == lv.PART.ITEMS:
        obj = e.get_target_obj()
        ser = obj.get_series_next(None)
        cnt = obj.get_point_count()
        # print("cnt: ",cnt)
        # Make older value more transparent
        dsc.rect_dsc.bg_opa = (lv.OPA.COVER *  dsc.id) // (cnt - 1)

        # Make smaller values blue, higher values red
        # x_array = chart.get_x_array(ser)
        # y_array = chart.get_y_array(ser)
        # dsc->id is the tells drawing order, but we need the ID of the point being␣
↪drawn.
        start_point = chart.get_x_start_point(ser)
        # print("start point: ",start_point)
```

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```
        p_act = (start_point + dsc.id) % cnt # Consider start point to get the index␣
↪of the array
        # print("p_act", p_act)
        x_opa = (x_array[p_act] * lv.OPA._50) // 200
        y_opa = (y_array[p_act] * lv.OPA._50) // 1000

        dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.RED).color_mix(
                                             lv.palette_main(lv.PALETTE.BLUE),
                                             x_opa + y_opa)

def add_data(timer,chart):
    # print("add_data")
    x = lv.rand(0,200)
    y = lv.rand(0,1000)
    chart.set_next_value2(ser, x, y)
    # chart.set_next_value2(chart.gx, y)
    x_array.pop(0)
    x_array.append(x)
    y_array.pop(0)
    y_array.append(y)

#
# A scatter chart
#

chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.align(lv.ALIGN.CENTER, 0, 0)
chart.add_event(draw_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)
chart.set_style_line_width(0, lv.PART.ITEMS)   # Remove the lines

chart.set_type(lv.chart.TYPE.SCATTER)

chart.set_axis_tick(lv.chart.AXIS.PRIMARY_X, 5, 5, 5, 1, True, 30)
chart.set_axis_tick(lv.chart.AXIS.PRIMARY_Y, 10, 5, 6, 5, True, 50)

chart.set_range(lv.chart.AXIS.PRIMARY_X, 0, 200)
chart.set_range(lv.chart.AXIS.PRIMARY_Y, 0, 1000)

chart.set_point_count(50)

ser = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)

x_array = []
y_array = []
for i in range(50):
    x_array.append(lv.rand(0, 200))
    y_array.append(lv.rand(0, 1000))

ser.x_points = x_array
ser.y_points = y_array

# Create an `lv_timer` to update the chart.

timer = lv.timer_create_basic()
timer.set_period(100)
timer.set_cb(lambda src: add_data(timer,chart))
```

Stacked area chart

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_USE_DRAW_MASKS && LV_BUILD_EXAMPLES

/*  A struct is used to keep track of the series list because later we need to draw␣
↪to the series in the reverse order to which they were initialised. */
typedef struct {
    lv_obj_t * obj;
    lv_chart_series_t * series_list[3];
} stacked_area_chart_t;

static stacked_area_chart_t stacked_area_chart;

/**
 * Callback which draws the blocks of colour under the lines
 **/
static void draw_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);

    /*Add the faded area before the lines are drawn*/
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->part == LV_PART_ITEMS) {
        if(!dsc->p1 || !dsc->p2)
            return;

        /*Add a line mask that keeps the area below the line*/
        lv_draw_mask_line_param_t line_mask_param;
        lv_draw_mask_line_points_init(&line_mask_param, dsc->p1->x, dsc->p1->y, dsc->
↪p2->x, dsc->p2->y,
                                      LV_DRAW_MASK_LINE_SIDE_BOTTOM);
        int16_t line_mask_id = lv_draw_mask_add(&line_mask_param, NULL);

        /*Draw a rectangle that will be affected by the mask*/
        lv_draw_rect_dsc_t draw_rect_dsc;
        lv_draw_rect_dsc_init(&draw_rect_dsc);
        draw_rect_dsc.bg_opa = LV_OPA_COVER;
        draw_rect_dsc.bg_color = dsc->line_dsc->color;

        lv_area_t a;
        a.x1 = dsc->p1->x;
        a.x2 = dsc->p2->x;
        a.y1 = LV_MIN(dsc->p1->y, dsc->p2->y);
        a.y2 = obj->coords.y2 -
               13; /* -13 cuts off where the rectangle draws over the chart margin.␣
↪Without this an area of 0 doesn't look like 0 */
        lv_draw_rect(dsc->draw_ctx, &draw_rect_dsc, &a);

        /*Remove the mask*/
        lv_draw_mask_free_param(&line_mask_param);
        lv_draw_mask_remove_id(line_mask_id);
    }
}

/**
 * Helper function to round a fixed point number
```

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```
 **/
static int32_t round_fixed_point(int32_t n, int8_t shift)
{
    /* Create a bitmask to isolates the decimal part of the fixed point number */
    int32_t mask = 1;
    for(int32_t bit_pos = 0; bit_pos < shift; bit_pos++) {
        mask = (mask << 1) + 1;
    }

    int32_t decimal_part = n & mask;

    /* Get 0.5 as fixed point */
    int32_t rounding_boundary = 1 << (shift - 1);

    /* Return either the integer part of n or the integer part + 1 */
    return (decimal_part < rounding_boundary) ? (n & ~mask) : ((n >> shift) + 1) <<␣
↪shift;
}

/**
 * Stacked area chart
 */
void lv_example_chart_8(void)
{
    /*Create a stacked_area_chart.obj*/
    stacked_area_chart.obj = lv_chart_create(lv_scr_act());
    lv_obj_set_size(stacked_area_chart.obj, 200, 150);
    lv_obj_center(stacked_area_chart.obj);
    lv_chart_set_type(stacked_area_chart.obj, LV_CHART_TYPE_LINE);
    lv_chart_set_div_line_count(stacked_area_chart.obj, 5, 7);
    lv_obj_add_event(stacked_area_chart.obj, draw_event_cb, LV_EVENT_DRAW_PART_BEGIN,␣
↪NULL);

    /* Set range to 0 to 100 for percentages. Draw ticks */
    lv_chart_set_range(stacked_area_chart.obj, LV_CHART_AXIS_PRIMARY_Y, 0, 100);
    lv_chart_set_axis_tick(stacked_area_chart.obj, LV_CHART_AXIS_PRIMARY_Y, 3, 0, 5,␣
↪1, true, 30);

    /*Set point size to 0 so the lines are smooth */
    lv_obj_set_style_size(stacked_area_chart.obj, 0, 0, LV_PART_INDICATOR);

    /*Add some data series*/
    stacked_area_chart.series_list[0] = lv_chart_add_series(stacked_area_chart.obj,␣
↪lv_palette_main(LV_PALETTE_RED),
                                                            LV_CHART_AXIS_PRIMARY_Y);
    stacked_area_chart.series_list[1] = lv_chart_add_series(stacked_area_chart.obj,␣
↪lv_palette_main(LV_PALETTE_BLUE),
                                                            LV_CHART_AXIS_PRIMARY_Y);
    stacked_area_chart.series_list[2] = lv_chart_add_series(stacked_area_chart.obj,␣
↪lv_palette_main(LV_PALETTE_GREEN),
                                                            LV_CHART_AXIS_PRIMARY_Y);

    for(int point = 0; point < 10; point++) {
        /* Make some random data */
        uint32_t vals[3] = {lv_rand(10, 20), lv_rand(20, 30), lv_rand(20, 30)};

        int8_t fixed_point_shift = 5;
```

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```
        uint32_t total = vals[0] + vals[1] + vals[2];
        uint32_t draw_heights[3];
        uint32_t int_sum = 0;
        uint32_t decimal_sum = 0;

        /* Fixed point cascade rounding ensures percentages add to 100 */
        for(int32_t series_index = 0; series_index < 3; series_index++) {
            decimal_sum += (((vals[series_index] * 100) << fixed_point_shift) /␣
↪total);
            int_sum += (vals[series_index] * 100) / total;

            int32_t modifier = (round_fixed_point(decimal_sum, fixed_point_shift) >>␣
↪fixed_point_shift) - int_sum;

            /*  The draw heights are equal to the percentage of the total each value␣
↪is + the cumulative sum of the previous percentages.
                The accumulation is how the values get "stacked" */
            draw_heights[series_index] = int_sum + modifier;

            /*  Draw to the series in the reverse order to which they were␣
↪initialised.
                Without this the higher values will draw on top of the lower ones.
                This is because the Z-height of a series matches the order it was␣
↪initialised */
            lv_chart_set_next_value(stacked_area_chart.obj, stacked_area_chart.series_
↪list[3 - series_index - 1],
                                    draw_heights[series_index]);
        }
    }

    lv_chart_refresh(stacked_area_chart.obj);
}

#endif
```

```
import lvgl as lv

# A class is used to keep track of the series list because later we
#  need to draw to the series in the reverse order to which they were initialised.
class StackedAreaChart:
    def __init__(self):
        self.obj = None
        self.series_list = [None, None, None]

stacked_area_chart = StackedAreaChart()

#
# Callback which draws the blocks of colour under the lines
#
def draw_event_cb(e):

    obj = e.get_target_obj()
    cont_a = lv.area_t()
    obj.get_coords(cont_a)

    #Add the faded area before the lines are drawn
```

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```
    dsc = e.get_draw_part_dsc()
    if dsc.part == lv.PART.ITEMS:
        if not dsc.p1 or not dsc.p2:
            return

        # Add a line mask that keeps the area below the line
        line_mask_param = lv.draw_mask_line_param_t()
        line_mask_param.points_init(dsc.p1.x, dsc.p1.y, dsc.p2.x, dsc.p2.y, lv.DRAW_
↪MASK_LINE_SIDE.BOTTOM)
        line_mask_id = lv.draw_mask_add(line_mask_param, None)

        #Draw a rectangle that will be affected by the mask
        draw_rect_dsc = lv.draw_rect_dsc_t()
        draw_rect_dsc.init()
        draw_rect_dsc.bg_opa = lv.OPA.COVER
        draw_rect_dsc.bg_color = dsc.line_dsc.color

        a = lv.area_t()
        a.x1 = dsc.p1.x
        a.x2 = dsc.p2.x
        a.y1 = min(dsc.p1.y, dsc.p2.y)
        a.y2 = cont_a.y2 - 13 # -13 cuts off where the rectangle draws over the chart␣
↪margin. Without this an area of 0 doesn't look like 0
        dsc.draw_ctx.rect(draw_rect_dsc, a)

        # Remove the mask
        lv.draw_mask_free_param(line_mask_param)
        lv.draw_mask_remove_id(line_mask_id)


#
# Helper function to round a fixed point number
#
def round_fixed_point(n, shift):
    # Create a bitmask to isolates the decimal part of the fixed point number
    mask = 1
    for bit_pos in range(shift):
        mask = (mask << 1) + 1

    decimal_part = n & mask

    # Get 0.5 as fixed point
    rounding_boundary = 1 << (shift - 1)

    # Return either the integer part of n or the integer part + 1
    if decimal_part < rounding_boundary:
        return (n & ~mask)
    return ((n >> shift) + 1) << shift


#
# Stacked area chart
#
def lv_example_chart_8():

    #Create a stacked_area_chart.obj
    stacked_area_chart.obj = lv.chart(lv.scr_act())
```

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```
    stacked_area_chart.obj.set_size(200, 150)
    stacked_area_chart.obj.center()
    stacked_area_chart.obj.set_type( lv.chart.TYPE.LINE)
    stacked_area_chart.obj.set_div_line_count(5, 7)
    stacked_area_chart.obj.add_event( draw_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)

    # Set range to 0 to 100 for percentages. Draw ticks
    stacked_area_chart.obj.set_range(lv.chart.AXIS.PRIMARY_Y,0,100)
    stacked_area_chart.obj.set_axis_tick(lv.chart.AXIS.PRIMARY_Y, 3, 0, 5, 1, True,␣
↪30)

    #Set point size to 0 so the lines are smooth
    stacked_area_chart.obj.set_style_size(0, 0, lv.PART.INDICATOR)

    # Add some data series
    stacked_area_chart.series_list[0] = stacked_area_chart.obj.add_series(lv.palette_
↪main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)
    stacked_area_chart.series_list[1] = stacked_area_chart.obj.add_series(lv.palette_
↪main(lv.PALETTE.BLUE), lv.chart.AXIS.PRIMARY_Y)
    stacked_area_chart.series_list[2] = stacked_area_chart.obj.add_series(lv.palette_
↪main(lv.PALETTE.GREEN), lv.chart.AXIS.PRIMARY_Y)

    for point in range(10):
        # Make some random data
        vals = [lv.rand(10, 20), lv.rand(20, 30), lv.rand(20, 30)]

        fixed_point_shift = 5
        total = vals[0] + vals[1] + vals[2]
        draw_heights = [0, 0, 0]
        int_sum = 0
        decimal_sum = 0

        # Fixed point cascade rounding ensures percentages add to 100
        for series_index in range(3):
            decimal_sum += int(((vals[series_index] * 100) << fixed_point_shift) //␣
↪total)
            int_sum += int((vals[series_index] * 100) / total)

            modifier = (round_fixed_point(decimal_sum, fixed_point_shift) >> fixed_
↪point_shift) - int_sum

            #  The draw heights are equal to the percentage of the total each value␣
↪is + the cumulative sum of the previous percentages.
            #   The accumulation is how the values get "stacked"
            draw_heights[series_index] = int(int_sum + modifier)

            #  Draw to the series in the reverse order to which they were initialised.
            #   Without this the higher values will draw on top of the lower ones.
            #   This is because the Z-height of a series matches the order it was␣
↪initialised
            stacked_area_chart.obj.set_next_value( stacked_area_chart.series_list[3 -␣
↪series_index - 1], draw_heights[series_index])

    stacked_area_chart.obj.refresh()

lv_example_chart_8()
```

2.7.9 Checkbox

Simple Checkboxes

```c
#include "../../lv_examples.h"
#if LV_USE_CHECKBOX && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        LV_UNUSED(obj);
        const char * txt = lv_checkbox_get_text(obj);
        const char * state = lv_obj_get_state(obj) & LV_STATE_CHECKED ? "Checked" :
↪"Unchecked";
        LV_UNUSED(txt);
        LV_UNUSED(state);
        LV_LOG_USER("%s: %s", txt, state);
    }
}

void lv_example_checkbox_1(void)
{
    lv_obj_set_flex_flow(lv_scr_act(), LV_FLEX_FLOW_COLUMN);
    lv_obj_set_flex_align(lv_scr_act(), LV_FLEX_ALIGN_CENTER, LV_FLEX_ALIGN_START, LV_
↪FLEX_ALIGN_CENTER);

    lv_obj_t * cb;
    cb = lv_checkbox_create(lv_scr_act());
    lv_checkbox_set_text(cb, "Apple");
    lv_obj_add_event(cb, event_handler, LV_EVENT_ALL, NULL);

    cb = lv_checkbox_create(lv_scr_act());
    lv_checkbox_set_text(cb, "Banana");
    lv_obj_add_state(cb, LV_STATE_CHECKED);
    lv_obj_add_event(cb, event_handler, LV_EVENT_ALL, NULL);

    cb = lv_checkbox_create(lv_scr_act());
    lv_checkbox_set_text(cb, "Lemon");
    lv_obj_add_state(cb, LV_STATE_DISABLED);
    lv_obj_add_event(cb, event_handler, LV_EVENT_ALL, NULL);

    cb = lv_checkbox_create(lv_scr_act());
    lv_obj_add_state(cb, LV_STATE_CHECKED | LV_STATE_DISABLED);
    lv_checkbox_set_text(cb, "Melon\nand a new line");
    lv_obj_add_event(cb, event_handler, LV_EVENT_ALL, NULL);

    lv_obj_update_layout(cb);
}

#endif
```

```python
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
```

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```
        txt = obj.get_text()
        if obj.get_state() & lv.STATE.CHECKED:
            state = "Checked"
        else:
            state = "Unchecked"
        print(txt + ":" + state)


lv.scr_act().set_flex_flow(lv.FLEX_FLOW.COLUMN)
lv.scr_act().set_flex_align(lv.FLEX_ALIGN.CENTER, lv.FLEX_ALIGN.START, lv.FLEX_ALIGN.
↪CENTER)

cb = lv.checkbox(lv.scr_act())
cb.set_text("Apple")
cb.add_event(event_handler, lv.EVENT.ALL, None)

cb = lv.checkbox(lv.scr_act())
cb.set_text("Banana")
cb.add_state(lv.STATE.CHECKED)
cb.add_event(event_handler, lv.EVENT.ALL, None)

cb = lv.checkbox(lv.scr_act())
cb.set_text("Lemon")
cb.add_state(lv.STATE.DISABLED)
cb.add_event(event_handler, lv.EVENT.ALL, None)

cb = lv.checkbox(lv.scr_act())
cb.add_state(lv.STATE.CHECKED | lv.STATE.DISABLED)
cb.set_text("Melon")
cb.add_event(event_handler, lv.EVENT.ALL, None)

cb.update_layout()
```

Checkboxes as radio buttons

```
#include "../../lv_examples.h"
#if LV_USE_CHECKBOX && LV_BUILD_EXAMPLES

static lv_style_t style_radio;
static lv_style_t style_radio_chk;
static uint32_t active_index_1 = 0;
static uint32_t active_index_2 = 0;

static void radio_event_handler(lv_event_t * e)
{
    uint32_t * active_id = lv_event_get_user_data(e);
    lv_obj_t * cont = lv_event_get_current_target(e);
    lv_obj_t * act_cb = lv_event_get_target(e);
    lv_obj_t * old_cb = lv_obj_get_child(cont, *active_id);

    /*Do nothing if the container was clicked*/
    if(act_cb == cont) return;

    lv_obj_clear_state(old_cb, LV_STATE_CHECKED);   /*Uncheck the previous radio␣
↪button*/
```

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```
    lv_obj_add_state(act_cb, LV_STATE_CHECKED);     /*Uncheck the current radio␣
↪button*/

    *active_id = lv_obj_get_index(act_cb);

    LV_LOG_USER("Selected radio buttons: %d, %d", (int)active_index_1, (int)active_
↪index_2);
}


static void radiobutton_create(lv_obj_t * parent, const char * txt)
{
    lv_obj_t * obj = lv_checkbox_create(parent);
    lv_checkbox_set_text(obj, txt);
    lv_obj_add_flag(obj, LV_OBJ_FLAG_EVENT_BUBBLE);
    lv_obj_add_style(obj, &style_radio, LV_PART_INDICATOR);
    lv_obj_add_style(obj, &style_radio_chk, LV_PART_INDICATOR | LV_STATE_CHECKED);
}

/**
 * Checkboxes as radio buttons
 */
void lv_example_checkbox_2(void)
{
    /* The idea is to enable `LV_OBJ_FLAG_EVENT_BUBBLE` on checkboxes and process the
     * `LV_EVENT_CLICKED` on the container.
     * A variable is passed as event user data where the index of the active
     * radiobutton is saved */


    lv_style_init(&style_radio);
    lv_style_set_radius(&style_radio, LV_RADIUS_CIRCLE);

    lv_style_init(&style_radio_chk);
    lv_style_set_bg_img_src(&style_radio_chk, NULL);

    uint32_t i;
    char buf[32];

    lv_obj_t * cont1 = lv_obj_create(lv_scr_act());
    lv_obj_set_flex_flow(cont1, LV_FLEX_FLOW_COLUMN);
    lv_obj_set_size(cont1, lv_pct(40), lv_pct(80));
    lv_obj_add_event(cont1, radio_event_handler, LV_EVENT_CLICKED, &active_index_1);

    for(i = 0; i < 5; i++) {
        lv_snprintf(buf, sizeof(buf), "A %d", (int)i + 1);
        radiobutton_create(cont1, buf);

    }
    /*Make the first checkbox checked*/
    lv_obj_add_state(lv_obj_get_child(cont1, 0), LV_STATE_CHECKED);

    lv_obj_t * cont2 = lv_obj_create(lv_scr_act());
    lv_obj_set_flex_flow(cont2, LV_FLEX_FLOW_COLUMN);
    lv_obj_set_size(cont2, lv_pct(40), lv_pct(80));
    lv_obj_set_x(cont2, lv_pct(50));
    lv_obj_add_event(cont2, radio_event_handler, LV_EVENT_CLICKED, &active_index_2);
```

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```
    for(i = 0; i < 3; i++) {
        lv_snprintf(buf, sizeof(buf), "B %d", (int)i + 1);
        radiobutton_create(cont2, buf);
    }

    /*Make the first checkbox checked*/
    lv_obj_add_state(lv_obj_get_child(cont2, 0), LV_STATE_CHECKED);
}


#endif
```

```
import time

class LV_Example_Checkbox_2:
    def __init__(self):
        #
        # Checkboxes as radio buttons
        #
        # The idea is to enable `LV_OBJ_FLAG_EVENT_BUBBLE` on checkboxes and process␣
↪the
        #`LV.EVENT.CLICKED` on the container.
        # Since user_data cannot be used to pass parameters in MicroPython I use an␣
↪instance variable to
        # keep the index of the active button

        self.active_index_1 = 0
        self.active_index_2 = 0
        self.style_radio = lv.style_t()
        self.style_radio.init()
        self.style_radio.set_radius(lv.RADIUS_CIRCLE)

        self.style_radio_chk = lv.style_t()
        self.style_radio_chk.init()
        self.style_radio_chk.init()
        self.style_radio_chk.set_bg_img_src(None)

        self.cont1 = lv.obj(lv.scr_act())
        self.cont1.set_flex_flow(lv.FLEX_FLOW.COLUMN)
        self.cont1.set_size(lv.pct(40), lv.pct(80))
        self.cont1.add_event(self.radio_event_handler, lv.EVENT.CLICKED, None)

        for i in range(5):
            txt = "A {:d}".format(i+1)
            self.radiobutton_create(self.cont1,txt)

        # Make the first checkbox checked
        #lv_obj_add_state(lv_obj_get_child(self.cont1, 0), LV_STATE_CHECKED);
        self.cont1.get_child(0).add_state(lv.STATE.CHECKED)

        self.cont2 = lv.obj(lv.scr_act())
        self.cont2.set_flex_flow(lv.FLEX_FLOW.COLUMN)
        self.cont2.set_size(lv.pct(40), lv.pct(80))
        self.cont2.set_x(lv.pct(50))
        self.cont2.add_event(self.radio_event_handler, lv.EVENT.CLICKED, None)
```

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```
        for i in range(3):
            txt = "B {:d}".format(i+1)
            self.radiobutton_create(self.cont2,txt)

        # Make the first checkbox checked*/
        self.cont2.get_child(0).add_state(lv.STATE.CHECKED)


    def radio_event_handler(self,e):
        cont = e.get_current_target_obj()
        act_cb = e.get_target_obj()
        if cont == self.cont1:
            active_id = self.active_index_1
        else:
            active_id = self.active_index_2
        old_cb = cont.get_child(active_id)

        # Do nothing if the container was clicked
        if act_cb == cont:
            return

        old_cb.clear_state(lv.STATE.CHECKED)          # Uncheck the previous radio␣
↪button
        act_cb.add_state(lv.STATE.CHECKED)            # Uncheck the current radio␣
↪button

        if cont == self.cont1:
            self.active_index_1 = act_cb.get_index()
            # print("active index 1: ", self.active_index_1)
        else:
            self.active_index_2 = act_cb.get_index()
            # print("active index 2: ", self.active_index_2)

        print("Selected radio buttons: {:d}, {:d}".format(self.active_index_1, self.
↪active_index_2))

    def radiobutton_create(self,parent, txt):
        obj = lv.checkbox(parent)
        obj.set_text(txt)
        obj.add_flag(lv.obj.FLAG.EVENT_BUBBLE)
        obj.add_style(self.style_radio, lv.PART.INDICATOR)
        obj.add_style(self.style_radio_chk, lv.PART.INDICATOR | lv.STATE.CHECKED)

lv_example_checkbox_2 = LV_Example_Checkbox_2()
```

2.7.10 Colorwheel

Simple Colorwheel

```
#include "../../lv_examples.h"
#if LV_USE_COLORWHEEL && LV_BUILD_EXAMPLES

void lv_example_colorwheel_1(void)
{
    lv_obj_t * cw;

    cw = lv_colorwheel_create(lv_scr_act(), true);
    lv_obj_set_size(cw, 200, 200);
    lv_obj_center(cw);
}

#endif
```

```
cw = lv.colorwheel(lv.scr_act(), True)
cw.set_size(200, 200)
cw.center()
```

2.7.11 Dropdown

Simple Drop down list

```
#include "../../lv_examples.h"
#if LV_USE_DROPDOWN && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        char buf[32];
        lv_dropdown_get_selected_str(obj, buf, sizeof(buf));
        LV_LOG_USER("Option: %s", buf);
    }
}

void lv_example_dropdown_1(void)
{

    /*Create a normal drop down list*/
    lv_obj_t * dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options(dd, "Apple\n"
                                "Banana\n"
                                "Orange\n"
                                "Cherry\n"
                                "Grape\n"
                                "Raspberry\n"
                                "Melon\n"
                                "Orange\n"
```

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```
                                "Lemon\n"
                                "Nuts");

    lv_obj_align(dd, LV_ALIGN_TOP_MID, 0, 20);
    lv_obj_add_event(dd, event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        option = " "*10 # should be large enough to store the option
        obj.get_selected_str(option, len(option))
        # .strip() removes trailing spaces
        print("Option: \"%s\"" % option.strip())

# Create a normal drop down list
dd = lv.dropdown(lv.scr_act())
dd.set_options("\n".join([
    "Apple",
    "Banana",
    "Orange",
    "Cherry",
    "Grape",
    "Raspberry",
    "Melon",
    "Orange",
    "Lemon",
    "Nuts"]))

dd.align(lv.ALIGN.TOP_MID, 0, 20)
dd.add_event(event_handler, lv.EVENT.ALL, None)
```

Drop down in four directions

```
#include "../../lv_examples.h"
#if LV_USE_DROPDOWN && LV_BUILD_EXAMPLES


/**
 * Create a drop down, up, left and right menus
 */
void lv_example_dropdown_2(void)
{
    static const char * opts = "Apple\n"
                               "Banana\n"
                               "Orange\n"
                               "Melon";

    lv_obj_t * dd;
    dd = lv_dropdown_create(lv_scr_act());
```

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```
    lv_dropdown_set_options_static(dd, opts);
    lv_obj_align(dd, LV_ALIGN_TOP_MID, 0, 10);

    dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options_static(dd, opts);
    lv_dropdown_set_dir(dd, LV_DIR_BOTTOM);
    lv_dropdown_set_symbol(dd, LV_SYMBOL_UP);
    lv_obj_align(dd, LV_ALIGN_BOTTOM_MID, 0, -10);

    dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options_static(dd, opts);
    lv_dropdown_set_dir(dd, LV_DIR_RIGHT);
    lv_dropdown_set_symbol(dd, LV_SYMBOL_RIGHT);
    lv_obj_align(dd, LV_ALIGN_LEFT_MID, 10, 0);

    dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options_static(dd, opts);
    lv_dropdown_set_dir(dd, LV_DIR_LEFT);
    lv_dropdown_set_symbol(dd, LV_SYMBOL_LEFT);
    lv_obj_align(dd, LV_ALIGN_RIGHT_MID, -10, 0);
}

#endif
```

```
#
# Create a drop down, up, left and right menus
#

opts = "\n".join([
    "Apple",
    "Banana",
    "Orange",
    "Melon",
    "Grape",
    "Raspberry"])

dd = lv.dropdown(lv.scr_act())
dd.set_options_static(opts)
dd.align(lv.ALIGN.TOP_MID, 0, 10)
dd = lv.dropdown(lv.scr_act())
dd.set_options_static(opts)
dd.set_dir(lv.DIR.BOTTOM)
dd.set_symbol(lv.SYMBOL.UP)
dd.align(lv.ALIGN.BOTTOM_MID, 0, -10)

dd = lv.dropdown(lv.scr_act())
dd.set_options_static(opts)
dd.set_dir(lv.DIR.RIGHT)
dd.set_symbol(lv.SYMBOL.RIGHT)
dd.align(lv.ALIGN.LEFT_MID, 10, 0)

dd = lv.dropdown(lv.scr_act())
dd.set_options_static(opts)
dd.set_dir(lv.DIR.LEFT)
dd.set_symbol(lv.SYMBOL.LEFT)
dd.align(lv.ALIGN.RIGHT_MID, -10, 0)
```

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Menu

```
#include "../../lv_examples.h"
#if LV_USE_DROPDOWN && LV_BUILD_EXAMPLES

static void event_cb(lv_event_t * e)
{
    lv_obj_t * dropdown = lv_event_get_target(e);
    char buf[64];
    lv_dropdown_get_selected_str(dropdown, buf, sizeof(buf));
    LV_LOG_USER("'%s' is selected", buf);
}

/**
 * Create a menu from a drop-down list and show some drop-down list features and␣
↪styling
 */
void lv_example_dropdown_3(void)
{
    /*Create a drop down list*/
    lv_obj_t * dropdown = lv_dropdown_create(lv_scr_act());
    lv_obj_align(dropdown, LV_ALIGN_TOP_LEFT, 10, 10);
    lv_dropdown_set_options(dropdown, "New project\n"
                            "New file\n"
                            "Save\n"
                            "Save as ...\n"
                            "Open project\n"
                            "Recent projects\n"
                            "Preferences\n"
                            "Exit");

    /*Set a fixed text to display on the button of the drop-down list*/
    lv_dropdown_set_text(dropdown, "Menu");

    /*Use a custom image as down icon and flip it when the list is opened*/
    LV_IMG_DECLARE(img_caret_down)
    lv_dropdown_set_symbol(dropdown, &img_caret_down);
    lv_obj_set_style_transform_angle(dropdown, 1800, LV_PART_INDICATOR | LV_STATE_
↪CHECKED);

    /*In a menu we don't need to show the last clicked item*/
    lv_dropdown_set_selected_highlight(dropdown, false);

    lv_obj_add_event(dropdown, event_cb, LV_EVENT_VALUE_CHANGED, NULL);
}

#endif
```

```
# Create an image from the png file
try:
    with open('../../assets/img_caret_down.png','rb') as f:
```

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```
        png_data = f.read()
except:
    print("Could not find img_caret_down.png")
    sys.exit()

img_caret_down_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def event_cb(e):
    dropdown = e.get_target_obj()
    option = " "*64 # should be large enough to store the option
    dropdown.get_selected_str(option, len(option))
    print(option.strip() +" is selected")
#
# Create a menu from a drop-down list and show some drop-down list features and␣
↪styling
#

# Create a drop down list
dropdown = lv.dropdown(lv.scr_act())
dropdown.align(lv.ALIGN.TOP_LEFT, 10, 10)
dropdown.set_options("\n".join([
    "New project",
    "New file",
    "Open project",
    "Recent projects",
    "Preferences",
    "Exit"]))

# Set a fixed text to display on the button of the drop-down list
dropdown.set_text("Menu")

# Use a custom image as down icon and flip it when the list is opened
# LV_IMG_DECLARE(img_caret_down)
dropdown.set_symbol(img_caret_down_argb)
dropdown.set_style_transform_angle(1800, lv.PART.INDICATOR | lv.STATE.CHECKED)

# In a menu we don't need to show the last clicked item
dropdown.set_selected_highlight(False)

dropdown.add_event(event_cb, lv.EVENT.VALUE_CHANGED, None)
```

2.7.12 Image

Image from variable and symbol

```
#include "../../lv_examples.h"
#if LV_USE_IMG && LV_BUILD_EXAMPLES


void lv_example_img_1(void)
```

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```
{
    LV_IMG_DECLARE(img_cogwheel_chroma_keyed);
    lv_obj_t * img1 = lv_img_create(lv_scr_act());
    lv_img_set_src(img1, &img_cogwheel_chroma_keyed);
    lv_obj_align(img1, LV_ALIGN_CENTER, 0, -20);
    lv_obj_set_size(img1, 200, 200);

    lv_obj_t * img2 = lv_img_create(lv_scr_act());
    lv_img_set_src(img2, LV_SYMBOL_OK "Accept");
    lv_obj_align_to(img2, img1, LV_ALIGN_OUT_BOTTOM_MID, 0, 20);
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import usys as sys
import lvgl as lv
import display_driver

# Create an image from the png file
try:
    with open('../../assets/img_cogwheel_argb.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_cogwheel_argb.png")
    sys.exit()

img_cogwheel_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

img1 = lv.img(lv.scr_act())
img1.set_src(img_cogwheel_argb)
img1.align(lv.ALIGN.CENTER, 0, -20)
img1.set_size(200, 200)

img2 = lv.img(lv.scr_act())
img2.set_src(lv.SYMBOL.OK + "Accept")
img2.align_to(img1, lv.ALIGN.OUT_BOTTOM_MID, 0, 20)
```

Image recoloring

```
#include "../../lv_examples.h"
#if LV_USE_IMG && LV_USE_SLIDER && LV_BUILD_EXAMPLES

static lv_obj_t * create_slider(lv_color_t color);
static void slider_event_cb(lv_event_t * e);

static lv_obj_t * red_slider, * green_slider, * blue_slider, * intense_slider;
static lv_obj_t * img1;


/**
```

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```
 * Demonstrate runtime image re-coloring
 */
void lv_example_img_2(void)
{
    /*Create 4 sliders to adjust RGB color and re-color intensity*/
    red_slider = create_slider(lv_palette_main(LV_PALETTE_RED));
    green_slider = create_slider(lv_palette_main(LV_PALETTE_GREEN));
    blue_slider = create_slider(lv_palette_main(LV_PALETTE_BLUE));
    intense_slider = create_slider(lv_palette_main(LV_PALETTE_GREY));

    lv_slider_set_value(red_slider, LV_OPA_20, LV_ANIM_OFF);
    lv_slider_set_value(green_slider, LV_OPA_90, LV_ANIM_OFF);
    lv_slider_set_value(blue_slider, LV_OPA_60, LV_ANIM_OFF);
    lv_slider_set_value(intense_slider, LV_OPA_50, LV_ANIM_OFF);

    lv_obj_align(red_slider, LV_ALIGN_LEFT_MID, 25, 0);
    lv_obj_align_to(green_slider, red_slider, LV_ALIGN_OUT_RIGHT_MID, 25, 0);
    lv_obj_align_to(blue_slider, green_slider, LV_ALIGN_OUT_RIGHT_MID, 25, 0);
    lv_obj_align_to(intense_slider, blue_slider, LV_ALIGN_OUT_RIGHT_MID, 25, 0);

    /*Now create the actual image*/
    LV_IMG_DECLARE(img_cogwheel_argb)
    img1 = lv_img_create(lv_scr_act());
    lv_img_set_src(img1, &img_cogwheel_argb);
    lv_obj_align(img1, LV_ALIGN_RIGHT_MID, -20, 0);

    lv_obj_send_event(intense_slider, LV_EVENT_VALUE_CHANGED, NULL);
}

static void slider_event_cb(lv_event_t * e)
{
    LV_UNUSED(e);

    /*Recolor the image based on the sliders' values*/
    lv_color_t color  = lv_color_make(lv_slider_get_value(red_slider), lv_slider_get_
↪value(green_slider),
                                      lv_slider_get_value(blue_slider));
    lv_opa_t intense = lv_slider_get_value(intense_slider);
    lv_obj_set_style_img_recolor_opa(img1, intense, 0);
    lv_obj_set_style_img_recolor(img1, color, 0);
}

static lv_obj_t * create_slider(lv_color_t color)
{
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_slider_set_range(slider, 0, 255);
    lv_obj_set_size(slider, 10, 200);
    lv_obj_set_style_bg_color(slider, color, LV_PART_KNOB);
    lv_obj_set_style_bg_color(slider, lv_color_darken(color, LV_OPA_40), LV_PART_
↪INDICATOR);
    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    return slider;
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import usys as sys
import lvgl as lv
import display_driver

# Create an image from the png file
try:
    with open('../../assets/img_cogwheel_argb.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_cogwheel_argb.png")
    sys.exit()

img_cogwheel_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def create_slider(color):
    slider = lv.slider(lv.scr_act())
    slider.set_range(0, 255)
    slider.set_size(10, 200)
    slider.set_style_bg_color(color, lv.PART.KNOB)
    slider.set_style_bg_color(color.color_darken(lv.OPA._40), lv.PART.INDICATOR)
    slider.add_event(slider_event_cb, lv.EVENT.VALUE_CHANGED, None)
    return slider

def slider_event_cb(e):
    # Recolor the image based on the sliders' values
    color  = lv.color_make(red_slider.get_value(), green_slider.get_value(), blue_
↪slider.get_value())
    intense = intense_slider.get_value()
    img1.set_style_img_recolor_opa(intense, 0)
    img1.set_style_img_recolor(color, 0)

#
# Demonstrate runtime image re-coloring
#
# Create 4 sliders to adjust RGB color and re-color intensity
red_slider = create_slider(lv.palette_main(lv.PALETTE.RED))
green_slider = create_slider(lv.palette_main(lv.PALETTE.GREEN))
blue_slider = create_slider(lv.palette_main(lv.PALETTE.BLUE))
intense_slider = create_slider(lv.palette_main(lv.PALETTE.GREY))

red_slider.set_value(lv.OPA._20, lv.ANIM.OFF)
green_slider.set_value(lv.OPA._90, lv.ANIM.OFF)
blue_slider.set_value(lv.OPA._60, lv.ANIM.OFF)
intense_slider.set_value(lv.OPA._50, lv.ANIM.OFF)

red_slider.align(lv.ALIGN.LEFT_MID, 25, 0)
green_slider.align_to(red_slider, lv.ALIGN.OUT_RIGHT_MID, 25, 0)
blue_slider.align_to(green_slider, lv.ALIGN.OUT_RIGHT_MID, 25, 0)
intense_slider.align_to(blue_slider, lv.ALIGN.OUT_RIGHT_MID, 25, 0)

# Now create the actual image
img1 = lv.img(lv.scr_act())
img1.set_src(img_cogwheel_argb)
```

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```
img1.align(lv.ALIGN.RIGHT_MID, -20, 0)

intense_slider.send_event(lv.EVENT.VALUE_CHANGED, None)
```

Rotate and zoom

```
#include "../../lv_examples.h"
#if LV_USE_IMG && LV_BUILD_EXAMPLES

static void set_angle(void * img, int32_t v)
{
    lv_img_set_angle(img, v);
}

static void set_zoom(void * img, int32_t v)
{
    lv_img_set_zoom(img, v);
}


/**
 * Show transformations (zoom and rotation) using a pivot point.
 */
void lv_example_img_3(void)
{
    LV_IMG_DECLARE(img_cogwheel_argb);

    /*Now create the actual image*/
    lv_obj_t * img = lv_img_create(lv_scr_act());
    lv_img_set_src(img, &img_cogwheel_argb);
    lv_obj_align(img, LV_ALIGN_CENTER, 50, 50);
    lv_img_set_pivot(img, 0, 0);    /*Rotate around the top left corner*/

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, img);
    lv_anim_set_exec_cb(&a, set_angle);
    lv_anim_set_values(&a, 0, 3600);
    lv_anim_set_time(&a, 5000);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);

    lv_anim_set_exec_cb(&a, set_zoom);
    lv_anim_set_values(&a, 128, 256);
    lv_anim_set_playback_time(&a, 3000);
    lv_anim_start(&a);
}

#endif
```

```python
#!/opt/bin/lv_micropython -i
import usys as sys
import lvgl as lv
import display_driver

# Create an image from the png file
try:
    with open('../../assets/img_cogwheel_argb.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_cogwheel_argb.png")
    sys.exit()

img_cogwheel_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def set_angle(img, v):
    img.set_angle(v)

def set_zoom(img, v):
    img.set_zoom(v)


#
# Show transformations (zoom and rotation) using a pivot point.
#

# Now create the actual image
img = lv.img(lv.scr_act())
img.set_src(img_cogwheel_argb)
img.align(lv.ALIGN.CENTER, 50, 50)
img.set_pivot(0, 0)               # Rotate around the top left corner

a1 = lv.anim_t()
a1.init()
a1.set_var(img)
a1.set_custom_exec_cb(lambda a,val: set_angle(img,val))
a1.set_values(0, 3600)
a1.set_time(5000)
a1.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
lv.anim_t.start(a1)

a2 = lv.anim_t()
a2.init()
a2.set_var(img)
a2.set_custom_exec_cb(lambda a,val: set_zoom(img,val))
a2.set_values(128, 256)
a2.set_time(5000)
a2.set_playback_time(3000)
a2.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
lv.anim_t.start(a2)
```

Image offset and styling

```c
#include "../../lv_examples.h"
#if LV_USE_IMG && LV_BUILD_EXAMPLES

static void ofs_y_anim(void * img, int32_t v)
{
    lv_img_set_offset_y(img, v);
}

/**
 * Image styling and offset
 */
void lv_example_img_4(void)
{
    LV_IMG_DECLARE(img_skew_strip);

    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_bg_color(&style, lv_palette_main(LV_PALETTE_YELLOW));
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_img_recolor_opa(&style, LV_OPA_COVER);
    lv_style_set_img_recolor(&style, lv_color_black());

    lv_obj_t * img = lv_img_create(lv_scr_act());
    lv_obj_add_style(img, &style, 0);
    lv_img_set_src(img, &img_skew_strip);
    lv_obj_set_size(img, 150, 100);
    lv_obj_center(img);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, img);
    lv_anim_set_exec_cb(&a, ofs_y_anim);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_set_time(&a, 3000);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);

}

#endif
```

```python
def ofs_y_anim(img, v):
    img.set_offset_y(v)
    # print(img,v)

# Create an image from the png file
try:
    with open('../../assets/img_skew_strip.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_skew_strip.png")
    sys.exit()
```

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```
img_skew_strip = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

#
# Image styling and offset
#

style = lv.style_t()
style.init()
style.set_bg_color(lv.palette_main(lv.PALETTE.YELLOW))
style.set_bg_opa(lv.OPA.COVER)
style.set_img_recolor_opa(lv.OPA.COVER)
style.set_img_recolor(lv.color_black())

img = lv.img(lv.scr_act())
img.add_style(style, 0)
img.set_src(img_skew_strip)
img.set_size(150, 100)
img.center()

a = lv.anim_t()
a.init()
a.set_var(img)
a.set_values(0, 100)
a.set_time(3000)
a.set_playback_time(500)
a.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a.set_custom_exec_cb(lambda a,val: ofs_y_anim(img,val))
lv.anim_t.start(a)
```

2.7.13 Image button

Simple Image button

```
#include "../../lv_examples.h"
#if LV_USE_IMGBTN && LV_BUILD_EXAMPLES

void lv_example_imgbtn_1(void)
{
    LV_IMG_DECLARE(imgbtn_left);
    LV_IMG_DECLARE(imgbtn_right);
    LV_IMG_DECLARE(imgbtn_mid);

    /*Create a transition animation on width transformation and recolor.*/
    static lv_style_prop_t tr_prop[] = {LV_STYLE_TRANSFORM_WIDTH, LV_STYLE_IMG_
↪RECOLOR_OPA, 0};
    static lv_style_transition_dsc_t tr;
    lv_style_transition_dsc_init(&tr, tr_prop, lv_anim_path_linear, 200, 0, NULL);

    static lv_style_t style_def;
    lv_style_init(&style_def);
```

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```
    lv_style_set_text_color(&style_def, lv_color_white());
    lv_style_set_transition(&style_def, &tr);

    /*Darken the button when pressed and make it wider*/
    static lv_style_t style_pr;
    lv_style_init(&style_pr);
    lv_style_set_img_recolor_opa(&style_pr, LV_OPA_30);
    lv_style_set_img_recolor(&style_pr, lv_color_black());
    lv_style_set_transform_width(&style_pr, 20);

    /*Create an image button*/
    lv_obj_t * imgbtn1 = lv_imgbtn_create(lv_scr_act());
    lv_imgbtn_set_src(imgbtn1, LV_IMGBTN_STATE_RELEASED, &imgbtn_left, &imgbtn_mid, &
↪imgbtn_right);
    lv_obj_add_style(imgbtn1, &style_def, 0);
    lv_obj_add_style(imgbtn1, &style_pr, LV_STATE_PRESSED);

    lv_obj_align(imgbtn1, LV_ALIGN_CENTER, 0, 0);

    /*Create a label on the image button*/
    lv_obj_t * label = lv_label_create(imgbtn1);
    lv_label_set_text(label, "Button");
    lv_obj_align(label, LV_ALIGN_CENTER, 0, -4);
}

#endif
```

```
# Create an image from the png file
try:
    with open('../../assets/imgbtn_left.png','rb') as f:
        imgbtn_left_data = f.read()
except:
    print("Could not find imgbtn_left.png")
    sys.exit()

imgbtn_left_dsc = lv.img_dsc_t({
  'data_size': len(imgbtn_left_data),
  'data': imgbtn_left_data
})

try:
    with open('../../assets/imgbtn_mid.png','rb') as f:
        imgbtn_mid_data = f.read()
except:
    print("Could not find imgbtn_mid.png")
    sys.exit()

imgbtn_mid_dsc = lv.img_dsc_t({
  'data_size': len(imgbtn_mid_data),
  'data': imgbtn_mid_data
})

try:
    with open('../../assets/imgbtn_right.png','rb') as f:
        imgbtn_right_data = f.read()
except:
```

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```
    print("Could not find imgbtn_right.png")
    sys.exit()

imgbtn_right_dsc = lv.img_dsc_t({
  'data_size': len(imgbtn_right_data),
  'data': imgbtn_right_data
})

# Create a transition animation on width transformation and recolor.
tr_prop = [lv.STYLE.TRANSFORM_WIDTH, lv.STYLE.IMG_RECOLOR_OPA, 0]
tr = lv.style_transition_dsc_t()
tr.init(tr_prop, lv.anim_t.path_linear, 200, 0, None)

style_def = lv.style_t()
style_def.init()
style_def.set_text_color(lv.color_white())
style_def.set_transition(tr)

# Darken the button when pressed and make it wider
style_pr = lv.style_t()
style_pr.init()
style_pr.set_img_recolor_opa(lv.OPA._30)
style_pr.set_img_recolor(lv.color_black())
style_pr.set_transform_width(20)

# Create an image button
imgbtn1 = lv.imgbtn(lv.scr_act())
imgbtn1.set_src(lv.imgbtn.STATE.RELEASED, imgbtn_left_dsc, imgbtn_mid_dsc, imgbtn_
↪right_dsc)
imgbtn1.add_style(style_def, 0)
imgbtn1.add_style(style_pr, lv.STATE.PRESSED)

imgbtn1.align(lv.ALIGN.CENTER, 0, 0)

# Create a label on the image button
label = lv.label(imgbtn1)
label.set_text("Button")
label.align(lv.ALIGN.CENTER, 0, -4)
```

2.7.14 Keyboard

Keyboard with text area

```
#include "../../lv_examples.h"
#if LV_USE_KEYBOARD && LV_BUILD_EXAMPLES

static void ta_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * ta = lv_event_get_target(e);
    lv_obj_t * kb = lv_event_get_user_data(e);
    if(code == LV_EVENT_FOCUSED) {
        lv_keyboard_set_textarea(kb, ta);
```

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```
        lv_obj_clear_flag(kb, LV_OBJ_FLAG_HIDDEN);
    }

    if(code == LV_EVENT_DEFOCUSED) {
        lv_keyboard_set_textarea(kb, NULL);
        lv_obj_add_flag(kb, LV_OBJ_FLAG_HIDDEN);
    }
}

void lv_example_keyboard_1(void)
{
    /*Create a keyboard to use it with an of the text areas*/
    lv_obj_t * kb = lv_keyboard_create(lv_scr_act());

    /*Create a text area. The keyboard will write here*/
    lv_obj_t * ta;
    ta = lv_textarea_create(lv_scr_act());
    lv_obj_align(ta, LV_ALIGN_TOP_LEFT, 10, 10);
    lv_obj_add_event(ta, ta_event_cb, LV_EVENT_ALL, kb);
    lv_textarea_set_placeholder_text(ta, "Hello");
    lv_obj_set_size(ta, 140, 80);

    ta = lv_textarea_create(lv_scr_act());
    lv_obj_align(ta, LV_ALIGN_TOP_RIGHT, -10, 10);
    lv_obj_add_event(ta, ta_event_cb, LV_EVENT_ALL, kb);
    lv_obj_set_size(ta, 140, 80);

    lv_keyboard_set_textarea(kb, ta);
}
#endif
```

```
def ta_event_cb(e,kb):
    code = e.get_code()
    ta = e.get_target_obj()
    if code == lv.EVENT.FOCUSED:
        kb.set_textarea(ta)
        kb.clear_flag(lv.obj.FLAG.HIDDEN)

    if code == lv.EVENT.DEFOCUSED:
        kb.set_textarea(None)
        kb.add_flag(lv.obj.FLAG.HIDDEN)

# Create a keyboard to use it with one of the text areas
kb = lv.keyboard(lv.scr_act())

# Create a text area. The keyboard will write here
ta = lv.textarea(lv.scr_act())
ta.set_width(200)
ta.align(lv.ALIGN.TOP_LEFT, 10, 10)
ta.add_event(lambda e: ta_event_cb(e,kb), lv.EVENT.ALL, None)
ta.set_placeholder_text("Hello")

ta = lv.textarea(lv.scr_act())
ta.set_width(200)
ta.align(lv.ALIGN.TOP_RIGHT, -10, 10)
ta.add_event(lambda e: ta_event_cb(e,kb), lv.EVENT.ALL, None)
```

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```
kb.set_textarea(ta)
```

Keyboard with custom map

```
#include "../../lv_examples.h"
#if LV_USE_KEYBOARD && LV_BUILD_EXAMPLES

void lv_example_keyboard_2(void)
{
    /*Create an AZERTY keyboard map*/
    static const char * kb_map[] = {"A", "Z", "E", "R", "T", "Y", "U", "I", "O", "P", LV_SYMBOL_BACKSPACE, "\n",
                                    "Q", "S", "D", "F", "G", "J", "K", "L", "M",  LV_SYMBOL_NEW_LINE, "\n",
                                    "W", "X", "C", "V", "B", "N", ",", ".", ":", "!", "?", "\n",
                                    LV_SYMBOL_CLOSE, " ",  " ", " ", LV_SYMBOL_OK, NULL
                                   };

    /*Set the relative width of the buttons and other controls*/
    static const lv_btnmatrix_ctrl_t kb_ctrl[] = {4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 6,
                                                  4, 4, 4, 4, 4, 4, 4, 4, 4, 6,
                                                  4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
                                                  2, LV_BTNMATRIX_CTRL_HIDDEN | 2, 6, LV_BTNMATRIX_CTRL_HIDDEN | 2, 2
                                                 };

    /*Create a keyboard and add the new map as USER_1 mode*/
    lv_obj_t * kb = lv_keyboard_create(lv_scr_act());

    lv_keyboard_set_map(kb, LV_KEYBOARD_MODE_USER_1, kb_map, kb_ctrl);
    lv_keyboard_set_mode(kb, LV_KEYBOARD_MODE_USER_1);

    /*Create a text area. The keyboard will write here*/
    lv_obj_t * ta;
    ta = lv_textarea_create(lv_scr_act());
    lv_obj_align(ta, LV_ALIGN_TOP_MID, 0, 10);
    lv_obj_set_size(ta, lv_pct(90), 80);
    lv_obj_add_state(ta, LV_STATE_FOCUSED);

    lv_keyboard_set_textarea(kb, ta);
}
#endif
```

```
# Create an AZERTY keyboard map
kb_map = ["A", "Z", "E", "R", "T", "Y", "U", "I", "O", "P", lv.SYMBOL.BACKSPACE, "\n",
          "Q", "S", "D", "F", "G", "J", "K", "L", "M",  lv.SYMBOL.NEW_LINE, "\n",
          "W", "X", "C", "V", "B", "N", ",", ".", ":", "!", "?", "\n",
          lv.SYMBOL.CLOSE, " ",  " ", " ", lv.SYMBOL.OK, None]

# Set the relative width of the buttons and other controls
```

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```
kb_ctrl = [4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 6,
           4, 4, 4, 4, 4, 4, 4, 4, 4, 6,
           4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
           2, lv.btnmatrix.CTRL.HIDDEN | 2, 6, lv.btnmatrix.CTRL.HIDDEN | 2, 2]

# Create a keyboard and add the new map as USER_1 mode
kb = lv.keyboard(lv.scr_act())

kb.set_map(lv.keyboard.MODE.USER_1, kb_map, kb_ctrl)
kb.set_mode(lv.keyboard.MODE.USER_1)

# Create a text area. The keyboard will write here
ta = lv.textarea(lv.scr_act())
ta.align(lv.ALIGN.TOP_MID, 0, 10)
ta.set_size(lv.pct(90), 80)
ta.add_state(lv.STATE.FOCUSED)

kb.set_textarea(ta)
```

2.7.15 Label

Line wrap, recoloring and scrolling

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_BUILD_EXAMPLES

/**
 * Show line wrap, re-color, line align and text scrolling.
 */
void lv_example_label_1(void)
{
    lv_obj_t * label1 = lv_label_create(lv_scr_act());
    lv_label_set_long_mode(label1, LV_LABEL_LONG_WRAP);     /*Break the long lines*/
    lv_label_set_recolor(label1, true);                      /*Enable re-coloring by␣
↪commands in the text*/
    lv_label_set_text(label1, "#0000ff Re-color# #ff00ff words# #ff0000 of a# label,␣
↪align the lines to the center "
                      "and wrap long text automatically.");
    lv_obj_set_width(label1, 150);  /*Set smaller width to make the lines wrap*/
    lv_obj_set_style_text_align(label1, LV_TEXT_ALIGN_CENTER, 0);
    lv_obj_align(label1, LV_ALIGN_CENTER, 0, -40);

    lv_obj_t * label2 = lv_label_create(lv_scr_act());
    lv_label_set_long_mode(label2, LV_LABEL_LONG_SCROLL_CIRCULAR);     /*Circular␣
↪scroll*/
    lv_obj_set_width(label2, 150);
    lv_label_set_text(label2, "It is a circularly scrolling text. ");
    lv_obj_align(label2, LV_ALIGN_CENTER, 0, 40);
}

#endif
```

```
#
# Show line wrap, re-color, line align and text scrolling.
#
label1 = lv.label(lv.scr_act())
label1.set_long_mode(lv.label.LONG.WRAP)      # Break the long lines*/
label1.set_recolor(True)                      # Enable re-coloring by commands in the␣
↪text
label1.set_text("#0000ff Re-color# #ff00ff words# #ff0000 of a# label, align the␣
↪lines to the center"
                              "and  wrap long text automatically.")
label1.set_width(150)                         # Set smaller width to make the lines␣
↪wrap
label1.set_style_text_align(lv.ALIGN.CENTER, 0)
label1.align(lv.ALIGN.CENTER, 0, -40)


label2 = lv.label(lv.scr_act())
label2.set_long_mode(lv.label.LONG.SCROLL_CIRCULAR) # Circular scroll
label2.set_width(150)
label2.set_text("It is a circularly scrolling text. ")
label2.align(lv.ALIGN.CENTER, 0, 40)
```

Text shadow

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_BUILD_EXAMPLES

/**
 * Create a fake text shadow
 */
void lv_example_label_2(void)
{
    /*Create a style for the shadow*/
    static lv_style_t style_shadow;
    lv_style_init(&style_shadow);
    lv_style_set_text_opa(&style_shadow, LV_OPA_30);
    lv_style_set_text_color(&style_shadow, lv_color_black());

    /*Create a label for the shadow first (it's in the background)*/
    lv_obj_t * shadow_label = lv_label_create(lv_scr_act());
    lv_obj_add_style(shadow_label, &style_shadow, 0);

    /*Create the main label*/
    lv_obj_t * main_label = lv_label_create(lv_scr_act());
    lv_label_set_text(main_label, "A simple method to create\n"
                      "shadows on a text.\n"
                      "It even works with\n\n"
                      "newlines     and spaces.");

    /*Set the same text for the shadow label*/
    lv_label_set_text(shadow_label, lv_label_get_text(main_label));

    /*Position the main label*/
    lv_obj_align(main_label, LV_ALIGN_CENTER, 0, 0);
```

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```
    /*Shift the second label down and to the right by 2 pixel*/
    lv_obj_align_to(shadow_label, main_label, LV_ALIGN_TOP_LEFT, 2, 2);
}

#endif
```

```
#
# Create a fake text shadow
#

# Create a style for the shadow
style_shadow = lv.style_t()
style_shadow.init()
style_shadow.set_text_opa(lv.OPA._30)
style_shadow.set_text_color(lv.color_black())

# Create a label for the shadow first (it's in the background)
shadow_label = lv.label(lv.scr_act())
shadow_label.add_style(style_shadow, 0)

# Create the main label
main_label = lv.label(lv.scr_act())
main_label.set_text("A simple method to create\n"
                   "shadows on a text.\n"
                   "It even works with\n\n"
                   "newlines     and spaces.")

# Set the same text for the shadow label
shadow_label.set_text(lv.label.get_text(main_label))

# Position the main label
main_label.align(lv.ALIGN.CENTER, 0, 0)

# Shift the second label down and to the right by 2 pixel
shadow_label.align_to(main_label, lv.ALIGN.TOP_LEFT, 2, 2)
```

Show LTR, RTL and Chinese texts

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_BUILD_EXAMPLES && LV_FONT_DEJAVU_16_PERSIAN_HEBREW && LV_FONT_
→SIMSUN_16_CJK && LV_USE_BIDI

/**
 * Show mixed LTR, RTL and Chinese label
 */
void lv_example_label_3(void)
{
    lv_obj_t * ltr_label = lv_label_create(lv_scr_act());
    lv_label_set_text(ltr_label, "In modern terminology, a microcontroller is similar␣
→to a system on a chip (SoC).");
    lv_obj_set_style_text_font(ltr_label, &lv_font_montserrat_16, 0);
    lv_obj_set_width(ltr_label, 310);
```

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```
    lv_obj_align(ltr_label, LV_ALIGN_TOP_LEFT, 5, 5);

    lv_obj_t * rtl_label = lv_label_create(lv_scr_act());
    lv_label_set_text(rtl_label,
                      ",□□□□ □□ □□□□ □□□□ □□□□□ □□□□□ □□□□□□ :□□□□□□□) CPU - Central␣
↪Processing Unit).");
    lv_obj_set_style_base_dir(rtl_label, LV_BASE_DIR_RTL, 0);
    lv_obj_set_style_text_font(rtl_label, &lv_font_dejavu_16_persian_hebrew, 0);
    lv_obj_set_width(rtl_label, 310);
    lv_obj_align(rtl_label, LV_ALIGN_LEFT_MID, 5, 0);

    lv_obj_t * cz_label = lv_label_create(lv_scr_act());
    lv_label_set_text(cz_label,
                      "□□□□□□Embedded System□□\n□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□");
    lv_obj_set_style_text_font(cz_label, &lv_font_simsun_16_cjk, 0);
    lv_obj_set_width(cz_label, 310);
    lv_obj_align(cz_label, LV_ALIGN_BOTTOM_LEFT, 5, -5);
}

#endif
```

```
import fs_driver
#
# Show mixed LTR, RTL and Chinese label
#

ltr_label = lv.label(lv.scr_act())
ltr_label.set_text("In modern terminology, a microcontroller is similar to a system␣
↪on a chip (SoC).")
# ltr_label.set_style_text_font(ltr_label, &lv_font_montserrat_16, 0);

fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'S')

try:
    ltr_label.set_style_text_font(ltr_label, lv.font_montserrat_16, 0)
except:
    font_montserrat_16 = lv.font_load("S:../../assets/font/montserrat-16.fnt")
    ltr_label.set_style_text_font(font_montserrat_16, 0)

ltr_label.set_width(310)
ltr_label.align(lv.ALIGN.TOP_LEFT, 5, 5)

rtl_label = lv.label(lv.scr_act())
rtl_label.set_text(",□□□□ □□ □□□□ □□□□ □□□□□ □□□□□ □□□□□□ :□□□□□□□) CPU - Central␣
↪Processing Unit).")
rtl_label.set_style_base_dir(lv.BASE_DIR.RTL, 0)
rtl_label.set_style_text_font(lv.font_dejavu_16_persian_hebrew, 0)
rtl_label.set_width(310)
rtl_label.align(lv.ALIGN.LEFT_MID, 5, 0)

font_simsun_16_cjk = lv.font_load("S:../../assets/font/lv_font_simsun_16_cjk.fnt")

cz_label = lv.label(lv.scr_act())
cz_label.set_style_text_font(font_simsun_16_cjk, 0)
cz_label.set_text("□□□□□□Embedded System□□\n□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□")
```

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```
cz_label.set_width(310)
cz_label.align(lv.ALIGN.BOTTOM_LEFT, 5, -5)
```

Draw label with gradient color

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_USE_CANVAS && LV_BUILD_EXAMPLES && LV_USE_DRAW_MASKS

#define MASK_WIDTH 100
#define MASK_HEIGHT 45

static void add_mask_event_cb(lv_event_t * e)
{
    static lv_draw_mask_map_param_t m;
    static int16_t mask_id;

    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    lv_opa_t * mask_map = lv_event_get_user_data(e);
    if(code == LV_EVENT_COVER_CHECK) {
        lv_event_set_cover_res(e, LV_COVER_RES_MASKED);
    }
    else if(code == LV_EVENT_DRAW_MAIN_BEGIN) {
        lv_draw_mask_map_init(&m, &obj->coords, mask_map);
        mask_id = lv_draw_mask_add(&m, NULL);

    }
    else if(code == LV_EVENT_DRAW_MAIN_END) {
        lv_draw_mask_free_param(&m);
        lv_draw_mask_remove_id(mask_id);
    }
}

/**
 * Draw label with gradient color
 */
void lv_example_label_4(void)
{
    /* Create the mask of a text by drawing it to a canvas*/
    static lv_opa_t mask_map[MASK_WIDTH * MASK_HEIGHT];

    /*Create a "8 bit alpha" canvas and clear it*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, mask_map, MASK_WIDTH, MASK_HEIGHT, LV_COLOR_FORMAT_
↪L8);
    lv_canvas_fill_bg(canvas, lv_color_black(), LV_OPA_TRANSP);

    /*Draw a label to the canvas. The result "image" will be used as mask*/
    lv_draw_label_dsc_t label_dsc;
    lv_draw_label_dsc_init(&label_dsc);
    label_dsc.color = lv_color_white();
    label_dsc.align = LV_TEXT_ALIGN_CENTER;
    lv_canvas_draw_text(canvas, 5, 5, MASK_WIDTH, &label_dsc, "Text with gradient");
```

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```
    /*The mask is reads the canvas is not required anymore*/
    lv_obj_del(canvas);

    /* Create an object from where the text will be masked out.
     * Now it's a rectangle with a gradient but it could be an image too*/
    lv_obj_t * grad = lv_obj_create(lv_scr_act());
    lv_obj_set_size(grad, MASK_WIDTH, MASK_HEIGHT);
    lv_obj_center(grad);
    lv_obj_set_style_bg_color(grad, lv_color_hex(0xff0000), 0);
    lv_obj_set_style_bg_grad_color(grad, lv_color_hex(0x0000ff), 0);
    lv_obj_set_style_bg_grad_dir(grad, LV_GRAD_DIR_HOR, 0);
    lv_obj_add_event(grad, add_mask_event_cb, LV_EVENT_ALL, mask_map);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/widgets/
↪label/lv_example_label_4.py
```

Customize circular scrolling animation

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_BUILD_EXAMPLES

/**
 * Show customizing the circular scrolling animation of a label with `LV_LABEL_LONG_
↪SCROLL_CIRCULAR`
 * long mode.
 */
void lv_example_label_5(void)
{
    static lv_anim_t animation_template;
    static lv_style_t label_style;

    lv_anim_init(&animation_template);
    lv_anim_set_delay(&animation_template, 1000);           /*Wait 1 second to start␣
↪the first scroll*/
    lv_anim_set_repeat_delay(&animation_template,
                             3000);    /*Repeat the scroll 3 seconds after the label␣
↪scrolls back to the initial position*/

    /*Initialize the label style with the animation template*/
    lv_style_init(&label_style);
    lv_style_set_anim(&label_style, &animation_template);

    lv_obj_t * label1 = lv_label_create(lv_scr_act());
    lv_label_set_long_mode(label1, LV_LABEL_LONG_SCROLL_CIRCULAR);      /*Circular␣
↪scroll*/
    lv_obj_set_width(label1, 150);
    lv_label_set_text(label1, "It is a circularly scrolling text. ");
    lv_obj_align(label1, LV_ALIGN_CENTER, 0, 40);
    lv_obj_add_style(label1, &label_style, LV_STATE_DEFAULT);           /*Add the␣
↪style to the label*/
}
```

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```
#endif
```

```
#
# Show customizing the circular scrolling animation of a label with `LV_LABEL_LONG_
↪SCROLL_CIRCULAR` long mode.
#

label1 = lv.label(lv.scr_act())
label1.set_long_mode(lv.label.LONG.SCROLL_CIRCULAR)         # Circular scroll
label1.set_width(150)
label1.set_text("It is a circularly scrolling text. ")
label1.align(lv.ALIGN.CENTER, 0, 40)
```

2.7.16 LED

LED with custom style

```
#include "../../lv_examples.h"
#if LV_USE_LED && LV_BUILD_EXAMPLES

/**
 * Create LED's with different brightness and color
 */
void lv_example_led_1(void)
{
    /*Create a LED and switch it OFF*/
    lv_obj_t * led1  = lv_led_create(lv_scr_act());
    lv_obj_align(led1, LV_ALIGN_CENTER, -80, 0);
    lv_led_off(led1);

    /*Copy the previous LED and set a brightness*/
    lv_obj_t * led2  = lv_led_create(lv_scr_act());
    lv_obj_align(led2, LV_ALIGN_CENTER, 0, 0);
    lv_led_set_brightness(led2, 150);
    lv_led_set_color(led2, lv_palette_main(LV_PALETTE_RED));

    /*Copy the previous LED and switch it ON*/
    lv_obj_t * led3  = lv_led_create(lv_scr_act());
    lv_obj_align(led3, LV_ALIGN_CENTER, 80, 0);
    lv_led_on(led3);
}

#endif
```

```
#
# Create LED's with different brightness and color
#

# Create a LED and switch it OFF
led1  = lv.led(lv.scr_act())
led1.align(lv.ALIGN.CENTER, -80, 0)
```

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```
led1.off()

# Copy the previous LED and set a brightness
led2  = lv.led(lv.scr_act())
led2.align(lv.ALIGN.CENTER, 0, 0)
led2.set_brightness(150)
led2.set_color(lv.palette_main(lv.PALETTE.RED))

# Copy the previous LED and switch it ON
led3  = lv.led(lv.scr_act())
led3.align(lv.ALIGN.CENTER, 80, 0)
led3.on()
```

2.7.17 Line

Simple Line

```
#include "../../lv_examples.h"
#if LV_USE_LINE && LV_BUILD_EXAMPLES

void lv_example_line_1(void)
{
    /*Create an array for the points of the line*/
    static lv_point_t line_points[] = { {5, 5}, {70, 70}, {120, 10}, {180, 60}, {240,␣
↪10} };

    /*Create style*/
    static lv_style_t style_line;
    lv_style_init(&style_line);
    lv_style_set_line_width(&style_line, 8);
    lv_style_set_line_color(&style_line, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_line_rounded(&style_line, true);

    /*Create a line and apply the new style*/
    lv_obj_t * line1;
    line1 = lv_line_create(lv_scr_act());
    lv_line_set_points(line1, line_points, 5);     /*Set the points*/
    lv_obj_add_style(line1, &style_line, 0);
    lv_obj_center(line1);
}

#endif
```

```
# Create an array for the points of the line
line_points = [ {"x":5, "y":5},
                {"x":70, "y":70},
                {"x":120, "y":10},
                {"x":180, "y":60},
                {"x":240, "y":10}]

# Create style
style_line = lv.style_t()
style_line.init()
```

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```
style_line.set_line_width(8)
style_line.set_line_color(lv.palette_main(lv.PALETTE.BLUE))
style_line.set_line_rounded(True)

# Create a line and apply the new style
line1 = lv.line(lv.scr_act())
line1.set_points(line_points, 5)     # Set the points
line1.add_style(style_line, 0)
line1.center()
```

2.7.18 List

Simple List

```
#include "../../lv_examples.h"
#if LV_USE_LIST && LV_BUILD_EXAMPLES
static lv_obj_t * list1;

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_CLICKED) {
        LV_UNUSED(obj);
        LV_LOG_USER("Clicked: %s", lv_list_get_btn_text(list1, obj));
    }
}
void lv_example_list_1(void)
{
    /*Create a list*/
    list1 = lv_list_create(lv_scr_act());
    lv_obj_set_size(list1, 180, 220);
    lv_obj_center(list1);

    /*Add buttons to the list*/
    lv_obj_t * btn;

    lv_list_add_text(list1, "File");
    btn = lv_list_add_btn(list1, LV_SYMBOL_FILE, "New");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_DIRECTORY, "Open");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_SAVE, "Save");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_CLOSE, "Delete");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_EDIT, "Edit");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    lv_list_add_text(list1, "Connectivity");
    btn = lv_list_add_btn(list1, LV_SYMBOL_BLUETOOTH, "Bluetooth");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_GPS, "Navigation");
```

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```
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_USB, "USB");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_BATTERY_FULL, "Battery");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    lv_list_add_text(list1, "Exit");
    btn = lv_list_add_btn(list1, LV_SYMBOL_OK, "Apply");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_CLOSE, "Close");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
            print("Clicked: list1." + list1.get_btn_text(obj))

# Create a list
list1 = lv.list(lv.scr_act())
list1.set_size(180, 220)
list1.center()

# Add buttons to the list
list1.add_text("File")
btn_new = list1.add_btn(lv.SYMBOL.FILE, "New")
btn_new.add_event(event_handler,lv.EVENT.ALL, None)
btn_open = list1.add_btn(lv.SYMBOL.DIRECTORY, "Open")
btn_open.add_event(event_handler,lv.EVENT.ALL, None)
btn_save = list1.add_btn(lv.SYMBOL.SAVE, "Save")
btn_save.add_event(event_handler,lv.EVENT.ALL, None)
btn_delete = list1.add_btn(lv.SYMBOL.CLOSE, "Delete")
btn_delete.add_event(event_handler,lv.EVENT.ALL, None)
btn_edit = list1.add_btn(lv.SYMBOL.EDIT, "Edit")
btn_edit.add_event(event_handler,lv.EVENT.ALL, None)

list1.add_text("Connectivity")
btn_bluetooth = list1.add_btn(lv.SYMBOL.BLUETOOTH, "Bluetooth")
btn_bluetooth.add_event(event_handler,lv.EVENT.ALL, None)
btn_navig = list1.add_btn(lv.SYMBOL.GPS, "Navigation")
btn_navig.add_event(event_handler,lv.EVENT.ALL, None)
btn_USB = list1.add_btn(lv.SYMBOL.USB, "USB")
btn_USB.add_event(event_handler,lv.EVENT.ALL, None)
btn_battery = list1.add_btn(lv.SYMBOL.BATTERY_FULL, "Battery")
btn_battery.add_event(event_handler,lv.EVENT.ALL, None)

list1.add_text("Exit")
btn_apply = list1.add_btn(lv.SYMBOL.OK, "Apply")
btn_apply.add_event(event_handler,lv.EVENT.ALL, None)
btn_close = list1.add_btn(lv.SYMBOL.CLOSE, "Close")
btn_close.add_event(event_handler,lv.EVENT.ALL, None)
```

Sorting a List using up and down buttons

```
#include <stdlib.h>


#include "../../lv_examples.h"
#if LV_USE_LIST && LV_BUILD_EXAMPLES

static lv_obj_t * list1;
static lv_obj_t * list2;

static lv_obj_t * currentButton = NULL;

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_CLICKED) {
        LV_LOG_USER("Clicked: %s", lv_list_get_btn_text(list1, obj));

        if(currentButton == obj) {
            currentButton = NULL;
        }
        else {
            currentButton = obj;
        }
        lv_obj_t * parent = lv_obj_get_parent(obj);
        uint32_t i;
        for(i = 0; i < lv_obj_get_child_cnt(parent); i++) {
            lv_obj_t * child = lv_obj_get_child(parent, i);
            if(child == currentButton) {
                lv_obj_add_state(child, LV_STATE_CHECKED);
            }
            else {
                lv_obj_clear_state(child, LV_STATE_CHECKED);
            }
        }
    }
}

static void event_handler_top(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_CLICKED) {
        if(currentButton == NULL) return;
        lv_obj_move_background(currentButton);
        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_up(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if((code == LV_EVENT_CLICKED) || (code == LV_EVENT_LONG_PRESSED_REPEAT)) {
        if(currentButton == NULL) return;
        uint32_t index = lv_obj_get_index(currentButton);
        if(index <= 0) return;
```

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```
        lv_obj_move_to_index(currentButton, index - 1);
        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_center(lv_event_t * e)
{
    const lv_event_code_t code = lv_event_get_code(e);
    if((code == LV_EVENT_CLICKED) || (code == LV_EVENT_LONG_PRESSED_REPEAT)) {
        if(currentButton == NULL) return;

        lv_obj_t * parent = lv_obj_get_parent(currentButton);
        const uint32_t pos = lv_obj_get_child_cnt(parent) / 2;

        lv_obj_move_to_index(currentButton, pos);

        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_dn(lv_event_t * e)
{
    const lv_event_code_t code = lv_event_get_code(e);
    if((code == LV_EVENT_CLICKED) || (code == LV_EVENT_LONG_PRESSED_REPEAT)) {
        if(currentButton == NULL) return;
        const uint32_t index = lv_obj_get_index(currentButton);

        lv_obj_move_to_index(currentButton, index + 1);
        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_bottom(lv_event_t * e)
{
    const lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_CLICKED) {
        if(currentButton == NULL) return;
        lv_obj_move_foreground(currentButton);
        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_swap(lv_event_t * e)
{
    const lv_event_code_t code = lv_event_get_code(e);
    // lv_obj_t* obj = lv_event_get_target(e);
    if((code == LV_EVENT_CLICKED) || (code == LV_EVENT_LONG_PRESSED_REPEAT)) {
        uint32_t cnt = lv_obj_get_child_cnt(list1);
        for(int i = 0; i < 100; i++)
            if(cnt > 1) {
                lv_obj_t * obj = lv_obj_get_child(list1, rand() % cnt);
                lv_obj_move_to_index(obj, rand() % cnt);
                if(currentButton != NULL) {
                    lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
                }
            }
    }
```

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```
}

void lv_example_list_2(void)
{
    /*Create a list*/
    list1 = lv_list_create(lv_scr_act());
    lv_obj_set_size(list1, lv_pct(60), lv_pct(100));
    lv_obj_set_style_pad_row(list1, 5, 0);

    /*Add buttons to the list*/
    lv_obj_t * btn;
    int i;
    for(i = 0; i < 15; i++) {
        btn = lv_btn_create(list1);
        lv_obj_set_width(btn, lv_pct(50));
        lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

        lv_obj_t * lab = lv_label_create(btn);
        lv_label_set_text_fmt(lab, "Item %d", i);
    }

    /*Select the first button by default*/
    currentButton = lv_obj_get_child(list1, 0);
    lv_obj_add_state(currentButton, LV_STATE_CHECKED);

    /*Create a second list with up and down buttons*/
    list2 = lv_list_create(lv_scr_act());
    lv_obj_set_size(list2, lv_pct(40), lv_pct(100));
    lv_obj_align(list2, LV_ALIGN_TOP_RIGHT, 0, 0);
    lv_obj_set_flex_flow(list2, LV_FLEX_FLOW_COLUMN);

    btn = lv_list_add_btn(list2, NULL, "Top");
    lv_obj_add_event(btn, event_handler_top, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, LV_SYMBOL_UP, "Up");
    lv_obj_add_event(btn, event_handler_up, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, LV_SYMBOL_LEFT, "Center");
    lv_obj_add_event(btn, event_handler_center, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, LV_SYMBOL_DOWN, "Down");
    lv_obj_add_event(btn, event_handler_dn, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, NULL, "Bottom");
    lv_obj_add_event(btn, event_handler_bottom, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, LV_SYMBOL_SHUFFLE, "Shuffle");
    lv_obj_add_event(btn, event_handler_swap, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);
}

#endif
```

```python
import urandom

currentButton = None
list1 = None

def event_handler(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
        if currentButton == obj:
            currentButton = None
        else:
            currentButton = obj
        parent = obj.get_parent()
        for i in range( parent.get_child_cnt()):
            child = parent.get_child(i)
            if child == currentButton:
                child.add_state(lv.STATE.CHECKED)
            else:
                child.clear_state(lv.STATE.CHECKED)

def event_handler_top(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
        if currentButton == None:
            return
        currentButton.move_background()
        currentButton.scroll_to_view( lv.ANIM.ON)

def event_handler_up(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        if currentButton == None:
            return
        index = currentButton.get_index()
        if index <= 0:
            return
        currentButton.move_to_index(index - 1)
        currentButton.scroll_to_view(lv.ANIM.ON)

def event_handler_center(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        if currentButton == None:
            return
        parent = currentButton.get_parent()
        pos = parent.get_child_cnt() // 2
        currentButton.move_to_index(pos)
        currentButton.scroll_to_view(lv.ANIM.ON)
```

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```
def event_handler_dn(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        if currentButton == None:
            return
        index = currentButton.get_index()
        currentButton.move_to_index(index + 1)
        currentButton.scroll_to_view(lv.ANIM.ON)

def event_handler_bottom(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        if currentButton == None:
            return
        currentButton.move_foreground()
        currentButton.scroll_to_view(lv.ANIM.ON)

def event_handler_swap(e):
    global currentButton
    global list1
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
        cnt = list1.get_child_cnt()
        for i in range(100):
            if cnt > 1:
                obj = list1.get_child(urandom.getrandbits(32) % cnt )
                obj.move_to_index(urandom.getrandbits(32) % cnt)
        if currentButton != None:
            currentButton.scroll_to_view(lv.ANIM.ON)

#Create a list with buttons that can be sorted
list1 = lv.list(lv.scr_act())
list1.set_size(lv.pct(60), lv.pct(100))
list1.set_style_pad_row( 5, 0)

for i in range(15):
    btn = lv.btn(list1)
    btn.set_width(lv.pct(100))
    btn.add_event( event_handler, lv.EVENT.CLICKED, None)
    lab = lv.label(btn)
    lab.set_text("Item " + str(i))

#Select the first button by default
currentButton = list1.get_child(0)
currentButton.add_state(lv.STATE.CHECKED)

#Create a second list with up and down buttons
list2 = lv.list(lv.scr_act())
list2.set_size(lv.pct(40), lv.pct(100))
list2.align(lv.ALIGN.TOP_RIGHT, 0, 0)
list2.set_flex_flow(lv.FLEX_FLOW.COLUMN)
```

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```python
btn = list2.add_btn(None, "Top")
btn.add_event(event_handler_top, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(lv.SYMBOL.UP, "Up")
btn.add_event(event_handler_up, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(lv.SYMBOL.LEFT, "Center")
btn.add_event(event_handler_center, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(lv.SYMBOL.DOWN, "Down")
btn.add_event(event_handler_dn, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(None, "Bottom")
btn.add_event(event_handler_bottom, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(lv.SYMBOL.SHUFFLE, "Shuffle")
btn.add_event(event_handler_swap, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)
```

2.7.19 Menu

Simple Menu

```c
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_BUILD_EXAMPLES

void lv_example_menu_1(void)
{
    /*Create a menu object*/
    lv_obj_t * menu = lv_menu_create(lv_scr_act());
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    lv_obj_t * cont;
    lv_obj_t * label;

    /*Create a sub page*/
    lv_obj_t * sub_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(sub_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    /*Create a main page*/
    lv_obj_t * main_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 1");
```

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```
    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 2");

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 3 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_page);

    lv_menu_set_page(menu, main_page);
}

#endif
```

```
# Create a menu object
menu = lv.menu(lv.scr_act())
menu.set_size(320, 240)
menu.center()

# Create a sub page
sub_page = lv.menu_page(menu, None)
cont = lv.menu_cont(sub_page)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")

# Create a main page
main_page = lv.menu_page(menu, None)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 1")

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 2")

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 3 (Click me!)")
menu.set_load_page_event(cont, sub_page)

menu.set_page(main_page)
```

Simple Menu with root btn

```
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_USE_MSGBOX && LV_BUILD_EXAMPLES

static void back_event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_t * menu = lv_event_get_user_data(e);
```

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```
    if(lv_menu_back_btn_is_root(menu, obj)) {
        lv_obj_t * mbox1 = lv_msgbox_create(NULL, "Hello", "Root back btn click.",␣
↪NULL, true);
        lv_obj_center(mbox1);
    }
}

void lv_example_menu_2(void)
{
    lv_obj_t * menu = lv_menu_create(lv_scr_act());
    lv_menu_set_mode_root_back_btn(menu, LV_MENU_ROOT_BACK_BTN_ENABLED);
    lv_obj_add_event(menu, back_event_handler, LV_EVENT_CLICKED, menu);
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    lv_obj_t * cont;
    lv_obj_t * label;

    /*Create a sub page*/
    lv_obj_t * sub_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(sub_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    /*Create a main page*/
    lv_obj_t * main_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 1");

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 2");

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 3 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_page);

    lv_menu_set_page(menu, main_page);
}

#endif
```

```
def back_event_handler(e):
    obj = e.get_target_obj()
    if menu.back_btn_is_root(obj):
        mbox1 = lv.msgbox(lv.scr_act(), "Hello", "Root back btn click.", None, True)
        mbox1.center()

# Create a menu object
menu = lv.menu(lv.scr_act())
menu.set_mode_root_back_btn(lv.menu.ROOT_BACK_BTN.ENABLED)
menu.add_event(back_event_handler, lv.EVENT.CLICKED, None)
```

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```
menu.set_size(320, 240)
menu.center()

# Create a sub page
sub_page = lv.menu_page(menu, None)
cont = lv.menu_cont(sub_page)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")

# Create a main page
main_page = lv.menu_page(menu, None)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 1")

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 2")

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 3 (Click me!)")
menu.set_load_page_event(cont, sub_page)

menu.set_page(main_page)
```

Simple Menu with custom header

```
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_USE_USER_DATA && LV_BUILD_EXAMPLES

void lv_example_menu_3(void)
{
    /*Create a menu object*/
    lv_obj_t * menu = lv_menu_create(lv_scr_act());
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    /*Modify the header*/
    lv_obj_t * back_btn = lv_menu_get_main_header_back_btn(menu);
    lv_obj_t * back_btn_label = lv_label_create(back_btn);
    lv_label_set_text(back_btn_label, "Back");

    lv_obj_t * cont;
    lv_obj_t * label;

    /*Create sub pages*/
    lv_obj_t * sub_1_page = lv_menu_page_create(menu, "Page 1");

    cont = lv_menu_cont_create(sub_1_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    lv_obj_t * sub_2_page = lv_menu_page_create(menu, "Page 2");
```

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```
    cont = lv_menu_cont_create(sub_2_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    lv_obj_t * sub_3_page = lv_menu_page_create(menu, "Page 3");

    cont = lv_menu_cont_create(sub_3_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    /*Create a main page*/
    lv_obj_t * main_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 1 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_1_page);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 2 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_2_page);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 3 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_3_page);

    lv_menu_set_page(menu, main_page);
}

#endif
```

```
# Create a menu object
menu = lv.menu(lv.scr_act())
menu.set_size(320, 240)
menu.center()

# Create sub pages
sub_page_1 = lv.menu_page(menu, "Page 1")

cont = lv.menu_cont(sub_page_1)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")

sub_page_2 = lv.menu_page(menu, "Page 2")

cont = lv.menu_cont(sub_page_2)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")

sub_page_3 = lv.menu_page(menu, "Page 3")

cont = lv.menu_cont(sub_page_3)
label = lv.label(cont)
```

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```
label.set_text("Hello, I am hiding here")

# Create a main page
main_page = lv.menu_page(menu, None)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 1 (Click me!)")
menu.set_load_page_event(cont, sub_page_1)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 2 (Click me!)")
menu.set_load_page_event(cont, sub_page_2)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 3 (Click me!)")
menu.set_load_page_event(cont, sub_page_3)

menu.set_page(main_page)
```

Simple Menu with floating btn to add new menu page

```
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_BUILD_EXAMPLES

static uint32_t btn_cnt = 1;
static lv_obj_t * main_page;
static lv_obj_t * menu;

static void float_btn_event_cb(lv_event_t * e)
{
    LV_UNUSED(e);

    btn_cnt++;

    lv_obj_t * cont;
    lv_obj_t * label;

    lv_obj_t * sub_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(sub_page);
    label = lv_label_create(cont);
    lv_label_set_text_fmt(label, "Hello, I am hiding inside %"LV_PRIu32"", btn_cnt);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text_fmt(label, "Item %"LV_PRIu32"", btn_cnt);
    lv_menu_set_load_page_event(menu, cont, sub_page);

    lv_obj_scroll_to_view_recursive(cont, LV_ANIM_ON);
}

void lv_example_menu_4(void)
```

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```
{
    /*Create a menu object*/
    menu = lv_menu_create(lv_scr_act());
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    lv_obj_t * cont;
    lv_obj_t * label;

    /*Create a sub page*/
    lv_obj_t * sub_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(sub_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding inside the first item");

    /*Create a main page*/
    main_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 1");
    lv_menu_set_load_page_event(menu, cont, sub_page);

    lv_menu_set_page(menu, main_page);

    /*Create floating btn*/
    lv_obj_t * float_btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(float_btn, 50, 50);
    lv_obj_add_flag(float_btn, LV_OBJ_FLAG_FLOATING);
    lv_obj_align(float_btn, LV_ALIGN_BOTTOM_RIGHT, -10, -10);
    lv_obj_add_event(float_btn, float_btn_event_cb, LV_EVENT_CLICKED, menu);
    lv_obj_set_style_radius(float_btn, LV_RADIUS_CIRCLE, 0);
    lv_obj_set_style_bg_img_src(float_btn, LV_SYMBOL_PLUS, 0);
    lv_obj_set_style_text_font(float_btn, lv_theme_get_font_large(float_btn), 0);
}

#endif
```

```
btn_cnt = 1

def float_btn_event_cb(e):
    global btn_cnt
    btn_cnt += 1

    sub_page = lv.menu_page(menu, None)

    cont = lv.menu_cont(sub_page)
    label = lv.label(cont)
    label.set_text("Hello, I am hiding inside {:d}".format(btn_cnt))

    cont = lv.menu_cont(main_page)
    label = lv.label(cont)
    label.set_text("Item {:d}".format(btn_cnt))
    menu.set_load_page_event(cont, sub_page)
```

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```
# Create a menu object
menu = lv.menu(lv.scr_act())
menu.set_size(320, 240)
menu.center()

# Create a sub page
sub_page = lv.menu_page(menu, None)

cont = lv.menu_cont(sub_page)
label = lv.label(cont)
label.set_text("Hello, I am hiding inside the first item")

# Create a main page
main_page = lv.menu_page(menu, None)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 1")
menu.set_load_page_event(cont, sub_page)

menu.set_page(main_page)

float_btn = lv.btn(lv.scr_act())
float_btn.set_size(50, 50)
float_btn.add_flag(lv.obj.FLAG.FLOATING)
float_btn.align(lv.ALIGN.BOTTOM_RIGHT, -10, -10)
float_btn.add_event(float_btn_event_cb, lv.EVENT.CLICKED, None)
float_btn.set_style_radius(lv.RADIUS_CIRCLE, 0)
float_btn.set_style_bg_img_src(lv.SYMBOL.PLUS, 0)
float_btn.set_style_text_font(lv.theme_get_font_large(float_btn), 0)
```

Complex Menu

```
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_USE_MSGBOX && LV_BUILD_EXAMPLES

enum {
    LV_MENU_ITEM_BUILDER_VARIANT_1,
    LV_MENU_ITEM_BUILDER_VARIANT_2
};
typedef uint8_t lv_menu_builder_variant_t;

static void back_event_handler(lv_event_t * e);
static void switch_handler(lv_event_t * e);
lv_obj_t * root_page;
static lv_obj_t * create_text(lv_obj_t * parent, const char * icon, const char * txt,
                              lv_menu_builder_variant_t builder_variant);
static lv_obj_t * create_slider(lv_obj_t * parent,
                                const char * icon, const char * txt, int32_t min,␣
↪int32_t max, int32_t val);
static lv_obj_t * create_switch(lv_obj_t * parent,
                                const char * icon, const char * txt, bool chk);

void lv_example_menu_5(void)
```

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```
{
    lv_obj_t * menu = lv_menu_create(lv_scr_act());

    lv_color_t bg_color = lv_obj_get_style_bg_color(menu, 0);
    if(lv_color_brightness(bg_color) > 127) {
        lv_obj_set_style_bg_color(menu, lv_color_darken(lv_obj_get_style_bg_
↪color(menu, 0), 10), 0);
    }
    else {
        lv_obj_set_style_bg_color(menu, lv_color_darken(lv_obj_get_style_bg_
↪color(menu, 0), 50), 0);
    }
    lv_menu_set_mode_root_back_btn(menu, LV_MENU_ROOT_BACK_BTN_ENABLED);
    lv_obj_add_event(menu, back_event_handler, LV_EVENT_CLICKED, menu);
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    lv_obj_t * cont;
    lv_obj_t * section;

    /*Create sub pages*/
    lv_obj_t * sub_mechanics_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_mechanics_page, lv_obj_get_style_pad_left(lv_menu_
↪get_main_header(menu), 0), 0);
    lv_menu_separator_create(sub_mechanics_page);
    section = lv_menu_section_create(sub_mechanics_page);
    create_slider(section, LV_SYMBOL_SETTINGS, "Velocity", 0, 150, 120);
    create_slider(section, LV_SYMBOL_SETTINGS, "Acceleration", 0, 150, 50);
    create_slider(section, LV_SYMBOL_SETTINGS, "Weight limit", 0, 150, 80);

    lv_obj_t * sub_sound_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_sound_page, lv_obj_get_style_pad_left(lv_menu_get_
↪main_header(menu), 0), 0);
    lv_menu_separator_create(sub_sound_page);
    section = lv_menu_section_create(sub_sound_page);
    create_switch(section, LV_SYMBOL_AUDIO, "Sound", false);

    lv_obj_t * sub_display_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_display_page, lv_obj_get_style_pad_left(lv_menu_get_
↪main_header(menu), 0), 0);
    lv_menu_separator_create(sub_display_page);
    section = lv_menu_section_create(sub_display_page);
    create_slider(section, LV_SYMBOL_SETTINGS, "Brightness", 0, 150, 100);

    lv_obj_t * sub_software_info_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_software_info_page, lv_obj_get_style_pad_left(lv_
↪menu_get_main_header(menu), 0), 0);
    section = lv_menu_section_create(sub_software_info_page);
    create_text(section, NULL, "Version 1.0", LV_MENU_ITEM_BUILDER_VARIANT_1);

    lv_obj_t * sub_legal_info_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_legal_info_page, lv_obj_get_style_pad_left(lv_menu_
↪get_main_header(menu), 0), 0);
    section = lv_menu_section_create(sub_legal_info_page);
    for(uint32_t i = 0; i < 15; i++) {
        create_text(section, NULL,
                        "This is a long long long long long long long long long text, if␣
↪it is long enough it may scroll.",
```

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```
                    LV_MENU_ITEM_BUILDER_VARIANT_1);
    }

    lv_obj_t * sub_about_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_about_page, lv_obj_get_style_pad_left(lv_menu_get_
↪main_header(menu), 0), 0);
    lv_menu_separator_create(sub_about_page);
    section = lv_menu_section_create(sub_about_page);
    cont = create_text(section, NULL, "Software information", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_software_info_page);
    cont = create_text(section, NULL, "Legal information", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_legal_info_page);

    lv_obj_t * sub_menu_mode_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_menu_mode_page, lv_obj_get_style_pad_left(lv_menu_
↪get_main_header(menu), 0), 0);
    lv_menu_separator_create(sub_menu_mode_page);
    section = lv_menu_section_create(sub_menu_mode_page);
    cont = create_switch(section, LV_SYMBOL_AUDIO, "Sidebar enable", true);
    lv_obj_add_event(lv_obj_get_child(cont, 2), switch_handler, LV_EVENT_VALUE_
↪CHANGED, menu);

    /*Create a root page*/
    root_page = lv_menu_page_create(menu, "Settings");
    lv_obj_set_style_pad_hor(root_page, lv_obj_get_style_pad_left(lv_menu_get_main_
↪header(menu), 0), 0);
    section = lv_menu_section_create(root_page);
    cont = create_text(section, LV_SYMBOL_SETTINGS, "Mechanics", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_mechanics_page);
    cont = create_text(section, LV_SYMBOL_AUDIO, "Sound", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_sound_page);
    cont = create_text(section, LV_SYMBOL_SETTINGS, "Display", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_display_page);

    create_text(root_page, NULL, "Others", LV_MENU_ITEM_BUILDER_VARIANT_1);
    section = lv_menu_section_create(root_page);
    cont = create_text(section, NULL, "About", LV_MENU_ITEM_BUILDER_VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_about_page);
    cont = create_text(section, LV_SYMBOL_SETTINGS, "Menu mode", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_menu_mode_page);

    lv_menu_set_sidebar_page(menu, root_page);

    lv_obj_send_event(lv_obj_get_child(lv_obj_get_child(lv_menu_get_cur_sidebar_
↪page(menu), 0), 0), LV_EVENT_CLICKED,
                      NULL);
}

static void back_event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
```

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```
    lv_obj_t * menu = lv_event_get_user_data(e);

    if(lv_menu_back_btn_is_root(menu, obj)) {
        lv_obj_t * mbox1 = lv_msgbox_create(NULL, "Hello", "Root back btn click.",␣
↪NULL, true);
        lv_obj_center(mbox1);
    }
}

static void switch_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * menu = lv_event_get_user_data(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        if(lv_obj_has_state(obj, LV_STATE_CHECKED)) {
            lv_menu_set_page(menu, NULL);
            lv_menu_set_sidebar_page(menu, root_page);
            lv_obj_send_event(lv_obj_get_child(lv_obj_get_child(lv_menu_get_cur_
↪sidebar_page(menu), 0), 0), LV_EVENT_CLICKED,
                              NULL);
        }
        else {
            lv_menu_set_sidebar_page(menu, NULL);
            lv_menu_clear_history(menu); /* Clear history because we will be showing␣
↪the root page later */
            lv_menu_set_page(menu, root_page);
        }
    }
}

static lv_obj_t * create_text(lv_obj_t * parent, const char * icon, const char * txt,
                              lv_menu_builder_variant_t builder_variant)
{
    lv_obj_t * obj = lv_menu_cont_create(parent);

    lv_obj_t * img = NULL;
    lv_obj_t * label = NULL;

    if(icon) {
        img = lv_img_create(obj);
        lv_img_set_src(img, icon);
    }

    if(txt) {
        label = lv_label_create(obj);
        lv_label_set_text(label, txt);
        lv_label_set_long_mode(label, LV_LABEL_LONG_SCROLL_CIRCULAR);
        lv_obj_set_flex_grow(label, 1);
    }

    if(builder_variant == LV_MENU_ITEM_BUILDER_VARIANT_2 && icon && txt) {
        lv_obj_add_flag(img, LV_OBJ_FLAG_FLEX_IN_NEW_TRACK);
        lv_obj_swap(img, label);
    }

    return obj;
```

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```
}

static lv_obj_t * create_slider(lv_obj_t * parent, const char * icon, const char *␣
↪txt, int32_t min, int32_t max,
                                int32_t val)
{
    lv_obj_t * obj = create_text(parent, icon, txt, LV_MENU_ITEM_BUILDER_VARIANT_2);

    lv_obj_t * slider = lv_slider_create(obj);
    lv_obj_set_flex_grow(slider, 1);
    lv_slider_set_range(slider, min, max);
    lv_slider_set_value(slider, val, LV_ANIM_OFF);

    if(icon == NULL) {
        lv_obj_add_flag(slider, LV_OBJ_FLAG_FLEX_IN_NEW_TRACK);
    }

    return obj;
}

static lv_obj_t * create_switch(lv_obj_t * parent, const char * icon, const char *␣
↪txt, bool chk)
{
    lv_obj_t * obj = create_text(parent, icon, txt, LV_MENU_ITEM_BUILDER_VARIANT_1);

    lv_obj_t * sw = lv_switch_create(obj);
    lv_obj_add_state(sw, chk ? LV_STATE_CHECKED : 0);

    return obj;
}

#endif
```

```
from micropython import const

def create_text(parent, icon, txt, builder_variant):

    obj = lv.menu_cont(parent)

    img = None
    label = None

    if icon  :
        img = lv.img(obj)
        img.set_src(icon)

    if txt :
        label = lv.label(obj)
        label.set_text(txt)
        label.set_long_mode(lv.label.LONG.SCROLL_CIRCULAR)
        label.set_flex_grow(1)

    if builder_variant == LV_MENU_ITEM_BUILDER_VARIANT_2 and icon and txt :
        img.add_flag(lv.OBJ_FLAG_FLEX_IN_NEW_TRACK)
        img.swap(label)
```

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```
    return obj


def create_slider(parent, icon, txt, min, max, val) :

    obj = create_text(parent, icon, txt, LV_MENU_ITEM_BUILDER_VARIANT_2)

    slider = lv.slider(obj)
    slider.set_flex_grow(1)
    slider.set_range(min, max)
    slider.set_value(val, lv.ANIM.OFF)

    if icon == None :
        slider.add_flag(lv.obj.FLAG_FLEX.IN_NEW_TRACK)

    return obj

def create_switch(parent, icon, txt, chk) :

    obj = create_text(parent, icon, txt, LV_MENU_ITEM_BUILDER_VARIANT_1)

    sw = lv.switch(obj)
    if chk == lv.STATE.CHECKED:
        sw.add_state(chk )
    else:
        sw.add_state(0)

    return obj


def back_event_handler(e,menu):

    obj = e.get_target_obj()
    # menu = lv_event_get_user_data(e);

    if menu.back_btn_is_root(obj) :
        mbox1 = lv.msgbox(None, "Hello", "Root back btn click.", None, True)
        mbox1.center()

def switch_handler(e,menu):

    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED :
        if obj.has_state(lv.STATE.CHECKED) :
            menu.set_page(None)
            menu.set_sidebar_page(root_page)
            menu.get_cur_sidebar_page().get_child(0).get_child(0).send_event(lv.EVENT.
↪CLICKED,None)
        else :
            menu.set_sidebar_page(None)
            menu.clear_history()      #  Clear history because we will be showing the␣
↪root page later
            menu.set_page(root_page)

LV_MENU_ITEM_BUILDER_VARIANT_1 = const(0)
```

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```
LV_MENU_ITEM_BUILDER_VARIANT_2 = const(1)

menu = lv.menu(lv.scr_act())

bg_color = menu.get_style_bg_color(0)
if bg_color.color_brightness() > 127 :
    menu.set_style_bg_color(menu.get_style_bg_color(0).color_darken(10),0)
else :
    menu.set_style_bg_color(menu.get_style_bg_color(0).color_darken(50),0)


menu.set_mode_root_back_btn(lv.menu.ROOT_BACK_BTN.ENABLED)
menu.add_event(lambda evt: back_event_handler(evt,menu), lv.EVENT.CLICKED, None)
menu.set_size(lv.pct(100), lv.pct(100))
menu.center()

# Create sub pages
sub_mechanics_page = lv.menu_page(menu, None)
sub_mechanics_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
lv.menu_separator(sub_mechanics_page)
section = lv.menu_section(sub_mechanics_page);
create_slider(section,lv.SYMBOL.SETTINGS, "Velocity", 0, 150, 120)
create_slider(section,lv.SYMBOL.SETTINGS, "Acceleration", 0, 150, 50)
create_slider(section,lv.SYMBOL.SETTINGS, "Weight limit", 0, 150, 80)

sub_sound_page = lv.menu_page(menu, None)
sub_sound_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
lv.menu_separator(sub_sound_page)
section = lv.menu_section(sub_sound_page)
create_switch(section,lv.SYMBOL.AUDIO, "Sound", False)

sub_display_page = lv.menu_page(menu, None)
sub_display_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
lv.menu_separator(sub_display_page)
section = lv.menu_section(sub_display_page)
create_slider(section,lv.SYMBOL.SETTINGS, "Brightness", 0, 150, 100)

sub_software_info_page = lv.menu_page(menu, None)
sub_software_info_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),
↪0)
section = lv.menu_section(sub_software_info_page)
create_text(section,None, "Version 1.0", LV_MENU_ITEM_BUILDER_VARIANT_1)

sub_legal_info_page = lv.menu_page(menu, None)
sub_legal_info_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)

section = lv.menu_section(sub_legal_info_page)

for i in range(15):
    create_text(section, None,
                "This is a long long long long long long long long long text, if it␣
↪is long enough it may scroll.",
                LV_MENU_ITEM_BUILDER_VARIANT_1)

sub_about_page = lv.menu_page(menu, None)
sub_about_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
```

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```
lv.menu_separator(sub_about_page)
section = lv.menu_section(sub_about_page)
cont = create_text(section, None, "Software information", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
menu.set_load_page_event(cont, sub_software_info_page);
cont = create_text(section, None, "Legal information", LV_MENU_ITEM_BUILDER_VARIANT_
↪1);
menu.set_load_page_event(cont, sub_legal_info_page)

sub_menu_mode_page = lv.menu_page(menu, None)
sub_menu_mode_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
lv.menu_separator(sub_menu_mode_page)
section = lv.menu_section(sub_menu_mode_page)
cont = create_switch(section, lv.SYMBOL.AUDIO, "Sidebar enable",True)
cont.get_child(2).add_event(lambda evt: switch_handler(evt,menu), lv.EVENT.VALUE_
↪CHANGED, None)

# Create a root page
root_page = lv.menu_page(menu, "Settings")
root_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
section = lv.menu_section(root_page)
cont = create_text(section, lv.SYMBOL.SETTINGS, "Mechanics", LV_MENU_ITEM_BUILDER_
↪VARIANT_1)
menu.set_load_page_event(cont, sub_mechanics_page);
cont = create_text(section, lv.SYMBOL.AUDIO, "Sound", LV_MENU_ITEM_BUILDER_VARIANT_1);
menu.set_load_page_event(cont, sub_sound_page)
cont = create_text(section, lv.SYMBOL.SETTINGS, "Display", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
menu.set_load_page_event(cont, sub_display_page)

create_text(root_page, None, "Others", LV_MENU_ITEM_BUILDER_VARIANT_1);
section = lv.menu_section(root_page)
cont = create_text(section, None, "About", LV_MENU_ITEM_BUILDER_VARIANT_1);
menu.set_load_page_event(cont, sub_about_page)
cont = create_text(section, lv.SYMBOL.SETTINGS, "Menu mode", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
menu.set_load_page_event(cont, sub_menu_mode_page)

menu.set_sidebar_page(root_page)


menu.get_cur_sidebar_page().get_child(0).get_child(0).send_event(lv.EVENT.CLICKED,
↪None)
```

2.7.20 Meter

Simple meter

```
#include "../../lv_examples.h"
#if LV_USE_METER && LV_BUILD_EXAMPLES

static lv_obj_t * meter;

static void set_value(void * indic, int32_t v)
{
    lv_meter_set_indicator_value(meter, indic, v);
}

/**
 * A simple meter
 */
void lv_example_meter_1(void)
{
    meter = lv_meter_create(lv_scr_act());
    lv_obj_center(meter);
    lv_obj_set_size(meter, 200, 200);

    /*Add a scale first*/
    lv_meter_set_scale_ticks(meter, 41, 2, 10, lv_palette_main(LV_PALETTE_GREY));
    lv_meter_set_scale_major_ticks(meter, 8, 4, 15, lv_color_black(), 10);

    lv_meter_indicator_t * indic;

    /*Add a blue arc to the start*/
    indic = lv_meter_add_arc(meter, 3, lv_palette_main(LV_PALETTE_BLUE), 0);
    lv_meter_set_indicator_start_value(meter, indic, 0);
    lv_meter_set_indicator_end_value(meter, indic, 20);

    /*Make the tick lines blue at the start of the scale*/
    indic = lv_meter_add_scale_lines(meter, lv_palette_main(LV_PALETTE_BLUE), lv_
↪palette_main(LV_PALETTE_BLUE),
                                     false, 0);
    lv_meter_set_indicator_start_value(meter, indic, 0);
    lv_meter_set_indicator_end_value(meter, indic, 20);

    /*Add a red arc to the end*/
    indic = lv_meter_add_arc(meter, 3, lv_palette_main(LV_PALETTE_RED), 0);
    lv_meter_set_indicator_start_value(meter, indic, 80);
    lv_meter_set_indicator_end_value(meter, indic, 100);

    /*Make the tick lines red at the end of the scale*/
    indic = lv_meter_add_scale_lines(meter, lv_palette_main(LV_PALETTE_RED), lv_
↪palette_main(LV_PALETTE_RED), false,
                                     0);
    lv_meter_set_indicator_start_value(meter, indic, 80);
    lv_meter_set_indicator_end_value(meter, indic, 100);

    /*Add a needle line indicator*/
    indic = lv_meter_add_needle_line(meter, 4, lv_palette_main(LV_PALETTE_GREY), -10);

    /*Create an animation to set the value*/
```

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```
    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_exec_cb(&a, set_value);
    lv_anim_set_var(&a, indic);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_set_time(&a, 2000);
    lv_anim_set_repeat_delay(&a, 100);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_set_playback_delay(&a, 100);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);
}

#endif
```

```
#!//opt/bin/lv_micropython -i
import utime as time
import lvgl as lv
import display_driver

def set_value(indic, v):
    meter.set_indicator_value(indic, v)

#
# A simple meter
#
meter = lv.meter(lv.scr_act())
meter.center()
meter.set_size(200, 200)

indic = lv.meter_indicator_t()

# Add a blue arc to the start
indic = meter.add_arc(3, lv.palette_main(lv.PALETTE.BLUE), 0)
meter.set_indicator_start_value(indic, 0)
meter.set_indicator_end_value(indic, 20)

# Make the tick lines blue at the start of the scale
indic = meter.add_scale_lines(lv.palette_main(lv.PALETTE.BLUE), lv.palette_main(lv.
↪PALETTE.BLUE), False, 0)
meter.set_indicator_start_value(indic, 0)
meter.set_indicator_end_value(indic, 20)

# Add a red arc to the end
indic = meter.add_arc(3, lv.palette_main(lv.PALETTE.RED), 0)
meter.set_indicator_start_value(indic, 80)
meter.set_indicator_end_value(indic, 100)

# Make the tick lines red at the end of the scale
indic = meter.add_scale_lines(lv.palette_main(lv.PALETTE.RED), lv.palette_main(lv.
↪PALETTE.RED), False, 0)
meter.set_indicator_start_value(indic, 80)
meter.set_indicator_end_value(indic, 100)

# Add a needle line indicator
indic = meter.add_needle_line(4, lv.palette_main(lv.PALETTE.GREY), -10)
```

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```
# Create an animation to set the value
a = lv.anim_t()
a.init()
a.set_var(indic)
a.set_values(0, 100)
a.set_time(2000)
a.set_repeat_delay(100)
a.set_playback_time(500)
a.set_playback_delay(100)
a.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a.set_custom_exec_cb(lambda a,val: set_value(indic,val))
lv.anim_t.start(a)
```

A meter with multiple arcs

```
#include "../../lv_examples.h"
#if LV_USE_METER && LV_BUILD_EXAMPLES

static lv_obj_t * meter;

static void set_value(void * indic, int32_t v)
{
    lv_meter_set_indicator_end_value(meter, indic, v);
}


/**
 * A meter with multiple arcs
 */
void lv_example_meter_2(void)
{
    meter = lv_meter_create(lv_scr_act());
    lv_obj_center(meter);
    lv_obj_set_size(meter, 220, 220);

    /*Remove the circle from the middle*/
    lv_obj_remove_style(meter, NULL, LV_PART_INDICATOR);

    /*Add a scale first*/
    lv_meter_set_scale_ticks(meter, 11, 2, 10, lv_palette_main(LV_PALETTE_GREY));
    lv_meter_set_scale_major_ticks(meter, 1, 2, 30, lv_color_hex3(0xeee), 15);
    lv_meter_set_scale_range(meter, 0, 100, 270, 90);

    /*Add a three arc indicator*/
    lv_meter_indicator_t * indic1 = lv_meter_add_arc(meter, 10, lv_palette_main(LV_
↪PALETTE_RED), 0);
    lv_meter_indicator_t * indic2 = lv_meter_add_arc(meter, 10, lv_palette_main(LV_
↪PALETTE_GREEN), -10);
    lv_meter_indicator_t * indic3 = lv_meter_add_arc(meter, 10, lv_palette_main(LV_
↪PALETTE_BLUE), -20);

    /*Create an animation to set the value*/
    lv_anim_t a;
```

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```
    lv_anim_init(&a);
    lv_anim_set_exec_cb(&a, set_value);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_set_repeat_delay(&a, 100);
    lv_anim_set_playback_delay(&a, 100);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);

    lv_anim_set_time(&a, 2000);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_set_var(&a, indic1);
    lv_anim_start(&a);

    lv_anim_set_time(&a, 1000);
    lv_anim_set_playback_time(&a, 1000);
    lv_anim_set_var(&a, indic2);
    lv_anim_start(&a);

    lv_anim_set_time(&a, 1000);
    lv_anim_set_playback_time(&a, 2000);
    lv_anim_set_var(&a, indic3);
    lv_anim_start(&a);
}

#endif
```

```
#!//opt/bin/lv_micropython -i
import utime as time
import lvgl as lv
import display_driver

def set_value(indic,v):
    meter.set_indicator_end_value(indic, v)

#
# A meter with multiple arcs
#

meter = lv.meter(lv.scr_act())
meter.center()
meter.set_size(200, 200)

# Remove the circle from the middle
meter.remove_style(None, lv.PART.INDICATOR)

# Scale settings
meter.set_scale_ticks(11, 2, 10, lv.palette_main(lv.PALETTE.GREY))
meter.set_scale_major_ticks(1, 2, 30, lv.color_hex3(0xeee), 10)
meter.set_scale_range(0, 100, 270, 90)

# Add a three arc indicator
indic1 = meter.add_arc(10, lv.palette_main(lv.PALETTE.RED), 0)
indic2 = meter.add_arc(10, lv.palette_main(lv.PALETTE.GREEN), -10)
indic3 = meter.add_arc(10, lv.palette_main(lv.PALETTE.BLUE), -20)

# Create an animation to set the value
a1 = lv.anim_t()
```

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```
a1.init()
a1.set_values(0, 100)
a1.set_time(2000)
a1.set_repeat_delay(100)
a1.set_playback_delay(100)
a1.set_playback_time(500)
a1.set_var(indic1)
a1.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a1.set_custom_exec_cb(lambda a,val: set_value(indic1,val))
lv.anim_t.start(a1)

a2 = lv.anim_t()
a2.init()
a2.set_values(0, 100)
a2.set_time(1000)
a2.set_repeat_delay(100)
a2.set_playback_delay(100)
a2.set_playback_time(1000)
a2.set_var(indic2)
a2.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a2.set_custom_exec_cb(lambda a,val: set_value(indic2,val))
lv.anim_t.start(a2)

a3 = lv.anim_t()
a3.init()
a3.set_values(0, 100)
a3.set_time(1000)
a3.set_repeat_delay(100)
a3.set_playback_delay(100)
a3.set_playback_time(2000)
a3.set_var(indic3)
a3.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a3.set_custom_exec_cb(lambda a,val: set_value(indic3,val))
lv.anim_t.start(a3)
```

A clock from a meter

```
#include "../../lv_examples.h"
#if LV_USE_METER && LV_BUILD_EXAMPLES

static lv_obj_t * meter;

static void set_value(void * indic, int32_t v)
{
    lv_meter_set_indicator_end_value(meter, indic, v);
}

static void tick_label_event(lv_event_t * e)
{
    lv_obj_draw_part_dsc_t * draw_part_dsc = lv_event_get_draw_part_dsc(e);

    /*Be sure it's drawing meter related parts*/
```

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```
    if(draw_part_dsc->class_p != &lv_meter_class) return;

    /*Be sure it's drawing the ticks*/
    if(draw_part_dsc->type != LV_METER_DRAW_PART_TICK) return;

    /*Be sure it's a major ticks*/
    if(draw_part_dsc->id % 5) return;

    /*The order of numbers on the clock is tricky: 12, 1, 2, 3...*/
    if(draw_part_dsc->id == 0) {
        lv_strncpy(draw_part_dsc->text, "12", 4);
    }
    else {
        lv_snprintf(draw_part_dsc->text, 4, "%d", draw_part_dsc->id / 5);
    }
}

/**
 * A clock from a meter
 */
void lv_example_meter_3(void)
{
    meter = lv_meter_create(lv_scr_act());
    lv_obj_set_size(meter, 220, 220);
    lv_obj_center(meter);

    /*Create a scale for the minutes*/
    /*61 ticks in a 360 degrees range (the last and the first line overlaps)*/
    lv_meter_set_scale_ticks(meter, 60, 1, 10, lv_palette_main(LV_PALETTE_GREY));
    lv_meter_set_scale_major_ticks(meter, 5, 2, 20, lv_color_black(), 10);
    lv_meter_set_scale_range(meter, 0, 59, 354, 270);

    LV_IMG_DECLARE(img_hand)

    /*Add a the hands from images*/
    lv_meter_indicator_t * indic_min = lv_meter_add_needle_img(meter, &img_hand, 5,␣
↪5);
    lv_meter_indicator_t * indic_hour = lv_meter_add_needle_img(meter, &img_hand, 5,␣
↪5);

    lv_obj_add_event(meter, tick_label_event, LV_EVENT_DRAW_PART_BEGIN, NULL);


    /*Create an animation to set the value*/
    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_exec_cb(&a, set_value);
    lv_anim_set_values(&a, 0, 59);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_set_time(&a, 5000);     /*2 sec for 1 turn of the minute hand (1 hour)*/
    lv_anim_set_var(&a, indic_min);
    lv_anim_start(&a);

    lv_anim_set_var(&a, indic_hour);
    lv_anim_set_time(&a, 240000);    /*24 sec for 1 turn of the hour hand*/
    lv_anim_set_values(&a, 0, 59);
    lv_anim_start(&a);
```

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```
}

#endif
```

```
#!//opt/bin/lv_micropython -i
import utime as time
import lvgl as lv
import display_driver

# Create an image from the png file
try:
    with open('../../assets/img_hand_min.png','rb') as f:
        img_hand_min_data = f.read()
except:
    print("Could not find img_hand_min.png")
    sys.exit()

img_hand_min_dsc = lv.img_dsc_t({
  'data_size': len(img_hand_min_data),
  'data': img_hand_min_data
})

# Create an image from the png file
try:
    with open('../../assets/img_hand_hour.png','rb') as f:
        img_hand_hour_data = f.read()
except:
    print("Could not find img_hand_hour.png")
    sys.exit()

img_hand_hour_dsc = lv.img_dsc_t({
  'data_size': len(img_hand_hour_data),
  'data': img_hand_hour_data
})

def set_value(indic, v):
    meter.set_indicator_value(indic, v)
#
# A clock from a meter
#

def tick_label_event(e):
    draw_part_dsc = e.get_draw_part_dsc();

    # Be sure it's drawing the ticks
    if draw_part_dsc.type != lv.meter.DRAW_PART.TICK: return

    # Be sure it's a major ticks
    if draw_part_dsc.id % 5:  return

    # The order of numbers on the clock is tricky: 12, 1, 2, 3...*/
    txt = ["12", "1", "2as", "3", "4", "5", "6", "7", "8", "9", "10", "11"]
    # dsc.text is defined char text[16], I must therefore convert the Python string␣
↪to a byte_array

    idx = int(draw_part_dsc.id / 5)
```

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```
    draw_part_dsc.text = bytes(txt[idx],"ascii")

meter = lv.meter(lv.scr_act())
meter.set_size(220, 220)
meter.center()

# Create a scale for the minutes
# 60 ticks in a 354 degrees range
meter.set_scale_ticks(60, 1, 10, lv.palette_main(lv.PALETTE.GREY))
meter.set_scale_major_ticks(5, 2, 20, lv.color_black(), 10)         # Every tick is␣
↪major
meter.set_scale_range(0, 59, 354, 270)

# Add the hands from images
indic_min = meter.add_needle_img(img_hand_min_dsc, 5, 5)
indic_hour = meter.add_needle_img(img_hand_hour_dsc, 5, 5)

#Add an event to set the numbers of hours
meter.add_event(tick_label_event, lv.EVENT.DRAW_PART_BEGIN, None)

# Create an animation to set the value
a1 = lv.anim_t()
a1.init()
a1.set_values(0, 60)
a1.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a1.set_time(2000)        # 2 sec for 1 turn of the minute hand (1 hour)
a1.set_var(indic_min)
a1.set_custom_exec_cb(lambda a1,val: set_value(indic_min,val))
lv.anim_t.start(a1)

a2 = lv.anim_t()
a2.init()
a2.set_var(indic_hour)
a2.set_time(24000)       # 24 sec for 1 turn of the hour hand
a2.set_values(0, 60)
a2.set_custom_exec_cb(lambda a2,val: set_value(indic_hour,val))
lv.anim_t.start(a2)
```

Pie chart

```
#include "../../lv_examples.h"
#if LV_USE_METER && LV_BUILD_EXAMPLES

/**
 * Create a pie chart
 */
void lv_example_meter_4(void)
{
    lv_obj_t * meter = lv_meter_create(lv_scr_act());

    /*Remove the background and the circle from the middle*/
    lv_obj_remove_style(meter, NULL, LV_PART_MAIN);
    lv_obj_remove_style(meter, NULL, LV_PART_INDICATOR);
```

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```
    lv_obj_set_size(meter, 200, 200);
    lv_obj_center(meter);

    /*Add a scale first with no ticks.*/
    lv_meter_set_scale_ticks(meter, 0, 0, 0, lv_color_black());
    lv_meter_set_scale_range(meter, 0, 100, 360, 0);

    /*Add a three arc indicator*/
    lv_coord_t indic_w = 100;
    lv_meter_indicator_t * indic1 = lv_meter_add_arc(meter, indic_w, lv_palette_
↪main(LV_PALETTE_ORANGE), 0);
    lv_meter_set_indicator_start_value(meter, indic1, 0);
    lv_meter_set_indicator_end_value(meter, indic1, 40);

    lv_meter_indicator_t * indic2 = lv_meter_add_arc(meter, indic_w, lv_palette_
↪main(LV_PALETTE_YELLOW), 0);
    lv_meter_set_indicator_start_value(meter, indic2, 40);  /*Start from the␣
↪previous*/
    lv_meter_set_indicator_end_value(meter, indic2, 80);

    lv_meter_indicator_t * indic3 = lv_meter_add_arc(meter, indic_w, lv_palette_
↪main(LV_PALETTE_DEEP_ORANGE), 0);
    lv_meter_set_indicator_start_value(meter, indic3, 80);  /*Start from the␣
↪previous*/
    lv_meter_set_indicator_end_value(meter, indic3, 100);
}

#endif
```

```
#
# Create a pie chart
#

meter = lv.meter(lv.scr_act())

# Remove the background and the circle from the middle
meter.remove_style(None, lv.PART.MAIN)
meter.remove_style(None, lv.PART.INDICATOR)

meter.set_size(200, 200)
meter.center()

# Add a scale first with no ticks.
meter.set_scale_ticks( 0, 0, 0, lv.color_black())
meter.set_scale_range(0, 100, 360, 0)

# Add a three arc indicator*
indic_w = 100
indic1 = meter.add_arc(indic_w,lv.palette_main(lv.PALETTE.ORANGE), 0)
meter.set_indicator_start_value(indic1, 0)
meter.set_indicator_end_value(indic1, 40)

indic2 = meter.add_arc(indic_w, lv.palette_main(lv.PALETTE.YELLOW), 0)
meter.set_indicator_start_value(indic2, 40)  # Start from the previous
meter.set_indicator_end_value(indic2, 80)
```

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```
indic3 = meter.add_arc(indic_w, lv.palette_main(lv.PALETTE.DEEP_ORANGE), 0)
meter.set_indicator_start_value(indic3, 80)  # Start from the previous
meter.set_indicator_end_value(indic3, 100)
```

2.7.21 Message box

Simple Message box

```
#include "../../lv_examples.h"
#if LV_USE_MSGBOX && LV_BUILD_EXAMPLES

static void event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_current_target(e);
    LV_UNUSED(obj);
    LV_LOG_USER("Button %s clicked", lv_msgbox_get_active_btn_text(obj));
}

void lv_example_msgbox_1(void)
{
    static const char * btns[] = {"Apply", "Close", ""};

    lv_obj_t * mbox1 = lv_msgbox_create(NULL, "Hello", "This is a message box with␣
↪two buttons.", btns, true);
    lv_obj_add_event(mbox1, event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_obj_center(mbox1);
}

#endif
```

```
def event_cb(e):
    mbox = e.get_target_obj()
    print("Button %s clicked" % mbox.get_active_btn_text())

btns = ["Apply", "Close", ""]

mbox1 = lv.msgbox(lv.scr_act(), "Hello", "This is a message box with two buttons.",␣
↪btns, True)
mbox1.add_event(event_cb, lv.EVENT.VALUE_CHANGED, None)
mbox1.center()
```

2.7.22 Roller

Simple Roller

```
#include "../../lv_examples.h"
#if LV_USE_ROLLER && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        char buf[32];
        lv_roller_get_selected_str(obj, buf, sizeof(buf));
        LV_LOG_USER("Selected month: %s\n", buf);
    }
}

/**
 * An infinite roller with the name of the months
 */
void lv_example_roller_1(void)
{
    lv_obj_t * roller1 = lv_roller_create(lv_scr_act());
    lv_roller_set_options(roller1,
                          "January\n"
                          "February\n"
                          "March\n"
                          "April\n"
                          "May\n"
                          "June\n"
                          "July\n"
                          "August\n"
                          "September\n"
                          "October\n"
                          "November\n"
                          "December",
                          LV_ROLLER_MODE_INFINITE);

    lv_roller_set_visible_row_count(roller1, 4);
    lv_obj_center(roller1);
    lv_obj_add_event(roller1, event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        option = " "*10
        obj.get_selected_str(option, len(option))
        print("Selected month: " + option.strip())

#
# An infinite roller with the name of the months
#
```

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```
roller1 = lv.roller(lv.scr_act())
roller1.set_options("\n".join([
    "January",
    "February",
    "March",
    "April",
    "May",
    "June",
    "July",
    "August",
    "September",
    "October",
    "November",
    "December"]),lv.roller.MODE.INFINITE)

roller1.set_visible_row_count(4)
roller1.center()
roller1.add_event(event_handler, lv.EVENT.ALL, None)
```

Styling the roller

```
#include "../../lv_examples.h"
#if LV_USE_ROLLER && LV_FONT_MONTSERRAT_22 && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        char buf[32];
        lv_roller_get_selected_str(obj, buf, sizeof(buf));
        LV_LOG_USER("Selected value: %s", buf);
    }
}

/**
 * Roller with various alignments and larger text in the selected area
 */
void lv_example_roller_2(void)
{
    /*A style to make the selected option larger*/
    static lv_style_t style_sel;
    lv_style_init(&style_sel);
    lv_style_set_text_font(&style_sel, &lv_font_montserrat_22);
    lv_style_set_bg_color(&style_sel, lv_color_hex3(0xf88));
    lv_style_set_border_width(&style_sel, 2);
    lv_style_set_border_color(&style_sel, lv_color_hex3(0xf00));

    const char * opts = "1\n2\n3\n4\n5\n6\n7\n8\n9\n10";
    lv_obj_t * roller;

    /*A roller on the left with left aligned text, and custom width*/
    roller = lv_roller_create(lv_scr_act());
```

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```
    lv_roller_set_options(roller, opts, LV_ROLLER_MODE_NORMAL);
    lv_roller_set_visible_row_count(roller, 2);
    lv_obj_set_width(roller, 100);
    lv_obj_add_style(roller, &style_sel, LV_PART_SELECTED);
    lv_obj_set_style_text_align(roller, LV_TEXT_ALIGN_LEFT, 0);
    lv_obj_set_style_bg_color(roller, lv_color_hex3(0x0f0), 0);
    lv_obj_set_style_bg_grad_color(roller, lv_color_hex3(0xafa), 0);
    lv_obj_set_style_bg_grad_dir(roller, LV_GRAD_DIR_VER, 0);
    lv_obj_align(roller, LV_ALIGN_LEFT_MID, 10, 0);
    lv_obj_add_event(roller, event_handler, LV_EVENT_ALL, NULL);
    lv_roller_set_selected(roller, 2, LV_ANIM_OFF);

    /*A roller on the middle with center aligned text, and auto (default) width*/
    roller = lv_roller_create(lv_scr_act());
    lv_roller_set_options(roller, opts, LV_ROLLER_MODE_NORMAL);
    lv_roller_set_visible_row_count(roller, 3);
    lv_obj_add_style(roller, &style_sel, LV_PART_SELECTED);
    lv_obj_align(roller, LV_ALIGN_CENTER, 0, 0);
    lv_obj_add_event(roller, event_handler, LV_EVENT_ALL, NULL);
    lv_roller_set_selected(roller, 5, LV_ANIM_OFF);

    /*A roller on the right with right aligned text, and custom width*/
    roller = lv_roller_create(lv_scr_act());
    lv_roller_set_options(roller, opts, LV_ROLLER_MODE_NORMAL);
    lv_roller_set_visible_row_count(roller, 4);
    lv_obj_set_width(roller, 80);
    lv_obj_add_style(roller, &style_sel, LV_PART_SELECTED);
    lv_obj_set_style_text_align(roller, LV_TEXT_ALIGN_RIGHT, 0);
    lv_obj_align(roller, LV_ALIGN_RIGHT_MID, -10, 0);
    lv_obj_add_event(roller, event_handler, LV_EVENT_ALL, NULL);
    lv_roller_set_selected(roller, 8, LV_ANIM_OFF);
}

#endif
```

```
import fs_driver


def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        option = " "*10
        obj.get_selected_str(option, len(option))
        print("Selected value: %s\n" + option.strip())

#
# Roller with various alignments and larger text in the selected area
#

# A style to make the selected option larger
style_sel = lv.style_t()
style_sel.init()

try:
    style_sel.set_text_font(lv.font_montserrat_22)
```

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```
except:
    fs_drv = lv.fs_drv_t()
    fs_driver.fs_register(fs_drv, 'S')
    print("montserrat-22 not enabled in lv_conf.h, dynamically loading the font")
    font_montserrat_22 = lv.font_load("S:" + "../../assets/font/montserrat-22.fnt")
    style_sel.set_text_font(font_montserrat_22)

opts = "\n".join(["1","2","3","4","5","6","7","8","9","10"])

# A roller on the left with left aligned text, and custom width
roller = lv.roller(lv.scr_act())
roller.set_options(opts, lv.roller.MODE.NORMAL)
roller.set_visible_row_count(2)
roller.set_width(100)
roller.add_style(style_sel, lv.PART.SELECTED)
roller.set_style_text_align(lv.TEXT_ALIGN.LEFT, 0)
roller.align(lv.ALIGN.LEFT_MID, 10, 0)
roller.add_event(event_handler, lv.EVENT.ALL, None)
roller.set_selected(2, lv.ANIM.OFF)

# A roller in the middle with center aligned text, and auto (default) width
roller = lv.roller(lv.scr_act())
roller.set_options(opts, lv.roller.MODE.NORMAL)
roller.set_visible_row_count(3)
roller.add_style(style_sel, lv.PART.SELECTED)
roller.align(lv.ALIGN.CENTER, 0, 0)
roller.add_event(event_handler, lv.EVENT.ALL, None)
roller.set_selected(5, lv.ANIM.OFF)

# A roller on the right with right aligned text, and custom width
roller = lv.roller(lv.scr_act())
roller.set_options(opts, lv.roller.MODE.NORMAL)
roller.set_visible_row_count(4)
roller.set_width(80)
roller.add_style(style_sel, lv.PART.SELECTED)
roller.set_style_text_align(lv.TEXT_ALIGN.RIGHT, 0)
roller.align(lv.ALIGN.RIGHT_MID, -10, 0)
roller.add_event(event_handler, lv.EVENT.ALL, None)
roller.set_selected(8, lv.ANIM.OFF)
```

add fade mask to roller

```
#include "../../lv_examples.h"
#if LV_USE_ROLLER && LV_USE_DRAW_MASKS && LV_BUILD_EXAMPLES

static void mask_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    static int16_t mask_top_id = -1;
    static int16_t mask_bottom_id = -1;

    if(code == LV_EVENT_COVER_CHECK) {
        lv_event_set_cover_res(e, LV_COVER_RES_MASKED);
```

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```
    }
    else if(code == LV_EVENT_DRAW_MAIN_BEGIN) {
        /* add mask */
        const lv_font_t * font = lv_obj_get_style_text_font(obj, LV_PART_MAIN);
        lv_coord_t line_space = lv_obj_get_style_text_line_space(obj, LV_PART_MAIN);
        lv_coord_t font_h = lv_font_get_line_height(font);

        lv_area_t roller_coords;
        lv_obj_get_coords(obj, &roller_coords);

        lv_area_t rect_area;
        rect_area.x1 = roller_coords.x1;
        rect_area.x2 = roller_coords.x2;
        rect_area.y1 = roller_coords.y1;
        rect_area.y2 = roller_coords.y1 + (lv_obj_get_height(obj) - font_h - line_
↪space) / 2;

        lv_draw_mask_fade_param_t * fade_mask_top = lv_malloc(sizeof(lv_draw_mask_
↪fade_param_t));
        lv_draw_mask_fade_init(fade_mask_top, &rect_area, LV_OPA_TRANSP, rect_area.y1,
↪ LV_OPA_COVER, rect_area.y2);
        mask_top_id = lv_draw_mask_add(fade_mask_top, NULL);

        rect_area.y1 = rect_area.y2 + font_h + line_space - 1;
        rect_area.y2 = roller_coords.y2;

        lv_draw_mask_fade_param_t * fade_mask_bottom = lv_malloc(sizeof(lv_draw_mask_
↪fade_param_t));
        lv_draw_mask_fade_init(fade_mask_bottom, &rect_area, LV_OPA_COVER, rect_area.
↪y1, LV_OPA_TRANSP, rect_area.y2);
        mask_bottom_id = lv_draw_mask_add(fade_mask_bottom, NULL);

    }
    else if(code == LV_EVENT_DRAW_POST_END) {
        lv_draw_mask_fade_param_t * fade_mask_top = lv_draw_mask_remove_id(mask_top_
↪id);
        lv_draw_mask_fade_param_t * fade_mask_bottom = lv_draw_mask_remove_id(mask_
↪bottom_id);
        lv_draw_mask_free_param(fade_mask_top);
        lv_draw_mask_free_param(fade_mask_bottom);
        lv_free(fade_mask_top);
        lv_free(fade_mask_bottom);
        mask_top_id = -1;
        mask_bottom_id = -1;
    }
}

/**
 * Add a fade mask to roller.
 */
void lv_example_roller_3(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_bg_color(&style, lv_color_black());
    lv_style_set_text_color(&style, lv_color_white());
```

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```
    lv_style_set_border_width(&style, 0);
    lv_style_set_pad_all(&style, 0);
    lv_obj_add_style(lv_scr_act(), &style, 0);

    lv_obj_t * roller1 = lv_roller_create(lv_scr_act());
    lv_obj_add_style(roller1, &style, 0);
    lv_obj_set_style_bg_opa(roller1, LV_OPA_TRANSP, LV_PART_SELECTED);

#if LV_FONT_MONTSERRAT_22
    lv_obj_set_style_text_font(roller1, &lv_font_montserrat_22, LV_PART_SELECTED);
#endif

    lv_roller_set_options(roller1,
                          "January\n"
                          "February\n"
                          "March\n"
                          "April\n"
                          "May\n"
                          "June\n"
                          "July\n"
                          "August\n"
                          "September\n"
                          "October\n"
                          "November\n"
                          "December",
                          LV_ROLLER_MODE_NORMAL);

    lv_obj_center(roller1);
    lv_roller_set_visible_row_count(roller1, 3);
    lv_obj_add_event(roller1, mask_event_cb, LV_EVENT_ALL, NULL);
}

#endif
```

```
import fs_driver
import sys

class Lv_Roller_3():

    def __init__(self):
        self.mask_top_id = -1
        self.mask_bottom_id = -1

        #
        # Add a fade mask to roller.
        #
        style = lv.style_t()
        style.init()
        style.set_bg_color(lv.color_black())
        style.set_text_color(lv.color_white())

        lv.scr_act().add_style(style, 0)

        roller1 = lv.roller(lv.scr_act())
        roller1.add_style(style, 0)
        roller1.set_style_border_width(0, 0)
```

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```
        roller1.set_style_pad_all(0, 0)
        roller1.set_style_bg_opa(lv.OPA.TRANSP, lv.PART.SELECTED)

        #if LV_FONT_MONTSERRAT_22
        #    lv_obj_set_style_text_font(roller1, &lv_font_montserrat_22, LV_PART_
↪SELECTED);
        #endif
        try:
            roller1.set_style_text_font(lv.font_montserrat_22,lv.PART.SELECTED)
        except:
            fs_drv = lv.fs_drv_t()
            fs_driver.fs_register(fs_drv, 'S')
            print("montserrat-22 not enabled in lv_conf.h, dynamically loading the␣
↪font")
            font_montserrat_22 = lv.font_load("S:" + "../../assets/font/montserrat-22.
↪fnt")
            roller1.set_style_text_font(font_montserrat_22,lv.PART.SELECTED)

        roller1.set_options("\n".join([
            "January",
            "February",
            "March",
            "April",
            "May",
            "June",
            "July",
            "August",
            "September",
            "October",
            "November",
            "December"]),lv.roller.MODE.NORMAL)

        roller1.center()
        roller1.set_visible_row_count(3)
        roller1.add_event(self.mask_event_cb, lv.EVENT.ALL, None)

    def mask_event_cb(self,e):

        code = e.get_code()
        obj = e.get_target_obj()

        if code == lv.EVENT.COVER_CHECK:
            e.set_cover_res(lv.COVER_RES.MASKED)

        elif code == lv.EVENT.DRAW_MAIN_BEGIN:
            # add mask
            font = obj.get_style_text_font(lv.PART.MAIN)
            line_space = obj.get_style_text_line_space(lv.PART.MAIN)
            font_h = font.get_line_height()

            roller_coords = lv.area_t()
            obj.get_coords(roller_coords)

            rect_area = lv.area_t()
            rect_area.x1 = roller_coords.x1
            rect_area.x2 = roller_coords.x2
            rect_area.y1 = roller_coords.y1
```

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```
            rect_area.y2 = roller_coords.y1 + (obj.get_height() - font_h - line_
↪space) // 2

            fade_mask_top = lv.draw_mask_fade_param_t()
            fade_mask_top.init(rect_area, lv.OPA.TRANSP, rect_area.y1, lv.OPA.COVER,␣
↪rect_area.y2)
            self.mask_top_id = lv.draw_mask_add(fade_mask_top,None)

            rect_area.y1 = rect_area.y2 + font_h + line_space - 1
            rect_area.y2 = roller_coords.y2

            fade_mask_bottom = lv.draw_mask_fade_param_t()
            fade_mask_bottom.init(rect_area, lv.OPA.COVER, rect_area.y1, lv.OPA.
↪TRANSP, rect_area.y2)
            self.mask_bottom_id = lv.draw_mask_add(fade_mask_bottom, None)

        elif code == lv.EVENT.DRAW_POST_END:
            fade_mask_top = lv.draw_mask_remove_id(self.mask_top_id)
            fade_mask_bottom = lv.draw_mask_remove_id(self.mask_bottom_id)
            # Remove the masks
            lv.draw_mask_remove_id(self.mask_top_id)
            lv.draw_mask_remove_id(self.mask_bottom_id)
            self.mask_top_id = -1
            self.mask_bottom_id = -1

roller3 = Lv_Roller_3()
```

2.7.23 Slider

Simple Slider

```
#include "../../lv_examples.h"
#if LV_USE_SLIDER && LV_BUILD_EXAMPLES

static void slider_event_cb(lv_event_t * e);
static lv_obj_t * slider_label;

/**
 * A default slider with a label displaying the current value
 */
void lv_example_slider_1(void)
{
    /*Create a slider in the center of the display*/
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_obj_center(slider);
    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_VALUE_CHANGED, NULL);

    /*Create a label below the slider*/
    slider_label = lv_label_create(lv_scr_act());
    lv_label_set_text(slider_label, "0%");

    lv_obj_align_to(slider_label, slider, LV_ALIGN_OUT_BOTTOM_MID, 0, 10);
}
```

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```
static void slider_event_cb(lv_event_t * e)
{
    lv_obj_t * slider = lv_event_get_target(e);
    char buf[8];
    lv_snprintf(buf, sizeof(buf), "%d%%", (int)lv_slider_get_value(slider));
    lv_label_set_text(slider_label, buf);
    lv_obj_align_to(slider_label, slider, LV_ALIGN_OUT_BOTTOM_MID, 0, 10);
}

#endif
```

```
#
# A default slider with a label displaying the current value
#
def slider_event_cb(e):

    slider = e.get_target_obj()
    slider_label.set_text("{:d}%".format(slider.get_value()))
    slider_label.align_to(slider, lv.ALIGN.OUT_BOTTOM_MID, 0, 10)

# Create a slider in the center of the display
slider = lv.slider(lv.scr_act())
slider.center()
slider.add_event(slider_event_cb, lv.EVENT.VALUE_CHANGED, None)

# Create a label below the slider
slider_label = lv.label(lv.scr_act())
slider_label.set_text("0%")

slider_label.align_to(slider, lv.ALIGN.OUT_BOTTOM_MID, 0, 10)
```

Slider with custom style

```
#include "../../lv_examples.h"
#if LV_USE_SLIDER && LV_BUILD_EXAMPLES



/**
 * Show how to style a slider.
 */
void lv_example_slider_2(void)
{
    /*Create a transition*/
    static const lv_style_prop_t props[] = {LV_STYLE_BG_COLOR, 0};
    static lv_style_transition_dsc_t transition_dsc;
    lv_style_transition_dsc_init(&transition_dsc, props, lv_anim_path_linear, 300, 0,␣
↪NULL);

    static lv_style_t style_main;
    static lv_style_t style_indicator;
    static lv_style_t style_knob;
    static lv_style_t style_pressed_color;
```

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```
    lv_style_init(&style_main);
    lv_style_set_bg_opa(&style_main, LV_OPA_COVER);
    lv_style_set_bg_color(&style_main, lv_color_hex3(0xbbb));
    lv_style_set_radius(&style_main, LV_RADIUS_CIRCLE);
    lv_style_set_pad_ver(&style_main, -2); /*Makes the indicator larger*/

    lv_style_init(&style_indicator);
    lv_style_set_bg_opa(&style_indicator, LV_OPA_COVER);
    lv_style_set_bg_color(&style_indicator, lv_palette_main(LV_PALETTE_CYAN));
    lv_style_set_radius(&style_indicator, LV_RADIUS_CIRCLE);
    lv_style_set_transition(&style_indicator, &transition_dsc);

    lv_style_init(&style_knob);
    lv_style_set_bg_opa(&style_knob, LV_OPA_COVER);
    lv_style_set_bg_color(&style_knob, lv_palette_main(LV_PALETTE_CYAN));
    lv_style_set_border_color(&style_knob, lv_palette_darken(LV_PALETTE_CYAN, 3));
    lv_style_set_border_width(&style_knob, 2);
    lv_style_set_radius(&style_knob, LV_RADIUS_CIRCLE);
    lv_style_set_pad_all(&style_knob, 6); /*Makes the knob larger*/
    lv_style_set_transition(&style_knob, &transition_dsc);

    lv_style_init(&style_pressed_color);
    lv_style_set_bg_color(&style_pressed_color, lv_palette_darken(LV_PALETTE_CYAN,␣
↪2));

    /*Create a slider and add the style*/
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_obj_remove_style_all(slider);        /*Remove the styles coming from the␣
↪theme*/

    lv_obj_add_style(slider, &style_main, LV_PART_MAIN);
    lv_obj_add_style(slider, &style_indicator, LV_PART_INDICATOR);
    lv_obj_add_style(slider, &style_pressed_color, LV_PART_INDICATOR | LV_STATE_
↪PRESSED);
    lv_obj_add_style(slider, &style_knob, LV_PART_KNOB);
    lv_obj_add_style(slider, &style_pressed_color, LV_PART_KNOB | LV_STATE_PRESSED);

    lv_obj_center(slider);
}

#endif
```

```
#
# Show how to style a slider.
#
# Create a transition
props = [lv.STYLE.BG_COLOR, 0]
transition_dsc = lv.style_transition_dsc_t()
transition_dsc.init(props, lv.anim_t.path_linear, 300, 0, None)

style_main = lv.style_t()
style_indicator = lv.style_t()
style_knob = lv.style_t()
style_pressed_color = lv.style_t()
style_main.init()
style_main.set_bg_opa(lv.OPA.COVER)
```

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```
style_main.set_bg_color(lv.color_hex3(0xbbb))
style_main.set_radius(lv.RADIUS_CIRCLE)
style_main.set_pad_ver(-2)                # Makes the indicator larger

style_indicator.init()
style_indicator.set_bg_opa(lv.OPA.COVER)
style_indicator.set_bg_color(lv.palette_main(lv.PALETTE.CYAN))
style_indicator.set_radius(lv.RADIUS_CIRCLE)
style_indicator.set_transition(transition_dsc)

style_knob.init()
style_knob.set_bg_opa(lv.OPA.COVER)
style_knob.set_bg_color(lv.palette_main(lv.PALETTE.CYAN))
style_knob.set_border_color(lv.palette_darken(lv.PALETTE.CYAN, 3))
style_knob.set_border_width(2)
style_knob.set_radius(lv.RADIUS_CIRCLE)
style_knob.set_pad_all(6)                  # Makes the knob larger
style_knob.set_transition(transition_dsc)

style_pressed_color.init()
style_pressed_color.set_bg_color(lv.palette_darken(lv.PALETTE.CYAN, 2))

# Create a slider and add the style
slider = lv.slider(lv.scr_act())
slider.remove_style_all()                  # Remove the styles coming from the theme

slider.add_style(style_main, lv.PART.MAIN)
slider.add_style(style_indicator, lv.PART.INDICATOR)
slider.add_style(style_pressed_color, lv.PART.INDICATOR | lv.STATE.PRESSED)
slider.add_style(style_knob, lv.PART.KNOB)
slider.add_style(style_pressed_color, lv.PART.KNOB | lv.STATE.PRESSED)

slider.center()
```

Slider with extended drawer

```
#include "../../lv_examples.h"
#if LV_USE_SLIDER && LV_BUILD_EXAMPLES

static void slider_event_cb(lv_event_t * e);

/**
 * Show the current value when the slider is pressed by extending the drawer
 *
 */
void lv_example_slider_3(void)
{
    /*Create a slider in the center of the display*/
    lv_obj_t * slider;
    slider = lv_slider_create(lv_scr_act());
    lv_obj_center(slider);

    lv_slider_set_mode(slider, LV_SLIDER_MODE_RANGE);
    lv_slider_set_value(slider, 70, LV_ANIM_OFF);
```

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```
    lv_slider_set_left_value(slider, 20, LV_ANIM_OFF);

    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_ALL, NULL);
    lv_obj_refresh_ext_draw_size(slider);
}

static void slider_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    /*Provide some extra space for the value*/
    if(code == LV_EVENT_REFR_EXT_DRAW_SIZE) {
        lv_event_set_ext_draw_size(e, 50);
    }
    else if(code == LV_EVENT_DRAW_PART_END) {
        lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
        if(dsc->part == LV_PART_INDICATOR) {
            char buf[16];
            lv_snprintf(buf, sizeof(buf), "%d - %d", (int)lv_slider_get_left_
↪value(obj), (int)lv_slider_get_value(obj));

            lv_point_t label_size;
            lv_txt_get_size(&label_size, buf, LV_FONT_DEFAULT, 0, 0, LV_COORD_MAX, 0);
            lv_area_t label_area;
            label_area.x1 = dsc->draw_area->x1 + lv_area_get_width(dsc->draw_area) /␣
↪2 - label_size.x / 2;
            label_area.x2 = label_area.x1 + label_size.x;
            label_area.y2 = dsc->draw_area->y1 - 10;
            label_area.y1 = label_area.y2 - label_size.y;

            lv_draw_label_dsc_t label_draw_dsc;
            lv_draw_label_dsc_init(&label_draw_dsc);
            label_draw_dsc.color = lv_color_hex3(0x888);
            lv_draw_label(dsc->draw_ctx, &label_draw_dsc, &label_area, buf, NULL);
        }
    }
}

#endif
```

```
def slider_event_cb(e):
    code = e.get_code()
    obj = e.get_target_obj()

    # Provide some extra space for the value
    if code == lv.EVENT.REFR_EXT_DRAW_SIZE:
        e.set_ext_draw_size(50)

    elif code == lv.EVENT.DRAW_PART_END:
        # print("DRAW_PART_END")
        dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
        # print(dsc)
        if dsc.part == lv.PART.INDICATOR:
            label_text = "{:d} - {:d}".format(obj.get_left_value(),slider.get_value())
            label_size = lv.point_t()
```

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```
            lv.txt_get_size(label_size, label_text, lv.font_default(), 0, 0, lv.COORD.
↪MAX, 0)
            # print(label_size.x,label_size.y)
            label_area = lv.area_t()
            label_area.x1 = dsc.draw_area.x1 + dsc.draw_area.get_width() // 2 - label_
↪size.x // 2
            label_area.x2 = label_area.x1 + label_size.x
            label_area.y2 = dsc.draw_area.y1 - 10
            label_area.y1 = label_area.y2 - label_size.y

            label_draw_dsc = lv.draw_label_dsc_t()
            label_draw_dsc.init()

            dsc.draw_ctx.label(label_draw_dsc, label_area, label_text, None)
#
# Show the current value when the slider if pressed by extending the drawer
#
#
#Create a slider in the center of the display

slider = lv.slider(lv.scr_act())
slider.center()

slider.set_mode(lv.slider.MODE.RANGE)
slider.set_value(70, lv.ANIM.OFF)
slider.set_left_value(20, lv.ANIM.OFF)

slider.add_event(slider_event_cb, lv.EVENT.ALL, None)
slider.refresh_ext_draw_size()
```

2.7.24 Span

Span with custom styles

```
#include "../../lv_examples.h"
#if LV_USE_SPAN && LV_BUILD_EXAMPLES

/**
 * Create span.
 */
void lv_example_span_1(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_border_width(&style, 1);
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_ORANGE));
    lv_style_set_pad_all(&style, 2);

    lv_obj_t * spans = lv_spangroup_create(lv_scr_act());
    lv_obj_set_width(spans, 300);
    lv_obj_set_height(spans, 300);
    lv_obj_center(spans);
    lv_obj_add_style(spans, &style, 0);
```

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```
    lv_spangroup_set_align(spans, LV_TEXT_ALIGN_LEFT);
    lv_spangroup_set_overflow(spans, LV_SPAN_OVERFLOW_CLIP);
    lv_spangroup_set_indent(spans, 20);
    lv_spangroup_set_mode(spans, LV_SPAN_MODE_BREAK);

    lv_span_t * span = lv_spangroup_new_span(spans);
    lv_span_set_text(span, "China is a beautiful country.");
    lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_text_decor(&span->style, LV_TEXT_DECOR_UNDERLINE);
    lv_style_set_text_opa(&span->style, LV_OPA_50);

    span = lv_spangroup_new_span(spans);
    lv_span_set_text_static(span, "good good study, day day up.");
#if LV_FONT_MONTSERRAT_24
    lv_style_set_text_font(&span->style,  &lv_font_montserrat_24);
#endif
    lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_GREEN));

    span = lv_spangroup_new_span(spans);
    lv_span_set_text_static(span, "LVGL is an open-source graphics library.");
    lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_BLUE));

    span = lv_spangroup_new_span(spans);
    lv_span_set_text_static(span, "the boy no name.");
    lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_GREEN));
#if LV_FONT_MONTSERRAT_20
    lv_style_set_text_font(&span->style, &lv_font_montserrat_20);
#endif
    lv_style_set_text_decor(&span->style, LV_TEXT_DECOR_UNDERLINE);

    span = lv_spangroup_new_span(spans);
    lv_span_set_text(span, "I have a dream that hope to come true.");
    lv_style_set_text_decor(&span->style, LV_TEXT_DECOR_STRIKETHROUGH);

    lv_spangroup_refr_mode(spans);
}

#endif
```

```
#
# Create span
#
style = lv.style_t()
style.init()
style.set_border_width(1)
style.set_border_color(lv.palette_main(lv.PALETTE.ORANGE))
style.set_pad_all(2)

spans = lv.spangroup(lv.scr_act())
spans.set_width(300)
spans.set_height(300)
spans.center()
spans.add_style(style, 0)

spans.set_align(lv.TEXT_ALIGN.LEFT)
```

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```
spans.set_overflow(lv.SPAN_OVERFLOW.CLIP)
spans.set_indent(20)
spans.set_mode(lv.SPAN_MODE.BREAK)

span = spans.new_span()
span.set_text("china is a beautiful country.")
span.style.set_text_color(lv.palette_main(lv.PALETTE.RED))
span.style.set_text_decor(lv.TEXT_DECOR.STRIKETHROUGH | lv.TEXT_DECOR.UNDERLINE)
span.style.set_text_opa(lv.OPA._30)

span = spans.new_span()
span.set_text_static("good good study, day day up.")
#if LV_FONT_MONTSERRAT_24
#    lv_style_set_text_font(&span->style,  &lv_font_montserrat_24);
#endif
span.style.set_text_color(lv.palette_main(lv.PALETTE.GREEN))

span = spans.new_span()
span.set_text_static("LVGL is an open-source graphics library.")
span.style.set_text_color(lv.palette_main(lv.PALETTE.BLUE))

span = spans.new_span()
span.set_text_static("the boy no name.")
span.style.set_text_color(lv.palette_main(lv.PALETTE.GREEN))
#if LV_FONT_MONTSERRAT_20
#    lv_style_set_text_font(&span->style, &lv_font_montserrat_20);
#endif
span.style.set_text_decor(lv.TEXT_DECOR.UNDERLINE)

span = spans.new_span()
span.set_text("I have a dream that hope to come true.")

spans.refr_mode()

# lv_span_del(spans, span);
# lv_obj_del(spans);
```

2.7.25 Spinbox

Simple Spinbox

```
#include "../../lv_examples.h"
#if LV_USE_SPINBOX && LV_BUILD_EXAMPLES

static lv_obj_t * spinbox;


static void lv_spinbox_increment_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_SHORT_CLICKED || code  == LV_EVENT_LONG_PRESSED_REPEAT) {
        lv_spinbox_increment(spinbox);
    }
```

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```
}

static void lv_spinbox_decrement_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_SHORT_CLICKED || code == LV_EVENT_LONG_PRESSED_REPEAT) {
        lv_spinbox_decrement(spinbox);
    }
}


void lv_example_spinbox_1(void)
{
    spinbox = lv_spinbox_create(lv_scr_act());
    lv_spinbox_set_range(spinbox, -1000, 25000);
    lv_spinbox_set_digit_format(spinbox, 5, 2);
    lv_spinbox_step_prev(spinbox);
    lv_obj_set_width(spinbox, 100);
    lv_obj_center(spinbox);

    lv_coord_t h = lv_obj_get_height(spinbox);

    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, h, h);
    lv_obj_align_to(btn, spinbox, LV_ALIGN_OUT_RIGHT_MID, 5, 0);
    lv_obj_set_style_bg_img_src(btn, LV_SYMBOL_PLUS, 0);
    lv_obj_add_event(btn, lv_spinbox_increment_event_cb, LV_EVENT_ALL,  NULL);

    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, h, h);
    lv_obj_align_to(btn, spinbox, LV_ALIGN_OUT_LEFT_MID, -5, 0);
    lv_obj_set_style_bg_img_src(btn, LV_SYMBOL_MINUS, 0);
    lv_obj_add_event(btn, lv_spinbox_decrement_event_cb, LV_EVENT_ALL, NULL);
}

#endif
```

```
def increment_event_cb(e):
    code = e.get_code()
    if code == lv.EVENT.SHORT_CLICKED or code  == lv.EVENT.LONG_PRESSED_REPEAT:
        spinbox.increment()

def decrement_event_cb(e):
    code = e.get_code()
    if code == lv.EVENT.SHORT_CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        spinbox.decrement()

spinbox = lv.spinbox(lv.scr_act())
spinbox.set_range(-1000, 25000)
spinbox.set_digit_format(5, 2)
spinbox.step_prev()
spinbox.set_width(100)
spinbox.center()

h = spinbox.get_height()
```

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```
btn = lv.btn(lv.scr_act())
btn.set_size(h, h)
btn.align_to(spinbox, lv.ALIGN.OUT_RIGHT_MID, 5, 0)
btn.set_style_bg_img_src(lv.SYMBOL.PLUS, 0)
btn.add_event(increment_event_cb, lv.EVENT.ALL,  None)

btn = lv.btn(lv.scr_act())
btn.set_size(h, h)
btn.align_to(spinbox, lv.ALIGN.OUT_LEFT_MID, -5, 0)
btn.set_style_bg_img_src(lv.SYMBOL.MINUS, 0)
btn.add_event(decrement_event_cb, lv.EVENT.ALL, None)
```

2.7.26 Spinner

Simple spinner

```
#include "../../lv_examples.h"
#if LV_USE_SPINNER && LV_BUILD_EXAMPLES

void lv_example_spinner_1(void)
{
    /*Create a spinner*/
    lv_obj_t * spinner = lv_spinner_create(lv_scr_act(), 1000, 60);
    lv_obj_set_size(spinner, 100, 100);
    lv_obj_center(spinner);
}

#endif
```

```
# Create a spinner
spinner = lv.spinner(lv.scr_act(), 1000, 60)
spinner.set_size(100, 100)
spinner.center()
```

2.7.27 Switch

Simple Switch

```
#include "../../lv_examples.h"
#if LV_USE_SWITCH && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        LV_UNUSED(obj);
        LV_LOG_USER("State: %s\n", lv_obj_has_state(obj, LV_STATE_CHECKED) ? "On" :
↪"Off");
```

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```
    }
}

void lv_example_switch_1(void)
{
    lv_obj_set_flex_flow(lv_scr_act(), LV_FLEX_FLOW_COLUMN);
    lv_obj_set_flex_align(lv_scr_act(), LV_FLEX_ALIGN_CENTER, LV_FLEX_ALIGN_CENTER,␣
↪LV_FLEX_ALIGN_CENTER);

    lv_obj_t * sw;

    sw = lv_switch_create(lv_scr_act());
    lv_obj_add_event(sw, event_handler, LV_EVENT_ALL, NULL);

    sw = lv_switch_create(lv_scr_act());
    lv_obj_add_state(sw, LV_STATE_CHECKED);
    lv_obj_add_event(sw, event_handler, LV_EVENT_ALL, NULL);

    sw = lv_switch_create(lv_scr_act());
    lv_obj_add_state(sw, LV_STATE_DISABLED);
    lv_obj_add_event(sw, event_handler, LV_EVENT_ALL, NULL);

    sw = lv_switch_create(lv_scr_act());
    lv_obj_add_state(sw, LV_STATE_CHECKED | LV_STATE_DISABLED);
    lv_obj_add_event(sw, event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        if obj.has_state(lv.STATE.CHECKED):
            print("State: on")
        else:
            print("State: off")


lv.scr_act().set_flex_flow(lv.FLEX_FLOW.COLUMN)
lv.scr_act().set_flex_align(lv.FLEX_ALIGN.CENTER, lv.FLEX_ALIGN.CENTER, lv.FLEX_ALIGN.
↪CENTER)

sw = lv.switch(lv.scr_act())
sw.add_event(event_handler,lv.EVENT.ALL, None)

sw = lv.switch(lv.scr_act())
sw.add_state(lv.STATE.CHECKED)
sw.add_event(event_handler, lv.EVENT.ALL, None)

sw = lv.switch(lv.scr_act())
sw.add_state(lv.STATE.DISABLED)
sw.add_event(event_handler, lv.EVENT.ALL, None)

sw = lv.switch(lv.scr_act())
sw.add_state(lv.STATE.CHECKED | lv.STATE.DISABLED)
```

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```
sw.add_event(event_handler, lv.EVENT.ALL, None)
```

2.7.28 Table

Simple table

```
#include "../../lv_examples.h"
#if LV_USE_TABLE && LV_BUILD_EXAMPLES

static void draw_part_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    /*If the cells are drawn...*/
    if(dsc->part == LV_PART_ITEMS) {
        uint32_t row = dsc->id /  lv_table_get_col_cnt(obj);
        uint32_t col = dsc->id - row * lv_table_get_col_cnt(obj);

        /*Make the texts in the first cell center aligned*/
        if(row == 0) {
            dsc->label_dsc->align = LV_TEXT_ALIGN_CENTER;
            dsc->rect_dsc->bg_color = lv_color_mix(lv_palette_main(LV_PALETTE_BLUE),␣
↪dsc->rect_dsc->bg_color, LV_OPA_20);
            dsc->rect_dsc->bg_opa = LV_OPA_COVER;
        }
        /*In the first column align the texts to the right*/
        else if(col == 0) {
            dsc->label_dsc->align = LV_TEXT_ALIGN_RIGHT;
        }

        /*MAke every 2nd row grayish*/
        if((row != 0 && row % 2) == 0) {
            dsc->rect_dsc->bg_color = lv_color_mix(lv_palette_main(LV_PALETTE_GREY),␣
↪dsc->rect_dsc->bg_color, LV_OPA_10);
            dsc->rect_dsc->bg_opa = LV_OPA_COVER;
        }
    }
}


void lv_example_table_1(void)
{
    lv_obj_t * table = lv_table_create(lv_scr_act());

    /*Fill the first column*/
    lv_table_set_cell_value(table, 0, 0, "Name");
    lv_table_set_cell_value(table, 1, 0, "Apple");
    lv_table_set_cell_value(table, 2, 0, "Banana");
    lv_table_set_cell_value(table, 3, 0, "Lemon");
    lv_table_set_cell_value(table, 4, 0, "Grape");
    lv_table_set_cell_value(table, 5, 0, "Melon");
    lv_table_set_cell_value(table, 6, 0, "Peach");
    lv_table_set_cell_value(table, 7, 0, "Nuts");
```

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```
    /*Fill the second column*/
    lv_table_set_cell_value(table, 0, 1, "Price");
    lv_table_set_cell_value(table, 1, 1, "$7");
    lv_table_set_cell_value(table, 2, 1, "$4");
    lv_table_set_cell_value(table, 3, 1, "$6");
    lv_table_set_cell_value(table, 4, 1, "$2");
    lv_table_set_cell_value(table, 5, 1, "$5");
    lv_table_set_cell_value(table, 6, 1, "$1");
    lv_table_set_cell_value(table, 7, 1, "$9");

    /*Set a smaller height to the table. It'll make it scrollable*/
    lv_obj_set_height(table, 200);
    lv_obj_center(table);

    /*Add an event callback to to apply some custom drawing*/
    lv_obj_add_event(table, draw_part_event_cb, LV_EVENT_DRAW_PART_BEGIN, NULL);
}

#endif
```

```
def draw_part_event_cb(e):
    obj = e.get_target_obj()
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    # If the cells are drawn../
    if dsc.part == lv.PART.ITEMS:
        row = dsc.id //  obj.get_col_cnt()
        col = dsc.id - row * obj.get_col_cnt()

        # Make the texts in the first cell center aligned
        if row == 0:
            dsc.label_dsc.align = lv.TEXT_ALIGN.CENTER
            dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.BLUE).color_mix(dsc.
↪rect_dsc.bg_color, lv.OPA._20)
            dsc.rect_dsc.bg_opa = lv.OPA.COVER

        # In the first column align the texts to the right
        elif col == 0:
            dsc.label_dsc.flag = lv.TEXT_ALIGN.RIGHT

        # Make every 2nd row grayish
        if row != 0 and (row % 2) == 0:
            dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.GREY).color_mix(dsc.
↪rect_dsc.bg_color, lv.OPA._10)
            dsc.rect_dsc.bg_opa = lv.OPA.COVER


table = lv.table(lv.scr_act())

# Fill the first column
table.set_cell_value(0, 0, "Name")
table.set_cell_value(1, 0, "Apple")
table.set_cell_value(2, 0, "Banana")
table.set_cell_value(3, 0, "Lemon")
table.set_cell_value(4, 0, "Grape")
table.set_cell_value(5, 0, "Melon")
```

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```
table.set_cell_value(6, 0, "Peach")
table.set_cell_value(7, 0, "Nuts")

# Fill the second column
table.set_cell_value(0, 1, "Price")
table.set_cell_value(1, 1, "$7")
table.set_cell_value(2, 1, "$4")
table.set_cell_value(3, 1, "$6")
table.set_cell_value(4, 1, "$2")
table.set_cell_value(5, 1, "$5")
table.set_cell_value(6, 1, "$1")
table.set_cell_value(7, 1, "$9")

# Set a smaller height to the table. It'll make it scrollable
table.set_height(200)
table.center()

# Add an event callback to apply some custom drawing
table.add_event(draw_part_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)
```

Lightweighted list from table

```
#include "../../lv_examples.h"
#if LV_USE_TABLE && LV_BUILD_EXAMPLES

#define ITEM_CNT 200

static void draw_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    /*If the cells are drawn...*/
    if(dsc->part == LV_PART_ITEMS) {
        bool chk = lv_table_has_cell_ctrl(obj, dsc->id, 0, LV_TABLE_CELL_CTRL_CUSTOM_
↪1);

        lv_draw_rect_dsc_t rect_dsc;
        lv_draw_rect_dsc_init(&rect_dsc);
        rect_dsc.bg_color = chk ? lv_theme_get_color_primary(obj) : lv_palette_
↪lighten(LV_PALETTE_GREY, 2);
        rect_dsc.radius = LV_RADIUS_CIRCLE;

        lv_area_t sw_area;
        sw_area.x1 = dsc->draw_area->x2 - 50;
        sw_area.x2 = sw_area.x1 + 40;
        sw_area.y1 = dsc->draw_area->y1 + lv_area_get_height(dsc->draw_area) / 2 - 10;
        sw_area.y2 = sw_area.y1 + 20;
        lv_draw_rect(dsc->draw_ctx, &rect_dsc, &sw_area);

        rect_dsc.bg_color = lv_color_white();
        if(chk) {
            sw_area.x2 -= 2;
            sw_area.x1 = sw_area.x2 - 16;
        }
```

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```
        else {
            sw_area.x1 += 2;
            sw_area.x2 = sw_area.x1 + 16;
        }
        sw_area.y1 += 2;
        sw_area.y2 -= 2;
        lv_draw_rect(dsc->draw_ctx, &rect_dsc, &sw_area);
    }
}

static void change_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    uint16_t col;
    uint16_t row;
    lv_table_get_selected_cell(obj, &row, &col);
    bool chk = lv_table_has_cell_ctrl(obj, row, 0, LV_TABLE_CELL_CTRL_CUSTOM_1);
    if(chk) lv_table_clear_cell_ctrl(obj, row, 0, LV_TABLE_CELL_CTRL_CUSTOM_1);
    else lv_table_add_cell_ctrl(obj, row, 0, LV_TABLE_CELL_CTRL_CUSTOM_1);
}


/**
 * A very light-weighted list created from table
 */
void lv_example_table_2(void)
{
    /*Measure memory usage*/
    lv_mem_monitor_t mon1;
    lv_mem_monitor(&mon1);

    uint32_t t = lv_tick_get();

    lv_obj_t * table = lv_table_create(lv_scr_act());

    /*Set a smaller height to the table. It'll make it scrollable*/
    lv_obj_set_size(table, LV_SIZE_CONTENT, 200);

    lv_table_set_col_width(table, 0, 150);
    lv_table_set_row_cnt(table, ITEM_CNT); /*Not required but avoids a lot of memory␣
↪reallocation lv_table_set_set_value*/
    lv_table_set_col_cnt(table, 1);

    /*Don't make the cell pressed, we will draw something different in the event*/
    lv_obj_remove_style(table, NULL, LV_PART_ITEMS | LV_STATE_PRESSED);

    uint32_t i;
    for(i = 0; i < ITEM_CNT; i++) {
        lv_table_set_cell_value_fmt(table, i, 0, "Item %"LV_PRIu32, i + 1);
    }

    lv_obj_align(table, LV_ALIGN_CENTER, 0, -20);

    /*Add an event callback to to apply some custom drawing*/
    lv_obj_add_event(table, draw_event_cb, LV_EVENT_DRAW_PART_END, NULL);
    lv_obj_add_event(table, change_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
```

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```
    lv_mem_monitor_t mon2;
    lv_mem_monitor(&mon2);

    uint32_t mem_used = mon1.free_size - mon2.free_size;

    uint32_t elaps = lv_tick_elaps(t);

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text_fmt(label, "%"LV_PRIu32" items were created in %"LV_PRIu32" ms\n
↪"
                                  "using %"LV_PRIu32" bytes of memory",
                                  (uint32_t)ITEM_CNT, elaps, mem_used);

    lv_obj_align(label, LV_ALIGN_BOTTOM_MID, 0, -10);

}

#endif
```

```
from utime import ticks_ms
import gc

ITEM_CNT = 200

def draw_event_cb(e):
    obj = e.get_target_obj()
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    # If the cells are drawn...
    if dsc.part == lv.PART.ITEMS:
        chk = obj.has_cell_ctrl(dsc.id, 0, lv.table.CELL_CTRL.CUSTOM_1)

        rect_dsc = lv.draw_rect_dsc_t()
        rect_dsc.init()

        if chk:
            rect_dsc.bg_color = lv.theme_get_color_primary(obj)
        else:
            rect_dsc.bg_color = lv.palette_lighten(lv.PALETTE.GREY, 2)

        rect_dsc.radius = lv.RADIUS_CIRCLE

        sw_area = lv.area_t()
        sw_area.x1 = dsc.draw_area.x2 - 50
        sw_area.x2 = sw_area.x1 + 40
        sw_area.y1 = dsc.draw_area.y1 + dsc.draw_area.get_height() // 2 - 10
        sw_area.y2 = sw_area.y1 + 20
        dsc.draw_ctx.rect(rect_dsc, sw_area)

        rect_dsc.bg_color = lv.color_white()

        if chk:
            sw_area.x2 -= 2
            sw_area.x1 = sw_area.x2 - 16
        else:
            sw_area.x1 += 2
            sw_area.x2 = sw_area.x1 + 16
```

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```
        sw_area.y1 += 2
        sw_area.y2 -= 2
        dsc.draw_ctx.rect(rect_dsc, sw_area)

def change_event_cb(e):
    obj = e.get_target_obj()
    row = lv.C_Pointer()
    col = lv.C_Pointer()
    table.get_selected_cell(row, col)
    # print("row: ",row.uint_val)

    chk = table.has_cell_ctrl(row.uint_val, 0, lv.table.CELL_CTRL.CUSTOM_1)
    if chk:
        table.clear_cell_ctrl(row.uint_val, 0, lv.table.CELL_CTRL.CUSTOM_1)
    else:
        table.add_cell_ctrl(row.uint_val, 0, lv.table.CELL_CTRL.CUSTOM_1)

#
# A very light-weighted list created from table
#

# Measure memory usage
gc.enable()
gc.collect()
mem_free = gc.mem_free()
print("mem_free: ", mem_free)
t = ticks_ms()
print("ticks: ", t)
table = lv.table(lv.scr_act())

# Set a smaller height to the table. It'll make it scrollable
table.set_size(150, 200)

table.set_col_width(0, 150)
table.set_row_cnt(ITEM_CNT)  # Not required but avoids a lot of memory reallocation␣
↪lv_table_set_set_value
table.set_col_cnt(1)

# Don't make the cell pressed, we will draw something different in the event
table.remove_style(None, lv.PART.ITEMS | lv.STATE.PRESSED)

for i in range(ITEM_CNT):
    table.set_cell_value(i, 0, "Item " + str(i+1))

table.align(lv.ALIGN.CENTER, 0, -20)

# Add an event callback to apply some custom drawing
table.add_event(draw_event_cb, lv.EVENT.DRAW_PART_END, None)
table.add_event(change_event_cb, lv.EVENT.VALUE_CHANGED, None)

gc.collect()
mem_used = mem_free - gc.mem_free()
elaps = ticks_ms()-t

label = lv.label(lv.scr_act())
label.set_text(str(ITEM_CNT) + " items were created in " + str(elaps) + " ms\n using
↪" + str(mem_used) + " bytes of memory")
```

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```
#label.set_text(str(ITEM_CNT) + " items were created in " + str(elaps) + " ms")

label.align(lv.ALIGN.BOTTOM_MID, 0, -10)
```

2.7.29 Tabview

Simple Tabview

```
#include "../../lv_examples.h"
#if LV_USE_TABVIEW && LV_BUILD_EXAMPLES

void lv_example_tabview_1(void)
{
    /*Create a Tab view object*/
    lv_obj_t * tabview;
    tabview = lv_tabview_create(lv_scr_act(), LV_DIR_TOP, 50);

    /*Add 3 tabs (the tabs are page (lv_page) and can be scrolled*/
    lv_obj_t * tab1 = lv_tabview_add_tab(tabview, "Tab 1");
    lv_obj_t * tab2 = lv_tabview_add_tab(tabview, "Tab 2");
    lv_obj_t * tab3 = lv_tabview_add_tab(tabview, "Tab 3");

    /*Add content to the tabs*/
    lv_obj_t * label = lv_label_create(tab1);
    lv_label_set_text(label, "This the first tab\n\n"
                      "If the content\n"
                      "of a tab\n"
                      "becomes too\n"
                      "longer\n"
                      "than the\n"
                      "container\n"
                      "then it\n"
                      "automatically\n"
                      "becomes\n"
                      "scrollable.\n"
                      "\n"
                      "\n"
                      "\n"
                      "Can you see it?");

    label = lv_label_create(tab2);
    lv_label_set_text(label, "Second tab");

    label = lv_label_create(tab3);
    lv_label_set_text(label, "Third tab");

    lv_obj_scroll_to_view_recursive(label, LV_ANIM_ON);

}
#endif
```

```
# Create a Tab view object
tabview = lv.tabview(lv.scr_act(), lv.DIR.TOP, 50)

```

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```
# Add 3 tabs (the tabs are page (lv_page) and can be scrolled
tab1 = tabview.add_tab("Tab 1")
tab2 = tabview.add_tab("Tab 2")
tab3 = tabview.add_tab("Tab 3")

# Add content to the tabs
label = lv.label(tab1)
label.set_text("""This the first tab

If the content
of a tab
becomes too
longer
than the
container
then it
automatically
becomes
scrollable.



Can you see it?""")

label = lv.label(tab2)
label.set_text("Second tab")

label = lv.label(tab3)
label.set_text("Third tab");

label.scroll_to_view_recursive(lv.ANIM.ON)
```

Tabs on the left, styling and no scrolling

```
#include "../../lv_examples.h"
#if LV_USE_TABVIEW && LV_BUILD_EXAMPLES

static void scroll_begin_event(lv_event_t * e)
{
    /*Disable the scroll animations. Triggered when a tab button is clicked */
    if(lv_event_get_code(e) == LV_EVENT_SCROLL_BEGIN) {
        lv_anim_t * a = lv_event_get_param(e);
        if(a)  a->time = 0;
    }
}

void lv_example_tabview_2(void)
{
    /*Create a Tab view object*/
    lv_obj_t * tabview;
    tabview = lv_tabview_create(lv_scr_act(), LV_DIR_LEFT, 80);
    lv_obj_add_event(lv_tabview_get_content(tabview), scroll_begin_event, LV_EVENT_
↪SCROLL_BEGIN, NULL);
```

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```
    lv_obj_set_style_bg_color(tabview, lv_palette_lighten(LV_PALETTE_RED, 2), 0);

    lv_obj_t * tab_btns = lv_tabview_get_tab_btns(tabview);
    lv_obj_set_style_bg_color(tab_btns, lv_palette_darken(LV_PALETTE_GREY, 3), 0);
    lv_obj_set_style_text_color(tab_btns, lv_palette_lighten(LV_PALETTE_GREY, 5), 0);
    lv_obj_set_style_border_side(tab_btns, LV_BORDER_SIDE_RIGHT, LV_PART_ITEMS | LV_
↪STATE_CHECKED);


    /*Add 3 tabs (the tabs are page (lv_page) and can be scrolled*/
    lv_obj_t * tab1 = lv_tabview_add_tab(tabview, "Tab 1");
    lv_obj_t * tab2 = lv_tabview_add_tab(tabview, "Tab 2");
    lv_obj_t * tab3 = lv_tabview_add_tab(tabview, "Tab 3");
    lv_obj_t * tab4 = lv_tabview_add_tab(tabview, "Tab 4");
    lv_obj_t * tab5 = lv_tabview_add_tab(tabview, "Tab 5");

    lv_obj_set_style_bg_color(tab2, lv_palette_lighten(LV_PALETTE_AMBER, 3), 0);
    lv_obj_set_style_bg_opa(tab2, LV_OPA_COVER, 0);

    /*Add content to the tabs*/
    lv_obj_t * label = lv_label_create(tab1);
    lv_label_set_text(label, "First tab");

    label = lv_label_create(tab2);
    lv_label_set_text(label, "Second tab");

    label = lv_label_create(tab3);
    lv_label_set_text(label, "Third tab");

    label = lv_label_create(tab4);
    lv_label_set_text(label, "Forth tab");

    label = lv_label_create(tab5);
    lv_label_set_text(label, "Fifth tab");

    lv_obj_clear_flag(lv_tabview_get_content(tabview), LV_OBJ_FLAG_SCROLLABLE);
}
#endif
```

```
def scroll_begin_event(e):

    #Disable the scroll animations. Triggered when a tab button is clicked */
    if e.get_code() == lv.EVENT.SCROLL_BEGIN:
        a = lv.anim_t.__cast__(e.get_param())
        if a:
            a.time = 0

# Create a Tab view object
tabview = lv.tabview(lv.scr_act(), lv.DIR.LEFT, 80)
tabview.get_content().add_event(scroll_begin_event, lv.EVENT.SCROLL_BEGIN, None)

tabview.set_style_bg_color(lv.palette_lighten(lv.PALETTE.RED, 2), 0)

tab_btns = tabview.get_tab_btns()
tab_btns.set_style_bg_color(lv.palette_darken(lv.PALETTE.GREY, 3), 0)
tab_btns.set_style_text_color(lv.palette_lighten(lv.PALETTE.GREY, 5), 0)
```

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```
tab_btns.set_style_border_side(lv.BORDER_SIDE.RIGHT, lv.PART.ITEMS | lv.STATE.CHECKED)


# Add 3 tabs (the tabs are page (lv_page) and can be scrolled
tab1 = tabview.add_tab("Tab 1")
tab2 = tabview.add_tab("Tab 2")
tab3 = tabview.add_tab("Tab 3")
tab4 = tabview.add_tab("Tab 4")
tab5 = tabview.add_tab("Tab 5")

tab2.set_style_bg_color(lv.palette_lighten(lv.PALETTE.AMBER, 3), 0)
tab2.set_style_bg_opa(lv.OPA.COVER, 0)

# Add content to the tabs
label = lv.label(tab1)
label.set_text("First tab")

label = lv.label(tab2)
label.set_text("Second tab")

label = lv.label(tab3)
label.set_text("Third tab")

label = lv.label(tab4)
label.set_text("Forth tab")

label = lv.label(tab5)
label.set_text("Fifth tab")

tabview.get_content().clear_flag(lv.obj.FLAG.SCROLLABLE)
```

2.7.30 Textarea

Simple Text area

```
#include "../../lv_examples.h"
#if LV_USE_TEXTAREA && LV_BUILD_EXAMPLES

static void textarea_event_handler(lv_event_t * e)
{
    lv_obj_t * ta = lv_event_get_target(e);
    LV_UNUSED(ta);
    LV_LOG_USER("Enter was pressed. The current text is: %s", lv_textarea_get_
↪text(ta));
}

static void btnm_event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_t * ta = lv_event_get_user_data(e);
    const char * txt = lv_btnmatrix_get_btn_text(obj, lv_btnmatrix_get_selected_
↪btn(obj));
```

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```
    if(strcmp(txt, LV_SYMBOL_BACKSPACE) == 0) lv_textarea_del_char(ta);
    else if(strcmp(txt, LV_SYMBOL_NEW_LINE) == 0) lv_obj_send_event(ta, LV_EVENT_
↪READY, NULL);
    else lv_textarea_add_text(ta, txt);

}

void lv_example_textarea_1(void)
{
    lv_obj_t * ta = lv_textarea_create(lv_scr_act());
    lv_textarea_set_one_line(ta, true);
    lv_obj_align(ta, LV_ALIGN_TOP_MID, 0, 10);
    lv_obj_add_event(ta, textarea_event_handler, LV_EVENT_READY, ta);
    lv_obj_add_state(ta, LV_STATE_FOCUSED); /*To be sure the cursor is visible*/

    static const char * btnm_map[] = {"1", "2", "3", "\n",
                                      "4", "5", "6", "\n",
                                      "7", "8", "9", "\n",
                                      LV_SYMBOL_BACKSPACE, "0", LV_SYMBOL_NEW_LINE, ""
                                     };

    lv_obj_t * btnm = lv_btnmatrix_create(lv_scr_act());
    lv_obj_set_size(btnm, 200, 150);
    lv_obj_align(btnm, LV_ALIGN_BOTTOM_MID, 0, -10);
    lv_obj_add_event(btnm, btnm_event_handler, LV_EVENT_VALUE_CHANGED, ta);
    lv_obj_clear_flag(btnm, LV_OBJ_FLAG_CLICK_FOCUSABLE); /*To keep the text area␣
↪focused on button clicks*/
    lv_btnmatrix_set_map(btnm, btnm_map);
}

#endif
```

```
def textarea_event_handler(e, ta):
    print("Enter was pressed. The current text is: " + ta.get_text())


def btnm_event_handler(e, ta):
    obj = e.get_target_obj()
    txt = obj.get_btn_text(obj.get_selected_btn())
    if txt == lv.SYMBOL.BACKSPACE:
        ta.del_char()
    elif txt == lv.SYMBOL.NEW_LINE:
        lv.event_send(ta, lv.EVENT.READY, None)
    elif txt:
        ta.add_text(txt)


ta = lv.textarea(lv.scr_act())
ta.set_one_line(True)
ta.align(lv.ALIGN.TOP_MID, 0, 10)
ta.add_event(lambda e: textarea_event_handler(e, ta), lv.EVENT.READY, None)
ta.add_state(lv.STATE.FOCUSED)   # To be sure the cursor is visible

btnm_map = ["1", "2", "3", "\n",
            "4", "5", "6", "\n",
            "7", "8", "9", "\n",
```

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```
             lv.SYMBOL.BACKSPACE, "0", lv.SYMBOL.NEW_LINE, ""]

btnm = lv.btnmatrix(lv.scr_act())
btnm.set_size(200, 150)
btnm.align(lv.ALIGN.BOTTOM_MID, 0, -10)
btnm.add_event(lambda e: btnm_event_handler(e, ta), lv.EVENT.VALUE_CHANGED, None)
btnm.clear_flag(lv.obj.FLAG.CLICK_FOCUSABLE)    # To keep the text area focused on␣
↪button clicks
btnm.set_map(btnm_map)
```

Text area with password field

```
#include "../../lv_examples.h"
#if LV_USE_TEXTAREA && LV_USE_KEYBOARD && LV_BUILD_EXAMPLES

static void ta_event_cb(lv_event_t * e);

static lv_obj_t * kb;

void lv_example_textarea_2(void)
{
    /*Create the password box*/
    lv_obj_t * pwd_ta = lv_textarea_create(lv_scr_act());
    lv_textarea_set_text(pwd_ta, "");
    lv_textarea_set_password_mode(pwd_ta, true);
    lv_textarea_set_one_line(pwd_ta, true);
    lv_obj_set_width(pwd_ta, lv_pct(40));
    lv_obj_set_pos(pwd_ta, 5, 20);
    lv_obj_add_event(pwd_ta, ta_event_cb, LV_EVENT_ALL, NULL);

    /*Create a label and position it above the text box*/
    lv_obj_t * pwd_label = lv_label_create(lv_scr_act());
    lv_label_set_text(pwd_label, "Password:");
    lv_obj_align_to(pwd_label, pwd_ta, LV_ALIGN_OUT_TOP_LEFT, 0, 0);

    /*Create the one-line mode text area*/
    lv_obj_t * text_ta = lv_textarea_create(lv_scr_act());
    lv_textarea_set_one_line(text_ta, true);
    lv_textarea_set_password_mode(text_ta, false);
    lv_obj_set_width(text_ta, lv_pct(40));
    lv_obj_add_event(text_ta, ta_event_cb, LV_EVENT_ALL, NULL);
    lv_obj_align(text_ta, LV_ALIGN_TOP_RIGHT, -5, 20);


    /*Create a label and position it above the text box*/
    lv_obj_t * oneline_label = lv_label_create(lv_scr_act());
    lv_label_set_text(oneline_label, "Text:");
    lv_obj_align_to(oneline_label, text_ta, LV_ALIGN_OUT_TOP_LEFT, 0, 0);

    /*Create a keyboard*/
    kb = lv_keyboard_create(lv_scr_act());
    lv_obj_set_size(kb,  LV_HOR_RES, LV_VER_RES / 2);

    lv_keyboard_set_textarea(kb, pwd_ta); /*Focus it on one of the text areas to␣
↪start*/
```

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```
}

static void ta_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * ta = lv_event_get_target(e);
    if(code == LV_EVENT_CLICKED || code == LV_EVENT_FOCUSED) {
        /*Focus on the clicked text area*/
        if(kb != NULL) lv_keyboard_set_textarea(kb, ta);
    }

    else if(code == LV_EVENT_READY) {
        LV_LOG_USER("Ready, current text: %s", lv_textarea_get_text(ta));
    }
}

#endif
```

```
def ta_event_cb(e):
    code = e.get_code()
    ta = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.FOCUSED:
        # Focus on the clicked text area
        if kb != None:
            kb.set_textarea(ta)

    elif code == lv.EVENT.READY:
        print("Ready, current text: " + ta.get_text())


# Create the password box

pwd_ta = lv.textarea(lv.scr_act())
pwd_ta.set_text("")
pwd_ta.set_password_mode(True)
pwd_ta.set_one_line(True)
pwd_ta.set_width(lv.pct(45))
pwd_ta.set_pos(5, 20)
pwd_ta.add_event(ta_event_cb, lv.EVENT.ALL, None)

# Create a label and position it above the text box
pwd_label = lv.label(lv.scr_act())
pwd_label.set_text("Password:")
pwd_label.align_to(pwd_ta, lv.ALIGN.OUT_TOP_LEFT, 0, 0)

# Create the one-line mode text area
text_ta = lv.textarea(lv.scr_act())
text_ta.set_width(lv.pct(45))
text_ta.set_one_line(True)
text_ta.add_event(ta_event_cb, lv.EVENT.ALL, None)
text_ta.set_password_mode(False)

text_ta.align(lv.ALIGN.TOP_RIGHT, -5, 20)

# Create a label and position it above the text box
oneline_label = lv.label(lv.scr_act())
```

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```
oneline_label.set_text("Text:")
oneline_label.align_to(text_ta, lv.ALIGN.OUT_TOP_LEFT, 0, 0)

# Create a keyboard
kb = lv.keyboard(lv.scr_act())
kb.set_size(lv.pct(100), lv.pct(50))

kb.set_textarea(pwd_ta)  # Focus it on one of the text areas to start
```

Text auto-formatting

```
#include "../../lv_examples.h"
#if LV_USE_TEXTAREA && LV_USE_KEYBOARD && LV_BUILD_EXAMPLES

static void ta_event_cb(lv_event_t * e);

static lv_obj_t * kb;

/**
 * Automatically format text like a clock. E.g. "12:34"
 * Add the ':' automatically.
 */
void lv_example_textarea_3(void)
{
    /*Create the text area*/
    lv_obj_t * ta = lv_textarea_create(lv_scr_act());
    lv_obj_add_event(ta, ta_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_textarea_set_accepted_chars(ta, "0123456789:");
    lv_textarea_set_max_length(ta, 5);
    lv_textarea_set_one_line(ta, true);
    lv_textarea_set_text(ta, "");

    /*Create a keyboard*/
    kb = lv_keyboard_create(lv_scr_act());
    lv_obj_set_size(kb,  LV_HOR_RES, LV_VER_RES / 2);
    lv_keyboard_set_mode(kb, LV_KEYBOARD_MODE_NUMBER);
    lv_keyboard_set_textarea(kb, ta);
}

static void ta_event_cb(lv_event_t * e)
{
    lv_obj_t * ta = lv_event_get_target(e);
    const char * txt = lv_textarea_get_text(ta);
    if(txt[0] >= '0' && txt[0] <= '9' &&
       txt[1] >= '0' && txt[1] <= '9' &&
       txt[2] != ':') {
        lv_textarea_set_cursor_pos(ta, 2);
        lv_textarea_add_char(ta, ':');
    }
}

#endif
```

```
def ta_event_cb(e):
    ta = e.get_target_obj()
    txt = ta.get_text()
    # print(txt)
    pos = ta.get_cursor_pos()
    # print("cursor pos: ",pos)
    # find position of ":" in text
    colon_pos= txt.find(":")
    # if there are more than 2 digits before the colon, remove the last one entered
    if colon_pos == 3:
        ta.del_char()
    if colon_pos != -1:
        # if there are more than 3 digits after the ":" remove the last one entered
        rest = txt[colon_pos:]
        if len(rest) > 3:
            ta.del_char()

    if len(txt) < 2:
        return
    if ":" in txt:
        return
    if  txt[0] >= '0' and txt[0] <= '9' and \
        txt[1] >= '0' and txt[1] <= '9':
        if len(txt) == 2 or txt[2] != ':' :
            ta.set_cursor_pos(2)
            ta.add_char(ord(':'))
#
# Automatically format text like a clock. E.g. "12:34"
# Add the ':' automatically
#
# Create the text area

ta = lv.textarea(lv.scr_act())
ta.add_event(ta_event_cb, lv.EVENT.VALUE_CHANGED, None)
ta.set_accepted_chars("0123456789:")
ta.set_max_length(5)
ta.set_one_line(True)
ta.set_text("")
ta.add_state(lv.STATE.FOCUSED)

# Create a keyboard
kb = lv.keyboard(lv.scr_act())
kb.set_size(lv.pct(100), lv.pct(50))
kb.set_mode(lv.keyboard.MODE.NUMBER)
kb.set_textarea(ta)
```

2.7.31 Tabview

Tileview with content

```c
#include "../../lv_examples.h"
#if LV_USE_TILEVIEW && LV_BUILD_EXAMPLES

/**
 * Create a 2x2 tile view and allow scrolling only in an "L" shape.
 * Demonstrate scroll chaining with a long list that
 * scrolls the tile view when it can't be scrolled further.
 */
void lv_example_tileview_1(void)
{
    lv_obj_t * tv = lv_tileview_create(lv_scr_act());

    /*Tile1: just a label*/
    lv_obj_t * tile1 = lv_tileview_add_tile(tv, 0, 0, LV_DIR_BOTTOM);
    lv_obj_t * label = lv_label_create(tile1);
    lv_label_set_text(label, "Scroll down");
    lv_obj_center(label);


    /*Tile2: a button*/
    lv_obj_t * tile2 = lv_tileview_add_tile(tv, 0, 1, LV_DIR_TOP | LV_DIR_RIGHT);

    lv_obj_t * btn = lv_btn_create(tile2);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Scroll up or right");

    lv_obj_set_size(btn, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_center(btn);

    /*Tile3: a list*/
    lv_obj_t * tile3 = lv_tileview_add_tile(tv, 1, 1, LV_DIR_LEFT);
    lv_obj_t * list = lv_list_create(tile3);
    lv_obj_set_size(list, LV_PCT(100), LV_PCT(100));

    lv_list_add_btn(list, NULL, "One");
    lv_list_add_btn(list, NULL, "Two");
    lv_list_add_btn(list, NULL, "Three");
    lv_list_add_btn(list, NULL, "Four");
    lv_list_add_btn(list, NULL, "Five");
    lv_list_add_btn(list, NULL, "Six");
    lv_list_add_btn(list, NULL, "Seven");
    lv_list_add_btn(list, NULL, "Eight");
    lv_list_add_btn(list, NULL, "Nine");
    lv_list_add_btn(list, NULL, "Ten");

}

#endif
```

```python
#
# Create a 2x2 tile view and allow scrolling only in an "L" shape.
# Demonstrate scroll chaining with a long list that
```

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```
# scrolls the tile view when it can't be scrolled further.
#
tv = lv.tileview(lv.scr_act())

# Tile1: just a label
tile1 = tv.add_tile(0, 0, lv.DIR.BOTTOM)
label = lv.label(tile1)
label.set_text("Scroll down")
label.center()

# Tile2: a button
tile2 = tv.add_tile(0, 1, lv.DIR.TOP | lv.DIR.RIGHT)

btn = lv.btn(tile2)

label = lv.label(btn)
label.set_text("Scroll up or right")

btn.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
btn.center()

# Tile3: a list
tile3 = tv.add_tile(1, 1, lv.DIR.LEFT)
list = lv.list(tile3)
list.set_size(lv.pct(100), lv.pct(100))

list.add_btn(None, "One")
list.add_btn(None, "Two")
list.add_btn(None, "Three")
list.add_btn(None, "Four")
list.add_btn(None, "Five")
list.add_btn(None, "Six")
list.add_btn(None, "Seven")
list.add_btn(None, "Eight")
list.add_btn(None, "Nine")
list.add_btn(None, "Ten")
```

2.7.32 Window

Simple window

```
#include "../../lv_examples.h"
#if LV_USE_WIN && LV_BUILD_EXAMPLES


static void event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    LV_UNUSED(obj);
    LV_LOG_USER("Button %d clicked", (int)lv_obj_get_index(obj));
}

void lv_example_win_1(void)
{
```

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```
    lv_obj_t * win = lv_win_create(lv_scr_act(), 40);
    lv_obj_t * btn;
    btn = lv_win_add_btn(win, LV_SYMBOL_LEFT, 40);
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    lv_win_add_title(win, "A title");

    btn = lv_win_add_btn(win, LV_SYMBOL_RIGHT, 40);
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    btn = lv_win_add_btn(win, LV_SYMBOL_CLOSE, 60);
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    lv_obj_t * cont = lv_win_get_content(win);  /*Content can be added here*/
    lv_obj_t * label = lv_label_create(cont);
    lv_label_set_text(label, "This is\n"
                      "a pretty\n"
                      "long text\n"
                      "to see how\n"
                      "the window\n"
                      "becomes\n"
                      "scrollable.\n"
                      "\n"
                      "\n"
                      "Some more\n"
                      "text to be\n"
                      "sure it\n"
                      "overflows. :)");


}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
        print("Button {:d} clicked".format(obj.get_child_id()))


win = lv.win(lv.scr_act(), 60)
btn1 = win.add_btn(lv.SYMBOL.LEFT, 40)
btn1.add_event(event_handler, lv.EVENT.ALL, None)
win.add_title("A title")
btn2=win.add_btn(lv.SYMBOL.RIGHT, 40)
btn2.add_event(event_handler, lv.EVENT.ALL, None)
btn3 = win.add_btn(lv.SYMBOL.CLOSE, 60)
btn3.add_event(event_handler, lv.EVENT.ALL, None)

cont = win.get_content()  # Content can be added here
label = lv.label(cont)
label.set_text("""This is
a pretty
long text
to see how
```

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```
the window
becomes
scrollable.


We need
quite some text
and we will
even put
some more
text to be
sure it
overflows.
""")
```

CHAPTER

THREE

GET STARTED

There are several ways to get your feet wet with LVGL. Here is one recommended order of documents to read and things to play with when you are learning to use LVGL:

1. Check the Online demos to see LVGL in action (3 minutes)
2. Read the Introduction page of the documentation (5 minutes)
3. Read the Quick overview page of the documentation (15 minutes)
4. Set up a Simulator (10 minutes)
5. Try out some Examples
6. Check out the Platform-specific tutorials. (in this section below). (10 minutes)
7. Port LVGL to a board. See the Porting guide or check the ready to use Projects
8. Read the Overview page to get a better understanding of the library. (2-3 hours)
9. Check the documentation of the Widgets to see their features and usage
10. If you have questions got to the Forum
11. Read the Contributing guide to see how you can help to improve LVGL (15 minutes)

3.1 Quick overview

Here you can learn the most important things about LVGL. You should read this first to get a general impression and read the detailed *Porting* and *Overview* sections after that.

3.1.1 Get started in a simulator

Instead of porting LVGL to embedded hardware straight away, it's highly recommended to get started in a simulator first.

LVGL is ported to many IDEs to be sure you will find your favorite one. Go to the *Simulators* section to get ready-to-use projects that can be run on your PC. This way you can save the time of porting for now and get some experience with LVGL immediately.

3.1.2 Add LVGL into your project

If you would rather try LVGL on your own project follow these steps:

- Download or clone the library from GitHub with `git clone https://github.com/lvgl/lvgl.git`.
- Copy the `lvgl` folder into your project.
- Copy `lvgl/lv_conf_template.h` as `lv_conf.h` next to the `lvgl` folder, change the first `#if 0` to `1` to enable the file's content and set the `LV_COLOR_DEPTH` defines.
- Include `lvgl/lvgl.h` in files where you need to use LVGL related functions.
- Call `lv_tick_inc(x)` every `x` milliseconds in a Timer or Task (`x` should be between 1 and 10). It is required for the internal timing of LVGL. Alternatively, configure `LV_TICK_CUSTOM` (see `lv_conf.h`) so that LVGL can retrieve the current time directly.
- Call `lv_init()`
- Create a draw buffer: LVGL will render the graphics here first, and send the rendered image to the display. The buffer size can be set freely but 1/10 screen size is a good starting point.

```
static lv_disp_draw_buf_t draw_buf;
static lv_color_t buf1[MY_DISP_HOR_RES * MY_DISP_VER_RES / 10];                ␣
↪ /*Declare a buffer for 1/10 screen size*/
lv_disp_draw_buf_init(&draw_buf, buf1, NULL, MY_DISP_HOR_RES * MY_DISP_VER_RES / 10);␣
↪ /*Initialize the display buffer.*/
```

- Implement and register a function which can copy the rendered image to an area of your display:

```
static lv_disp_t disp_drv;        /*Descriptor of a display driver*/
lv_disp_drv_init(&disp_drv);          /*Basic initialization*/
disp_drv.flush_cb = my_disp_flush;    /*Set your driver function*/
disp_drv.draw_buf = &draw_buf;        /*Assign the buffer to the display*/
disp_drv.hor_res = MY_DISP_HOR_RES;   /*Set the horizontal resolution of the display*/
disp_drv.ver_res = MY_DISP_VER_RES;   /*Set the vertical resolution of the display*/
lv_disp_drv_register(&disp_drv);      /*Finally register the driver*/

void my_disp_flush(lv_disp_t * disp, const lv_area_t * area, lv_color_t * color_p)
{
    int32_t x, y;
    /*It's a very slow but simple implementation.
     *`set_pixel` needs to be written by you to a set pixel on the screen*/
    for(y = area->y1; y <= area->y2; y++) {
        for(x = area->x1; x <= area->x2; x++) {
            set_pixel(x, y, *color_p);
            color_p++;
        }
    }

    lv_disp_flush_ready(disp);         /* Indicate you are ready with the flushing*/
}
```

- Implement and register a function which can read an input device. E.g. for a touchpad:

```
static lv_indev_t indev_drv;           /*Descriptor of a input device driver*/
lv_indev_drv_init(&indev_drv);             /*Basic initialization*/
indev_drv.type = LV_INDEV_TYPE_POINTER;    /*Touch pad is a pointer-like device*/
indev_drv.read_cb = my_touchpad_read;      /*Set your driver function*/
lv_indev_drv_register(&indev_drv);         /*Finally register the driver*/
```

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```
void my_touchpad_read(lv_indev_drv_t * indev_drv, lv_indev_data_t * data)
{
    /*`touchpad_is_pressed` and `touchpad_get_xy` needs to be implemented by you*/
    if(touchpad_is_pressed()) {
      data->state = LV_INDEV_STATE_PRESSED;
      touchpad_get_xy(&data->point.x, &data->point.y);
    } else {
      data->state = LV_INDEV_STATE_RELEASED;
    }

}
```

- Call `lv_timer_handler()` periodically every few milliseconds in the main `while(1)` loop or in an operating system task. It will redraw the screen if required, handle input devices, animation etc.

For a more detailed guide go to the *Porting* section.

3.1.3 Learn the basics

Widgets

The graphical elements like Buttons, Labels, Sliders, Charts etc. are called objects or widgets. Go to *Widgets* to see the full list of available widgets.

Every object has a parent object where it is created. For example, if a label is created on a button, the button is the parent of label.

The child object moves with the parent and if the parent is deleted the children will be deleted too.

Children can be visible only within their parent's bounding area. In other words, the parts of the children outside the parent are clipped.

A Screen is the "root" parent. You can have any number of screens.

To get the current screen call `lv_scr_act()`, and to load a screen use `lv_scr_load(scr1)`.

You can create a new object with `lv_<type>_create(parent)`. It will return an `lv_obj_t *` variable that can be used as a reference to the object to set its parameters.

For example:

```
lv_obj_t * slider1 = lv_slider_create(lv_scr_act());
```

To set some basic attributes `lv_obj_set_<parameter_name>(obj, <value>)` functions can be used. For example:

```
lv_obj_set_x(btn1, 30);
lv_obj_set_y(btn1, 10);
lv_obj_set_size(btn1, 200, 50);
```

Along with the basic attributes, widgets can have type specific parameters which are set by `lv_<widget_type>_set_<parameter_name>(obj, <value>)` functions. For example:

```
lv_slider_set_value(slider1, 70, LV_ANIM_ON);
```

To see the full API visit the documentation of the widgets or the related header file (e.g. lvgl/src/widgets/slider/lv_slider.h).

Events

Events are used to inform the user that something has happened with an object. You can assign one or more callbacks to an object which will be called if the object is clicked, released, dragged, being deleted, etc.

A callback is assigned like this:

```
lv_obj_add_event(btn, btn_event_cb, LV_EVENT_CLICKED, NULL); /*Assign a callback to␣
↪the button*/

...

void btn_event_cb(lv_event_t * e)
{
    printf("Clicked\n");
}
```

LV_EVENT_ALL can be used instead of LV_EVENT_CLICKED to invoke the callback for any event.

From lv_event_t * e the current event code can be retrieved with:

```
lv_event_code_t code = lv_event_get_code(e);
```

The object that triggered the event can be retrieved with:

```
lv_obj_t * obj = lv_event_get_target(e);
```

To learn all features of the events go to the *Event overview* section.

Parts

Widgets might be built from one or more *parts*. For example, a button has only one part called LV_PART_MAIN. However, a *Slider* has LV_PART_MAIN, LV_PART_INDICATOR and LV_PART_KNOB.

By using parts you can apply different styles to sub-elements of a widget. (See below)

Read the widgets' documentation to learn which parts each uses.

States

LVGL objects can be in a combination of the following states:

- LV_STATE_DEFAULT Normal, released state
- LV_STATE_CHECKED Toggled or checked state
- LV_STATE_FOCUSED Focused via keypad or encoder or clicked via touchpad/mouse
- LV_STATE_FOCUS_KEY Focused via keypad or encoder but not via touchpad/mouse
- LV_STATE_EDITED Edit by an encoder
- LV_STATE_HOVERED Hovered by mouse (not supported now)
- LV_STATE_PRESSED Being pressed
- LV_STATE_SCROLLED Being scrolled
- LV_STATE_DISABLED Disabled

For example, if you press an object it will automatically go to the `LV_STATE_FOCUSED` and `LV_STATE_PRESSED` states and when you release it the `LV_STATE_PRESSED` state will be removed while focus remains active.

To check if an object is in a given state use `lv_obj_has_state(obj, LV_STATE_...)`. It will return `true` if the object is currently in that state.

To manually add or remove states use:

```
lv_obj_add_state(obj, LV_STATE_...);
lv_obj_clear_state(obj, LV_STATE_...);
```

Styles

A style instance contains properties such as background color, border width, font, etc. that describe the appearance of objects.

Styles are represented with `lv_style_t` variables. Only their pointer is saved in the objects so they need to be defined as static or global. Before using a style it needs to be initialized with `lv_style_init(&style1)`. After that, properties can be added to configure the style. For example:

```
static lv_style_t style1;
lv_style_init(&style1);
lv_style_set_bg_color(&style1, lv_color_hex(0xa03080))
lv_style_set_border_width(&style1, 2))
```

See the full list of properties here.

Styles are assigned using the ORed combination of an object's part and state. For example to use this style on the slider's indicator when the slider is pressed:

```
lv_obj_add_style(slider1, &style1, LV_PART_INDICATOR | LV_STATE_PRESSED);
```

If the *part* is `LV_PART_MAIN` it can be omitted:

```
lv_obj_add_style(btn1, &style1, LV_STATE_PRESSED); /*Equal to LV_PART_MAIN | LV_STATE_
↪PRESSED*/
```

Similarly, `LV_STATE_DEFAULT` can be omitted too:

```
lv_obj_add_style(slider1, &style1, LV_PART_INDICATOR); /*Equal to LV_PART_INDICATOR |␣
↪LV_STATE_DEFAULT*/
```

For `LV_STATE_DEFAULT` and `LV_PART_MAIN` simply write `0`:

```
lv_obj_add_style(btn1, &style1, 0); /*Equal to LV_PART_MAIN | LV_STATE_DEFAULT*/
```

Styles can be cascaded (similarly to CSS). It means you can add more styles to a part of an object. For example `style_btn` can set a default button appearance, and `style_btn_red` can overwrite the background color to make the button red:

```
lv_obj_add_style(btn1, &style_btn, 0);
lv_obj_add_style(btn1, &style1_btn_red, 0);
```

If a property is not set on for the current state, the style with `LV_STATE_DEFAULT` will be used. A default value is used if the property is not defined in the default state.

Some properties (typically the text-related ones) can be inherited. This means if a property is not set in an object it will be searched for in its parents too. For example, you can set the font once in the screen's style and all text on that screen will inherit it by default.

Local style properties also can be added to objects. This creates a style which resides inside the object and is used only by the object:

```
lv_obj_set_style_bg_color(slider1, lv_color_hex(0x2080bb), LV_PART_INDICATOR | LV_
↪STATE_PRESSED);
```

To learn all the features of styles see the *Style overview* section.

Themes

Themes are the default styles for objects. Styles from a theme are applied automatically when objects are created.

The theme for your application is a compile time configuration set in `lv_conf.h`.

3.1.4 Examples

A very simple "hello world" label

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LABEL

/**
 * Basic example to create a "Hello world" label
 */
void lv_example_get_started_1(void)
{
    /*Change the active screen's background color*/
    lv_obj_set_style_bg_color(lv_scr_act(), lv_color_hex(0x003a57), LV_PART_MAIN);

    /*Create a white label, set its text and align it to the center*/
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Hello world");
    lv_obj_set_style_text_color(lv_scr_act(), lv_color_hex(0xffffff), LV_PART_MAIN);
    lv_obj_align(label, LV_ALIGN_CENTER, 0, 0);
}

#endif
```

```
# Change the active screen's background color
scr = lv.scr_act()
scr.set_style_bg_color(lv.color_hex(0x003a57), lv.PART.MAIN)

# Create a white label, set its text and align it to the center
label = lv.label(lv.scr_act())
label.set_text("Hello world")
label.set_style_text_color(lv.color_hex(0xffffff), lv.PART.MAIN)
label.align(lv.ALIGN.CENTER, 0, 0)
```

A button with a label and react on click event

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_BTN

static void btn_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * btn = lv_event_get_target(e);
    if(code == LV_EVENT_CLICKED) {
        static uint8_t cnt = 0;
        cnt++;

        /*Get the first child of the button which is the label and change its text*/
        lv_obj_t * label = lv_obj_get_child(btn, 0);
        lv_label_set_text_fmt(label, "Button: %d", cnt);
    }
}

/**
 * Create a button with a label and react on click event.
 */
void lv_example_get_started_2(void)
{
    lv_obj_t * btn = lv_btn_create(lv_scr_act());     /*Add a button the current␣
↪screen*/
    lv_obj_set_pos(btn, 10, 10);                            /*Set its position*/
    lv_obj_set_size(btn, 120, 50);                          /*Set its size*/
    lv_obj_add_event(btn, btn_event_cb, LV_EVENT_ALL, NULL);           /*Assign a␣
↪callback to the button*/

    lv_obj_t * label = lv_label_create(btn);          /*Add a label to the button*/
    lv_label_set_text(label, "Button");                     /*Set the labels text*/
    lv_obj_center(label);
}

#endif
```

```
class CounterBtn():
    def __init__(self):
        self.cnt = 0
        #
        # Create a button with a label and react on click event.
        #

        btn = lv.btn(lv.scr_act())                               # Add a button the␣
↪current screen
        btn.set_pos(10, 10)                                      # Set its position
        btn.set_size(120, 50)                                    # Set its size
        btn.align(lv.ALIGN.CENTER,0,0)
        btn.add_event(self.btn_event_cb, lv.EVENT.ALL, None)  # Assign a callback to␣
↪the button
        label = lv.label(btn)                                    # Add a label to the␣
↪button
        label.set_text("Button")                                 # Set the labels text
        label.center()
```

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```
    def btn_event_cb(self,e):
        code = e.get_code()
        btn = e.get_target_obj()
        if code == lv.EVENT.CLICKED:
            self.cnt += 1

        # Get the first child of the button which is the label and change its text
        label = btn.get_child(0)
        label.set_text("Button: " + str(self.cnt))


counterBtn = CounterBtn()
```

Create styles from scratch for buttons

```
#include "../lv_examples.h"
#if LV_USE_BTN && LV_BUILD_EXAMPLES

static lv_style_t style_btn;
static lv_style_t style_btn_pressed;
static lv_style_t style_btn_red;

static lv_color_t darken(const lv_color_filter_dsc_t * dsc, lv_color_t color, lv_opa_
↪t opa)
{
    LV_UNUSED(dsc);
    return lv_color_darken(color, opa);
}

static void style_init(void)
{
    /*Create a simple button style*/
    lv_style_init(&style_btn);
    lv_style_set_radius(&style_btn, 10);
    lv_style_set_bg_opa(&style_btn, LV_OPA_COVER);
    lv_style_set_bg_color(&style_btn, lv_palette_lighten(LV_PALETTE_GREY, 3));
    lv_style_set_bg_grad_color(&style_btn, lv_palette_main(LV_PALETTE_GREY));
    lv_style_set_bg_grad_dir(&style_btn, LV_GRAD_DIR_VER);

    lv_style_set_border_color(&style_btn, lv_color_black());
    lv_style_set_border_opa(&style_btn, LV_OPA_20);
    lv_style_set_border_width(&style_btn, 2);

    lv_style_set_text_color(&style_btn, lv_color_black());

    /*Create a style for the pressed state.
     *Use a color filter to simply modify all colors in this state*/
    static lv_color_filter_dsc_t color_filter;
    lv_color_filter_dsc_init(&color_filter, darken);
    lv_style_init(&style_btn_pressed);
    lv_style_set_color_filter_dsc(&style_btn_pressed, &color_filter);
    lv_style_set_color_filter_opa(&style_btn_pressed, LV_OPA_20);
```

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```
    /*Create a red style. Change only some colors.*/
    lv_style_init(&style_btn_red);
    lv_style_set_bg_color(&style_btn_red, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_bg_grad_color(&style_btn_red, lv_palette_lighten(LV_PALETTE_RED, 3));
}

/**
 * Create styles from scratch for buttons.
 */
void lv_example_get_started_3(void)
{
    /*Initialize the style*/
    style_init();

    /*Create a button and use the new styles*/
    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    /* Remove the styles coming from the theme
     * Note that size and position are also stored as style properties
     * so lv_obj_remove_style_all will remove the set size and position too */
    lv_obj_remove_style_all(btn);
    lv_obj_set_pos(btn, 10, 10);
    lv_obj_set_size(btn, 120, 50);
    lv_obj_add_style(btn, &style_btn, 0);
    lv_obj_add_style(btn, &style_btn_pressed, LV_STATE_PRESSED);

    /*Add a label to the button*/
    lv_obj_t * label = lv_label_create(btn);
    lv_label_set_text(label, "Button");
    lv_obj_center(label);

    /*Create another button and use the red style too*/
    lv_obj_t * btn2 = lv_btn_create(lv_scr_act());
    lv_obj_remove_style_all(btn2);                      /*Remove the styles coming␣
↪from the theme*/
    lv_obj_set_pos(btn2, 10, 80);
    lv_obj_set_size(btn2, 120, 50);
    lv_obj_add_style(btn2, &style_btn, 0);
    lv_obj_add_style(btn2, &style_btn_red, 0);
    lv_obj_add_style(btn2, &style_btn_pressed, LV_STATE_PRESSED);
    lv_obj_set_style_radius(btn2, LV_RADIUS_CIRCLE, 0); /*Add a local style too*/

    label = lv_label_create(btn2);
    lv_label_set_text(label, "Button 2");
    lv_obj_center(label);
}

#endif
```

```
#
# Create styles from scratch for buttons.
#
style_btn =  lv.style_t()
style_btn_red = lv.style_t()
style_btn_pressed = lv.style_t()

# Create a simple button style
```

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```
style_btn.init()
style_btn.set_radius(10)
style_btn.set_bg_opa(lv.OPA.COVER)
style_btn.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 3))
style_btn.set_bg_grad_color(lv.palette_main(lv.PALETTE.GREY))
style_btn.set_bg_grad_dir(lv.GRAD_DIR.VER)

# Add a border
style_btn.set_border_color(lv.color_white())
style_btn.set_border_opa(lv.OPA._70)
style_btn.set_border_width(2)

# Set the text style
style_btn.set_text_color(lv.color_white())

# Create a red style. Change only some colors.
style_btn_red.init()
style_btn_red.set_bg_color(lv.palette_main(lv.PALETTE.RED))
style_btn_red.set_bg_grad_color(lv.palette_lighten(lv.PALETTE.RED, 2))

# Create a style for the pressed state.
style_btn_pressed.init()
style_btn_pressed.set_bg_color(lv.palette_main(lv.PALETTE.BLUE))
style_btn_pressed.set_bg_grad_color(lv.palette_darken(lv.PALETTE.RED, 3))

# Create a button and use the new styles
btn = lv.btn(lv.scr_act())                  # Add a button the current screen
# Remove the styles coming from the theme
# Note that size and position are also stored as style properties
# so lv_obj_remove_style_all will remove the set size and position too
btn.remove_style_all()                      # Remove the styles coming from the theme
btn.set_pos(10, 10)                         # Set its position
btn.set_size(120, 50)                       # Set its size
btn.add_style(style_btn, 0)
btn.add_style(style_btn_pressed, lv.STATE.PRESSED)

label = lv.label(btn)                       # Add a label to the button
label.set_text("Button")                    # Set the labels text
label.center()

# Create a slider in the center of the display
slider = lv.slider(lv.scr_act())
slider.set_width(200)                                              # Set the width
slider.center()                                                    # Align to the␣
↪center of the parent (screen)

# Create another button and use the red style too
btn2 = lv.btn(lv.scr_act())
btn2.remove_style_all()                     # Remove the styles coming from the theme
btn2.set_pos(10, 80)                        # Set its position
btn2.set_size(120, 50)                      # Set its size
btn2.add_style(style_btn, 0)
btn2.add_style(style_btn_red, 0)
btn2.add_style(style_btn_pressed, lv.STATE.PRESSED)
btn2.set_style_radius(lv.RADIUS_CIRCLE, 0)  # Add a local style

label = lv.label(btn2)                      # Add a label to the button
```

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```
label.set_text("Button 2")                    # Set the labels text
label.center()
```

Create a slider and write its value on a label

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SLIDER

static lv_obj_t * label;

static void slider_event_cb(lv_event_t * e)
{
    lv_obj_t * slider = lv_event_get_target(e);

    /*Refresh the text*/
    lv_label_set_text_fmt(label, "%"LV_PRId32, lv_slider_get_value(slider));
    lv_obj_align_to(label, slider, LV_ALIGN_OUT_TOP_MID, 0, -15);    /*Align top of␣
↪the slider*/
}

/**
 * Create a slider and write its value on a label.
 */
void lv_example_get_started_4(void)
{
    /*Create a slider in the center of the display*/
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_obj_set_width(slider, 200);                          /*Set the width*/
    lv_obj_center(slider);                                  /*Align to the center of␣
↪the parent (screen)*/
    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_VALUE_CHANGED, NULL);     /
↪*Assign an event function*/

    /*Create a label above the slider*/
    label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "0");
    lv_obj_align_to(label, slider, LV_ALIGN_OUT_TOP_MID, 0, -15);    /*Align top of␣
↪the slider*/
}

#endif
```

```
def slider_event_cb(e):
    slider = e.get_target_obj()

    # Refresh the text
    label.set_text(str(slider.get_value()))

#
# Create a slider and write its value on a label.
#
```

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```
# Create a slider in the center of the display
slider = lv.slider(lv.scr_act())
slider.set_width(200)                                  # Set the width
slider.center()                                        # Align to the␣
↪center of the parent (screen)
slider.add_event(slider_event_cb, lv.EVENT.VALUE_CHANGED, None) # Assign an event␣
↪function

# Create a label above the slider
label = lv.label(lv.scr_act())
label.set_text("0")
label.align_to(slider, lv.ALIGN.OUT_TOP_MID, 0, -15)         # Align below the␣
↪slider
```

3.1.5 Micropython

Learn more about *Micropython*.

```
# Create a Button and a Label
scr = lv.obj()
btn = lv.btn(scr)
btn.align(lv.scr_act(), lv.ALIGN.CENTER, 0, 0)
label = lv.label(btn)
label.set_text("Button")

# Load the screen
lv.scr_load(scr)
```

3.2 Platforms

3.2.1 Simulator on PC

You can try out LVGL **using only your PC** (i.e. without any development boards). LVGL will run on a simulator environment on the PC where anyone can write and experiment with real LVGL applications.

Using the simulator on a PC has the following advantages:

- Hardware independent - Write code, run it on the PC and see the result on a monitor.
- Cross-platform - Any Windows, Linux or macOS system can run the PC simulator.
- Portability - The written code is portable, which means you can simply copy it when migrating to embedded hardware.
- Easy Validation - The simulator is also very useful to report bugs because it provides a common platform for every user. So it's a good idea to reproduce a bug in the simulator and use that code snippet in the Forum.

Select an IDE

The simulator is ported to various IDEs (Integrated Development Environments). Choose your favorite IDE, read its README on GitHub, download the project, and load it to the IDE.

- Eclipse with SDL driver: Recommended on Linux and Mac
- CodeBlocks: Recommended on Windows
- VisualStudio with SDL driver: For Windows
- VSCode with SDL driver: Recommended on Linux and Mac
- PlatformIO with SDL driver: Recommended on Linux and Mac
- MDK with FastModel: For Windows

External project not maintained by the LVGL organization:

- QT Creator: Cross platform

You can use any IDE for development but, for simplicity, the configuration for Eclipse CDT is what we'll focus on in this tutorial. The following section describes the set-up guide of Eclipse CDT in more detail.

Note: If you are on Windows, it's usually better to use the Visual Studio or CodeBlocks projects instead. They work out of the box without requiring extra steps.

Set-up Eclipse CDT

Install Eclipse CDT

Eclipse CDT is a C/C++ IDE.

Eclipse is a Java-based tool so be sure **Java Runtime Environment** is installed on your system.

On Debian-based distros (e.g. Ubuntu): `sudo apt-get install default-jre`

Note: If you are using other distros, then please install a 'Java Runtime Environment' suitable to your distro. Note: If you are using macOS and get a "Failed to create the Java Virtual Machine" error, uninstall any other Java JDK installs and install Java JDK 8u. This should fix the problem.

You can download Eclipse's CDT from: https://www.eclipse.org/cdt/downloads.php. Start the installer and choose *Eclipse CDT* from the list.

Install SDL 2

The PC simulator uses the SDL 2 cross-platform library to simulate a TFT display and a touchpad.

Linux

On **Linux** you can easily install SDL2 using a terminal:

1. Find the current version of SDL2: `apt-cache search libsdl2 (e.g. libsdl2-2.0-0)`
2. Install SDL2: `sudo apt-get install libsdl2-2.0-0` (replace with the found version)
3. Install SDL2 development package: `sudo apt-get install libsdl2-dev`
4. If build essentials are not installed yet: `sudo apt-get install build-essential`

Windows

If you are using **Windows** firstly you need to install MinGW (64 bit version). After installing MinGW, do the following steps to add SDL2:

1. Download the development libraries of SDL. Go to https://www.libsdl.org/download-2.0.php and download *Development Libraries: SDL2-devel-2.0.5-mingw.tar.gz*
2. Decompress the file and go to *x86_64-w64-mingw32* directory (for 64 bit MinGW) or to *i686-w64-mingw32* (for 32 bit MinGW)
3. Copy _*...mingw32/include/SDL2* folder to *C:/MinGW/.../x86_64-w64-mingw32/include*
4. Copy _*...mingw32/lib/* content to *C:/MinGW/.../x86_64-w64-mingw32/lib*
5. Copy _*...mingw32/bin/SDL2.dll* to *{eclipse_workspace}/pc_simulator/Debug/*. Do it later when Eclipse is installed.

Note: If you are using **Microsoft Visual Studio** instead of Eclipse then you don't have to install MinGW.

OSX

On **OSX** you can easily install SDL2 with brew: `brew install sdl2`

If something is not working, then please refer this tutorial to get started with SDL.

Pre-configured project

A pre-configured graphics library project (based on the latest release) is always available to get started easily. You can find the latest one on GitHub. (Please note that, the project is configured for Eclipse CDT).

Add the pre-configured project to Eclipse CDT

Run Eclipse CDT. It will show a dialogue about the **workspace path**. Before accepting the path, check that path and copy (and unzip) the downloaded pre-configured project there. After that, you can accept the workspace path. Of course you can modify this path but in that case copy the project to the corresponding location.

Close the start-up window and go to **File->Import** and choose **General->Existing project into Workspace**. **Browse the root directory** of the project and click **Finish**

On **Windows** you have to do two additional things:

- Copy the **SDL2.dll** into the project's Debug folder
- Right-click on the project -> Project properties -> C/C++ Build -> Settings -> Libraries -> Add ... and add *mingw32* above SDLmain and SDL. (The order is important: mingw32, SDLmain, SDL)

Compile and Run

Now you are ready to run LVGL on your PC. Click on the Hammer Icon on the top menu bar to Build the project. If you have done everything right, then you will not get any errors. Note that on some systems additional steps might be required to "see" SDL 2 from Eclipse but in most cases the configuration in the downloaded project is enough.

After a successful build, click on the Play button on the top menu bar to run the project. Now a window should appear in the middle of your screen.

Now you are ready to use LVGL and begin development on your PC.

3.2.2 NXP

NXP has integrated LVGL into the MCUXpresso SDK packages for general purpose and crossover microcontrollers, allowing easy evaluation and migration into your product design. Download an SDK for a supported board today and get started with your next GUI application.

Creating new project with LVGL

Downloading the MCU SDK example project is recommended as a starting point. It comes fully configured with LVGL (and with PXP/VGLite support if the modules are present), no additional integration work is required.

HW acceleration for NXP iMX RT platforms

Depending on the RT platform used, the acceleration can be done by NXP PXP (PiXel Pipeline) and/or the Verisilicon GPU through an API named VGLite. Each accelerator has its own context that allows them to be used individually as well simultaneously (in LVGL multithreading mode).

PXP accelerator

Several drawing features in LVGL can be offloaded to the PXP engine. The CPU is available for other operations while the PXP is running. RTOS is required to block the LVGL drawing thread and switch to another task or suspend the CPU for power savings.

Supported draw callbacks are available in "src/draw/nxp/pxp/lv_draw_pxp.c":

```
    pxp_draw_ctx->base_draw.draw_img_decoded = lv_draw_pxp_img_decoded;
    pxp_draw_ctx->blend = lv_draw_pxp_blend;
    pxp_draw_ctx->base_draw.wait_for_finish = lv_draw_pxp_wait_for_finish;
```

Features supported:

```
All operations can be used in conjunction with optional transparency.
```

- RGB565 and ARGB8888 color formats
- Area fill with color
- BLIT (BLock Image Transfer)
- Screen Rotation (90, 180, 270 degree)

- Color keying
- Recoloring (color tint)
- Image Rotation (90, 180, 270 degree)
- RTOS integration layer
- Default FreeRTOS and bare metal code provided
- Combination of recolor and/or rotation + color key/alpha blend/transparency is supported. That is achieved by PXP in two steps:
  - First step is to recolor/rotate the image to a temporary buffer (statically allocated)
  - Second step is required to handle color keying, alpha channel or to apply transparency

Known limitations:

- Rotation is not supported for images unaligned to blocks of 16x16 pixels. PXP is set to process 16x16 blocks to optimize the system for memory bandwidth and image processing time. The output engine essentially truncates any output pixels after the desired number of pixels has been written. When rotating a source image and the output is not divisible by the block size, the incorrect pixels could be truncated and the final output image can look shifted.

Basic configuration:

- Select NXP PXP engine in lv_conf.h: Set `LV_USE_GPU_NXP_PXP` to 1
- Enable default implementation for interrupt handling, PXP start function and automatic initialization: Set `LV_USE_GPU_NXP_PXP_AUTO_INIT` to 1
- If `SDK_OS_FREE_RTOS` symbol is defined, FreeRTOS implementation will be used, otherwise bare metal code will be included

Basic initialization:

- If `LV_USE_GPU_NXP_PXP_AUTO_INIT` is enabled, no user code is required; PXP is initialized automatically in `lv_init()`
- For manual PXP initialization, default configuration structure for callbacks can be used. Initialize PXP before calling `lv_init()`

```
#if LV_USE_GPU_NXP_PXP
  #include "src/draw/nxp/pxp/lv_gpu_nxp_pxp.h"
#endif
. . .
#if LV_USE_GPU_NXP_PXP
  PXP_COND_STOP(!lv_gpu_nxp_pxp_init(), "PXP init failed.");
#endif
```

Project setup:

- Add PXP related files to project:
  - src/draw/nxp/pxp/lv_draw_pxp.c[.h]: draw context callbacks
  - src/draw/nxp/pxp/lv_draw_pxp_blend.c[.h]: fill and blit (with optional transformation)
  - src/draw/nxp/pxp/lv_gpu_nxp_pxp.c[.h]: init, uninit, run/wait PXP device
  - src/draw/nxp/pxp/lv_gpu_nxp_pxp_osa.c[.h]: OS abstraction (FreeRTOS or bare metal)
    - optional, required only if `LV_USE_GPU_NXP_PXP_AUTO_INIT` is set to 1
- PXP related code depends on two drivers provided by MCU SDK. These drivers need to be added to project:
  - fsl_pxp.c[.h]: PXP driver
  - fsl_cache.c[.h]: CPU cache handling functions

Logging:

- By default, `LV_GPU_NXP_PXP_LOG_ERRORS` is enabled so that any PXP error will be seen on SDK debug console
- By default, `LV_GPU_NXP_PXP_LOG_TRACES` is disabled. Enable it for tracing logs (like PXP limitations)

Advanced configuration:

- Implementation depends on multiple OS-specific functions. The struct `lv_nxp_pxp_cfg_t` with callback pointers is used as a parameter for the `lv_gpu_nxp_pxp_init()` function. Default implementation for FreeRTOS and bare metal is provided in lv_gpu_nxp_pxp_osa.c
  - `pxp_interrupt_init()`: Initialize PXP interrupt (HW setup, OS setup)
  - `pxp_interrupt_deinit()`: Deinitialize PXP interrupt (HW setup, OS setup)
  - `pxp_run()`: Start PXP job. Use OS-specific mechanism to block drawing thread. PXP must finish drawing before leaving this function.
- Area threshold (size limit) is configurable and used to decide whether the area will be processed by PXP or not. Areas smaller than the defined value will be processed by CPU and those bigger than the threshold will be processed by PXP. The threshold is defined as a macro in lv_draw_pxp.c
  - `LV_GPU_NXP_PXP_SIZE_LIMIT`: size threshold for fill/blit (with optional transformation)

VGLite accelerator

Extra drawing features in LVGL can be handled by the VGLite engine. The CPU is available for other operations while the VGLite is running. An RTOS is required to block the LVGL drawing thread and switch to another task or suspend the CPU for power savings.

Supported draw callbacks are available in "src/draw/nxp/vglite/lv_draw_vglite.c":

```
    vglite_draw_ctx->base_draw.init_buf = lv_draw_vglite_init_buf;
    vglite_draw_ctx->base_draw.draw_line = lv_draw_vglite_line;
    vglite_draw_ctx->base_draw.draw_arc = lv_draw_vglite_arc;
    vglite_draw_ctx->base_draw.draw_rect = lv_draw_vglite_rect;
```

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```
    vglite_draw_ctx->base_draw.draw_img_decoded = lv_draw_vglite_img_decoded;
    vglite_draw_ctx->blend = lv_draw_vglite_blend;
    vglite_draw_ctx->base_draw.wait_for_finish = lv_draw_vglite_wait_for_finish;
```

Features supported:

```
All operations can be used in conjunction with optional transparency.
```

- RGB565 and ARGB8888 color formats
- Area fill with color
- BLIT (BLock Image Transfer)
- Image Rotation (any degree with decimal)
- Image Scale
- Draw rectangle background with optional radius or gradient
- Blit rectangle background image
- Draw rectangle border/outline with optional rounded corners
- Draw arc with optional rounded ending
- Draw line or dashed line with optional rounded ending

Known limitations:

- Source image alignment: The byte alignment requirement for a pixel depends on the specific pixel format. Both buffer address and buffer stride must be aligned. As general rule, the alignment is set to 16 pixels. This makes the buffer address alignment to be 32 bytes for RGB565 and 64 bytes for ARGB8888.
- For pixel engine (PE) destination, the alignment should be 64 bytes for all tiled (4x4) buffer layouts. The pixel engine has no additional alignment requirement for linear buffer layouts (`VG_LITE_LINEAR`).

Basic configuration:

- Select NXP VGLite engine in lv_conf.h: Set `LV_USE_GPU_NXP_VG_LITE` to 1
- `SDK_OS_FREE_RTOS` symbol needs to be defined so that the FreeRTOS implementation will be used

Basic initialization:

- Initialize VGLite before calling `lv_init()` by specifying the width/height of tessellation window. Value should be a multiple of 16; minimum value is 16 pixels, maximum cannot be greater than the frame width. If less than or equal to 0, then no tessellation buffer is created, in which case VGLite is initialized only for blitting.

```
      #if LV_USE_GPU_NXP_VG_LITE
        #include "vg_lite.h"
      #endif
      . . .
```

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```
    #if LV_USE_GPU_NXP_VG_LITE
      VG_LITE_COND_STOP(vg_lite_init(64, 64) != VG_LITE_SUCCESS, "VGLite init␣
↪failed.");
    #endif
```

Project setup:

- Add VGLite related files to project:
  - src/draw/nxp/vglite/lv_draw_vglite.c[.h]: draw context callbacks
  - src/draw/nxp/vglite/lv_draw_vglite_blend.c[.h]: fill and blit (with optional transformation)
  - src/draw/nxp/vglite/lv_draw_vglite_rect.c[.h]: draw rectangle
  - src/draw/nxp/vglite/lv_draw_vglite_arc.c[.h]: draw arc
  - src/draw/nxp/vglite/lv_draw_vglite_line.c[.h]: draw line
  - src/draw/nxp/vglite/lv_vglite_buf.c[.h]: init/get vglite buffer
  - src/draw/nxp/vglite/lv_vglite_utils.c[.h]: function helpers

Logging:

- By default, `LV_GPU_NXP_VG_LITE_LOG_ERRORS` is enabled so that any VGLite error will be seen on SDK debug console
- By default, `LV_GPU_NXP_VG_LITE_LOG_TRACES` is disabled. Enable it for tracing logs (like blit split workaround or VGLite fallback to CPU due to any error on the driver)

Advanced configuration:

- Area threshold (size limit) is configurable and used to decide whether the area will be processed by VGLite or not. Areas smaller than the defined value will be processed by CPU and those bigger than the threshold will be processed by VGLite. The threshold is defined as a macro in lv_draw_vglite.c
  - `LV_GPU_NXP_VG_LITE_SIZE_LIMIT`: size threshold for fill/blit (with optional transformation)

3.2.3 STM32

LVGL Can be added to STM32CubeIDE in a similar fashion to any other Eclipse-based IDE.

Including LVGL in a Project

- Create or open a project in STM32CubeIDE.
- Copy the entire LVGL folder to *[project_folder]/Drivers/lvgl*.
- In the STM32CubeIDE **Project Explorer** pane: right click on the LVGL folder that you copied (you may need to refresh the view first before it will appear), and select **Add/remove include path...**. If this doesn't appear, or doesn't work, you can review your project include paths under the **Project** - **Properties** menu, and then navigating to **C/C++ Build** - **Settings** - **Include paths**, and ensuring that the LVGL directory is listed.

Now that the source files are included in your project, follow the instructions for Porting your project to create the `lv_conf.h` file, and initialise the display.

Bare Metal Example

A minimal example using STM32CubeIDE, and HAL.

- When setting up **Pinout and Configuration** using the **Device Configuration Tool**, select **System Core** - **SYS** and ensure that **Timebase Source** is set to **SysTick**.
- Configure any other peripherals (including the LCD panel), and initialise them in *main.c*.
- `#include "lvgl.h"` in the *main.c* file.
- Create some frame buffer(s) as global variables:

```
//Frame buffers
/*A static or global variable to store the buffers*/
static lv_disp_draw_buf_t disp_buf;

/*Static or global buffer(s). The second buffer is optional*/
static lv_color_t buf_1[BUFF_SIZE]; //TODO: Chose a buffer size. DISPLAY_WIDTH * 10␣
↪is one suggestion.
static lv_color_t buf_2[BUFF_SIZE];
```

- In your `main()` function, after initialising your CPU, peripherals, and LCD panel, call `lv_init();` to initialise LVGL. You can then register the frame buffers using `lv_disp_draw_buf_init()`, and create the display driver using `lv_disp_drv_init()`.

```
//Initialise LVGL UI library
lv_init();
lv_disp_draw_buf_init(&disp_buf, buf_1, NULL, BUFF_SIZE);

static lv_disp_drv_t disp_drv;          /*A variable to hold the drivers. Must be␣
↪static or global.*/
lv_disp_drv_init(&disp_drv);            /*Basic initialization*/
disp_drv.draw_buf = &disp_buf;          /*Set an initialized buffer*/
disp_drv.flush_cb = my_flush_cb;        /*Set a flush callback to draw to the␣
↪display*/
disp_drv.hor_res = WIDTH;                 /*Set the horizontal resolution in pixels*/
disp_drv.ver_res = HEIGHT;                 /*Set the vertical resolution in pixels*/

lv_disp_t * disp;
disp = lv_disp_drv_register(&disp_drv); /*Register the driver and save the created␣
↪display objects*/
```

- Create some dummy objects to test the output:

```
// Change the active screen's background color
lv_obj_set_style_bg_color(lv_scr_act(), lv_color_hex(0x003a57), LV_PART_MAIN);
lv_obj_set_style_text_color(lv_scr_act(), lv_color_hex(0xffffff), LV_PART_MAIN);

/*Create a spinner*/
lv_obj_t * spinner = lv_spinner_create(lv_scr_act(), 1000, 60);
lv_obj_set_size(spinner, 64, 64);
lv_obj_align(spinner, LV_ALIGN_BOTTOM_MID, 0, 0);
```

- Add a call to `lv_timer_handler()` inside your `while(1)` loop:

```
/* Infinite loop */
while (1)
{
  lv_timer_handler();
  HAL_Delay(5);
}
```

- Add a call to `lv_tick_inc()` inside the `SysTick_Handler()` function. Open the *stm32xxxx_it.c* file (the name will depend on your specific MCU), and update the `SysTick_Handler()` function:

```
void SysTick_Handler(void)
{
  /* USER CODE BEGIN SysTick_IRQn 0 */

    HAL_SYSTICK_IRQHandler();
    lv_tick_inc(1);
    #ifdef USE_RTOS_SYSTICK
      osSystickHandler();
    #endif

  /* USER CODE END SysTick_IRQn 0 */
  HAL_IncTick();
  /* USER CODE BEGIN SysTick_IRQn 1 */

  /* USER CODE END SysTick_IRQn 1 */
}
```

- Finally, write the callback function, `my_flush_cb()`, which will send the display buffer to your LCD panel. Below is one example, but it will vary depending on your setup.

```
void my_flush_cb(lv_disp_drv_t * disp_drv, const lv_area_t * area, lv_color_t * color_
↪p)
{
  //Set the drawing region
  set_draw_window(area->x1, area->y1, area->x2, area->y2);

  int height = area->y2 - area->y1 + 1;
  int width = area->x2 - area->x1 + 1;

  //We will do the SPI write manually here for speed
  HAL_GPIO_WritePin(DC_PORT, DC_PIN, GPIO_PIN_SET);
  //CS low to begin data
  HAL_GPIO_WritePin(CS_PORT, CS_PIN, GPIO_PIN_RESET);

  //Write colour to each pixel
  for (int i = 0; i < width * height; i++) {
```

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```
    parallel_write(color_p->full);
    color_p++;
  }

  //Return CS to high
  HAL_GPIO_WritePin(CS_PORT, CS_PIN, GPIO_PIN_SET);

  /* IMPORTANT!!!
  * Inform the graphics library that you are ready with the flushing*/
  lv_disp_flush_ready(disp_drv);
}
```

FreeRTOS Example

A minimal example using STM32CubeIDE, HAL, and CMSISv1 (FreeRTOS). *Note that we have not used Mutexes in this example, however LVGL is **NOT** thread safe and so Mutexes should be used. See:* Operating system and interrupts

- `#include "lvgl.h"`
- Create your frame buffer(s) as global variables:

```
//Frame buffers
/*A static or global variable to store the buffers*/
static lv_disp_draw_buf_t disp_buf;

/*Static or global buffer(s). The second buffer is optional*/
static lv_color_t buf_1[BUFF_SIZE]; //TODO: Declare your own BUFF_SIZE appropriate to␣
↪your system.
static lv_color_t buf_2[BUFF_SIZE];
```

- In your `main()` function, after your peripherals (SPI, GPIOs, LCD etc) have been initialised, initialise LVGL using `lv_init();`, register the frame buffers using `lv_disp_draw_buf_init()`, and create a new display driver using `lv_disp_drv_init()`.

```
//Initialise LVGL UI library
lv_init();
lv_disp_draw_buf_init(&disp_buf, buf_1, buf_2, BUFF_SIZE);

static lv_disp_drv_t disp_drv;          /*A variable to hold the drivers. Must be␣
↪static or global.*/
lv_disp_drv_init(&disp_drv);            /*Basic initialization*/
disp_drv.draw_buf = &disp_buf;          /*Set an initialized buffer*/
disp_drv.flush_cb = my_flush_cb;        /*Set a flush callback to draw to the␣
↪display*/
disp_drv.hor_res = WIDTH;                 /*Set the horizontal resolution in pixels*/
disp_drv.ver_res = HEIGHT;                 /*Set the vertical resolution in pixels*/

lv_disp_t * disp;
disp = lv_disp_drv_register(&disp_drv); /*Register the driver and save the created␣
↪display objects*/

// Register the touch controller with LVGL - Not included here for brevity.
```

- Create some dummy objects to test the output:

```
// Change the active screen's background color
lv_obj_set_style_bg_color(lv_scr_act(), lv_color_hex(0x003a57), LV_PART_MAIN);
lv_obj_set_style_text_color(lv_scr_act(), lv_color_hex(0xffffff), LV_PART_MAIN);

/*Create a spinner*/
lv_obj_t * spinner = lv_spinner_create(lv_scr_act(), 1000, 60);
lv_obj_set_size(spinner, 64, 64);
lv_obj_align(spinner, LV_ALIGN_BOTTOM_MID, 0, 0);
```

- Create two threads to call `lv_timer_handler()`, and `lv_tick_inc()`.You will need two `osThreadId` handles for CMSISv1. These don't strictly have to be globally accessible in this case, however STM32Cube code generation does by default. If you are using CMSIS and STM32Cube code generation it should look something like this:

```
//Thread Handles
osThreadId lvgl_tickHandle;
osThreadId lvgl_timerHandle;
```

```
/* definition and creation of lvgl_tick */
osThreadDef(lvgl_tick, LGVLTick, osPriorityNormal, 0, 1024);
lvgl_tickHandle = osThreadCreate(osThread(lvgl_tick), NULL);

//LVGL update timer
osThreadDef(lvgl_timer, LVGLTimer, osPriorityNormal, 0, 1024);
lvgl_timerHandle = osThreadCreate(osThread(lvgl_timer), NULL);
```

And create the thread functions:

```
/* LVGL timer for tasks. */
void LVGLTimer(void const * argument)
{
  for(;;)
  {
    lv_timer_handler();
    osDelay(20);
  }
}
/* LVGL tick source */
void LGVLTick(void const * argument)
{
  for(;;)
  {
    lv_tick_inc(10);
    osDelay(10);
  }
}
```

- Finally, create the `my_flush_cb()` function to output the frame buffer to your LCD. The specifics of this function will vary depending on which MCU features you are using. Below is an example for a typical MCU interface.

```
void my_flush_cb(lv_disp_drv_t * disp_drv, const lv_area_t * area, lv_color_t * color_
↪p)
{
  //Set the drawing region
  set_draw_window(area->x1, area->y1, area->x2, area->y2);
```

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```
    int height = area->y2 - area->y1 + 1;
    int width = area->x2 - area->x1 + 1;

    //Begin SPI Write for DATA
    HAL_GPIO_WritePin(DC_PORT, DC_PIN, GPIO_PIN_SET);
    HAL_GPIO_WritePin(CS_PORT, CS_PIN, GPIO_PIN_RESET);

    //Write colour to each pixel
    for (int i = 0; i < width * height; i++) {
            parallel_write(color_p->full);
            color_p++;
    }

    //Return CS to high
    HAL_GPIO_WritePin(CS_PORT, CS_PIN, GPIO_PIN_SET);

    /* IMPORTANT!!!
     * Inform the graphics library that you are ready with the flushing*/
    lv_disp_flush_ready(disp_drv);
}
```

3.2.4 Espressif (ESP32 chip series)

LVGL can be used and configured as a standard ESP-IDF component.

More information about ESP-IDF build system can be found here.

LVGL demo project for ESP32

We've created lv_port_esp32, a project using ESP-IDF and LVGL to show one of the demos from demos. You can configure the project to use one of the many supported display controllers and targets (chips).

See lvgl_esp32_drivers repository for a complete list of supported display and indev (touch) controllers and targets.

Using LVGL in your ESP-IDF project

Prerequisites

- ESP-IDF v4.1 and above
- ESP evaluation board with a display

Obtaining LVGL

Option 1: git submodule

Simply clone LVGL into your `project_root/components` directory and it will be automatically integrated into the project. If the project is a git repository you can include LVGL as a git submodule:

```
git submodule add https://github.com/lvgl/lvgl.git components/lvgl
```

The above command will clone LVGL's main repository into the `components/lvgl` directory. LVGL includes a `CMakeLists.txt` file that sets some configuration options so you can use LVGL right away.

Option 2: IDF Component Manager

LVGL is also distributed through IDF Component Manager. It allows users to seamlessly integrate LVGL component into their project with following command:

```
idf.py add-dependency lvgl/lvgl>=8.*
```

During next project build, LVGL component will be fetched from the component registry and added to project build.

Configuration

When you are ready to configure LVGL, launch the configuration menu with `idf.py menuconfig` in your project root directory, go to `Component config` and then `LVGL configuration`.

Using lvgl_esp32_drivers in ESP-IDF project

You can also add `lvgl_esp32_drivers` as a "component". This component should be located inside a directory named "components" in your project root directory.

When your project is a git repository you can include `lvgl_esp32_drivers` as a git submodule:

```
git submodule add https://github.com/lvgl/lvgl_esp32_drivers.git components/lvgl_
↪esp32_drivers
```

3.2.5 Arduino

The LVGL library is directly available as Arduino libraries.

Note that you need to choose a board powerful enough to run LVGL and your GUI. See the requirements of LVGL.

For example ESP32 is a good candidate to create UI's with LVGL.

Get the LVGL Arduino library

LVGL can be installed via the Arduino IDE Library Manager or as a .ZIP library.

You can Download the latest version of LVGL from GitHub and simply copy it to Arduino's library folder.

Set up drivers

To get started it's recommended to use TFT_eSPI library as a TFT driver to simplify testing. To make it work, setup `TFT_eSPI` according to your TFT display type via editing either

- `User_Setup.h`
- or by selecting a configuration in the `User_Setup_Select.h`

Both files are located in `TFT_eSPI` library's folder.

Configure LVGL

LVGL has its own configuration file called `lv_conf.h`. When LVGL is installed, follow these configuration steps:

1. Go to the directory of the installed Arduino libraries
2. Go to `lvgl` and copy `lv_conf_template.h` as `lv_conf.h` into the Arduino Libraries directory next to the `lvgl` library folder.
3. Open `lv_conf.h` and change the first `#if 0` to `#if 1` to enable the content of the file
4. Set the color depth of you display in `LV_COLOR_DEPTH`
5. Set `LV_TICK_CUSTOM 1`

Finally the layout with `lv_conf.h` should look like this:

```
arduino
 |-libraries
   |-lvgl
   |-other_lib_1
   |-other_lib_2
   |-lv_conf.h
```

Initialize and run LVGL

Take a look at LVGL_Arduino.ino to see how to initialize LVGL. `TFT_eSPI` is used as the display driver.

In the INO file you can see how to register a display and a touchpad for LVGL and call an example.

Use the examples and demos

Note that, there is no dedicated INO file for every example. Instead, you can load an example by calling an `lv_example_...` function. For example `lv_example_btn_1()`.

IMPORTANT Due to some the limitations of Arduino's build system you need to copy `lvgl/examples` to `lvgl/src/examples`. Similarly for the demos `lvgl/demos` to `lvgl/src/demos`.

Debugging and logging

LVGL can display debug information in case of trouble. In the `LVGL_Arduino.ino` example there is a `my_print` method, which sends this debug information to the serial interface. To enable this feature you have to edit the `lv_conf.h` file and enable logging in the section `log settings`:

```
/*Log settings*/
#define USE_LV_LOG      1   /*Enable/disable the log module*/
#if LV_USE_LOG
/* How important log should be added:
 * LV_LOG_LEVEL_TRACE       A lot of logs to give detailed information
 * LV_LOG_LEVEL_INFO        Log important events
 * LV_LOG_LEVEL_WARN        Log if something unwanted happened but didn't cause a␣
↪problem
 * LV_LOG_LEVEL_ERROR       Only critical issue, when the system may fail
 * LV_LOG_LEVEL_NONE        Do not log anything
 */
#  define LV_LOG_LEVEL    LV_LOG_LEVEL_WARN
```

After enabling the log module and setting LV_LOG_LEVEL accordingly, the output log is sent to the `Serial` port @ 115200 bps.

3.2.6 Tasmota and berry

What is Tasmota?

Tasmota is a widely used open-source firmware for ESP8266 and EPS32 based devices. It supports a wide variety of devices, sensors and integrations to Home Automation and Cloud services. Tasmota firmware is downloaded more than 200,000 times each month, and has an active and growing community.

Tasmota provides access to hundreds of supported devices, full support of MQTT, HTTP(S), integration with major Home Automation systems, myriad of sensors, IR, RF, Zigbee, Bluetooth, AWS IoT, Azure IoT, Alexa and many more.

What is Berry?

Berry is a ultra-lightweight dynamically typed embedded scripting language. It is designed for lower-performance embedded devices. The interpreter of Berry include a one-pass compiler and register-based VM, all the code is written in ANSI C99. Berry offers a syntax very similar to Python, and is inspired from LUA VM. It is fully integrated in Tasmota

Highlights of Berry

Berry has the following advantages:

- Lightweight: A well-optimized interpreter with very little resources. Ideal for use in microprocessors.
- Fast: optimized one-pass bytecode compiler and register-based virtual machine.
- Powerful: supports imperative programming, object-oriented programming, functional programming.
- Flexible: Berry is a dynamic type script, and it's intended for embedding in applications. It can provide good dynamic scalability for the host system.
- Simple: simple and natural syntax, support garbage collection, and easy to use FFI (foreign function interface).
- RAM saving: With compile-time object construction, most of the constant objects are stored in read-only code data segments, so the RAM usage of the interpreter is very low when it starts.

All features are detailed in the Berry Reference Manual

Why LVGL + Tasmota + Berry?

In 2021, Tasmota added full support of LVGL for ESP32 based devices. It also introduced the Berry scripting language, a small-footprint language similar to Python and fully integrated in Tasmota.

A comprehensive mapping of LVGL in Berry language is now available, similar to the mapping of Micropython. It allows to use +98% of all LVGL features. It is also possible to write custom widgets in Berry.

Versions supported: LVGL v8.0.2, LodePNG v20201017, Freetype 2.10.4

Tasmota + Berry + LVGL could be used for:

- Fast prototyping GUI.
- Shortening the cycle of changing and fine-tuning the GUI.
- Modelling the GUI in a more abstract way by defining reusable composite objects, taking advantage of Berry's language features such as Inheritance, Closures, Exception Handling…
- Make LVGL accessible to a larger audience. No need to know C to create a nice GUI on an embedded system.

A higher level interface compatible with OpenHASP is also under development.

So what does it look like?

TL;DR: Similar to MicroPython, it's very much like the C API, but Object-Oriented for LVGL components.

Let's dive right into an example!

A simple example

```
lv.start()                  # start LVGL
scr = lv.scr_act()          # get default screen
btn = lv.btn(scr)           # create button
btn.center()
label = lv.label(btn)       # create a label in the button
label.set_text("Button")    # set a label to the button
```

How can I use it?

You can start in less than 10 minutes on a M5Stack or equivalent device in less than 10 minutes in this short tutorial

Where can I find more information?

3.2.7 CMake

LVGL supports integrating with CMake. It comes with preconfigured targets for:

On top of the preconfigured targets you can also use "plain" CMake to integrate LVGL into any custom C/C++ project.

Prerequisites

- CMake (>= 3.12.4)
- Compatible build tool e.g.

Building LVGL with CMake

There are many ways to include external CMake projects into your own. A modern one also used in this example is the CMake FetchContent module. This module conveniently allows us to download dependencies directly at configure time from e.g. GitHub. Here is an example how we might include LVGL into our own project.

```
cmake_minimum_required(VERSION 3.14)
include(FetchContent)

project(MyProject LANGUAGES C CXX)

# Build an executable called "MyFirmware"
add_executable(MyFirmware src/main.c)

# Specify path to own LVGL config header
set(LV_CONF_PATH
    ${CMAKE_CURRENT_SOURCE_DIR}/src/lv_conf.h
    CACHE STRING "" FORCE)

# Fetch LVGL from GitHub
FetchContent_Declare(lvgl GIT_REPOSITORY https://github.com/lvgl/lvgl.git)
FetchContent_MakeAvailable(lvgl)

# The target "MyFirmware" depends on LVGL
target_link_libraries(MyFirmware PRIVATE lvgl::lvgl)
```

This configuration declares a dependency between the two targets **MyFirmware** and **lvgl**. Upon building the target **MyFirmware** this dependency will be resolved and **lvgl** will be built and linked with it. Since LVGL requires a config header called lv_conf.h to be includable by its sources we also set the option `LV_CONF_PATH` to point to our own copy of it.

Additional CMake options

Besides `LV_CONF_PATH` there are few additional CMake options available.

Include paths options

- `LV_LVGL_H_INCLUDE_SIMPLE`: which specifies whether to `#include "lvgl.h"` absolut or relative
- `LV_CONF_INCLUDE_SIMPLE`: which specifies whether to `#include "lv_conf.h"` and `"lv_drv_conf.h"` absolut or relative

  We do not recommend disabling those options unless your folder layout makes it absolutely necessary.

Examples/demos options

LVGL examples and demos are built by default in the main CMake file.To disable their built, use:

- `LV_CONF_BUILD_DISABLE_EXAMPLES`: Set to `1` to disable *examples* build
- `LV_CONF_BUILD_DISABLE_DEMOS`: Set to `1` to disable *demos* build

Building LVGL drivers

To build LVGL drivers, you can use:

```
FetchContent_Declare(lv_drivers
                     GIT_REPOSITORY https://github.com/lvgl/lv_drivers)
FetchContent_MakeAvailable(lv_drivers)

# The target "MyFirmware" depends on LVGL and drivers
target_link_libraries(MyFirmware PRIVATE lvgl::lvgl lvgl::drivers)
```

3.2.8 Build shared libraries with CMake

By default, LVGL will be built as a static library (archive). CMake can instead be instructed to build LVGL as shared library (.so/.dll/etc.):

```
set(BUILD_SHARED_LIBS ON)
```

OR

```
$ cmake "-DBUILD_SHARED_LIBS=ON" .
```

3.2.9 MDK

TODO

3.3 (RT)OS

3.3.1 NuttX RTOS

What is NuttX?

NuttX is a mature and secure real-time operating system (RTOS) with an emphasis on technical standards compliance and small size. It is scalable from 8-bit to 64-bit microcontrollers and microprocessors and compliant with the Portable Operating System Interface (POSIX) and the American National Standards Institute (ANSI) standards and with many Linux-like subsystems. The best way to think about NuttX is to think of it as a small Unix/Linux for microcontrollers.

Highlights of NuttX

- **Small** - Fits and runs in microcontrollers as small as 32 kB Flash and 8 kB of RAM.
- **Compliant** - Strives to be as compatible as possible with POSIX and Linux.
- **Versatile** - Supports many architectures (ARM, ARM Thumb, AVR, MIPS, OpenRISC, RISC-V 32-bit and 64-bit, RX65N, x86-64, Xtensa, Z80/Z180, etc.).
- **Modular** - Its modular design allows developers to select only what really matters and use modules to include new features.
- **Popular** - NuttX is used by many companies around the world. Probably you already used a product with NuttX without knowing it was running NuttX.
- **Predictable** - NuttX is a preemptible Realtime kernel, so you can use it to create predictable applications for realtime control.

Why NuttX + LVGL?

Although NuttX has its own graphic library called NX, LVGL is a good alternative because users could find more eye-candy demos and they can reuse code from previous projects. LVGL is an Object-Oriented Component Based high-level GUI library, that could fit very well for a RTOS with advanced features like NuttX. LVGL is implemented in C and its APIs are in C.

Here are some advantages of using LVGL in NuttX

- Develop GUI in Linux first and when it is done just compile it for NuttX. Nothing more, no wasting of time.
- Usually, GUI development for low level RTOS requires multiple iterations to get things right, where each iteration consists of **`Change code`** > **`Build`** > **`Flash`** > **`Run`**. Using LVGL, Linux and NuttX you can reduce this process and just test everything on your computer and when it is done, compile it on NuttX and that is it.

NuttX + LVGL could be used for

- GUI demos to demonstrate your board graphics capacities.
- Fast prototyping GUI for MVP (Minimum Viable Product) presentation.
- visualize sensor data directly and easily on the board without using a computer.
- Final products with a GUI without a touchscreen (i.e. 3D Printer Interface using Rotary Encoder to Input data).
- Final products with a touchscreen (and all sorts of bells and whistles).

How to get started with NuttX and LVGL?

There are many boards in the NuttX mainline with support for LVGL. Let's use the STM32F429IDISCOVERY as an example because it is a very popular board.

First you need to install the pre-requisites on your system

Let's use the Windows Subsystem for Linux

```
$ sudo apt-get install automake bison build-essential flex gcc-arm-none-eabi gperf␣
↪git libncurses5-dev libtool libusb-dev libusb-1.0.0-dev pkg-config kconfig-
↪frontends openocd
```

Now let's create a workspace to save our files

```
$ mkdir ~/nuttxspace
$ cd ~/nuttxspace
```

Clone the NuttX and Apps repositories:

```
$ git clone https://github.com/apache/incubator-nuttx nuttx
$ git clone https://github.com/apache/incubator-nuttx-apps apps
```

Configure NuttX to use the stm32f429i-disco board and the LVGL Demo

```
$ ./tools/configure.sh stm32f429i-disco:lvgl
$ make
```

If everything went fine you should have now the file `nuttx.bin` to flash on your board:

```
$ ls -l nuttx.bin
-rwxrwxr-x 1 alan alan 287144 Jun 27 09:26 nuttx.bin
```

Flashing the firmware in the board using OpenOCD:

```
$ sudo openocd -f interface/stlink-v2.cfg -f target/stm32f4x.cfg -c init -c "reset␣
↪halt" -c "flash write_image erase nuttx.bin 0x08000000"
```

Reset the board and using the 'NSH>' terminal start the LVGL demo:

```
nsh> lvgldemo
```

Where can I find more information?

- This blog post: LVGL on LPCXpresso54628
- NuttX mailing list: Apache NuttX Mailing List

3.3.2 RT-Thread RTOS

What is RT-Thread?

RT-Thread is an open source, neutral, and community-based real-time operating system (RTOS). RT-Thread has **Standard version** and **Nano version**. For resource-constrained microcontroller (MCU) systems, the Nano version that requires only 3 KB Flash and 1.2 KB RAM memory resources can be tailored with easy-to-use tools. For resource-rich IoT devices, RT-Thread can use the **online software package** management tool, together with system configuration tools, to achieve intuitive and rapid modular cutting, seamlessly import rich software packages; thus, achieving complex functions like Android's graphical interface and touch sliding effects, smart voice interaction effects, and so on.

Key features

- Designed for resource-constrained devices, the minimum kernel requires only 1.2KB of RAM and 3 KB of Flash.
- A variety of standard interfaces, such as POSIX, CMSIS, C++ application environment.
- Has rich components and a prosperous and fast growing package ecosystem
- Elegant code style, easy to use, read and master.
- High Scalability. RT-Thread has high-quality scalable software architecture, loose coupling, modularity, is easy to tailor and expand.
- Supports high-performance applications.
- Supports all mainstream compiling tools such as GCC, Keil and IAR.
- Supports a wide range of architectures and chips.

How to run LVGL on RT-Thread?

□□□□

LVGL has registered as a software package of RT-Thread. By using Env tool or RT-Thread Studio IDE, RT-Thread users can easily download LVGL source code and combine with RT-Thread project. RT-Thread community has port LVGL to several BSPs:

Tutorials

3.3.3 FreeRTOS

TODO

3.3.4 Zephyr

TODO

3.4 Bindings

3.4.1 Micropython

What is Micropython?

Micropython is Python for microcontrollers. Using Micropython, you can write Python3 code and run it even on a bare metal architecture with limited resources.

Highlights of Micropython

- **Compact** - Fits and runs within just 256k of code space and 16k of RAM. No OS is needed, although you can also run it with an OS, if you want.
- **Compatible** - Strives to be as compatible as possible with normal Python (known as CPython).
- **Versatile** - Supports many architectures (x86, x86-64, ARM, ARM Thumb, Xtensa).
- **Interactive** - No need for the compile-flash-boot cycle. With the REPL (interactive prompt) you can type commands and execute them immediately, run scripts, etc.
- **Popular** - Many platforms are supported. The user base is growing bigger. Notable forks: MicroPython, CircuitPython, MicroPython_ESP32_psRAM_LoBo
- **Embedded Oriented** - Comes with modules specifically for embedded systems, such as the machine module for accessing low-level hardware (I/O pins, ADC, UART, SPI, I2C, RTC, Timers etc.)

Why Micropython + LVGL?

Micropython does not have a good native high-level GUI library. LVGL is an Object-Oriented Component Based high-level GUI library, which seems to be a natural candidate to map into a higher level language, such as Python. LVGL is implemented in C and its APIs are in C.

Here are some advantages of using LVGL in Micropython:

- Develop GUI in Python, a very popular high level language. Use paradigms such as Object-Oriented Programming.
- Usually, GUI development requires multiple iterations to get things right. With C, each iteration consists of **`Change code`** > **`Build`** > **`Flash`** > **`Run`**. In Micropython it's just **`Change code`** > **`Run`** ! You can even run commands interactively using the REPL (the interactive prompt)

Micropython + LVGL could be used for:

- Fast prototyping GUI.
- Shortening the cycle of changing and fine-tuning the GUI.
- Modelling the GUI in a more abstract way by defining reusable composite objects, taking advantage of Python's language features such as Inheritance, Closures, List Comprehension, Generators, Exception Handling, Arbitrary Precision Integers and others.
- Make LVGL accessible to a larger audience. No need to know C to create a nice GUI on an embedded system. This goes well with CircuitPython vision. CircuitPython was designed with education in mind, to make it easier for new or inexperienced users to get started with embedded development.
- Creating tools to work with LVGL at a higher level (e.g. drag-and-drop designer).

So what does it look like?

TL;DR: It's very much like the C API, but Object-Oriented for LVGL components.

Let's dive right into an example!

A simple example

```python
import lvgl as lv
lv.init()
scr = lv.obj()
btn = lv.btn(scr)
btn.align(lv.ALIGN.CENTER, 0, 0)
label = lv.label(btn)
label.set_text('Hello World!')
lv.scr_load(scr)
```

How can I use it?

Online Simulator

If you want to experiment with LVGL + Micropython without downloading anything - you can use our online simulator! It's a fully functional LVGL + Micropython that runs entirely in the browser and allows you to edit a python script and run it.

Click here to experiment on the online simulator

Many LVGL examples are available also for Micropython.Just click the link!

PC Simulator

Micropython is ported to many platforms. One notable port is "unix", which allows you to build and run Micropython (+LVGL) on a Linux machine. (On a Windows machine you might need Virtual Box or WSL or MinGW or Cygwin etc.)

Click here to know more information about building and running the unix port

Embedded Platforms

In the end, the goal is to run it all on an embedded platform. Both Micropython and LVGL can be used on many embedded architectures. lv_micropython is a fork of Micropython+LVGL and currently supports Linux, ESP32, STM32 and RP2. It can be ported to any other platform supported by Micropython.

You would also need display and input drivers. You can either use one of the existing drivers provided with lv_micropython, or you can create your own input/display drivers for your specific hardware.Drivers can be implemented either in C as a Micropython module, or in pure Python!

lv_micropython already contains these drivers:

- Display drivers:
  - SDL on Linux
  - ESP32 specific: ILI9341, ILI9488, GC9A01, ST7789, ST7735
  - Generic (pure Python): ILI9341, ST7789, ST7735
- Input drivers:
  - SDL, XPT2046, FT6X36, ESP32 ADC with resistive touch

Where can I find more information?

- `lv_micropython` README
- `lv_binding_micropython` README
- The LVGL micropython forum (Feel free to ask anything!)
- At Micropython: docs and forum
- Blog Post, a little outdated.

The Micropython Binding is auto generated!

LVGL is a git submodule inside lv_micropython (LVGL is a git submodule of lv_binding_micropython which is itself a submodule of lv_micropython).When building lv_micropython, the public LVGL C API is scanned and Micropython API is auto-generated. That means that lv_micropython provides LVGL API for **any** LVGL version, and generally does not require code changes as LVGL evolves.

LVGL C API Coding Conventions

To support the auto-generation of the Python API, the LVGL C API must follow some coding conventions:

- Use `enum`s instead of macros. If inevitable to use `define`s export them with `LV_EXPORT_CONST_INT(defined_value)` right after the `define`.
- In function arguments use `type name[]` declaration for array parameters instead of `type * name`
- Use typed pointers instead of `void *` pointers
- Widget constructor must follow the `lv_<widget_name>_create(lv_obj_t * parent)` pattern.
- Widget members function must start with `lv_<modul_name>` and should receive `lv_obj_t *` as first argument which is a pointer to widget object itself.
- `struct` APIs should follow the widgets' conventions. That is to receive a pointer to the `struct` as the first argument, and the prefix of the `struct` name should be used as the prefix of the function name too (e.g. `lv_disp_set_default(lv_disp_t * disp)`)
- Functions and `struct`s which are not part of the public API must begin with underscore in order to mark them as "private".
- Argument must be named in H files too.
- Do not `malloc` into a static or global variables. Instead declare the variable in `LV_ITERATE_ROOTS` list in `lv_gc.h` and mark the variable with `GC_ROOT(variable)` when it's used.**See *Memory Management***
- To register and use callbacks one of the followings needs to be followed. **See *Callbacks***
  - Pass a pointer to a `struct` as the first argument of both the registration function and the callback. That `struct` must contain `void * user_data` field.
  - The last argument of the registration function must be `void * user_data` and the same `user_data` needs to be passed as the last argument of the callback.

Most of these rules are simple and straightforward but there are two related concepts that worth a deeper look: **Memory Management** and **Callbacks**.

Memory Management

When LVGL runs in Micropython, all dynamic memory allocations (`lv_malloc`) are handled by Micropython's memory manager which is garbage-collected (GC).To prevent GC from collecting memory prematurely, all dynamic allocated RAM must be reachable by GC.GC is aware of most allocations, except from pointers on the Data Segment:

- Pointers which are global variables
- Pointers which are static global variables
- Pointers which are static local variables

Such pointers need to be defined in a special way to make them reachable by GC

Identify The Problem

Problem happens when an allocated memory's pointer (return value of `lv_malloc`) is stored only in either **global**, **static global** or **static local** pointer variable and not as part of a previously allocated `struct` or other variable.

Solve The Problem

- Replace the global/static local var with `LV_GC_ROOT(_var)`
- Include `lv_gc.h` on files that use `LV_GC_ROOT`
- Add `_var` to `LV_ITERATE_ROOTS` on `lv_gc.h`

Example

https://github.com/lvgl/lvgl/commit/adced46eccfa0437f84aa51aedca4895cc3c679c

More Information

Callbacks

In C a callback is just a function pointer. But in Micropython we need to register a *Micropython callable object* for each callback. Therefore in the Micropython binding we need to register both a function pointer and a Micropython object for every callback.

Therefore we defined a **callback convention** for the LVGL C API that expects lvgl headers to be defined in a certain way. Callbacks that are declared according to the convention would allow the binding to register a Micropython object next to the function pointer when registering a callback, and access that object when the callback is called.

The basic idea is that we have `void * user_data` field that is used automatically by the Micropython Binding to save the *Micropython callable object* for a callback. This field must be provided when registering the function pointer, and provided to the callback function itself.Although called "user_data", the user is not expectd to read/write that field. Instead, the Micropython glue code uses `user_data` to automatically keep track of the Micropython callable object. The glue code updates it when the callback is registered, and uses it when the callback is called in order to invoke a call to the original callable object.

There are a few options for defining a callback in LVGL C API:

- Option 1: `user_data` in a struct
  - There's a struct that contains a field called `void * user_data`
  - A pointer to that struct is provided as the **first** argument of a callback registration function
  - A pointer to that struct is provided as the **first** argument of the callback itself
- Option 2: `user_data` as a function argument
  - A parameter called `void * user_data` is provided to the registration function as the **last** argument
  - The callback itself recieves `void *` as the **last** argument
- Option 3: both callback and `user_data` are struct fields
  - The API exposes a struct with both function pointer member and `user_data` member
  - The function pointer member receives the same struct as its **first** argument

In practice it's also possible to mix these options, for example provide a struct pointer when registering a callback (option 1) and provide `user_data` argument when calling the callback (options 2), **as long as the same `user_data` that was registered is passed to the callback when it's called**.

Examples

- lv_anim_t contains `user_data` field. lv_anim_set_path_cb registers `path_cb` callback. Both `lv_anim_set_path_cb` and `lv_anim_path_cb_t` recieve `lv_anim_t` as their first argument
- `path_cb` field can also be assigned directly in the Python code because it's a member of `lv_anim_t` which contains `user_data` field, and `lv_anim_path_cb_t` recieve `lv_anim_t` as its first argument.
- `lv_imgfont_create` registers `path_cb` and recieves `user_data` as the last argument. The callback `lv_imgfont_get_path_cb_t` also receieves the `user_data` as the last argument.

More Information

- In the Blog and in the README
- [v6.0] Callback conventions #1036
- Various discussions: here and here and here

3.4.2 Cpp

In progress: https://github.com/lvgl/lv_binding_cpp

3.4.3 PikaScript

What is PikaScript ?

PikaScript is a Python interpreter designed specifically for microcontrollers, and it supports a subset of the common Python3 syntax.

It's lighter, requiring only 32k of code space and 4k of RAM, which means it can run on stm32f103c8 (blue-pill) or even stm32g030c8, on the other hand, you can leave valuable space for more material or larger buffer areas.

It is simpler, out of the box, runs with no porting and configuration at all, does not depend on OS or file system, has good support for popular IDEs for Windows platforms like Keil, IAR, RT-Thread-Studio, and of course, supports linux-gcc development platforms.

It's smarter, with a unique C module mechanism that allows you to generate bindings automatically by simply writing the API for the C module in Python, and you don't need to deal with the headache of writing any macros or global tables manually. On the other hand, all C modules have sophisticated smart hints, even hinting at the types of your arguments .

Why PikaScript + LVGL ?

PikaScript now supports the main features of LVGL8, and these APIs are fully compatible with Micropython!

This means that you can continue to use already written code from Micropython, and then use less code space and RAM.

Enjoy detailed code hints down to the parameter type for a better programming experience

Use a more convenient IDE, such as vs-based simulation projects

So how does it look like?

Here are some examples of lvgl that PikaScript can already run, they are mainly from the lvgl documentation examples

LV_ARC

```
import pika_lvgl as lv
import PikaStdLib
mem = PikaStdLib.MemChecker()
# Create an Arc
arc = lv.arc(lv.scr_act())
arc.set_end_angle(200)
arc.set_size(150, 150)
arc.center()
print('mem used max: %0.2f kB' % (mem.getMax()))
print('mem used now: %0.2f kB' % (mem.getNow()))
```

LV_BAR

```
import pika_lvgl as lv
import PikaStdLib
mem = PikaStdLib.MemChecker()
bar1 = lv.bar(lv.scr_act())
bar1.set_size(200, 20)
bar1.center()
bar1.set_value(70, lv.ANIM.OFF)
print('mem used max: %0.2f kB' % (mem.getMax()))
print('mem used now: %0.2f kB' % (mem.getNow()))
```

LV_BTN

```
import pika_lvgl as lv
import PikaStdLib
mem = PikaStdLib.MemChecker()
def event_cb_1(evt):
    print('in evt1')
    print('mem used now: %0.2f kB' % (mem.getNow()))
def event_cb_2(evt):
    print('in evt2')
    print('mem used now: %0.2f kB' % (mem.getNow()))
btn1 = lv.btn(lv.scr_act())
```

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```
btn1.align(lv.ALIGN.TOP_MID, 0, 10)
btn2 = lv.btn(lv.scr_act())
btn2.align(lv.ALIGN.TOP_MID, 0, 50)
btn1.add_event(event_cb_1, lv.EVENT.CLICKED, 0)
btn2.add_event(event_cb_2, lv.EVENT.CLICKED, 0)
print('mem used max: %0.2f kB' % (mem.getMax()))
print('mem used now: %0.2f kB' % (mem.getNow()))
```

LV_CHECKBOX

```
import pika_lvgl as lv
import PikaStdLib
mem = PikaStdLib.MemChecker()
cb = lv.checkbox(lv.scr_act())
cb.set_text("Apple")
cb.align(lv.ALIGN.TOP_LEFT, 0 ,0)
cb = lv.checkbox(lv.scr_act())
cb.set_text("Banana")
cb.add_state(lv.STATE.CHECKED)
cb.align(lv.ALIGN.TOP_LEFT, 0 ,30)
cb = lv.checkbox(lv.scr_act())
cb.set_text("Lemon")
cb.add_state(lv.STATE.DISABLED)
cb.align(lv.ALIGN.TOP_LEFT, 0 ,60)
cb = lv.checkbox(lv.scr_act())
cb.add_state(lv.STATE.CHECKED | lv.STATE.DISABLED)
cb.set_text("Melon")
cb.align(lv.ALIGN.TOP_LEFT, 0 ,90)
print('mem used max: %0.2f kB' % (mem.getMax()))
print('mem used now: %0.2f kB' % (mem.getNow()))
```

How does it work?

PikaScript has a unique C module smart binding tool

Just write the Python interface in pika_lvgl.pyi (.pyi is the python interface file)

```
# pika_lvgl.pyi
class arc(lv_obj):
    def set_end_angle(self, angle: int): ...
    def set_bg_angles(self, start: int, end: int): ...
    def set_angles(self, start: int, end: int): ...
```

Then PikaScript's pre-compiler can automatically bind the following C functions, simply by naming the functions in the module_class_method format, without any additional work, and all binding and registration is done automatically.

```
/* pika_lvgl_arc.c */
void pika_lvgl_arc_set_end_angle(PikaObj* self, int angle) {
    lv_obj_t* lv_obj = obj_getPtr(self, "lv_obj");
    lv_arc_set_end_angle(lv_obj, angle);
}
```

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```
void pika_lvgl_arc_set_bg_angles(PikaObj *self, int start, int end){
    lv_obj_t* lv_obj = obj_getPtr(self, "lv_obj");
    lv_arc_set_bg_angles(lv_obj, start, end);
}
void pika_lvgl_arc_set_angles(PikaObj *self, int start, int end){
    lv_obj_t* lv_obj = obj_getPtr(self, "lv_obj");
    lv_arc_set_angles(lv_obj, start, end);
}
```

To use the module, just `import pika_lvgl` and the precompiler will automatically scan main.py and bind the `pika_lvgl` module

```
$ ./rust-msc-latest-win10.exe
(pikascript) packages installed:
    pikascript-core==v1.10.0
    PikaStdLib==v1.10.0
    PikaStdDevice==v1.10.0
(pikascript) pika compiler:
  scaning main.py...
    binding pika_lvgl.pyi...
```

The precompiler is written in Rust, runs on windows and linux, and is completely open source.

In addition to binding C modules, the precompiler compiles Python scripts to bytecode in the PC, reducing the size of the script and increasing its speed.

How can I use it?

The simulation repo on vs is available on https://github.com/pikasTech/lv_pikascript

---

3.4.4 JavaScript

With lv_binding_js you can write lvgl with JavaScript.

It uses React's virtual DOM concept to manipulate lvgl UI components, providing a familiar React-like experience to users.

Code

Code Runing on Real Device

Table of Contents

- *Animation*
- *Style*
- *JSAPI*
- *Thanks*

Features

- Support all lvgl built-in components
- Fully suport lvgl flex and grid style
- support most lvgl style□just write like html5 css
- support dynamic load image
- Fully support lvgl animation

Demo

See the demo folder

Building

The following are developer notes on how to build lvgljs on your native platform. They are not complete guides, but include notes on the necessary libraries, compile flags, etc.

lvgljs

JS Bundle

Components

Font

Buitin-Symbol

Animation

Animation

Style

JSAPI

Thanks

lvgljs depends on following excellent work

lvgl: Create beautiful UIs for any MCU, MPU and display type QuickJS: JavaScript engine libuv: platform abstraction layer curl: HTTP client txiki.js: Tiny JavaScript runtime

CHAPTER

FOUR

PORTING

4.1 Set up a project

4.1.1 Get the library

LVGL is available on GitHub: https://github.com/lvgl/lvgl.

You can clone it or Download the latest version of the library from GitHub.

4.1.2 Add lvgl to your project

The graphics library itself is the `lvgl` directory. It contains a couple of folders but to use `lvgl` you only need `.c` and `.h` files from the `src` folder.

Automatically add files

If your IDE automatically adds the files from the folders copied to the project folder (as Eclipse or VSCode does), you can simply copy the `lvgl` folder as it is into your project.

Make and CMake

LVGL also supports `make` and `CMake` build systems out of the box. To add LVGL to your Makefile based build system add these lines to your main Makefile:

```
LVGL_DIR_NAME ?= lvgl     #The name of the lvgl folder (change this if you have␣
↪renamed it)
LVGL_DIR ?= ${shell pwd}  #The path where the lvgl folder is
include $(LVGL_DIR)/$(LVGL_DIR_NAME)/lvgl.mk
```

For integration with CMake take a look this section of the *Documentation*.

Other platforms and tools

The *Get started* section contains many platform specific descriptions e.g. for ESP32, Arduino, NXP, RT-Thread, NuttX, etc.

Demos and Examples

The `lvgl` folder also contains an `examples` and a `demos` folder. If you needed to add the source files manually to your project, you can do the same with the source files of these two folders too. `make` and `CMake` handles the examples and demos, so no extra action required in these cases.

4.1.3 Configuration file

There is a configuration header file for LVGL called **lv_conf.h**. You modify this header to set the library's basic behavior, disable unused modules and features, adjust the size of memory buffers in compile-time, etc.

To get `lv_conf.h` **copy lvgl/lv_conf_template.h** next to the `lvgl` directory and rename it to *lv_conf.h*. Open the file and change the `#if 0` at the beginning to `#if 1` to enable its content. So the layout of the files should look like this:

```
|-lvgl
|-lv_conf.h
|-other files and folders
```

Comments in the config file explain the meaning of the options. Be sure to set at least `LV_COLOR_DEPTH` according to your display's color depth. Note that, the examples and demos explicitly need to be enabled in `lv_conf.h`.

Alternatively, `lv_conf.h` can be copied to another place but then you should add the `LV_CONF_INCLUDE_SIMPLE` define to your compiler options (e.g. `-DLV_CONF_INCLUDE_SIMPLE` for GCC compiler) and set the include path manually (e.g. `-I../include/gui`). In this case LVGL will attempt to include `lv_conf.h` simply with `#include "lv_conf.h"`.

You can even use a different name for `lv_conf.h`. The custom path can be set via the `LV_CONF_PATH` define. For example `-DLV_CONF_PATH="/home/joe/my_project/my_custom_conf.h"`

If `LV_CONF_SKIP` is defined, LVGL will not try to include `lv_conf.h`. Instead you can pass the config defines using build options. For example `"-DLV_COLOR_DEPTH=32 -DLV_USE_BTN=1"`. The unset options will get a default value which is the same as the ones in `lv_conf_template.h`.

LVGL also can be used via `Kconfig` and `menuconfig`. You can use `lv_conf.h` together with Kconfig, but keep in mind that the value from `lv_conf.h` or build settings (`-D...`) overwrite the values set in Kconfig. To ignore the configs from `lv_conf.h` simply remove its content, or define `LV_CONF_SKIP`.

4.1.4 Initialization

To use the graphics library you have to initialize it and setup required components. The order of the initialization is:

1. Call `lv_init()`.
2. Initialize your drivers.
3. Register the display and input devices drivers in LVGL. Learn more about *Display* and *Input device* registration.
4. Call `lv_tick_inc(x)` every `x` milliseconds in an interrupt to report the elapsed time to LVGL. *Learn more*.
5. Call `lv_timer_handler()` every few milliseconds to handle LVGL related tasks. *Learn more*.

4.2 Display interface

To create a display for LVGL call `lv_disp_t * disp = lv_disp_create(hor_res, ver_res)`. You can create a multiple displays and a different driver for each (see below),

4.2.1 Basic setup

Draw buffer(s) are simple array(s) that LVGL uses to render the screen's content. Once rendering is ready the content of the draw buffer is sent to the display using the `flush_cb` function.

flush_cb

An example `flush_cb` looks like this:

```
void my_flush_cb(lv_disp_t * disp, const lv_area_t * area, lv_color_t * buf)
{
    /*The most simple case (but also the slowest) to put all pixels to the screen one-
↪by-one
     *`put_px` is just an example, it needs to be implemented by you.*/
    int32_t x, y;
    for(y = area->y1; y <= area->y2; y++) {
        for(x = area->x1; x <= area->x2; x++) {
            put_px(x, y, *color_p);
            color_p++;
        }
    }

    /* IMPORTANT!!!
     * Inform LVGL that you are ready with the flushing and buf is not used anymore*/
    lv_disp_flush_ready(disp);
}
```

Use `lv_disp_set_flush_cb(disp, my_flush_cb)` to set a new `flush_cb`.

`lv_disp_flush_ready(disp)` needs to be called when flushing is ready to inform LVGL the buffer is not used anymore by the driver and it can render new content into it.

LVGL might render the screen in multiple chunks and therefore call `flush_cb` multiple times. To see if the current one is the last chunk of rendering use `lv_disp_flush_is_last(disp)`.

Draw buffers

The draw buffers can be set with `lv_disp_set_draw_buffers(disp, buf1, buf2, buf_size_px, render_mode);`

- `buf1` a bufer where LVGL can render
- `buf2` a second optional buffer (see more details below)
- `buf_size_byte` size of the buffer(s) in bytes
- `render_mode`
  - `LV_DISP_RENDER_MODE_PARTIAL` Use the buffer(s) to render the screen is smaller parts. This way the buffers can be smaller then the display to save RAM. At least 1/10 sceen size buffer(s) are recommended. In `flush_cb` the rendered images needs to be copied to the given area of the display.

   - `LV_DISP_RENDER_MODE_DIRECT` The buffer(s) has to be screen sized and LVGL will render into the correct location of the buffer. This way the buffer always contain the whole image. If two buffer are used the rendered ares are automatically copied to the other buffer after flushing. Due to this in `flush_cb` typically only a frame buffer address needs to be changed and always the changed areas will be redrawn.
   - `LV_DISP_RENDER_MODE_FULL` The buffer can smaller or screen sized but LVGL will always redraw the whole screen even is only 1 pixel has been changed. If two screen sized draw buffers are provided, LVGL's display handling works like "traditional" double buffering. This means the `flush_cb` callback only has to update the address of the framebuffer (`color_p` parameter).

Example:

```
static lv_color_t buf[LCD_HOR_RES * LCD_VER_RES / 10];
lv_disp_set_draw_buffers(disp, buf, NULL, sizeof(buf), LV_DISP_RENDER_MODE_PARTIAL);
```

One buffer

If only one buffer is used LVGL draws the content of the screen into that draw buffer and sends it to the display via the `flush_cb`. LVGL then needs to wait until the content of the buffer is sent to the display before drawing something new into it.

Two buffers

If two buffers are used LVGL can draw into one buffer while the content of the other buffer is sent to the display in the background. DMA or other hardware should be used to transfer data to the display so the MCU can continue drawing. This way, the rendering and refreshing of the display become parallel operations.

4.2.2 Advnaced options

Resoltion

To set the resolution of the display after creation use `lv_disp_set_res(disp, hor_res, ver_res);`

It's not mandatory to use the whole display for LVGL, however in some cases the physical resolution is important. For example the touchpad still sees the whole resolution and the values needs to be converted to the active LVGL display area. So the physical resoltution and the offset of the active area can be set with `lv_disp_set_physical_res(disp, hor_res, ver_res);` and `lv_disp_set_offset(disp, x, y);`

Rotation

LVGL supports rotation of the display in 90 degree increments. You can select whether you'd like software rotation or hardware rotation.

The orientation of the display can be changed with `lv_disp_set_rotation(disp, LV_DISP_ROTATION_0/90/180/270, true/false)`. LVGL will swap the horizontal and vertical resolutions internally according to the set degree. IF the last paramter is `true` LVGL will rotate the rendered image. If it's `false` the display driver should rotate the rendered image.

Color format

Set the color format of the display. The default is `LV_COLOR_FORMAT_NATIVE` which means LVGL render with the follow formats dpeneding on `LV_COLOR_DEPTH`:

- `LV_COLOR_DEPTH 32` XRGB8888 (4 bytes/pixel)
- `LV_COLOR_DEPTH 24` RGB888 (3 bytes/pixel)
- `LV_COLOR_DEPTH 16` RGB565 (2 bytes/pixel)
- `LV_COLOR_DEPTH 8` L8 (1 bytes/pixel)

The `color_format` can be changed with `lv_disp_set_color_depth(disp, LV_COLOR_FORMAT_... )` to the following values:

- `LV_COLOR_FORMAT_NATIVE_ALPHA` Append an alpha byte to the native format resulting in A8L8, ARGB8565, ARGB8888 formats.
- `LV_COLOR_FORMAT_NATIVE_REVERSE` Reverse the byte order of the native format. Useful if the rendered image is sent to the disply via SPI and the display needs the bytes in the opposite order.
- `LV_COLOR_FORMAT_L8` Lightness only on 8 bit
- `LV_COLOR_FORMAT_A8` Alpha only on 8 bit
- `LV_COLOR_FORMAT_I8` Indexed (palette) 8 bit
- `LV_COLOR_FORMAT_A8L8` Lightness on 8 bit with 8 bit alpha
- `LV_COLOR_FORMAT_ARGB2222` ARGB with 2 bit for each channel
- `LV_COLOR_FORMAT_RGB565` 16 bit RGB565 format without alpha channel
- `LV_COLOR_FORMAT_ARGB8565` 16 bit RGB565 format and 8 bit alpha channel
- `LV_COLOR_FORMAT_ARGB1555` 5 bit for each color channel and 1 bit for alpha
- `LV_COLOR_FORMAT_ARGB4444` 4 bit for each channel
- `LV_COLOR_FORMAT_RGB888` 8 bit for each color channel with out alpha channel
- `LV_COLOR_FORMAT_ARGB8888` 8 bit for each channel
- `LV_COLOR_FORMAT_XRGB8888` 8 bit for each color channel and 8 bit placholder for the alpha cannel

If the color fotmat is set to non-native `draw_ctx->buffer_convert` function will be called before calling `flush_cb` to convert the native color format to the desired, therfore rendering in non-native formats has a negative effect on peroformance. Learn more about `draw_ctx` *here*.

It's very important that draw buffer(s) should be large enough for both the native format and the target color format. For example if `LV_COLOR_DEPTH == 16` and `LV_COLOR_FORMAT_XRGB8888` is selected LVGL will choosoe the larger to figure out how many pixel can be rendered at once. Therefore with `LV_DISP_RENDER_MODE_FULL` and the larger pixel size needs to choosen.

`LV_DISP_RENDER_MODE_DIRECT` supports only the `LV_COLOR_FORMAT_NATIVE` format.

Antialiasing

`lv_disp_set_antialiasing(disp, true/false)` enables/disables the antialiasing (edge smoothing) on the given display.

User data

With `lv_disp_set_user_data(disp, p)` a pointer to a custom data can be stored in display object.

4.2.3 Events

`lv_disp_add_event(disp, event_cb, LV_DISP_EVENT_..., user_data)` adds an event handler to a display. The following events are sent:

- `LV_DISP_EVENT_INVALIDATE_AREA` An area is invalidated (marked for redraw). `lv_event_get_param(e)` returns a pointer to an `lv_area_t` varaible with the coordinates of the area to be invalidated. The ara can be freely modified is needed to adopt it the specialrequirement of the display. Usually needed with monoschrome displays to invalidate Nx8 lines at once.
- `LV_DISP_EVENT_RENDER_START` Called when rendering starts.
- `LV_DISP_EVENT_RENDER_READY` Called when rendering is ready
- `LV_DISP_EVENT_RESOLUTION_CHANGED` CAlled when the resolution changes due to `lv_disp_set_resolution()` or `lv_disp_set_rotation()`.

4.2.4 Other options

Decoupling the display refresh timer

Normally the dirty (a.k.a invalid) areas are checked and redrawn in every `LV_DEF_REFR_PERIOD` milliseconds (set in `lv_hal_disp.h`). However, in some cases you might need more control on when the display refreshing happen, for example to synchronize rendering with VSYNC or the TE signal.

You can do this in the following way:

```
/*Delete the original display refresh timer*/
lv_timer_del(disp->refr_timer);
disp->refr_timer = NULL;


/*Call this anywhere you want to refresh the dirty areas*/
_lv_disp_refr_timer(NULL);
```

If you have multiple displays call `lv_disp_set_deafult(disp1);` to select the display to refresh before `_lv_disp_refr_timer(NULL);`.

Note that `lv_timer_handler()` and `_lv_disp_refr_timer()` can not run at the same time.

If the performance monitor is enabled, the value of `LV_DEF_REFR_PERIOD` needs to be set to be consistent with the refresh period of the display to ensure that the statistical results are correct.

4.2.5 Further reading

- lv_port_disp_template.c for a template for your own driver.
- *Drawing* to learn more about how rendering works in LVGL.
- *Display features* to learn more about higher level display features.

4.2.6 API

Typedefs

typedef struct _lv_disp_t **`lv_disp_t`**

Enums

enum **`lv_disp_rotation_t`**

Values:

enumerator **`LV_DISP_ROTATION_0`**

enumerator **`LV_DISP_ROTATION_90`**

enumerator **`LV_DISP_ROTATION_180`**

enumerator **`LV_DISP_ROTATION_270`**

enum **`lv_disp_render_mode_t`**

Values:

enumerator **`LV_DISP_RENDER_MODE_PARTIAL`**

Use the buffer(s) to render the screen is smaller parts. This way the buffers can be smaller then the display to save RAM. At least 1/10 sceen size buffer(s) are recommended.

enumerator **`LV_DISP_RENDER_MODE_DIRECT`**

The buffer(s) has to be screen sized and LVGL will render into the correct location of the buffer. This way the buffer always contain the whole image. Only the changed ares will be updated. With 2 buffers the buffers' content are kept in sync automatically and in flush_cb only address change is required.

enumerator **`LV_DISP_RENDER_MODE_FULL`**

Always redraw the whole screen even if only one pixel has been changed. With 2 buffers in flush_cb only and address change is required.

enum **`lv_scr_load_anim_t`**

Values:

enumerator **`LV_SCR_LOAD_ANIM_NONE`**

enumerator **`LV_SCR_LOAD_ANIM_OVER_LEFT`**

enumerator **`LV_SCR_LOAD_ANIM_OVER_RIGHT`**

enumerator **`LV_SCR_LOAD_ANIM_OVER_TOP`**

enumerator **`LV_SCR_LOAD_ANIM_OVER_BOTTOM`**

enumerator **`LV_SCR_LOAD_ANIM_MOVE_LEFT`**

enumerator **`LV_SCR_LOAD_ANIM_MOVE_RIGHT`**

enumerator **`LV_SCR_LOAD_ANIM_MOVE_TOP`**

enumerator **`LV_SCR_LOAD_ANIM_MOVE_BOTTOM`**

enumerator **`LV_SCR_LOAD_ANIM_FADE_IN`**

enumerator **`LV_SCR_LOAD_ANIM_FADE_ON`**

enumerator **`LV_SCR_LOAD_ANIM_FADE_OUT`**

enumerator **`LV_SCR_LOAD_ANIM_OUT_LEFT`**

enumerator **`LV_SCR_LOAD_ANIM_OUT_RIGHT`**

enumerator **`LV_SCR_LOAD_ANIM_OUT_TOP`**

enumerator **`LV_SCR_LOAD_ANIM_OUT_BOTTOM`**

Functions

lv_disp_t ***`lv_disp_create`**(lv_coord_t hor_res, lv_coord_t ver_res)

Create a new display with the given resolution

Parameters

- **`hor_res`** -- horizontal resolution in pixels
- **`ver_res`** -- vertical resolution in pixels

Returns pointer to a display object or `NULL` on error void **lv_disp_remove**(*lv_disp_t* *disp)

Remove a display

Parameters **disp** -- pointer to display

void **lv_disp_set_default**(*lv_disp_t* *disp)

Set a default display. The new screens will be created on it by default.

Parameters **disp** -- pointer to a display

lv_disp_t ***lv_disp_get_default**(void)

Get the default display

Returns pointer to the default display

lv_disp_t ***lv_disp_get_next**(*lv_disp_t* *disp)

Get the next display.

Parameters **disp** -- pointer to the current display. NULL to initialize.

Returns the next display or NULL if no more. Gives the first display when the parameter is NULL.

void **lv_disp_set_res**(*lv_disp_t* *disp, lv_coord_t hor_res, lv_coord_t ver_res)

Sets the resolution of a display. `LV_EVENT_RESOLUTION_CHANGED` event will be sent. Here the native resolution of the device should be set. If the display will be rotated later with `lv_disp_set_rotation` LVGL will swap the hor. and ver. resolution automatically.

Parameters

- **disp** -- pointer to a display
- **hor_res** -- the new horizontal resolution
- **ver_res** -- the new vertical resolution

void **lv_disp_set_physical_res**(*lv_disp_t* *disp, lv_coord_t hor_res, lv_coord_t ver_res)

It's not mandatory to use the whole display for LVGL, however in some cases physical resolution is important. For example the touchpad still sees whole resolution and the values needs to be converted to the active LVGL display area.

Parameters

- **disp** -- pointer to a display
- **hor_res** -- the new physical horizontal resolution, or -1 to assume it's the same as the normal hor. res.
- **ver_res** -- the new physical vertical resolution, or -1 to assume it's the same as the normal hor. res.

void **lv_disp_set_offset**(*lv_disp_t* *disp, lv_coord_t x, lv_coord_t y)

If physical resolution is not the same as the normal resolution the offset of the active display area can be set here.

Parameters

- **disp** -- pointer to a display
- **x** -- X offset
- **y** -- Y offset

void **`lv_disp_set_rotation`**(*lv_disp_t* *disp, *lv_disp_rotation_t* rotation, bool sw_rotate)

Set the rotation of this display. LVGL will swap the horizontal and vertical resolutions internally.

Parameters

- **`disp`** -- pointer to a display (NULL to use the default display)
- **`rotation`** -- `LV_DISP_ROTATION_0/90/180/270`
- **`sw_rotate`** -- true: make LVGL rotate the rendered image; false: the display driver should rotate the rendered image

void **`lv_disp_set_dpi`**(*lv_disp_t* *disp, lv_coord_t dpi)

Set the DPI (dot per inch) of the display. dpi = sqrt(hor_res^2 + ver_res^2) / diagonal"

Parameters

- **`disp`** -- pointer to a display
- **`dpi`** -- the new DPI

lv_coord_t **`lv_disp_get_hor_res`**(const *lv_disp_t* *disp)

Get the horizontal resolution of a display.

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns the horizontal resolution of the display.

lv_coord_t **`lv_disp_get_ver_res`**(const *lv_disp_t* *disp)

Get the vertical resolution of a display

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns the vertical resolution of the display

lv_coord_t **`lv_disp_get_physical_hor_res`**(const *lv_disp_t* *disp)

Get the physical horizontal resolution of a display

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns the physical horizontal resolution of the display

lv_coord_t **`lv_disp_get_physical_ver_res`**(const *lv_disp_t* *disp)

Get the physical vertical resolution of a display

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns the physical vertical resolution of the display

lv_coord_t **`lv_disp_get_offset_x`**(const *lv_disp_t* *disp)

Get the horizontal offset from the full / physical display

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns the horizontal offset from the physical display

lv_coord_t **`lv_disp_get_offset_y`**(const *lv_disp_t* *disp)

Get the vertical offset from the full / physical display

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns the horizontal offset from the physical display *lv_disp_rotation_t* **`lv_disp_get_rotation`**(*lv_disp_t* *disp)

Get the current rotation of this display.

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns the current rotation

lv_coord_t **`lv_disp_get_dpi`**(const *lv_disp_t* *disp)

Get the DPI of the display

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns dpi of the display

void **`lv_disp_set_draw_buffers`**(*lv_disp_t* *disp, void *buf1, void *buf2, uint32_t buf_size_px, *lv_disp_render_mode_t* render_mode)

Set the buffers for a display

Parameters

- **`disp`** -- pointer to a display
- **`buf1`** -- first buffer
- **`buf2`** -- second buffer (can be `NULL`)
- **`buf_size_px`** -- size of the buffer in pixels
- **`render_mode`** -- LV_DISP_RENDER_MODE_PARTIAL/DIRECT/FULL

void **`lv_disp_set_flush_cb`**(*lv_disp_t* *disp, void (*flush_cb)(struct _lv_disp_t *disp, const lv_area_t *area, lv_color_t *color_p))

Set the flush callback whcih will be called to copy the rendered image to the display.

Parameters

- **`disp`** -- pointer to a display
- **`flush_cb`** -- the flush callback

void **`lv_disp_set_color_format`**(*lv_disp_t* *disp, *lv_color_format_t* color_format)

Set the color format of the display. If set to other than `LV_COLOR_FORMAT_NATIVE` the draw_ctx's `buffer_convert` function will be used to convert the rendered content to the desired color format.

Parameters

- **`disp`** -- pointer to a display
- **`color_format`** -- By default `LV_COLOR_FORMAT_NATIVE` to render with L8, RGB565, RGB888 or ARGB8888. `LV_COLOR_FORMAT_NATIVE_REVERSE` to change endianess.

lv_color_format_t **`lv_disp_get_color_format`**(*lv_disp_t* *disp)

Get the color format of the display

Parameters **`disp`** -- pointer to a display

Returns the color format

void **`lv_disp_set_antialaising`**(*lv_disp_t* *disp, bool en)

Enable anti-aliasing for the render engine

Parameters

- **`disp`** -- pointer to a display

- **en** -- true/false

bool **lv_disp_get_antialiasing**(*lv_disp_t* *disp)

Get if anti-aliasing is enabled for a display or not

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns true/false

bool **lv_disp_is_double_buffered**(*lv_disp_t* *disp)

void **lv_disp_set_draw_ctx**(*lv_disp_t* *disp, void (*draw_ctx_init)(*lv_disp_t* *disp, struct _lv_draw_ctx_t *draw_ctx), void (*draw_ctx_deinit)(*lv_disp_t* *disp, struct _lv_draw_ctx_t *draw_ctx), size_t draw_ctx_size)

Initialize a new draw context for the display

Parameters

- **disp** -- pointer to a display
- **draw_ctx_init** -- init callback
- **draw_ctx_deinit** -- deinit callback
- **draw_ctx_size** -- size of the draw context instance

struct *_lv_obj_t* ***lv_disp_get_scr_act**(*lv_disp_t* *disp)

Return a pointer to the active screen on a display

Parameters **disp** -- pointer to display which active screen should be get. (NULL to use the default screen)

Returns pointer to the active screen object (loaded by 'lv_scr_load()')

struct *_lv_obj_t* ***lv_disp_get_scr_prev**(*lv_disp_t* *disp)

Return with a pointer to the previous screen. Only used during screen transitions.

Parameters **disp** -- pointer to display which previous screen should be get. (NULL to use the default screen)

Returns pointer to the previous screen object or NULL if not used now

void **lv_disp_load_scr**(struct *_lv_obj_t* *scr)

Make a screen active

Parameters **scr** -- pointer to a screen

struct *_lv_obj_t* ***lv_disp_get_layer_top**(*lv_disp_t* *disp)

Return the top layer. The top layer is the same on all screens and it is above the normal screen layer.

Parameters **disp** -- pointer to display which top layer should be get. (NULL to use the default screen)

Returns pointer to the top layer object

struct *_lv_obj_t* ***lv_disp_get_layer_sys**(*lv_disp_t* *disp)

Return the sys. layer. The system layer is the same on all screen and it is above the normal screen and the top layer.

Parameters **disp** -- pointer to display which sys. layer should be retrieved. (NULL to use the default screen)

Returns pointer to the sys layer object struct *_lv_obj_t* ***lv_disp_get_layer_bottom**(*lv_disp_t* *disp)

Return the bottom layer. The bottom layer is the same on all screen and it is under the normal screen layer. It's visble only if the the screen is transparent.

Parameters **disp** -- pointer to display (NULL to use the default screen)

Returns pointer to the bottom layer object

void **lv_scr_load_anim**(struct *_lv_obj_t* *scr, *lv_scr_load_anim_t* anim_type, uint32_t time, uint32_t delay, bool auto_del)

Switch screen with animation

Parameters

- **scr** -- pointer to the new screen to load
- **anim_type** -- type of the animation from `lv_scr_load_anim_t`, e.g. `LV_SCR_LOAD_ANIM_MOVE_LEFT`
- **time** -- time of the animation
- **delay** -- delay before the transition
- **auto_del** -- true: automatically delete the old screen

static inline struct *_lv_obj_t* ***lv_scr_act**(void)

Get the active screen of the default display

Returns pointer to the active screen

static inline struct *_lv_obj_t* ***lv_layer_top**(void)

Get the top layer of the default display

Returns pointer to the top layer

static inline struct *_lv_obj_t* ***lv_layer_sys**(void)

Get the system layer of the default display

Returns pointer to the sys layer

static inline struct *_lv_obj_t* ***lv_layer_bottom**(void)

Get the bottom layer of the default display

Returns pointer to the bottom layer

static inline void **lv_scr_load**(struct *_lv_obj_t* *scr)

Load a screen on the default display

Parameters **scr** -- pointer to a screen

void **lv_disp_add_event**(*lv_disp_t* *disp, *lv_event_cb_t* event_cb, *lv_event_code_t* filter, void *user_data)

Add an event handler to the display

Parameters

- **disp** -- pointer to a display
- **event_cb** -- an event callback
- **filter** -- event code to react or `LV_EVENT_ALL`
- **user_data** -- optional user_data

uint32_t **lv_disp_get_event_count**(*lv_disp_t* *disp) *lv_event_dsc_t* ***lv_disp_get_event_dsc**(*lv_disp_t* *disp, uint32_t index)

bool **lv_disp_remove_event**(*lv_disp_t* *disp, uint32_t index)

lv_res_t **lv_disp_send_event**(*lv_disp_t* *disp, *lv_event_code_t* code, void *user_data)

Send amn event to a display

Parameters

- **disp** -- pointer to a display
- **code** -- an event code. LV_EVENT_...
- **user_data** -- optional user_data

Returns LV_RES_OK: disp wasn't deleted in the event.

void **lv_disp_set_theme**(*lv_disp_t* *disp, struct *_lv_theme_t* *th)

Set the theme of a display. If there are no user created widgets yet the screens' theme will be updated

Parameters

- **disp** -- pointer to a display
- **th** -- pointer to a theme

struct *_lv_theme_t* ***lv_disp_get_theme**(*lv_disp_t* *disp)

Get the theme of a display

Parameters **disp** -- pointer to a display

Returns the display's theme (can be NULL)

uint32_t **lv_disp_get_inactive_time**(const *lv_disp_t* *disp)

Get elapsed time since last user activity on a display (e.g. click)

Parameters **disp** -- pointer to a display (NULL to get the overall smallest inactivity)

Returns elapsed ticks (milliseconds) since the last activity

void **lv_disp_trig_activity**(*lv_disp_t* *disp)

Manually trigger an activity on a display

Parameters **disp** -- pointer to a display (NULL to use the default display)

void **lv_disp_enable_invalidation**(*lv_disp_t* *disp, bool en)

Temporarily enable and disable the invalidation of the display.

Parameters

- **disp** -- pointer to a display (NULL to use the default display)
- **en** -- true: enable invalidation; false: invalidation

bool **lv_disp_is_invalidation_enabled**(*lv_disp_t* *disp)

Get display invalidation is enabled.

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns return true if invalidation is enabled

lv_timer_t ***_lv_disp_get_refr_timer**(*lv_disp_t* *disp)

Get a pointer to the screen refresher timer to modify its parameters with `lv_timer_...` functions.

Parameters **disp** -- pointer to a display

Returns pointer to the display refresher timer. (NULL on error)

lv_color_t **`lv_disp_get_chroma_key_color`**(*lv_disp_t* *disp)

void **`lv_disp_set_user_data`**(*lv_disp_t* *disp, void *user_data)

void **`lv_disp_set_driver_data`**(*lv_disp_t* *disp, void *driver_data)

void ***`lv_disp_get_user_data`**(*lv_disp_t* *disp)

void ***`lv_disp_get_driver_data`**(*lv_disp_t* *disp)

static inline lv_coord_t **`lv_dpx`**(lv_coord_t n)

Scale the given number of pixels (a distance or size) relative to a 160 DPI display considering the DPI of the default display. It ensures that e.g. `lv_dpx(100)` will have the same physical size regardless to the DPI of the display.

Parameters **`n`** -- the number of pixels to scale

Returns `n x current_dpi/160`

static inline lv_coord_t **`lv_disp_dpx`**(const *lv_disp_t* *disp, lv_coord_t n)

Scale the given number of pixels (a distance or size) relative to a 160 DPI display considering the DPI of the given display. It ensures that e.g. `lv_dpx(100)` will have the same physical size regardless to the DPI of the display.

Parameters

- **`obj`** -- a display whose dpi should be considered
- **`n`** -- the number of pixels to scale

Returns `n x current_dpi/160`

4.3 Input device interface

4.3.1 Types of input devices

To create an input device use

```
/*Register at least one display before you register any input devices*/
lv_indev_t * indev = lv_indev_create();
lv_indev_set_type(indev, LV_INDEV_TYPE_...);   /*See below.*/
lv_indev_set_read_cb(indev, read_cb);  /*See below.*/
```

The `type` member can be:

- `LV_INDEV_TYPE_POINTER` touchpad or mouse
- `LV_INDEV_TYPE_KEYPAD` keyboard or keypad
- `LV_INDEV_TYPE_ENCODER` encoder with left/right turn and push options
- `LV_INDEV_TYPE_BUTTON` external buttons virtually pressing the screen

`read_cb` is a function pointer which will be called periodically to report the current state of an input device.

Visit *Input devices* to learn more about input devices in general.

Touchpad, mouse or any pointer

Input devices that can click points on the screen belong to this category.

```c
lv_indev_set_type(indev, LV_INDEV_TYPE_POINTER);
...

void my_input_read(lv_indev_t * indev, lv_indev_data_t*data)
{
  if(touchpad_pressed) {
    data->point.x = touchpad_x;
    data->point.y = touchpad_y;
    data->state = LV_INDEV_STATE_PRESSED;
  } else {
    data->state = LV_INDEV_STATE_RELEASED;
  }
}
```

To set a mouse cursor use `lv_indev_set_cursor(indev, &img_cursor)`.

Keypad or keyboard

Full keyboards with all the letters or simple keypads with a few navigation buttons belong here.

To use a keyboard/keypad:

- Register a `read_cb` function and use `LV_INDEV_TYPE_KEYPAD` type.
- An object group has to be created: `lv_group_t * g = lv_group_create()` and objects have to be added to it with `lv_group_add_obj(g, obj)`
- The created group has to be assigned to an input device: `lv_indev_set_group(indev, g)`
- Use `LV_KEY_...` to navigate among the objects in the group. See `lv_core/lv_group.h` for the available keys.

```c

lv_indev_set_type(indev, LV_INDEV_TYPE_KEYPAD);

...

void keyboard_read(lv_indev_t * indev, lv_indev_data_t*data){
  data->key = last_key();            /*Get the last pressed or released key*/

  if(key_pressed()) data->state = LV_INDEV_STATE_PRESSED;
  else data->state = LV_INDEV_STATE_RELEASED;
}
```

Encoder

With an encoder you can do the following:

1. Press its button
2. Long-press its button
3. Turn left
4. Turn right

In short, the Encoder input devices work like this:

- By turning the encoder you can focus on the next/previous object.
- When you press the encoder on a simple object (like a button), it will be clicked.
- If you press the encoder on a complex object (like a list, message box, etc.) the object will go to edit mode whereby you can navigate inside the object by turning the encoder.
- To leave edit mode, long press the button.

To use an *Encoder* (similarly to the *Keypads*) the objects should be added to groups.

```
lv_indev_set_type(indev, LV_INDEV_TYPE_ENCODER);

...

void encoder_read(lv_indev_t * indev, lv_indev_data_t*data){
  data->enc_diff = enc_get_new_moves();

  if(enc_pressed()) data->state = LV_INDEV_STATE_PRESSED;
  else data->state = LV_INDEV_STATE_RELEASED;
}
```

Using buttons with Encoder logic

In addition to standard encoder behavior, you can also utilize its logic to navigate(focus) and edit widgets using buttons. This is especially handy if you have only few buttons available, or you want to use other buttons in addition to encoder wheel.

You need to have 3 buttons available:

- `LV_KEY_ENTER` will simulate press or pushing of the encoder button
- `LV_KEY_LEFT` will simulate turning encoder left
- `LV_KEY_RIGHT` will simulate turning encoder right
- other keys will be passed to the focused widget

If you hold the keys it will simulate an encoder advance with period specified in `indev_drv.long_press_repeat_time`.

```

lv_indev_set_type(indev, LV_INDEV_TYPE_ENCODER);

...

void encoder_with_keys_read(lv_indev_t * indev, lv_indev_data_t*data){
```

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```
  data->key = last_key();            /*Get the last pressed or released key*/
                                     /* use LV_KEY_ENTER for encoder press */
  if(key_pressed()) data->state = LV_INDEV_STATE_PRESSED;
  else {
      data->state = LV_INDEV_STATE_RELEASED;
      /* Optionally you can also use enc_diff, if you have encoder*/
      data->enc_diff = enc_get_new_moves();
  }
}
```

Button

Buttons mean external "hardware" buttons next to the screen which are assigned to specific coordinates of the screen. If a button is pressed it will simulate the pressing on the assigned coordinate. (Similarly to a touchpad)

To assign buttons to coordinates use `lv_indev_set_button_points(my_indev, points_array)`. `points_array` should look like `const lv_point_t points_array[] = { {12,30},{60,90}, ...}`

Important: The points_array can't go out of scope. Either declare it as a global variable or as a static variable inside a function.

```

lv_indev_set_type(indev, LV_INDEV_TYPE_BUTTON);

...

void button_read(lv_indev_t * indev, lv_indev_data_t*data){
    static uint32_t last_btn = 0;   /*Store the last pressed button*/
    int btn_pr = my_btn_read();     /*Get the ID (0,1,2...) of the pressed button*/
    if(btn_pr >= 0) {               /*Is there a button press? (E.g. -1 indicated no␣
↪button was pressed)*/
       last_btn = btn_pr;           /*Save the ID of the pressed button*/
       data->state = LV_INDEV_STATE_PRESSED;  /*Set the pressed state*/
    } else {
       data->state = LV_INDEV_STATE_RELEASED; /*Set the released state*/
    }

    data->btn = last_btn;            /*Save the last button*/
}
```

4.3.2 Other features

Parameters

The default value of the following parameters can be changed in `lv_indev_t`:

- `scroll_limit` Number of pixels to slide before actually scrolling the object.
- `scroll_throw` Scroll throw (momentum) slow-down in [%]. Greater value means faster slow-down.
- `long_press_time` Press time to send `LV_EVENT_LONG_PRESSED` (in milliseconds)

- `long_press_repeat_time` Interval of sending `LV_EVENT_LONG_PRESSED_REPEAT` (in milliseconds)
- `read_timer` pointer to the `lv_timer` which reads the input device. Its parameters can be changed by `lv_timer_...()` functions. `LV_DEF_REFR_PERIOD` in `lv_hal_disp.h` sets the default read period.

Feedback

Besides `read_cb` a `feedback_cb` callback can be also specified in `lv_indev_t`. `feedback_cb` is called when any type of event is sent by the input devices (independently of its type). This allows generating feedback for the user, e.g. to play a sound on `LV_EVENT_CLICKED`.

Associating with a display

Every input device is associated with a display. By default, a new input device is added to the last display created or explicitly selected (using `lv_disp_set_default()`). The associated display is stored and can be changed in `disp` field of the driver.

Buffered reading

By default, LVGL calls `read_cb` periodically. Because of this intermittent polling there is a chance that some user gestures are missed.

To solve this you can write an event driven driver for your input device that buffers measured data. In `read_cb` you can report the buffered data instead of directly reading the input device. Setting the `data->continue_reading` flag will tell LVGL there is more data to read and it should call `read_cb` again.

4.3.3 Further reading

- lv_port_indev_template.c for a template for your own driver.
- *INdev features* to learn more about higher level input device features.

4.3.4 API

Typedefs

typedef struct _lv_indev_t **`lv_indev_t`**

Enums

enum **`lv_indev_type_t`**

Possible input device types

Values:

enumerator **`LV_INDEV_TYPE_NONE`**

Uninitialized state

enumerator **`LV_INDEV_TYPE_POINTER`**

Touch pad, mouse, external button

enumerator **`LV_INDEV_TYPE_KEYPAD`**

Keypad or keyboard

enumerator **`LV_INDEV_TYPE_BUTTON`**

External (hardware button) which is assigned to a specific point of the screen

enumerator **`LV_INDEV_TYPE_ENCODER`**

Encoder with only Left, Right turn and a Button

enum **`lv_indev_state_t`**

States for input devices

Values:

enumerator **`LV_INDEV_STATE_RELEASED`**

enumerator **`LV_INDEV_STATE_PRESSED`**

Functions

lv_indev_t ***`lv_indev_create`**(void)

void **`lv_indev_delete`**(*lv_indev_t* *indev)

Remove the provided input device. Make sure not to use the provided input device afterwards anymore.

Parameters **`indev`** -- pointer to delete

lv_indev_t ***`lv_indev_get_next`**(*lv_indev_t* *indev)

Get the next input device.

Parameters **`indev`** -- pointer to the current input device. NULL to initialize.

Returns the next input device or NULL if there are no more. Provide the first input device when the parameter is NULL

void **`_lv_indev_read`**(*lv_indev_t* *indev, *lv_indev_data_t* *data)

Read data from an input device.

Parameters

- **`indev`** -- pointer to an input device
- **`data`** -- input device will write its data here

void **`lv_indev_read_timer_cb`**(*lv_timer_t* *timer)

Called periodically to read the input devices

Parameters **`timer`** -- pointer to a timer to read void **`lv_indev_enable`**(*lv_indev_t* *indev, bool en)

Enable or disable one or all input devices (default enabled)

Parameters

- **`indev`** -- pointer to an input device or NULL to enable/disable all of them
- **`en`** -- true to enable, false to disable

lv_indev_t ***`lv_indev_get_act`**(void)

Get the currently processed input device. Can be used in action functions too.

Returns pointer to the currently processed input device or NULL if no input device processing right now

void **`lv_indev_set_type`**(*lv_indev_t* *indev, *lv_indev_type_t* indev_type)

Set the type of an input device

Parameters

- **`indev`** -- pointer to an input device
- **`indev_type`** -- the type of the input device from `lv_indev_type_t` (`LV_INDEV_TYPE_...`)

void **`lv_indev_set_read_cb`**(*lv_indev_t* *indev, void (*read_cb)(struct _lv_indev_t *indev, *lv_indev_data_t* *data))

void **`lv_indev_set_user_data`**(*lv_indev_t* *indev, void *user_data)

void **`lv_indev_set_driver_data`**(*lv_indev_t* *indev, void *driver_data)

lv_indev_type_t **`lv_indev_get_type`**(const *lv_indev_t* *indev)

Get the type of an input device

Parameters **`indev`** -- pointer to an input device

Returns the type of the input device from `lv_hal_indev_type_t` (`LV_INDEV_TYPE_...`)

lv_indev_state_t **`lv_indev_get_state`**(const *lv_indev_t* *indev)

lv_group_t ***`lv_indev_get_group`**(const *lv_indev_t* *indev)

struct _lv_disp_t ***`lv_indev_get_disp`**(const *lv_indev_t* *indev)

void **`lv_indev_set_disp`**(*lv_indev_t* *indev, struct _lv_disp_t *disp)

void ***`lv_indev_get_user_data`**(const *lv_indev_t* *indev)

void ***`lv_indev_get_driver_data`**(const *lv_indev_t* *indev)

void **`lv_indev_reset`**(*lv_indev_t* *indev, struct *_lv_obj_t* *obj)

Reset one or all input devices

Parameters

- **`indev`** -- pointer to an input device to reset or NULL to reset all of them
- **`obj`** -- pointer to an object which triggers the reset.

void **`lv_indev_reset_long_press`**(*lv_indev_t* *indev)

Reset the long press state of an input device

Parameters **`indev`** -- pointer to an input device void **lv_indev_set_cursor**(*lv_indev_t* *indev, struct *_lv_obj_t* *cur_obj)

Set a cursor for a pointer input device (for LV_INPUT_TYPE_POINTER and LV_INPUT_TYPE_BUTTON)

Parameters

- **indev** -- pointer to an input device
- **cur_obj** -- pointer to an object to be used as cursor

void **lv_indev_set_group**(*lv_indev_t* *indev, *lv_group_t* *group)

Set a destination group for a keypad input device (for LV_INDEV_TYPE_KEYPAD)

Parameters

- **indev** -- pointer to an input device
- **group** -- point to a group

void **lv_indev_set_button_points**(*lv_indev_t* *indev, const lv_point_t points[])

Set the an array of points for LV_INDEV_TYPE_BUTTON. These points will be assigned to the buttons to press a specific point on the screen

Parameters

- **indev** -- pointer to an input device
- **group** -- point to a group

void **lv_indev_get_point**(const *lv_indev_t* *indev, lv_point_t *point)

Get the last point of an input device (for LV_INDEV_TYPE_POINTER and LV_INDEV_TYPE_BUTTON)

Parameters

- **indev** -- pointer to an input device
- **point** -- pointer to a point to store the result

lv_dir_t **lv_indev_get_gesture_dir**(const *lv_indev_t* *indev)

Get the current gesture direct

Parameters **indev** -- pointer to an input device

Returns current gesture direct

uint32_t **lv_indev_get_key**(const *lv_indev_t* *indev)

Get the last pressed key of an input device (for LV_INDEV_TYPE_KEYPAD)

Parameters **indev** -- pointer to an input device

Returns the last pressed key (0 on error)

lv_dir_t **lv_indev_get_scroll_dir**(const *lv_indev_t* *indev)

Check the current scroll direction of an input device (for LV_INDEV_TYPE_POINTER and LV_INDEV_TYPE_BUTTON)

Parameters **indev** -- pointer to an input device

Returns LV_DIR_NONE: no scrolling now LV_DIR_HOR/VER

struct *_lv_obj_t* ***lv_indev_get_scroll_obj**(const *lv_indev_t* *indev)

Get the currently scrolled object (for LV_INDEV_TYPE_POINTER and LV_INDEV_TYPE_BUTTON)

Parameters **indev** -- pointer to an input device

Returns pointer to the currently scrolled object or NULL if no scrolling by this indev void **`lv_indev_get_vect`**(const *lv_indev_t* *indev, lv_point_t *point)

Get the movement vector of an input device (for LV_INDEV_TYPE_POINTER and LV_INDEV_TYPE_BUTTON)

Parameters

- **`indev`** -- pointer to an input device
- **`point`** -- pointer to a point to store the types.pointer.vector

void **`lv_indev_wait_release`**(*lv_indev_t* *indev)

Do nothing until the next release

Parameters **`indev`** -- pointer to an input device

struct *_lv_obj_t* ***`lv_indev_get_obj_act`**(void)

Gets a pointer to the currently active object in the currently processed input device.

Returns pointer to currently active object or NULL if no active object

lv_timer_t ***`lv_indev_get_read_timer`**(*lv_indev_t* *indev)

Get a pointer to the indev read timer to modify its parameters with `lv_timer_...` functions.

Parameters **`indev`** -- pointer to an input device

Returns pointer to the indev read refresher timer. (NULL on error)

struct *_lv_obj_t* ***`lv_indev_search_obj`**(struct *_lv_obj_t* *obj, lv_point_t *point)

Search the most top, clickable object by a point

Parameters

- **`obj`** -- pointer to a start object, typically the screen
- **`point`** -- pointer to a point for searching the most top child

Returns pointer to the found object or NULL if there was no suitable object

struct **`lv_indev_data_t`**

#include <lv_indev.h> Data structure passed to an input driver to fill

Public Members

lv_point_t **`point`**

For LV_INDEV_TYPE_POINTER the currently pressed point

uint32_t **`key`**

For LV_INDEV_TYPE_KEYPAD the currently pressed key

uint32_t **`btn_id`**

For LV_INDEV_TYPE_BUTTON the currently pressed button

int16_t **`enc_diff`**

For LV_INDEV_TYPE_ENCODER number of steps since the previous read *lv_indev_state_t* **state**

LV_INDEV_STATE_REL or LV_INDEV_STATE_PR

bool **continue_reading**

If set to true, the read callback is invoked again

4.4 Tick interface

LVGL needs a system tick to know elapsed time for animations and other tasks.

You need to call the `lv_tick_inc(tick_period)` function periodically and provide the call period in milliseconds. For example, `lv_tick_inc(1)` when calling every millisecond.

`lv_tick_inc` should be called in a higher priority routine than `lv_task_handler()` (e.g. in an interrupt) to precisely know the elapsed milliseconds even if the execution of `lv_task_handler` takes more time.

With FreeRTOS `lv_tick_inc` can be called in `vApplicationTickHook`.

On Linux based operating systems (e.g. on Raspberry Pi) `lv_tick_inc` can be called in a thread like below:

```
void * tick_thread (void *args)
{
      while(1) {
        usleep(5*1000);   /*Sleep for 5 millisecond*/
        lv_tick_inc(5);      /*Tell LVGL that 5 milliseconds were elapsed*/
    }
}
```

4.4.1 API

Provide access to the system tick with 1 millisecond resolution

Functions

uint32_t **lv_tick_get**(void)

Get the elapsed milliseconds since start up

Returns the elapsed milliseconds

uint32_t **lv_tick_elaps**(uint32_t prev_tick)

Get the elapsed milliseconds since a previous time stamp

Parameters **prev_tick** -- a previous time stamp (return value of *lv_tick_get()*)

Returns the elapsed milliseconds since 'prev_tick'

4.5 Timer Handler

To handle the tasks of LVGL you need to call `lv_timer_handler()` periodically in one of the following:

- *while(1)* of *main()* function
- timer interrupt periodically (lower priority than `lv_tick_inc()`)
- an OS task periodically

The timing is not critical but it should be about 5 milliseconds to keep the system responsive.

Example:

```
while(1) {
  lv_timer_handler();
  my_delay_ms(5);
}
```

If you want to use `lv_timer_handler()` in a super-loop, a helper function`lv_timer_handler_run_in_period()` is provided to simplify the porting:

```
while(1) {
    ...
    lv_timer_handler_run_in_period(5); /* run lv_timer_handler() every 5ms */
    ...
}
```

In an OS environment, you can use it together with the **delay** or **sleep** provided by OS to release CPU whenever possible:

```
while (1) {
    lv_timer_handler_run_in_period(5); /* run lv_timer_handler() every 5ms */
    my_delay_ms(5);                    /* delay 5ms to avoid unnecessary polling */
}
```

To learn more about timers visit the *Timer* section.

4.6 Sleep management

The MCU can go to sleep when no user input happens. In this case, the main `while(1)` should look like this:

```
while(1) {
  /*Normal operation (no sleep) in < 1 sec inactivity*/
  if(lv_disp_get_inactive_time(NULL) < 1000) {
          lv_task_handler();
  }
  /*Sleep after 1 sec inactivity*/
  else {
          timer_stop();   /*Stop the timer where lv_tick_inc() is called*/
          sleep();        /*Sleep the MCU*/
  }
  my_delay_ms(5);
}
```

You should also add the following lines to your input device read function to signal a wake-up (press, touch or click etc.) has happened:

```
lv_tick_inc(LV_DEF_REFR_PERIOD); /*Force task execution on wake-up*/
timer_start();                   /*Restart the timer where lv_tick_inc() is called*/
lv_task_handler();               /*Call `lv_task_handler()` manually to process the␣
↪wake-up event*/
```

In addition to `lv_disp_get_inactive_time()` you can check `lv_anim_count_running()` to see if all animations have finished.

4.7 Operating system and interrupts

LVGL is **not thread-safe** by default.

However, in the following conditions it's valid to call LVGL related functions:

- In *events*. Learn more in *Events*.
- In *lv_timer*. Learn more in *Timers*.

4.7.1 Tasks and threads

If you need to use real tasks or threads, you need a mutex which should be invoked before the call of `lv_timer_handler` and released after it. Also, you have to use the same mutex in other tasks and threads around every LVGL (`lv_...`) related function call and code. This way you can use LVGL in a real multitasking environment. Just make use of a mutex to avoid the concurrent calling of LVGL functions.

Here is some pseudocode to illustrate the concept:

```
static mutex_t lvgl_mutex;

void lvgl_thread(void)
{
    while(1) {
        mutex_lock(&lvgl_mutex);
        lv_task_handler();
        mutex_unlock(&lvgl_mutex);
        thread_sleep(10); /* sleep for 10 ms */
    }
}

void other_thread(void)
{
    /* You must always hold the mutex while using LVGL APIs */
    mutex_lock(&lvgl_mutex);
    lv_obj_t *img = lv_img_create(lv_scr_act());
    mutex_unlock(&lvgl_mutex);

    while(1) {
        mutex_lock(&lvgl_mutex);
        /* change to the next image */
        lv_img_set_src(img, next_image);
        mutex_unlock(&lvgl_mutex);
        thread_sleep(2000);
    }
}
```

4.7.2 Interrupts

Try to avoid calling LVGL functions from interrupt handlers (except `lv_tick_inc()` and `lv_disp_flush_ready()`). But if you need to do this you have to disable the interrupt which uses LVGL functions while `lv_timer_handler` is running.

It's a better approach to simply set a flag or some value in the interrupt, and periodically check it in an LVGL timer (which is run by `lv_timer_handler`).

4.8 Logging

LVGL has a built-in *Log* module to inform the user about what is happening in the library.

4.8.1 Log level

To enable logging, set `LV_USE_LOG 1` in `lv_conf.h` and set `LV_LOG_LEVEL` to one of the following values:

- `LV_LOG_LEVEL_TRACE` A lot of logs to give detailed information
- `LV_LOG_LEVEL_INFO` Log important events
- `LV_LOG_LEVEL_WARN` Log if something unwanted happened but didn't cause a problem
- `LV_LOG_LEVEL_ERROR` Only critical issues, where the system may fail
- `LV_LOG_LEVEL_USER` Only user messages
- `LV_LOG_LEVEL_NONE` Do not log anything

The events which have a higher level than the set log level will be logged too. E.g. if you `LV_LOG_LEVEL_WARN`, errors will be also logged.

4.8.2 Printing logs

Logging with printf

If your system supports `printf`, you just need to enable `LV_LOG_PRINTF` in `lv_conf.h` to send the logs with `printf`.

Custom log function

If you can't use `printf` or want to use a custom function to log, you can register a "logger" callback with `lv_log_register_print_cb()`.

For example:

```
void my_log_cb(lv_log_level_t level, const char * buf)
{
  serial_send(buf, strlen(buf));
}

...
```

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```
lv_log_register_print_cb(my_log_cb);
```

4.8.3 Add logs

You can also use the log module via the `LV_LOG_TRACE/INFO/WARN/ERROR/USER(text)` or `LV_LOG(text)` functions. Here:

- `LV_LOG_TRACE/INFO/WARN/ERROR/USER(text)` append following information to your `text`
- Log Level
- __FILE__
- __LINE__
- __func__
- `LV_LOG(text)` is similar to `LV_LOG_USER` but has no extra information attached.

4.9 Add custom GPU

LVGL has a flexible and extendable draw pipeline. You can hook it to do some rendering with a GPU or even completely replace the built-in software renderer.

4.9.1 Draw context

The core structure of drawing is `lv_draw_ctx_t`. It contains a pointer to a buffer where drawing should happen and a couple of callbacks to draw rectangles, texts, and other primitives.

Fields

`lv_draw_ctx_t` has the following fields:

- `void * buf` Pointer to a buffer to draw into
- `lv_area_t * buf_area` The position and size of `buf` (absolute coordinates)
- `const lv_area_t * clip_area` The current clip area with absolute coordinates, always the same or smaller than `buf_area`. All drawings should be clipped to this area.
- `void (*draw_rect)()` Draw a rectangle with shadow, gradient, border, etc.
- `void (*draw_arc)()` Draw an arc
- `void (*draw_img_decoded)()` Draw an (A)RGB image that is already decoded by LVGL.
- `lv_res_t (*draw_img)()` Draw an image before decoding it (it bypasses LVGL's internal image decoders)
- `void (*draw_letter)()` Draw a letter
- `void (*draw_line)()` Draw a line
- `void (*draw_polygon)()` Draw a polygon
- `void (*draw_bg)()` Replace the buffer with a rect without decoration like radius or borders.

- `void (*wait_for_finish)()` Wait until all background operation are finished. (E.g. GPU operations)
- `void * user_data` Custom user data for arbitrary purpose

(For the sake of simplicity the parameters of the callbacks are not shown here.)

All `draw_*` callbacks receive a pointer to the current `draw_ctx` as their first parameter. Among the other parameters there is a descriptor that tells what to draw, e.g. for `draw_rect` it's called lv_draw_rect_dsc_t, for `lv_draw_line` it's called lv_draw_line_dsc_t, etc.

To correctly render according to a `draw_dsc` you need to be familiar with the Boxing model of LVGL and the meanings of the fields. The name and meaning of the fields are identical to name and meaning of the Style properties.

Initialization

The `lv_disp_t` has 4 fields related to the draw context:

- `lv_draw_ctx_t * draw_ctx` Pointer to the `draw_ctx` of this display
- `void (*draw_ctx_init)(struct _lv_disp_t * disp_drv, lv_draw_ctx_t * draw_ctx)` Callback to initialize a `draw_ctx`
- `void (*draw_ctx_deinit)(struct _lv_disp_t * disp_drv, lv_draw_ctx_t * draw_ctx)` Callback to de-initialize a `draw_ctx`
- `size_t draw_ctx_size` Size of the draw context structure. E.g. `sizeof(lv_draw_sw_ctx_t)`

When you ignore these fields, LVGL will set default values for callbacks and size in `lv_disp_drv_init()` based on the configuration in `lv_conf.h`. `lv_disp_drv_register()` will allocate a `draw_ctx` based on `draw_ctx_size` and call `draw_ctx_init()` on it.

However, you can overwrite the callbacks and the size values before calling `lv_disp_drv_register()`. It makes it possible to use your own `draw_ctx` with your own callbacks.

4.9.2 Software renderer

LVGL's built in software renderer extends the basic `lv_draw_ctx_t` structure and sets the draw callbacks. It looks like this:

```
typedef struct {
   /** Include the basic draw_ctx type*/
    lv_draw_ctx_t base_draw;

    /** Blend a color or image to an area*/
    void (*blend)(lv_draw_ctx_t * draw_ctx, const lv_draw_sw_blend_dsc_t * dsc);
} lv_draw_sw_ctx_t;
```

Set the draw callbacks in `draw_ctx_init()` like:

```
draw_sw_ctx->base_draw.draw_rect = lv_draw_sw_rect;
draw_sw_ctx->base_draw.draw_letter = lv_draw_sw_letter;
...
```

Blend callback

As you saw above the software renderer adds the `blend` callback field. It's a special callback related to how the software renderer works. All draw operations end up in the `blend` callback which can either fill an area or copy an image to an area by considering an optional mask.

The `lv_draw_sw_blend_dsc_t` parameter describes what and how to blend. It has the following fields:

- `const lv_area_t * blend_area` The area with absolute coordinates to draw on `draw_ctx->buf`. If `src_buf` is set, it's the coordinates of the image to blend.
- `const lv_color_t * src_buf` Pointer to an image to blend. If set, `color` is ignored. If not set fill `blend_area` with `color`
- `lv_color_t color` Fill color. Used only if `src_buf == NULL`
- `lv_opa_t * mask_buf` NULL if ignored, or an alpha mask to apply on `blend_area`
- `lv_draw_mask_res_t mask_res` The result of the previous mask operation. (`LV_DRAW_MASK_RES_...`)
- `const lv_area_t * mask_area` The area of `mask_buf` with absolute coordinates
- `lv_opa_t opa` The overall opacity
- `lv_blend_mode_t blend_mode` E.g. `LV_BLEND_MODE_ADDITIVE`

4.9.3 Extend the software renderer

New blend callback

Let's take a practical example: you would like to use your MCUs GPU for color fill operations only.

As all draw callbacks call `blend` callback to fill an area in the end only the `blend` callback needs to be overwritten.

First extend `lv_draw_sw_ctx_t`:

```
/*We don't add new fields, so just for clarity add new type*/
typedef lv_draw_sw_ctx_t my_draw_ctx_t;

void my_draw_ctx_init(lv_disp_t * drv, lv_draw_ctx_t * draw_ctx)
{
    /*Initialize the parent type first */
    lv_draw_sw_init_ctx(drv, draw_ctx);

    /*Change some callbacks*/
    my_draw_ctx_t * my_draw_ctx = (my_draw_ctx_t *)draw_ctx;

    my_draw_ctx->blend = my_draw_blend;
    my_draw_ctx->base_draw.wait_for_finish = my_gpu_wait;
}
```

After calling `lv_disp_draw_init(&drv)` you can assign the new `draw_ctx_init` callback and set `draw_ctx_size` to overwrite the defaults:

```
static lv_disp_t drv;
lv_disp_draw_init(&drv);
drv->hor_res = my_hor_res;
```

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```
drv->ver_res = my_ver_res;
drv->flush_cb = my_flush_cb;

/*New draw ctx settings*/
drv->draw_ctx_init = my_draw_ctx_init;
drv->draw_ctx_size = sizeof(my_draw_ctx_t);

lv_disp_drv_register(&drv);
```

This way when LVGL calls `blend` it will call `my_draw_blend` and we can do custom GPU operations. Here is a complete example:

```
void my_draw_blend(lv_draw_ctx_t * draw_ctx, const lv_draw_sw_blend_dsc_t * dsc)
{
    /*Let's get the blend area which is the intersection of the area to fill and the␣
↪clip area.*/
    lv_area_t blend_area;
    if(!_lv_area_intersect(&blend_area, dsc->blend_area, draw_ctx->clip_area)) return;
↪  /*Fully clipped, nothing to do*/

    /*Fill only non masked, fully opaque, normal blended and not too small areas*/
    if(dsc->src_buf == NULL && dsc->mask == NULL && dsc->opa >= LV_OPA_MAX &&
       dsc->blend_mode == LV_BLEND_MODE_NORMAL && lv_area_get_size(&blend_area) >␣
↪100) {

        /*Got the first pixel on the buffer*/
        lv_coord_t dest_stride = lv_area_get_width(draw_ctx->buf_area); /*Width of␣
↪the destination buffer*/
        lv_color_t * dest_buf = draw_ctx->buf;
        dest_buf += dest_stride * (blend_area.y1 - draw_ctx->buf_area->y1) + (blend_
↪area.x1 - draw_ctx->buf_area->x1);

        /*Make the blend area relative to the buffer*/
        lv_area_move(&blend_area, -draw_ctx->buf_area->x1, -draw_ctx->buf_area->y1);

        /*Call your custom gou fill function to fill blend_area, on dest_buf with dsc-
↪>color*/
        my_gpu_fill(dest_buf, dest_stride, &blend_area, dsc->color);
    }
    /*Fallback: the GPU doesn't support these settings. Call the SW renderer.*/
    else {
      lv_draw_sw_blend_basic(draw_ctx, dsc);
    }
}
```

The implementation of wait callback is much simpler:

```
void my_gpu_wait(lv_draw_ctx_t * draw_ctx)
{
    while(my_gpu_is_working());

    /*Call SW renderer's wait callback too*/
    lv_draw_sw_wait_for_finish(draw_ctx);
}
```

New rectangle drawer

If your MCU has a more powerful GPU that can draw e.g. rounded rectangles you can replace the original software drawer too. A custom `draw_rect` callback might look like this:

```
void my_draw_rect(lv_draw_ctx_t * draw_ctx, const lv_draw_rect_dsc_t * dsc, const lv_
↪area_t * coords)
{
  if(lv_draw_mask_is_any(coords) == false && dsc->grad == NULL && dsc->bg_img_src ==␣
↪NULL &&
     dsc->shadow_width == 0 && dsc->blend_mode = LV_BLEND_MODE_NORMAL)
  {
    /*Draw the background*/
    my_bg_drawer(draw_ctx, coords, dsc->bg_color, dsc->radius);

    /*Draw the border if any*/
    if(dsc->border_width) {
      my_border_drawer(draw_ctx, coords, dsc->border_width, dsc->border_color, dsc->
↪border_opa)
    }

    /*Draw the outline if any*/
    if(dsc->outline_width) {
      my_outline_drawer(draw_ctx, coords, dsc->outline_width, dsc->outline_color, dsc-
↪>outline_opa, dsc->outline_pad)
    }
  }
  /*Fallback*/
  else {
    lv_draw_sw_rect(draw_ctx, dsc, coords);
  }
}
```

`my_draw_rect` can fully bypass the use of `blend` callback if needed.

4.9.4 Fully custom draw engine

For example if your MCU/MPU supports a powerful vector graphics engine you might use only that instead of LVGL's SW renderer. In this case, you need to base the renderer on the basic `lv_draw_ctx_t` (instead of `lv_draw_sw_ctx_t`) and extend/initialize it as you wish.

CHAPTER

FIVE

OVERVIEW

5.1 Objects

In LVGL the **basic building blocks** of a user interface are the objects, also called *Widgets*. For example a *Button*, *Label*, *Image*, *List*, *Chart* or *Text area*.

You can see all the *Object types* here.

All objects are referenced using an `lv_obj_t` pointer as a handle. This pointer can later be used to set or get the attributes of the object.

5.1.1 Attributes

Basic attributes

All object types share some basic attributes:

- Position
- Size
- Parent
- Styles
- Event handlers
- Etc

You can set/get these attributes with `lv_obj_set_...` and `lv_obj_get_...` functions. For example:

```
/*Set basic object attributes*/
lv_obj_set_size(btn1, 100, 50);          /*Set a button's size*/
lv_obj_set_pos(btn1, 20,30);      /*Set a button's position*/
```

To see all the available functions visit the *Base object's documentation*.

Specific attributes

The object types have special attributes too. For example, a slider has

- Minimum and maximum values
- Current value

For these special attributes, every object type may have unique API functions. For example for a slider:

```
/*Set slider specific attributes*/
lv_slider_set_range(slider1, 0, 100);                                   /*Set␣
↪the min. and max. values*/
lv_slider_set_value(slider1, 40, LV_ANIM_ON);                 /*Set the current value␣
↪(position)*/
```

The API of the widgets is described in their *Documentation* but you can also check the respective header files (e.g. *widgets/lv_slider.h*)

5.1.2 Working mechanisms

Parent-child structure

A parent object can be considered as the container of its children. Every object has exactly one parent object (except screens), but a parent can have any number of children. There is no limitation for the type of the parent but there are objects which are typically a parent (e.g. button) or a child (e.g. label).

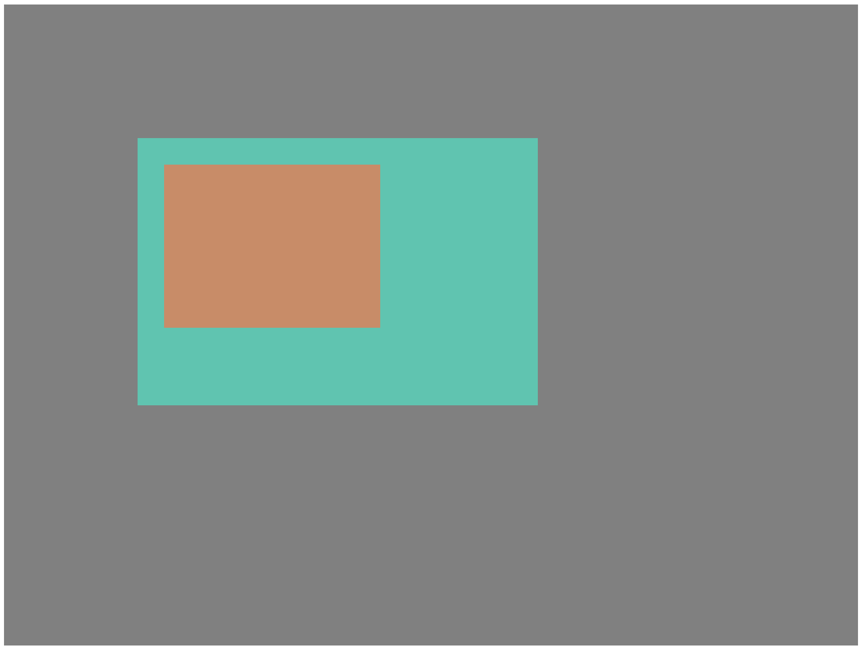
Moving together

If the position of a parent changes, the children will move along with it. Therefore, all positions are relative to the parent.

```
lv_obj_t * parent = lv_obj_create(lv_scr_act());   /*Create a parent object on the␣
↪current screen*/
lv_obj_set_size(parent, 100, 80);                      /*Set the size of the␣
↪parent*/

lv_obj_t * obj1 = lv_obj_create(parent);               /*Create an object on the␣
↪previously created parent object*/
lv_obj_set_pos(obj1, 10, 10);                          /*Set the position of the␣
↪new object*/
```

Modify the position of the parent:

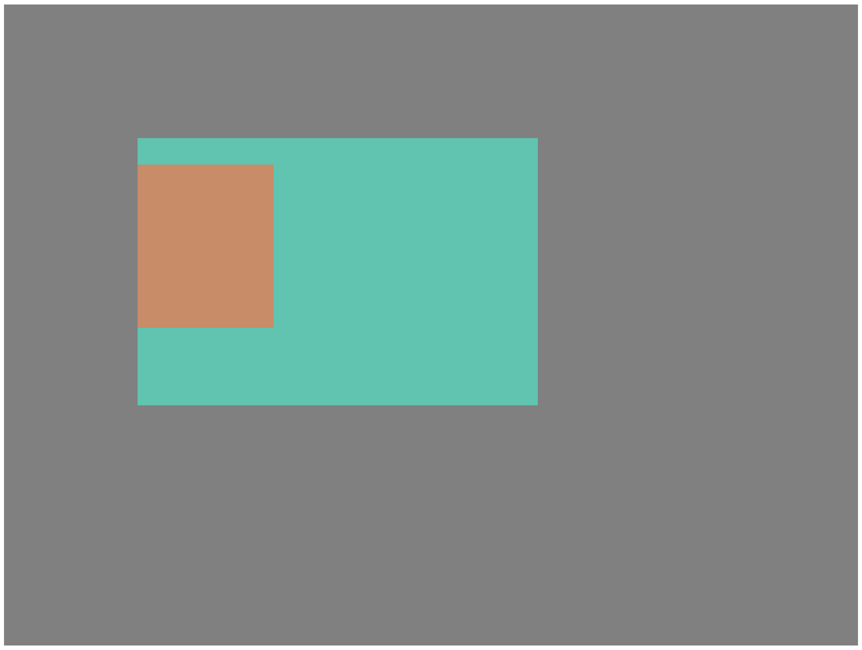


```
lv_obj_set_pos(parent, 50, 50);         /*Move the parent. The child will move with it.
↪*/
```

(For simplicity the adjusting of colors of the objects is not shown in the example.)

Visibility only on the parent

If a child is partially or fully outside its parent then the parts outside will not be visible.



```
lv_obj_set_x(obj1, -30);        /*Move the child a little bit off the parent*/
```

This behavior can be overwritten with `lv_obj_add_flag(obj, LV_OBJ_FLAG_OVERFLOW_VISIBLE);` which allow the children to be drawn out of the parent.

Create and delete objects

In LVGL, objects can be created and deleted dynamically at run time. It means only the currently created (existing) objects consume RAM.

This allows for the creation of a screen just when a button is clicked to open it, and for deletion of screens when a new screen is loaded.

UIs can be created based on the current environment of the device. For example one can create meters, charts, bars and sliders based on the currently attached sensors.

Every widget has its own **create** function with a prototype like this:

```
lv_obj_t * lv_<widget>_create(lv_obj_t * parent, <other parameters if any>);
```

Typically, the create functions only have a *parent* parameter telling them on which object to create the new widget.

The return value is a pointer to the created object with `lv_obj_t *` type.

There is a common **delete** function for all object types. It deletes the object and all of its children.

```
void lv_obj_del(lv_obj_t * obj);
```

`lv_obj_del` will delete the object immediately. If for any reason you can't delete the object immediately you can use `lv_obj_del_async(obj)` which will perform the deletion on the next call of `lv_timer_handler()`. This is useful e.g. if you want to delete the parent of an object in the child's `LV_EVENT_DELETE` handler.

You can remove all the children of an object (but not the object itself) using `lv_obj_clean(obj)`.

You can use `lv_obj_del_delayed(obj, 1000)` to delete an object after some time. The delay is expressed in milliseconds.

5.1.3 Screens

Create screens

The screens are special objects which have no parent object. So they can be created like:

```
lv_obj_t * scr1 = lv_obj_create(NULL);
```

Screens can be created with any object type. For example, a *Base object* or an image to make a wallpaper.

Get the active screen

There is always an active screen on each display. By default, the library creates and loads a "Base object" as a screen for each display.

To get the currently active screen use the `lv_scr_act()` function.

Load screens

To load a new screen, use `lv_scr_load(scr1)`.

Layers

There are two automatically generated layers:

- top layer
- system layer

They are independent of the screens and they will be shown on every screen. The *top layer* is above every object on the screen and the *system layer* is above the *top layer*. You can add any pop-up windows to the *top layer* freely. But, the *system layer* is restricted to system-level things (e.g. mouse cursor will be placed there with `lv_indev_set_cursor()`).

The `lv_layer_top()` and `lv_layer_sys()` functions return pointers to the top and system layers respectively.

Read the *Layer overview* section to learn more about layers.

Load screen with animation

A new screen can be loaded with animation by using `lv_scr_load_anim(scr, transition_type, time, delay, auto_del)`. The following transition types exist:

- `LV_SCR_LOAD_ANIM_NONE` Switch immediately after `delay` milliseconds
- `LV_SCR_LOAD_ANIM_OVER_LEFT/RIGHT/TOP/BOTTOM` Move the new screen over the current towards the given direction
- `LV_SCR_LOAD_ANIM_OUT_LEFT/RIGHT/TOP/BOTTOM` Move out the old screen over the current towards the given direction
- `LV_SCR_LOAD_ANIM_MOVE_LEFT/RIGHT/TOP/BOTTOM` Move both the current and new screens towards the given direction
- `LV_SCR_LOAD_ANIM_FADE_IN/OUT` Fade the new screen over the old screen, or vice versa

Setting `auto_del` to `true` will automatically delete the old screen when the animation is finished.

The new screen will become active (returned by `lv_scr_act()`) when the animation starts after `delay` time. All inputs are disabled during the screen animation.

Handling multiple displays

Screens are created on the currently selected *default display*. The *default display* is the last registered display with `lv_disp_drv_register`. You can also explicitly select a new default display using `lv_disp_set_default(disp)`.

`lv_scr_act()`, `lv_scr_load()` and `lv_scr_load_anim()` operate on the default screen.

Visit *Multi-display support* to learn more.

5.1.4 Parts

The widgets are built from multiple parts. For example a *Base object* uses the main and scrollbar parts but a *Slider* uses the main, indicator and knob parts. Parts are similar to *pseudo-elements* in CSS.

The following predefined parts exist in LVGL:

- `LV_PART_MAIN` A background like rectangle
- `LV_PART_SCROLLBAR` The scrollbar(s)
- `LV_PART_INDICATOR` Indicator, e.g. for slider, bar, switch, or the tick box of the checkbox
- `LV_PART_KNOB` Like a handle to grab to adjust the value
- `LV_PART_SELECTED` Indicate the currently selected option or section
- `LV_PART_ITEMS` Used if the widget has multiple similar elements (e.g. table cells)
- `LV_PART_TICKS` Ticks on scales e.g. for a chart or meter
- `LV_PART_CURSOR` Mark a specific place e.g. text area's or chart's cursor
- `LV_PART_CUSTOM_FIRST` Custom parts can be added from here.

The main purpose of parts is to allow styling the "components" of the widgets. They are described in more detail in the *Style overview* section.

5.1.5 States

The object can be in a combination of the following states:

- `LV_STATE_DEFAULT` Normal, released state
- `LV_STATE_CHECKED` Toggled or checked state
- `LV_STATE_FOCUSED` Focused via keypad or encoder or clicked via touchpad/mouse
- `LV_STATE_FOCUS_KEY` Focused via keypad or encoder but not via touchpad/mouse
- `LV_STATE_EDITED` Edit by an encoder
- `LV_STATE_HOVERED` Hovered by mouse (not supported now)
- `LV_STATE_PRESSED` Being pressed
- `LV_STATE_SCROLLED` Being scrolled

- `LV_STATE_DISABLED` Disabled state
- `LV_STATE_USER_1` Custom state
- `LV_STATE_USER_2` Custom state
- `LV_STATE_USER_3` Custom state
- `LV_STATE_USER_4` Custom state

The states are usually automatically changed by the library as the user interacts with an object (presses, releases, focuses, etc.). However, the states can be changed manually too. To set or clear given state (but leave the other states untouched) use `lv_obj_add/clear_state(obj, LV_STATE_...)` In both cases OR-ed state values can be used as well. E.g. `lv_obj_add_state(obj, part, LV_STATE_PRESSED | LV_PRESSED_CHECKED)`.

To learn more about the states read the related section of the *Style overview*.

5.1.6 Snapshot

A snapshot image can be generated for an object together with its children. Check details in *Snapshot*.

5.2 Positions, sizes, and layouts

5.2.1 Overview

Similarly to many other parts of LVGL, the concept of setting the coordinates was inspired by CSS. LVGL has by no means a complete implementation of CSS but a comparable subset is implemented (sometimes with minor adjustments).

In short this means:

- Explicitly set coordinates are stored in styles (size, position, layouts, etc.)
- support min-width, max-width, min-height, max-height
- have pixel, percentage, and "content" units
- x=0; y=0 coordinate means the top-left corner of the parent plus the left/top padding plus border width
- width/height means the full size, the "content area" is smaller with padding and border width
- a subset of flexbox and grid layouts are supported

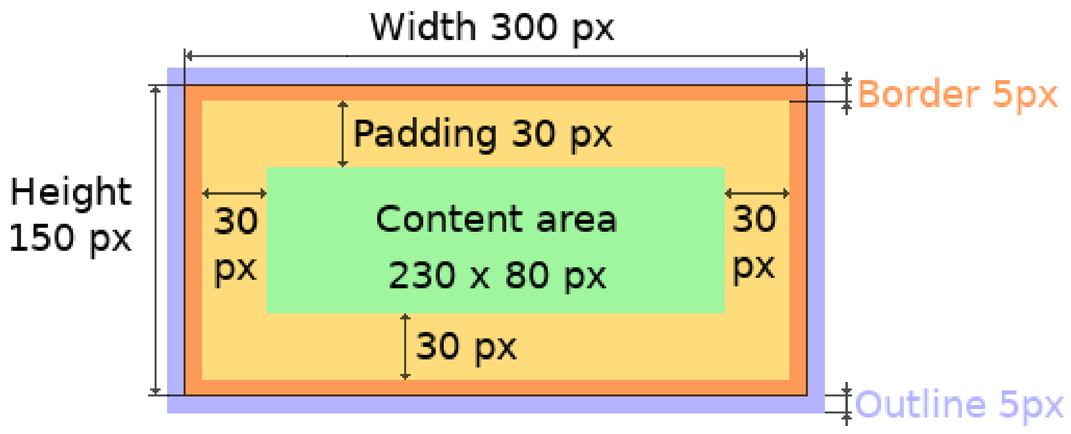
Units

- pixel: Simply a position in pixels. An integer always means pixels. E.g. `lv_obj_set_x(btn, 10)`
- percentage: The percentage of the size of the object or its parent (depending on the property). `lv_pct(value)` converts a value to percentage. E.g. `lv_obj_set_width(btn, lv_pct(50))`
- `LV_SIZE_CONTENT`: Special value to set the width/height of an object to involve all the children. It's similar to `auto` in CSS. E.g. `lv_obj_set_width(btn, LV_SIZE_CONTENT)`.

Boxing model

LVGL follows CSS's border-box model. An object's "box" is built from the following parts:

- bounding box: the width/height of the elements.
- border width: the width of the border.
- padding: space between the sides of the object and its children.
- content: the content area which is the size of the bounding box reduced by the border width and padding.



The border is drawn inside the bounding box. Inside the border LVGL keeps a "padding margin" when placing an object's children.

The outline is drawn outside the bounding box.

Important notes

This section describes special cases in which LVGL's behavior might be unexpected.

Postponed coordinate calculation

LVGL doesn't recalculate all the coordinate changes immediately. This is done to improve performance. Instead, the objects are marked as "dirty" and before redrawing the screen LVGL checks if there are any "dirty" objects. If so it refreshes their position, size and layout.

In other words, if you need to get the coordinate of an object and the coordinates were just changed, LVGL needs to be forced to recalculate the coordinates. To do this call `lv_obj_update_layout(obj)`.

The size and position might depend on the parent or layout. Therefore `lv_obj_update_layout` recalculates the coordinates of all objects on the screen of `obj`.

Removing styles

As it's described in the *Using styles* section, coordinates can also be set via style properties. To be more precise, under the hood every style coordinate related property is stored as a style property. If you use `lv_obj_set_x(obj, 20)` LVGL saves `x=20` in the local style of the object.

This is an internal mechanism and doesn't matter much as you use LVGL. However, there is one case in which you need to be aware of the implementation. If the style(s) of an object are removed by

```
lv_obj_remove_style_all(obj)
```

or

```
lv_obj_remove_style(obj, NULL, LV_PART_MAIN);
```

the earlier set coordinates will be removed as well.

For example:

```
/*The size of obj1 will be set back to the default in the end*/
lv_obj_set_size(obj1, 200, 100);  /*Now obj1 has 200;100 size*/
lv_obj_remove_style_all(obj1);    /*It removes the set sizes*/


/*obj2 will have 200;100 size in the end */
lv_obj_remove_style_all(obj2);
lv_obj_set_size(obj2, 200, 100);
```

5.2.2 Position

Simple way

To simply set the x and y coordinates of an object use:

```
lv_obj_set_x(obj, 10);        //Separate...
lv_obj_set_y(obj, 20);
lv_obj_set_pos(obj, 10, 20);         //Or in one function
```

By default, the x and y coordinates are measured from the top left corner of the parent's content area. For example if the parent has five pixels of padding on every side the above code will place `obj` at (15, 25) because the content area starts after the padding.

Percentage values are calculated from the parent's content area size.

```
lv_obj_set_x(btn, lv_pct(10)); //x = 10 % of parent content area width
```

Align

In some cases it's convenient to change the origin of the positioning from the default top left. If the origin is changed e.g. to bottom-right, the (0,0) position means: align to the bottom-right corner. To change the origin use:

```
lv_obj_set_align(obj, align);
```

To change the alignment and set new coordinates:

```
lv_obj_align(obj, align, x, y);
```

The following alignment options can be used:

- LV_ALIGN_TOP_LEFT
- LV_ALIGN_TOP_MID
- LV_ALIGN_TOP_RIGHT
- LV_ALIGN_BOTTOM_LEFT
- LV_ALIGN_BOTTOM_MID
- LV_ALIGN_BOTTOM_RIGHT
- LV_ALIGN_LEFT_MID
- LV_ALIGN_RIGHT_MID
- LV_ALIGN_CENTER

It's quite common to align a child to the center of its parent, therefore a dedicated function exists:

```
lv_obj_center(obj);

//Has the same effect
lv_obj_align(obj, LV_ALIGN_CENTER, 0, 0);
```

If the parent's size changes, the set alignment and position of the children is updated automatically.

The functions introduced above align the object to its parent. However, it's also possible to align an object to an arbitrary reference object.

```
lv_obj_align_to(obj_to_align, reference_obj, align, x, y);
```

Besides the alignments options above, the following can be used to align an object outside the reference object:

- LV_ALIGN_OUT_TOP_LEFT
- LV_ALIGN_OUT_TOP_MID
- LV_ALIGN_OUT_TOP_RIGHT
- LV_ALIGN_OUT_BOTTOM_LEFT
- LV_ALIGN_OUT_BOTTOM_MID
- LV_ALIGN_OUT_BOTTOM_RIGHT
- LV_ALIGN_OUT_LEFT_TOP
- LV_ALIGN_OUT_LEFT_MID
- LV_ALIGN_OUT_LEFT_BOTTOM
- LV_ALIGN_OUT_RIGHT_TOP

- `LV_ALIGN_OUT_RIGHT_MID`
- `LV_ALIGN_OUT_RIGHT_BOTTOM`

For example to align a label above a button and center the label horizontally:

```
lv_obj_align_to(label, btn, LV_ALIGN_OUT_TOP_MID, 0, -10);
```

Note that, unlike with `lv_obj_align()`, `lv_obj_align_to()` can not realign the object if its coordinates or the reference object's coordinates change.

5.2.3 Size

Simple way

The width and the height of an object can be set easily as well:

```
lv_obj_set_width(obj, 200);       //Separate...
lv_obj_set_height(obj, 100);
lv_obj_set_size(obj, 200, 100);         //Or in one function
```

Percentage values are calculated based on the parent's content area size. For example to set the object's height to the screen height:

```
lv_obj_set_height(obj, lv_pct(100));
```

The size settings support a special value: `LV_SIZE_CONTENT`. It means the object's size in the respective direction will be set to the size of its children. Note that only children on the right and bottom sides will be considered and children on the top and left remain cropped. This limitation makes the behavior more predictable.

Objects with `LV_OBJ_FLAG_HIDDEN` or `LV_OBJ_FLAG_FLOATING` will be ignored by the `LV_SIZE_CONTENT` calculation.

The above functions set the size of an object's bounding box but the size of the content area can be set as well. This means an object's bounding box will be enlarged with the addition of padding.

```
lv_obj_set_content_width(obj, 50); //The actual width: padding left + 50 + padding␣
↪right
lv_obj_set_content_height(obj, 30); //The actual width: padding top + 30 + padding␣
↪bottom
```

The size of the bounding box and the content area can be retrieved with the following functions:

```
lv_coord_t w = lv_obj_get_width(obj);
lv_coord_t h = lv_obj_get_height(obj);
lv_coord_t content_w = lv_obj_get_content_width(obj);
lv_coord_t content_h = lv_obj_get_content_height(obj);
```

5.2.4 Using styles

Under the hood the position, size and alignment properties are style properties. The above described "simple functions" hide the style related code for the sake of simplicity and set the position, size, and alignment properties in the local styles of the object.

However, using styles to set the coordinates has some great advantages:

- It makes it easy to set the width/height/etc. for several objects together. E.g. make all the sliders 100x10 pixels sized.
- It also makes possible to modify the values in one place.
- The values can be partially overwritten by other styles. For example `style_btn` makes the object `100x50` by default but adding `style_full_width` overwrites only the width of the object.
- The object can have different position or size depending on state. E.g. 100 px wide in `LV_STATE_DEFAULT` but 120 px in `LV_STATE_PRESSED`.
- Style transitions can be used to make the coordinate changes smooth.

Here are some examples to set an object's size using a style:

```
static lv_style_t style;
lv_style_init(&style);
lv_style_set_width(&style, 100);

lv_obj_t * btn = lv_btn_create(lv_scr_act());
lv_obj_add_style(btn, &style, LV_PART_MAIN);
```

As you will see below there are some other great features of size and position setting. However, to keep the LVGL API lean, only the most common coordinate setting features have a "simple" version and the more complex features can be used via styles.

5.2.5 Translation

Let's say the there are 3 buttons next to each other. Their position is set as described above. Now you want to move a button up a little when it's pressed.

One way to achieve this is by setting a new Y coordinate for the pressed state:

```
static lv_style_t style_normal;
lv_style_init(&style_normal);
lv_style_set_y(&style_normal, 100);

static lv_style_t style_pressed;
lv_style_init(&style_pressed);
lv_style_set_y(&style_pressed, 80);

lv_obj_add_style(btn1, &style_normal, LV_STATE_DEFAULT);
lv_obj_add_style(btn1, &style_pressed, LV_STATE_PRESSED);

lv_obj_add_style(btn2, &style_normal, LV_STATE_DEFAULT);
lv_obj_add_style(btn2, &style_pressed, LV_STATE_PRESSED);

lv_obj_add_style(btn3, &style_normal, LV_STATE_DEFAULT);
lv_obj_add_style(btn3, &style_pressed, LV_STATE_PRESSED);
```

This works, but it's not really flexible because the pressed coordinate is hard-coded. If the buttons are not at y=100, `style_pressed` won't work as expected. Translations can be used to solve this:

```
static lv_style_t style_normal;
lv_style_init(&style_normal);
lv_style_set_y(&style_normal, 100);

static lv_style_t style_pressed;
lv_style_init(&style_pressed);
lv_style_set_translate_y(&style_pressed, -20);

lv_obj_add_style(btn1, &style_normal, LV_STATE_DEFAULT);
lv_obj_add_style(btn1, &style_pressed, LV_STATE_PRESSED);

lv_obj_add_style(btn2, &style_normal, LV_STATE_DEFAULT);
lv_obj_add_style(btn2, &style_pressed, LV_STATE_PRESSED);

lv_obj_add_style(btn3, &style_normal, LV_STATE_DEFAULT);
lv_obj_add_style(btn3, &style_pressed, LV_STATE_PRESSED);
```

Translation is applied from the current position of the object.

Percentage values can be used in translations as well. The percentage is relative to the size of the object (and not to the size of the parent). For example `lv_pct(50)` will move the object with half of its width/height.

The translation is applied after the layouts are calculated. Therefore, even laid out objects' position can be translated.

The translation actually moves the object. That means it makes the scrollbars and `LV_SIZE_CONTENT` sized objects react to the position change.

5.2.6 Transformation

Similarly to position, an object's size can be changed relative to the current size as well. The transformed width and height are added on both sides of the object. This means a 10 px transformed width makes the object 2x10 pixels wider.

Unlike position translation, the size transformation doesn't make the object "really" larger. In other words scrollbars, layouts, and `LV_SIZE_CONTENT` will not react to the transformed size. Hence, size transformation is "only" a visual effect.

This code enlarges a button when it's pressed:

```
static lv_style_t style_pressed;
lv_style_init(&style_pressed);
lv_style_set_transform_width(&style_pressed, 10);
lv_style_set_transform_height(&style_pressed, 10);

lv_obj_add_style(btn, &style_pressed, LV_STATE_PRESSED);
```

Min and Max size

Similarly to CSS, LVGL also supports `min-width`, `max-width`, `min-height` and `max-height`. These are limits preventing an object's size from becoming smaller/larger than these values. They are especially useful if the size is set by percentage or `LV_SIZE_CONTENT`.

```
static lv_style_t style_max_height;
lv_style_init(&style_max_height);
lv_style_set_y(&style_max_height, 200);

lv_obj_set_height(obj, lv_pct(100));
lv_obj_add_style(obj, &style_max_height, LV_STATE_DEFAULT); //Limit the  height to␣
↪200 px
```

Percentage values can be used as well which are relative to the size of the parent's content area.

```
static lv_style_t style_max_height;
lv_style_init(&style_max_height);
lv_style_set_y(&style_max_height, lv_pct(50));

lv_obj_set_height(obj, lv_pct(100));
lv_obj_add_style(obj, &style_max_height, LV_STATE_DEFAULT); //Limit the height to␣
↪half parent height
```

5.2.7 Layout

Overview

Layouts can update the position and size of an object's children. They can be used to automatically arrange the children into a line or column, or in much more complicated forms.

The position and size set by the layout overwrites the "normal" x, y, width, and height settings.

There is only one function that is the same for every layout: `lv_obj_set_layout(obj, <LAYOUT_NAME>)` sets the layout on an object. For further settings of the parent and children see the documentation of the given layout.

Built-in layout

LVGL comes with two very powerful layouts:

- Flexbox
- Grid

Both are heavily inspired by the CSS layouts with the same name.

Flags

There are some flags that can be used on objects to affect how they behave with layouts:

- `LV_OBJ_FLAG_HIDDEN` Hidden objects are ignored in layout calculations.
- `LV_OBJ_FLAG_IGNORE_LAYOUT` The object is simply ignored by the layouts. Its coordinates can be set as usual.
- `LV_OBJ_FLAG_FLOATING` Same as `LV_OBJ_FLAG_IGNORE_LAYOUT` but the object with `LV_OBJ_FLAG_FLOATING` will be ignored in `LV_SIZE_CONTENT` calculations.

These flags can be added/removed with `lv_obj_add/clear_flag(obj, FLAG);`

Adding new layouts

LVGL can be freely extended by a custom layout like this:

```
uint32_t MY_LAYOUT;

...

MY_LAYOUT = lv_layout_register(my_layout_update, &user_data);

...

void my_layout_update(lv_obj_t * obj, void * user_data)
{
        /*Will be called automatically if it's required to reposition/resize the␣
↪children of "obj" */
}
```

Custom style properties can be added which can be retrieved and used in the update callback. For example:

```
uint32_t MY_PROP;
...

LV_STYLE_MY_PROP = lv_style_register_prop();

...
static inline void lv_style_set_my_prop(lv_style_t * style, uint32_t value)
{
    lv_style_value_t v = {
        .num = (int32_t)value
    };
    lv_style_set_prop(style, LV_STYLE_MY_PROP, v);
}
```

5.2.8 Examples

5.3 Styles

Styles are used to set the appearance of objects. Styles in lvgl are heavily inspired by CSS. The concept in a nutshell is as follows:

- A style is an `lv_style_t` variable which can hold properties like border width, text color and so on. It's similar to a `class` in CSS.
- Styles can be assigned to objects to change their appearance. Upon assignment, the target part (*pseudo-element* in CSS) and target state (*pseudo class*) can be specified. For example one can add `style_blue` to the knob of a slider when it's in pressed state.
- The same style can be used by any number of objects.
- Styles can be cascaded which means multiple styles may be assigned to an object and each style can have different properties. Therefore, not all properties have to be specified in a style. LVGL will search for a property until a style defines it or use a default if it's not specified by any of the styles. For example `style_btn` can result in a default gray button and `style_btn_red` can add only a `background-color=red` to overwrite the background color.
- The most recently added style has higher precedence. This means if a property is specified in two styles the newest style in the object will be used.
- Some properties (e.g. text color) can be inherited from a parent(s) if it's not specified in an object.
- Objects can also have local styles with higher precedence than "normal" styles.
- Unlike CSS (where pseudo-classes describe different states, e.g. `:focus`), in LVGL a property is assigned to a given state.
- Transitions can be applied when the object changes state.

5.3.1 States

The objects can be in the combination of the following states:

- `LV_STATE_DEFAULT` (0x0000) Normal, released state
- `LV_STATE_CHECKED` (0x0001) Toggled or checked state
- `LV_STATE_FOCUSED` (0x0002) Focused via keypad or encoder or clicked via touchpad/mouse
- `LV_STATE_FOCUS_KEY` (0x0004) Focused via keypad or encoder but not via touchpad/mouse
- `LV_STATE_EDITED` (0x0008) Edit by an encoder
- `LV_STATE_HOVERED` (0x0010) Hovered by mouse (not supported now)
- `LV_STATE_PRESSED` (0x0020) Being pressed
- `LV_STATE_SCROLLED` (0x0040) Being scrolled
- `LV_STATE_DISABLED` (0x0080) Disabled state
- `LV_STATE_USER_1` (0x1000) Custom state
- `LV_STATE_USER_2` (0x2000) Custom state
- `LV_STATE_USER_3` (0x4000) Custom state
- `LV_STATE_USER_4` (0x8000) Custom state

An object can be in a combination of states such as being focused and pressed at the same time. This is represented as `LV_STATE_FOCUSED | LV_STATE_PRESSED`.

A style can be added to any state or state combination. For example, setting a different background color for the default and pressed states. If a property is not defined in a state the best matching state's property will be used. Typically this means the property with `LV_STATE_DEFAULT` is used.˛ If the property is not set even for the default state the default value will be used. (See later)

But what does the "best matching state's property" really mean? States have a precedence which is shown by their value (see in the above list). A higher value means higher precedence. To determine which state's property to use let's take an example. Imagine the background color is defined like this:

- `LV_STATE_DEFAULT`: white
- `LV_STATE_PRESSED`: gray
- `LV_STATE_FOCUSED`: red

1. Initially the object is in the default state, so it's a simple case: the property is perfectly defined in the object's current state as white.
2. When the object is pressed there are 2 related properties: default with white (default is related to every state) and pressed with gray. The pressed state has 0x0020 precedence which is higher than the default state's 0x0000 precedence, so gray color will be used.
3. When the object is focused the same thing happens as in pressed state and red color will be used. (Focused state has higher precedence than default state).
4. When the object is focused and pressed both gray and red would work, but the pressed state has higher precedence than focused so gray color will be used.
5. It's possible to set e.g. rose color for `LV_STATE_PRESSED | LV_STATE_FOCUSED`. In this case, this combined state has 0x0020 + 0x0002 = 0x0022 precedence, which is higher than the pressed state's precedence so rose color would be used.
6. When the object is in the checked state there is no property to set the background color for this state. So for lack of a better option, the object remains white from the default state's property.

Some practical notes:

- The precedence (value) of states is quite intuitive, and it's something the user would expect naturally. E.g. if an object is focused the user will still want to see if it's pressed, therefore the pressed state has a higher precedence. If the focused state had a higher precedence it would overwrite the pressed color.
- If you want to set a property for all states (e.g. red background color) just set it for the default state. If the object can't find a property for its current state it will fall back to the default state's property.
- Use ORed states to describe the properties for complex cases. (E.g. pressed + checked + focused)
- It might be a good idea to use different style elements for different states. For example, finding background colors for released, pressed, checked + pressed, focused, focused + pressed, focused + pressed + checked, etc. states is quite difficult. Instead, for example, use the background color for pressed and checked states and indicate the focused state with a different border color.

5.3.2 Cascading styles

It's not required to set all the properties in one style. It's possible to add more styles to an object and have the latter added style modify or extend appearance. For example, create a general gray button style and create a new one for red buttons where only the new background color is set.

This is much like in CSS when used classes are listed like `<div class=".btn .btn-red">`.

Styles added later have precedence over ones set earlier. So in the gray/red button example above, the normal button style should be added first and the red style second. However, the precedence of the states are still taken into account. So let's examine the following case:

- the basic button style defines dark-gray color for the default state and light-gray color for the pressed state
- the red button style defines the background color as red only in the default state

In this case, when the button is released (it's in default state) it will be red because a perfect match is found in the most recently added style (red). When the button is pressed the light-gray color is a better match because it describes the current state perfectly, so the button will be light-gray.

5.3.3 Inheritance

Some properties (typically those related to text) can be inherited from the parent object's styles. Inheritance is applied only if the given property is not set in the object's styles (even in default state). In this case, if the property is inheritable, the property's value will be searched in the parents until an object specifies a value for the property. The parents will use their own state to determine the value. So if a button is pressed, and the text color comes from here, the pressed text color will be used.

5.3.4 Forced value inheritance/default value

Sometimes you may want to force a child object to use the parent's value for a given style property. To do this you can use one of the following (depending on what type of style you're using):

```
/* regular style */
lv_style_set_prop_meta(&style, LV_STYLE_TEXT_COLOR, LV_STYLE_PROP_META_INHERIT);
/* local style */
lv_obj_set_local_style_prop_meta(child, LV_STYLE_TEXT_COLOR, LV_STYLE_PROP_META_
↪INHERIT, LV_PART_MAIN);
```

This acts like a value has been set on the style, so setting the value of the property afterwards will remove the flag.

You may also want to force the default value of a property to be used, without needing to hardcode it in your application. To do this you can use the same API but with `LV_STYLE_PROP_META_INITIAL` instead. In future versions of LVGL, this will use the value based upon the current theme, but for now it just selects the internal default regardless of theme.

5.3.5 Parts

Objects can be composed of *parts* which may each have their own styles.

The following predefined parts exist in LVGL:

- `LV_PART_MAIN` A background like rectangle
- `LV_PART_SCROLLBAR` The scrollbar(s)
- `LV_PART_INDICATOR` Indicator, e.g. for slider, bar, switch, or the tick box of the checkbox
- `LV_PART_KNOB` Like a handle to grab to adjust a value
- `LV_PART_SELECTED` Indicate the currently selected option or section
- `LV_PART_ITEMS` Used if the widget has multiple similar elements (e.g. table cells)
- `LV_PART_TICKS` Ticks on scales e.g. for a chart or meter
- `LV_PART_CURSOR` Mark a specific place e.g. text area's or chart's cursor
- `LV_PART_CUSTOM_FIRST` Custom part identifiers can be added starting from here.

For example a *Slider* has three parts:

- Background
- Indicator
- Knob

This means all three parts of the slider can have their own styles. See later how to add styles to objects and parts.

5.3.6 Initialize styles and set/get properties

Styles are stored in `lv_style_t` variables. Style variables should be `static`, global or dynamically allocated. In other words they cannot be local variables in functions which are destroyed when the function exits. Before using a style it should be initialized with `lv_style_init(&my_style)`. After initializing a style, properties can be added or changed.

Property set functions looks like this: `lv_style_set_<property_name>(&style, <value>);` For example:

```
static lv_style_t style_btn;
lv_style_init(&style_btn);
lv_style_set_bg_color(&style_btn, lv_color_hex(0x115588));
lv_style_set_bg_opa(&style_btn, LV_OPA_50);
lv_style_set_border_width(&style_btn, 2);
lv_style_set_border_color(&style_btn, lv_color_black());

static lv_style_t style_btn_red;
lv_style_init(&style_btn_red);
lv_style_set_bg_color(&style_btn_red, lv_plaette_main(LV_PALETTE_RED));
lv_style_set_bg_opa(&style_btn_red, LV_OPA_COVER);
```

To remove a property use:

```
lv_style_remove_prop(&style, LV_STYLE_BG_COLOR);
```

To get a property's value from a style:

```
lv_style_value_t v;
lv_res_t res = lv_style_get_prop(&style, LV_STYLE_BG_COLOR, &v);
if(res == LV_RES_OK) {        /*Found*/
        do_something(v.color);
}
```

`lv_style_value_t` has 3 fields:

- `num` for integer, boolean and opacity properties
- `color` for color properties
- `ptr` for pointer properties

To reset a style (free all its data) use:

```
lv_style_reset(&style);
```

Styles can be built as `const` too to save RAM:

```
const lv_style_const_prop_t style1_props[] = {
   LV_STYLE_CONST_WIDTH(50),
   LV_STYLE_CONST_HEIGHT(50),
   LV_STYLE_CONST_PROPS_END
};

LV_STYLE_CONST_INIT(style1, style1_props);
```

Later `const` style can be used like any other style but (obviously) new properties can not be added.

5.3.7 Add and remove styles to a widget

A style on its own is not that useful. It must be assigned to an object to take effect.

Add styles

To add a style to an object use `lv_obj_add_style(obj, &style, <selector>)`. `<selector>` is an OR-ed value of parts and state to which the style should be added. Some examples:

- `LV_PART_MAIN | LV_STATE_DEFAULT`
- `LV_STATE_PRESSED`: The main part in pressed state. `LV_PART_MAIN` can be omitted
- `LV_PART_SCROLLBAR`: The scrollbar part in the default state. `LV_STATE_DEFAULT` can be omitted.
- `LV_PART_SCROLLBAR | LV_STATE_SCROLLED`: The scrollbar part when the object is being scrolled
- `0` Same as `LV_PART_MAIN | LV_STATE_DEFAULT`.
- `LV_PART_INDICATOR | LV_STATE_PRESSED | LV_STATE_CHECKED` The indicator part when the object is pressed and checked at the same time.

Using `lv_obj_add_style`:

```
lv_obj_add_style(btn, &style_btn, 0);                                  /
↪*Default button style*/
lv_obj_add_style(btn, &btn_red, LV_STATE_PRESSED);  /*Overwrite only some colors to␣
↪red when pressed*/
```

Replace styles

To replace a specific style of an object use `lv_obj_replace_style(obj, old_style, new_style, selector)`. This function will only replace `old_style` with `new_style` if the `selector` matches the `selector` used in `lv_obj_add_style`. Both styles, i.e. `old_style` and `new_style`, must not be `NULL` (for adding and removing separate functions exist). If the combination of `old_style` and `selector` exists multiple times in `obj`'s styles, all occurrences will be replaced. The return value of the function indicates whether at least one successful replacement took place.

Using `lv_obj_replace_style`:

```
lv_obj_add_style(btn, &style_btn, 0);                      /*Add a button style*/
lv_obj_replace_style(btn, &style_btn, &new_style_btn, 0);  /*Replace the button style␣
↪with a different one*/
```

Remove styles

To remove all styles from an object use `lv_obj_remove_style_all(obj)`.

To remove specific styles use `lv_obj_remove_style(obj, style, selector)`. This function will remove `style` only if the `selector` matches with the `selector` used in `lv_obj_add_style`. `style` can be `NULL` to check only the `selector` and remove all matching styles. The `selector` can use the `LV_STATE_ANY` and `LV_PART_ANY` values to remove the style from any state or part.

Report style changes

If a style which is already assigned to an object changes (i.e. a property is added or changed), the objects using that style should be notified. There are 3 options to do this:

1. If you know that the changed properties can be applied by a simple redraw (e.g. color or opacity changes) just call `lv_obj_invalidate(obj)` or `lv_obj_invalidate(lv_scr_act())`.
2. If more complex style properties were changed or added, and you know which object(s) are affected by that style call `lv_obj_refresh_style(obj, part, property)`. To refresh all parts and properties use `lv_obj_refresh_style(obj, LV_PART_ANY, LV_STYLE_PROP_ANY)`.
3. To make LVGL check all objects to see if they use a style and refresh them when needed, call `lv_obj_report_style_change(&style)`. If `style` is `NULL` all objects will be notified about a style change.

Get a property's value on an object

To get a final value of property - considering cascading, inheritance, local styles and transitions (see below) - property get functions like this can be used: `lv_obj_get_style_<property_name>(obj, <part>)`. These functions use the object's current state and if no better candidate exists they return a default value. For example:

```
lv_color_t color = lv_obj_get_style_bg_color(btn, LV_PART_MAIN);
```

5.3.8 Local styles

In addition to "normal" styles, objects can also store local styles. This concept is similar to inline styles in CSS (e.g. `<div style="color:red">`) with some modification.

Local styles are like normal styles, but they can't be shared among other objects. If used, local styles are allocated automatically, and freed when the object is deleted. They are useful to add local customization to an object.

Unlike in CSS, LVGL local styles can be assigned to states (*pseudo-classes*) and parts (*pseudo-elements*).

To set a local property use functions like `lv_obj_set_style_<property_name>(obj, <value>, <selector>);` For example:

```
lv_obj_set_style_bg_color(slider, lv_color_red(), LV_PART_INDICATOR | LV_STATE_
↪FOCUSED);
```

5.3.9 Properties

For the full list of style properties click *here*.

Typical background properties

In the documentation of the widgets you will see sentences like "The widget uses the typical background properties". These "typical background properties" are the ones related to:

- Background
- Border
- Outline
- Shadow
- Padding
- Width and height transformation
- X and Y translation

5.3.10 Transitions

By default, when an object changes state (e.g. it's pressed) the new properties from the new state are set immediately. However, with transitions it's possible to play an animation on state change. For example, on pressing a button its background color can be animated to the pressed color over 300 ms.

The parameters of the transitions are stored in the styles. It's possible to set

- the time of the transition
- the delay before starting the transition
- the animation path (also known as the timing or easing function)
- the properties to animate

The transition properties can be defined for each state. For example, setting a 500 ms transition time in the default state means that when the object goes to the default state a 500 ms transition time is applied. Setting a 100 ms transition time in the pressed state causes a 100 ms transition when going to the pressed state. This example configuration results in going to the pressed state quickly and then going back to default slowly.

To describe a transition an `lv_transition_dsc_t` variable needs to be initialized and added to a style:

```
/*Only its pointer is saved so must static, global or dynamically allocated */
static const lv_style_prop_t trans_props[] = {                                    LV_
↪STYLE_BG_OPA, LV_STYLE_BG_COLOR,                                                  0,
↪ /*End marker*/
};

static lv_style_transition_dsc_t trans1;
lv_style_transition_dsc_init(&trans1, trans_props, lv_anim_path_ease_out, duration_ms,
↪ delay_ms);

lv_style_set_transition(&style1, &trans1);
```

5.3.11 Opacity, Blend modes and Transformations

If the `opa`, `blend_mode`, `transform_angle`, or `transform_zoom` properties are set to their non-default value LVGL creates a snapshot about the widget and all its children in order to blend the whole widget with the set opacity, blend mode and transformation properties.

These properties have this effect only on the `MAIN` part of the widget.

The created snapshot is called "intermediate layer" or simply "layer". If only `opa` and/or `blend_mode` is set to a non-default value LVGL can build the layer from smaller chunks. The size of these chunks can be configured by the following properties in `lv_conf.h`:

- `LV_LAYER_SIMPLE_BUF_SIZE`: [bytes] the optimal target buffer size. LVGL will try to allocate this size of memory.
- `LV_LAYER_SIMPLE_FALLBACK_BUF_SIZE`: [bytes] used if `LV_LAYER_SIMPLE_BUF_SIZE` couldn't be allocated.

If transformation properties were also used the layer can not be rendered in chunks, but one larger memory needs to be allocated. The required memory depends on the angle, zoom and pivot parameters, and the size of the area to redraw, but it's never larger than the size of the widget (including the extra draw size used for shadow, outline, etc).

If the widget can fully cover the area to redraw, LVGL creates an RGB layer (which is faster to render and uses less memory). If the opposite case ARGB rendering needs to be used. A widget might not cover its area if it has radius, `bg_opa != 255`, has shadow, outline, etc.

The click area of the widget is also transformed accordingly.

5.3.12 Color filter

TODO

5.3.13 Themes

Themes are a collection of styles. If there is an active theme LVGL applies it on every created widget. This will give a default appearance to the UI which can then be modified by adding further styles.

Every display can have a different theme. For example, you could have a colorful theme on a TFT and monochrome theme on a secondary monochrome display.

To set a theme for a display, two steps are required:

1. Initialize a theme
2. Assign the initialized theme to a display.

Theme initialization functions can have different prototypes. This example shows how to set the "default" theme:

```
lv_theme_t * th = lv_theme_default_init(display,  /*Use the DPI, size, etc from this␣
↪display*/
                                        LV_COLOR_PALETTE_BLUE, LV_COLOR_PALETTE_CYAN,␣
↪  /*Primary and secondary palette*/
                                        false,    /*Light or dark mode*/
                                        &lv_font_montserrat_10, &lv_font_montserrat_
↪14, &lv_font_montserrat_18); /*Small, normal, large fonts*/

lv_disp_set_theme(display, th); /*Assign the theme to the display*/
```

The included themes are enabled in `lv_conf.h`. If the default theme is enabled by `LV_USE_THEME_DEFAULT 1` LVGL automatically initializes and sets it when a display is created.

Extending themes

Built-in themes can be extended. If a custom theme is created, a parent theme can be selected. The parent theme's styles will be added before the custom theme's styles. Any number of themes can be chained this way. E.g. default theme -> custom theme -> dark theme.

`lv_theme_set_parent(new_theme, base_theme)` extends the `base_theme` with the `new_theme`.

There is an example for it below.

5.3.14 Examples

Size styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Using the Size, Position and Padding style properties
 */
void lv_example_style_1(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_radius(&style, 5);

    /*Make a gradient*/
```

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```
    lv_style_set_width(&style, 150);
    lv_style_set_height(&style, LV_SIZE_CONTENT);

    lv_style_set_pad_ver(&style, 20);
    lv_style_set_pad_left(&style, 5);

    lv_style_set_x(&style, lv_pct(50));
    lv_style_set_y(&style, 80);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);

    lv_obj_t * label = lv_label_create(obj);
    lv_label_set_text(label, "Hello");
}

#endif
```

```
#
# Using the Size, Position and Padding style properties
#
style = lv.style_t()
style.init()
style.set_radius(5)

# Make a gradient
style.set_width(150)
style.set_height(lv.SIZE_CONTENT)

style.set_pad_ver(20)
style.set_pad_left(5)

style.set_x(lv.pct(50))
style.set_y(80)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)

label = lv.label(obj)
label.set_text("Hello")
```

Background styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Using the background style properties
 */
void lv_example_style_2(void)
{
```

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```
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_radius(&style, 5);

    /*Make a gradient*/
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    static lv_grad_dsc_t grad;
    grad.dir = LV_GRAD_DIR_VER;
    grad.stops_count = 2;
    grad.stops[0].color = lv_palette_lighten(LV_PALETTE_GREY, 1);
    grad.stops[1].color = lv_palette_main(LV_PALETTE_BLUE);

    /*Shift the gradient to the bottom*/
    grad.stops[0].frac  = 128;
    grad.stops[1].frac  = 192;

    lv_style_set_bg_grad(&style, &grad);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);
    lv_obj_center(obj);
}

#endif
```

```
#
# Using the background style properties
#
style = lv.style_t()
style.init()
style.set_radius(5)

# Make a gradient
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 1))
style.set_bg_grad_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_bg_grad_dir(lv.GRAD_DIR.VER)

# Shift the gradient to the bottom
style.set_bg_main_stop(128)
style.set_bg_grad_stop(192)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)
obj.center()
```

Border styles

```c
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Using the border style properties
 */
void lv_example_style_3(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    /*Set a background color and a radius*/
    lv_style_set_radius(&style, 10);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 1));

    /*Add border to the bottom+right*/
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_border_width(&style, 5);
    lv_style_set_border_opa(&style, LV_OPA_50);
    lv_style_set_border_side(&style, LV_BORDER_SIDE_BOTTOM | LV_BORDER_SIDE_RIGHT);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);
    lv_obj_center(obj);
}

#endif
```

```python
#
# Using the border style properties
#
style = lv.style_t()
style.init()

# Set a background color and a radius
style.set_radius(10)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 1))

# Add border to the bottom+right
style.set_border_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_border_width(5)
style.set_border_opa(lv.OPA._50)
style.set_border_side(lv.BORDER_SIDE.BOTTOM | lv.BORDER_SIDE.RIGHT)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)
obj.center()
```

Outline styles

```c
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Using the outline style properties
 */
void lv_example_style_4(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    /*Set a background color and a radius*/
    lv_style_set_radius(&style, 5);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 1));

    /*Add outline*/
    lv_style_set_outline_width(&style, 2);
    lv_style_set_outline_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_outline_pad(&style, 8);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);
    lv_obj_center(obj);
}

#endif
```

```python
#
# Using the outline style properties
#

style = lv.style_t()
style.init()

# Set a background color and a radius
style.set_radius(5)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 1))

# Add outline
style.set_outline_width(2)
style.set_outline_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_outline_pad(8)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)
obj.center()
```

Shadow styles

```c
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Using the Shadow style properties
 */
void lv_example_style_5(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    /*Set a background color and a radius*/
    lv_style_set_radius(&style, 5);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 1));

    /*Add a shadow*/
    lv_style_set_shadow_width(&style, 55);
    lv_style_set_shadow_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    //    lv_style_set_shadow_ofs_x(&style, 10);
    //    lv_style_set_shadow_ofs_y(&style, 20);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);
    lv_obj_center(obj);
}

#endif
```

```python
#
# Using the Shadow style properties
#

style = lv.style_t()
style.init()

# Set a background color and a radius
style.set_radius(5)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 1))

# Add a shadow
style.set_shadow_width(8)
style.set_shadow_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_shadow_ofs_x(10)
style.set_shadow_ofs_y(20)

# Create an object with the new style
obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)
obj.center()
```

Image styles

```c
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Using the Image style properties
 */
void lv_example_style_6(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    /*Set a background color and a radius*/
    lv_style_set_radius(&style, 5);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 3));
    lv_style_set_border_width(&style, 2);
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_BLUE));

    lv_style_set_img_recolor(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_img_recolor_opa(&style, LV_OPA_50);
    lv_style_set_transform_angle(&style, 300);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_img_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);

    LV_IMG_DECLARE(img_cogwheel_argb);
    lv_img_set_src(obj, &img_cogwheel_argb);

    lv_obj_center(obj);
}

#endif
```

```python
# Create an image from the png file
try:
    with open('../assets/img_cogwheel_argb.png', 'rb') as f:
        png_data = f.read()
except:
    print("Could not find img_cogwheel_argb.png")
    sys.exit()

img_cogwheel_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

#
# Using the Image style properties
#
style = lv.style_t()
style.init()

# Set a background color and a radius
style.set_radius(5)
```

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```
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 3))
style.set_border_width(2)
style.set_border_color(lv.palette_main(lv.PALETTE.BLUE))

style.set_img_recolor(lv.palette_main(lv.PALETTE.BLUE))
style.set_img_recolor_opa(lv.OPA._50)
# style.set_transform_angle(300)

# Create an object with the new style
obj = lv.img(lv.scr_act())
obj.add_style(style, 0)

obj.set_src(img_cogwheel_argb)

obj.center()
```

Arc styles

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/style/lv_
↪example_style_7.c
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/style/lv_
↪example_style_7.py
```

Text styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LABEL

/**
 * Using the text style properties
 */
void lv_example_style_8(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    lv_style_set_radius(&style, 5);
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_bg_color(&style, lv_palette_lighten(LV_PALETTE_GREY, 2));
    lv_style_set_border_width(&style, 2);
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_pad_all(&style, 10);

    lv_style_set_text_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_text_letter_space(&style, 5);
    lv_style_set_text_line_space(&style, 20);
    lv_style_set_text_decor(&style, LV_TEXT_DECOR_UNDERLINE);

    /*Create an object with the new style*/
    lv_obj_t * obj = lv_label_create(lv_scr_act());
```

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```
    lv_obj_add_style(obj, &style, 0);
    lv_label_set_text(obj, "Text of\n"
                      "a label");

    lv_obj_center(obj);
}

#endif
```

```
#
# Using the text style properties
#

style = lv.style_t()
style.init()

style.set_radius(5)
style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_lighten(lv.PALETTE.GREY, 3))
style.set_border_width(2)
style.set_border_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_pad_all(10)

style.set_text_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_text_letter_space(5)
style.set_text_line_space(20)
style.set_text_decor(lv.TEXT_DECOR.UNDERLINE)

# Create an object with the new style
obj = lv.label(lv.scr_act())
obj.add_style(style, 0)
obj.set_text("Text of\n"
             "a label")

obj.center()
```

Line styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LINE

/**
 * Using the line style properties
 */
void lv_example_style_9(void)
{
    static lv_style_t style;
    lv_style_init(&style);

    lv_style_set_line_color(&style, lv_palette_main(LV_PALETTE_GREY));
    lv_style_set_line_width(&style, 6);
    lv_style_set_line_rounded(&style, true);
```

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```
    /*Create an object with the new style*/
    lv_obj_t * obj = lv_line_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);

    static lv_point_t p[] = {{10, 30}, {30, 50}, {100, 0}};
    lv_line_set_points(obj, p, 3);

    lv_obj_center(obj);
}

#endif
```

```
#
# Using the line style properties
#

style = lv.style_t()
style.init()

style.set_line_color(lv.palette_main(lv.PALETTE.GREY))
style.set_line_width(6)
style.set_line_rounded(True)

# Create an object with the new style
obj = lv.line(lv.scr_act())
obj.add_style(style, 0)
p =  [ {"x":10, "y":30},
       {"x":30, "y":50},
       {"x":100, "y":0}]

obj.set_points(p, 3)

obj.center()
```

Transition

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Creating a transition
 */
void lv_example_style_10(void)
{
    static const lv_style_prop_t props[] = {LV_STYLE_BG_COLOR, LV_STYLE_BORDER_COLOR,␣
↪LV_STYLE_BORDER_WIDTH, 0};

    /* A default transition
     * Make it fast (100ms) and start with some delay (200 ms)*/
    static lv_style_transition_dsc_t trans_def;
    lv_style_transition_dsc_init(&trans_def, props, lv_anim_path_linear, 100, 200,␣
↪NULL);

    /* A special transition when going to pressed state
```

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```
     * Make it slow (500 ms) but start  without delay*/
    static lv_style_transition_dsc_t trans_pr;
    lv_style_transition_dsc_init(&trans_pr, props, lv_anim_path_linear, 500, 0, NULL);

    static lv_style_t style_def;
    lv_style_init(&style_def);
    lv_style_set_transition(&style_def, &trans_def);

    static lv_style_t style_pr;
    lv_style_init(&style_pr);
    lv_style_set_bg_color(&style_pr, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_border_width(&style_pr, 6);
    lv_style_set_border_color(&style_pr, lv_palette_darken(LV_PALETTE_RED, 3));
    lv_style_set_transition(&style_pr, &trans_pr);

    /*Create an object with the new style_pr*/
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style_def, 0);
    lv_obj_add_style(obj, &style_pr, LV_STATE_PRESSED);

    lv_obj_center(obj);
}

#endif
```

```
#
# Creating a transition
#

props = [lv.STYLE.BG_COLOR, lv.STYLE.BORDER_COLOR, lv.STYLE.BORDER_WIDTH, 0]

# A default transition
# Make it fast (100ms) and start with some delay (200 ms)

trans_def = lv.style_transition_dsc_t()
trans_def.init(props, lv.anim_t.path_linear, 100, 200, None)

# A special transition when going to pressed state
# Make it slow (500 ms) but start  without delay

trans_pr = lv.style_transition_dsc_t()
trans_pr.init(props, lv.anim_t.path_linear, 500, 0, None)

style_def = lv.style_t()
style_def.init()
style_def.set_transition(trans_def)

style_pr = lv.style_t()
style_pr.init()
style_pr.set_bg_color(lv.palette_main(lv.PALETTE.RED))
style_pr.set_border_width(6)
style_pr.set_border_color(lv.palette_darken(lv.PALETTE.RED, 3))
style_pr.set_transition(trans_pr)

# Create an object with the new style_pr
obj = lv.obj(lv.scr_act())
```

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```
obj.add_style(style_def, 0)
obj.add_style(style_pr, lv.STATE.PRESSED)

obj.center()
```

Using multiple styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Using multiple styles
 */
void lv_example_style_11(void)
{
    /*A base style*/
    static lv_style_t style_base;
    lv_style_init(&style_base);
    lv_style_set_bg_color(&style_base, lv_palette_main(LV_PALETTE_LIGHT_BLUE));
    lv_style_set_border_color(&style_base, lv_palette_darken(LV_PALETTE_LIGHT_BLUE,␣
↪3));
    lv_style_set_border_width(&style_base, 2);
    lv_style_set_radius(&style_base, 10);
    lv_style_set_shadow_width(&style_base, 10);
    lv_style_set_shadow_ofs_y(&style_base, 5);
    lv_style_set_shadow_opa(&style_base, LV_OPA_50);
    lv_style_set_text_color(&style_base, lv_color_white());
    lv_style_set_width(&style_base, 100);
    lv_style_set_height(&style_base, LV_SIZE_CONTENT);

    /*Set only the properties that should be different*/
    static lv_style_t style_warning;
    lv_style_init(&style_warning);
    lv_style_set_bg_color(&style_warning, lv_palette_main(LV_PALETTE_YELLOW));
    lv_style_set_border_color(&style_warning, lv_palette_darken(LV_PALETTE_YELLOW,␣
↪3));
    lv_style_set_text_color(&style_warning, lv_palette_darken(LV_PALETTE_YELLOW, 4));

    /*Create an object with the base style only*/
    lv_obj_t * obj_base = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj_base, &style_base, 0);
    lv_obj_align(obj_base, LV_ALIGN_LEFT_MID, 20, 0);

    lv_obj_t * label = lv_label_create(obj_base);
    lv_label_set_text(label, "Base");
    lv_obj_center(label);

    /*Create another object with the base style and earnings style too*/
    lv_obj_t * obj_warning = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj_warning, &style_base, 0);
    lv_obj_add_style(obj_warning, &style_warning, 0);
    lv_obj_align(obj_warning, LV_ALIGN_RIGHT_MID, -20, 0);

    label = lv_label_create(obj_warning);
    lv_label_set_text(label, "Warning");
```

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```
    lv_obj_center(label);
}

#endif
```

```
#
# Using multiple styles
#
# A base style

style_base = lv.style_t()
style_base.init()
style_base.set_bg_color(lv.palette_main(lv.PALETTE.LIGHT_BLUE))
style_base.set_border_color(lv.palette_darken(lv.PALETTE.LIGHT_BLUE, 3))
style_base.set_border_width(2)
style_base.set_radius(10)
style_base.set_shadow_width(10)
style_base.set_shadow_ofs_y(5)
style_base.set_shadow_opa(lv.OPA._50)
style_base.set_text_color(lv.color_white())
style_base.set_width(100)
style_base.set_height(lv.SIZE_CONTENT)

# Set only the properties that should be different
style_warning = lv.style_t()
style_warning.init()
style_warning.set_bg_color(lv.palette_main(lv.PALETTE.YELLOW))
style_warning.set_border_color(lv.palette_darken(lv.PALETTE.YELLOW, 3))
style_warning.set_text_color(lv.palette_darken(lv.PALETTE.YELLOW, 4))

# Create an object with the base style only
obj_base = lv.obj(lv.scr_act())
obj_base.add_style(style_base, 0)
obj_base.align(lv.ALIGN.LEFT_MID, 20, 0)

label = lv.label(obj_base)
label.set_text("Base")
label.center()

# Create another object with the base style and earnings style too
obj_warning = lv.obj(lv.scr_act())
obj_warning.add_style(style_base, 0)
obj_warning.add_style(style_warning, 0)
obj_warning.align(lv.ALIGN.RIGHT_MID, -20, 0)

label = lv.label(obj_warning)
label.set_text("Warning")
label.center()
```

Local styles

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Local styles
 */
void lv_example_style_12(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_bg_color(&style, lv_palette_main(LV_PALETTE_GREEN));
    lv_style_set_border_color(&style, lv_palette_lighten(LV_PALETTE_GREEN, 3));
    lv_style_set_border_width(&style, 3);

    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj, &style, 0);

    /*Overwrite the background color locally*/
    lv_obj_set_style_bg_color(obj, lv_palette_main(LV_PALETTE_ORANGE), LV_PART_MAIN);

    lv_obj_center(obj);
}

#endif
```

```
#
# Local styles
#

style = lv.style_t()
style.init()
style.set_bg_color(lv.palette_main(lv.PALETTE.GREEN))
style.set_border_color(lv.palette_lighten(lv.PALETTE.GREEN, 3))
style.set_border_width(3)

obj = lv.obj(lv.scr_act())
obj.add_style(style, 0)

# Overwrite the background color locally
obj.set_style_bg_color(lv.palette_main(lv.PALETTE.ORANGE), lv.PART.MAIN)

obj.center()
```

Add styles to parts and states

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG

/**
 * Add styles to parts and states
 */
void lv_example_style_13(void)
{
```

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```
    static lv_style_t style_indic;
    lv_style_init(&style_indic);
    lv_style_set_bg_color(&style_indic, lv_palette_lighten(LV_PALETTE_RED, 3));
    lv_style_set_bg_grad_color(&style_indic, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_bg_grad_dir(&style_indic, LV_GRAD_DIR_HOR);

    static lv_style_t style_indic_pr;
    lv_style_init(&style_indic_pr);
    lv_style_set_shadow_color(&style_indic_pr, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_shadow_width(&style_indic_pr, 10);
    lv_style_set_shadow_spread(&style_indic_pr, 3);

    /*Create an object with the new style_pr*/
    lv_obj_t * obj = lv_slider_create(lv_scr_act());
    lv_obj_add_style(obj, &style_indic, LV_PART_INDICATOR);
    lv_obj_add_style(obj, &style_indic_pr, LV_PART_INDICATOR | LV_STATE_PRESSED);
    lv_slider_set_value(obj, 70, LV_ANIM_OFF);
    lv_obj_center(obj);
}

#endif
```

```
#
# Add styles to parts and states
#

style_indic = lv.style_t()
style_indic.init()
style_indic.set_bg_color(lv.palette_lighten(lv.PALETTE.RED, 3))
style_indic.set_bg_grad_color(lv.palette_main(lv.PALETTE.RED))
style_indic.set_bg_grad_dir(lv.GRAD_DIR.HOR)

style_indic_pr = lv.style_t()
style_indic_pr.init()
style_indic_pr.set_shadow_color(lv.palette_main(lv.PALETTE.RED))
style_indic_pr.set_shadow_width(10)
style_indic_pr.set_shadow_spread(3)

# Create an object with the new style_pr
obj = lv.slider(lv.scr_act())
obj.add_style(style_indic, lv.PART.INDICATOR)
obj.add_style(style_indic_pr, lv.PART.INDICATOR | lv.STATE.PRESSED)
obj.set_value(70, lv.ANIM.OFF)
obj.center()
```

Extending the current theme

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_IMG


static lv_style_t style_btn;

/*Will be called when the styles of the base theme are already added
  to add new styles*/
static void new_theme_apply_cb(lv_theme_t * th, lv_obj_t * obj)
{
    LV_UNUSED(th);

    if(lv_obj_check_type(obj, &lv_btn_class)) {
        lv_obj_add_style(obj, &style_btn, 0);
    }
}

static void new_theme_init_and_set(void)
{
    /*Initialize the styles*/
    lv_style_init(&style_btn);
    lv_style_set_bg_color(&style_btn, lv_palette_main(LV_PALETTE_GREEN));
    lv_style_set_border_color(&style_btn, lv_palette_darken(LV_PALETTE_GREEN, 3));
    lv_style_set_border_width(&style_btn, 3);

    /*Initialize the new theme from the current theme*/
    lv_theme_t * th_act = lv_disp_get_theme(NULL);
    static lv_theme_t th_new;
    th_new = *th_act;

    /*Set the parent theme and the style apply callback for the new theme*/
    lv_theme_set_parent(&th_new, th_act);
    lv_theme_set_apply_cb(&th_new, new_theme_apply_cb);

    /*Assign the new theme to the current display*/
    lv_disp_set_theme(NULL, &th_new);
}



/**
 * Extending the current theme
 */
void lv_example_style_14(void)
{
    lv_obj_t * btn;
    lv_obj_t * label;

    btn = lv_btn_create(lv_scr_act());
    lv_obj_align(btn, LV_ALIGN_TOP_MID, 0, 20);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Original theme");

    new_theme_init_and_set();
```

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```
    btn = lv_btn_create(lv_scr_act());
    lv_obj_align(btn, LV_ALIGN_BOTTOM_MID, 0, -20);

    label = lv_label_create(btn);
    lv_label_set_text(label, "New theme");
}

#endif
```

```
# Will be called when the styles of the base theme are already added
# to add new styles


class NewTheme(lv.theme_t):
    def __init__(self):
        super().__init__()
        # Initialize the styles
        self.style_btn = lv.style_t()
        self.style_btn.init()
        self.style_btn.set_bg_color(lv.palette_main(lv.PALETTE.GREEN))
        self.style_btn.set_border_color(lv.palette_darken(lv.PALETTE.GREEN, 3))
        self.style_btn.set_border_width(3)

        # This theme is based on active theme
        th_act = lv.theme_get_from_obj(lv.scr_act())
        # This theme will be applied only after base theme is applied
        self.set_parent(th_act)


class ExampleStyle_14:

    def __init__(self):
        #
        # Extending the current theme
        #

        btn = lv.btn(lv.scr_act())
        btn.align(lv.ALIGN.TOP_MID, 0, 20)

        label = lv.label(btn)
        label.set_text("Original theme")

        self.new_theme_init_and_set()

        btn = lv.btn(lv.scr_act())
        btn.align(lv.ALIGN.BOTTOM_MID, 0, -20)

        label = lv.label(btn)
        label.set_text("New theme")

    def new_theme_apply_cb(self, th, obj):
        print(th,obj)
        if obj.get_class() == lv.btn_class:
            obj.add_style(self.th_new.style_btn, 0)
```

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```
    def new_theme_init_and_set(self):
        print("new_theme_init_and_set")
        # Initialize the new theme from the current theme
        self.th_new = NewTheme()
        self.th_new.set_apply_cb(self.new_theme_apply_cb)
        lv.disp_get_default().set_theme(self.th_new)


exampleStyle_14 = ExampleStyle_14()
```

Opacity and Transformations

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_BTN && LV_USE_LABEL



/**
 * Opacity and Transformations
 */
void lv_example_style_15(void)
{
    lv_obj_t * btn;
    lv_obj_t * label;

    /*Normal button*/
    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 40);
    lv_obj_align(btn, LV_ALIGN_CENTER, 0, -70);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Normal");
    lv_obj_center(label);

    /*Set opacity
     *The button and the label is rendered to a layer first and that layer is␣
↪blended*/
    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 40);
    lv_obj_set_style_opa(btn, LV_OPA_50, 0);
    lv_obj_align(btn, LV_ALIGN_CENTER, 0, 0);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Opa:50%");
    lv_obj_center(label);

    /*Set transformations
     *The button and the label is rendered to a layer first and that layer is␣
↪transformed*/
    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 40);
    lv_obj_set_style_transform_angle(btn, 150, 0);        /*15 deg*/
    lv_obj_set_style_transform_zoom(btn, 256 + 64, 0);   /*1.25x*/
    lv_obj_set_style_transform_pivot_x(btn, 50, 0);
    lv_obj_set_style_transform_pivot_y(btn, 20, 0);
```

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```
    lv_obj_set_style_opa(btn, LV_OPA_50, 0);
    lv_obj_align(btn, LV_ALIGN_CENTER, 0, 70);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Transf.");
    lv_obj_center(label);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/styles/lv_
↪example_style_15.py
```

5.3.15 API

Typedefs

typedef uint8_t **lv_blend_mode_t**

typedef uint8_t **lv_text_decor_t**

typedef uint8_t **lv_border_side_t**

typedef uint8_t **lv_grad_dir_t**

typedef uint8_t **lv_dither_mode_t**

typedef uint16_t **lv_style_prop_t**

typedef uint8_t **lv_style_res_t**

Enums

enum **[anonymous]**

Possible options how to blend opaque drawings

Values:

enumerator **LV_BLEND_MODE_NORMAL**

Simply mix according to the opacity value

enumerator **LV_BLEND_MODE_ADDITIVE**

Add the respective color channels

enumerator **`LV_BLEND_MODE_SUBTRACTIVE`**

Subtract the foreground from the background

enumerator **`LV_BLEND_MODE_MULTIPLY`**

Multiply the foreground and background

enumerator **`LV_BLEND_MODE_REPLACE`**

Replace background with foreground in the area

enum **`[anonymous]`**

Some options to apply decorations on texts. 'OR'ed values can be used.

Values:

enumerator **`LV_TEXT_DECOR_NONE`**

enumerator **`LV_TEXT_DECOR_UNDERLINE`**

enumerator **`LV_TEXT_DECOR_STRIKETHROUGH`**

enum **`[anonymous]`**

Selects on which sides border should be drawn 'OR'ed values can be used.

Values:

enumerator **`LV_BORDER_SIDE_NONE`**

enumerator **`LV_BORDER_SIDE_BOTTOM`**

enumerator **`LV_BORDER_SIDE_TOP`**

enumerator **`LV_BORDER_SIDE_LEFT`**

enumerator **`LV_BORDER_SIDE_RIGHT`**

enumerator **`LV_BORDER_SIDE_FULL`**

enumerator **`LV_BORDER_SIDE_INTERNAL`**

FOR matrix-like objects (e.g. Button matrix)

enum **`[anonymous]`**

The direction of the gradient.

Values:

enumerator **LV_GRAD_DIR_NONE**

No gradient (the `grad_color` property is ignored)

enumerator **LV_GRAD_DIR_VER**

Vertical (top to bottom) gradient

enumerator **LV_GRAD_DIR_HOR**

Horizontal (left to right) gradient

enum **[anonymous]**

The dithering algorithm for the gradient Depends on LV_DRAW_SW_GRADIENT_DITHER

Values:

enumerator **LV_DITHER_NONE**

No dithering, colors are just quantized to the output resolution

enumerator **LV_DITHER_ORDERED**

Ordered dithering. Faster to compute and use less memory but lower quality

enumerator **LV_DITHER_ERR_DIFF**

Error diffusion mode. Slower to compute and use more memory but give highest dither quality

enum **[anonymous]**

Enumeration of all built in style properties

Props are split into groups of 16. When adding a new prop to a group, ensure it does not overflow into the next one.

Values:

enumerator **LV_STYLE_PROP_INV**

enumerator **LV_STYLE_WIDTH**

enumerator **LV_STYLE_MIN_WIDTH**

enumerator **LV_STYLE_MAX_WIDTH**

enumerator **LV_STYLE_HEIGHT**

enumerator **LV_STYLE_MIN_HEIGHT**

enumerator **LV_STYLE_MAX_HEIGHT**

enumerator **LV_STYLE_X**

enumerator **LV_STYLE_Y**

enumerator **LV_STYLE_ALIGN**

enumerator **LV_STYLE_LAYOUT**

enumerator **LV_STYLE_RADIUS**

enumerator **LV_STYLE_PAD_TOP**

enumerator **LV_STYLE_PAD_BOTTOM**

enumerator **LV_STYLE_PAD_LEFT**

enumerator **LV_STYLE_PAD_RIGHT**

enumerator **LV_STYLE_PAD_ROW**

enumerator **LV_STYLE_PAD_COLUMN**

enumerator **LV_STYLE_BASE_DIR**

enumerator **LV_STYLE_CLIP_CORNER**

enumerator **LV_STYLE_MARGIN_TOP**

enumerator **LV_STYLE_MARGIN_BOTTOM**

enumerator **LV_STYLE_MARGIN_LEFT**

enumerator **LV_STYLE_MARGIN_RIGHT**

enumerator **LV_STYLE_BG_COLOR**

enumerator **LV_STYLE_BG_OPA**

enumerator **LV_STYLE_BG_GRAD_COLOR**

enumerator **LV_STYLE_BG_GRAD_DIR**

enumerator **LV_STYLE_BG_MAIN_STOP**

enumerator **LV_STYLE_BG_GRAD_STOP**

enumerator **LV_STYLE_BG_GRAD**

enumerator **LV_STYLE_BG_DITHER_MODE**

enumerator **LV_STYLE_BG_IMG_SRC**

enumerator **LV_STYLE_BG_IMG_OPA**

enumerator **LV_STYLE_BG_IMG_RECOLOR**

enumerator **LV_STYLE_BG_IMG_RECOLOR_OPA**

enumerator **LV_STYLE_BG_IMG_TILED**

enumerator **LV_STYLE_BORDER_COLOR**

enumerator **LV_STYLE_BORDER_OPA**

enumerator **LV_STYLE_BORDER_WIDTH**

enumerator **LV_STYLE_BORDER_SIDE**

enumerator **LV_STYLE_BORDER_POST**

enumerator **LV_STYLE_OUTLINE_WIDTH**

enumerator **LV_STYLE_OUTLINE_COLOR**

enumerator **LV_STYLE_OUTLINE_OPA**

enumerator **LV_STYLE_OUTLINE_PAD**

enumerator **LV_STYLE_SHADOW_WIDTH**

enumerator **LV_STYLE_SHADOW_OFS_X**

enumerator **LV_STYLE_SHADOW_OFS_Y**

enumerator **LV_STYLE_SHADOW_SPREAD**

enumerator **LV_STYLE_SHADOW_COLOR**

enumerator **LV_STYLE_SHADOW_OPA**

enumerator **LV_STYLE_IMG_OPA**

enumerator **LV_STYLE_IMG_RECOLOR**

enumerator **LV_STYLE_IMG_RECOLOR_OPA**

enumerator **LV_STYLE_LINE_WIDTH**

enumerator **LV_STYLE_LINE_DASH_WIDTH**

enumerator **LV_STYLE_LINE_DASH_GAP**

enumerator **LV_STYLE_LINE_ROUNDED**

enumerator **LV_STYLE_LINE_COLOR**

enumerator **LV_STYLE_LINE_OPA**

enumerator **LV_STYLE_ARC_WIDTH**

enumerator **LV_STYLE_ARC_ROUNDED**

enumerator **LV_STYLE_ARC_COLOR**

enumerator **LV_STYLE_ARC_OPA**

enumerator **LV_STYLE_ARC_IMG_SRC**

enumerator **LV_STYLE_TEXT_COLOR**

enumerator **LV_STYLE_TEXT_OPA**

enumerator **LV_STYLE_TEXT_FONT**

enumerator **LV_STYLE_TEXT_LETTER_SPACE**

enumerator **LV_STYLE_TEXT_LINE_SPACE**

enumerator **LV_STYLE_TEXT_DECOR**

enumerator **LV_STYLE_TEXT_ALIGN**

enumerator **LV_STYLE_OPA**

enumerator **LV_STYLE_COLOR_FILTER_DSC**

enumerator **LV_STYLE_COLOR_FILTER_OPA**

enumerator **LV_STYLE_ANIM**

enumerator **LV_STYLE_ANIM_TIME**

enumerator **LV_STYLE_ANIM_SPEED**

enumerator **LV_STYLE_TRANSITION**

enumerator **LV_STYLE_BLEND_MODE**

enumerator **LV_STYLE_TRANSFORM_WIDTH**

enumerator **LV_STYLE_TRANSFORM_HEIGHT**

enumerator **LV_STYLE_TRANSLATE_X**

enumerator **LV_STYLE_TRANSLATE_Y**

enumerator **LV_STYLE_TRANSFORM_ZOOM**

enumerator **LV_STYLE_TRANSFORM_ANGLE**

enumerator **LV_STYLE_TRANSFORM_PIVOT_X**

enumerator **LV_STYLE_TRANSFORM_PIVOT_Y**

enumerator **_LV_STYLE_LAST_BUILT_IN_PROP**

enumerator **_LV_STYLE_NUM_BUILT_IN_PROPS**

enumerator **LV_STYLE_PROP_ANY**

enumerator **`_LV_STYLE_PROP_CONST`**

enum **`[anonymous]`**

Values:

enumerator **`LV_STYLE_RES_NOT_FOUND`**

enumerator **`LV_STYLE_RES_FOUND`**

enumerator **`LV_STYLE_RES_INHERIT`**

Functions

`LV_EXPORT_CONST_INT``(`LV_ZOOM_NONE`)`

void **`lv_style_init`**`(`*lv_style_t* *style`)`

Initialize a style

Note: Do not call `lv_style_init` on styles that already have some properties because this function won't free the used memory, just sets a default state for the style. In other words be sure to initialize styles only once!

Parameters **`style`** -- pointer to a style to initialize

void **`lv_style_reset`**`(`*lv_style_t* *style`)`

Clear all properties from a style and free all allocated memories.

Parameters **`style`** -- pointer to a style

lv_style_prop_t **`lv_style_register_prop`**`(`uint8_t flag`)`

lv_style_prop_t **`lv_style_get_num_custom_props`**`(`void`)`

Get the number of custom properties that have been registered thus far.

bool **`lv_style_remove_prop`**`(`*lv_style_t* *style, *lv_style_prop_t* prop`)`

Remove a property from a style

Parameters

- **`style`** -- pointer to a style
- **`prop`** -- a style property ORed with a state.

Returns true: the property was found and removed; false: the property wasn't found

void **`lv_style_set_prop`**`(`*lv_style_t* *style, *lv_style_prop_t* prop, *lv_style_value_t* value`)`

Set the value of property in a style. This function shouldn't be used directly by the user. Instead use `lv_style_set_<prop_name>()`. E.g. `lv_style_set_bg_color()`

Parameters

- **`style`** -- pointer to style
- **`prop`** -- the ID of a property (e.g. `LV_STYLE_BG_COLOR`)

- **`value`** -- *`lv_style_value_t`* variable in which a field is set according to the type of `prop`

void **`lv_style_set_prop_meta`**(*lv_style_t* *style, *lv_style_prop_t* prop, uint16_t meta)

Set a special meta state for a property in a style. This function shouldn't be used directly by the user.

Parameters

- **`style`** -- pointer to style
- **`prop`** -- the ID of a property (e.g. `LV_STYLE_BG_COLOR`)
- **`meta`** -- the meta value to attach to the property in the style

lv_style_res_t **`lv_style_get_prop`**(const *lv_style_t* *style, *lv_style_prop_t* prop, *lv_style_value_t* *value)

Get the value of a property

Note: For performance reasons there are no sanity check on `style`

Parameters

- **`style`** -- pointer to a style
- **`prop`** -- the ID of a property
- **`value`** -- pointer to a *`lv_style_value_t`* variable to store the value

Returns LV_RES_INV: the property wasn't found in the style (`value` is unchanged) LV_RES_OK: the property was fond, and `value` is set accordingly

void **`lv_style_transition_dsc_init`**(*lv_style_transition_dsc_t* *tr, const *lv_style_prop_t* props[], *lv_anim_path_cb_t* path_cb, uint32_t time, uint32_t delay, void *user_data)

lv_style_value_t **`lv_style_prop_get_default`**(*lv_style_prop_t* prop)

Get the default value of a property

Parameters **`prop`** -- the ID of a property

Returns the default value

static inline *lv_style_res_t* **`lv_style_get_prop_inlined`**(const *lv_style_t* *style, *lv_style_prop_t* prop, *lv_style_value_t* *value)

Get the value of a property

Note: For performance reasons there are no sanity check on `style`

Note: This function is the same as *lv_style_get_prop* but inlined. Use it only on performance critical places

Parameters

- **`style`** -- pointer to a style
- **`prop`** -- the ID of a property
- **`value`** -- pointer to a *`lv_style_value_t`* variable to store the value

Returns LV_RES_INV: the property wasn't found in the style (`value` is unchanged) LV_RES_OK: the property was fond, and `value` is set accordingly

bool **`lv_style_is_empty`**(const *lv_style_t* *style)

Checks if a style is empty (has no properties)

Parameters **`style`** -- pointer to a style

Returns true if the style is empty

uint8_t **`_lv_style_get_prop_group`**(*lv_style_prop_t* prop)

Tell the group of a property. If the a property from a group is set in a style the (1 << group) bit of style->has_group is set. It allows early skipping the style if the property is not exists in the style at all.

Parameters **`prop`** -- a style property

Returns the group [0..7] 7 means all the custom properties with index > 112

uint8_t **`_lv_style_prop_lookup_flags`**(*lv_style_prop_t* prop)

Get the flags of a built-in or custom property.

Parameters **`prop`** -- a style property

Returns the flags of the property

static inline void **`lv_style_set_size`**(*lv_style_t* *style, lv_coord_t width, lv_coord_t height)

static inline void **`lv_style_set_pad_all`**(*lv_style_t* *style, lv_coord_t value)

static inline void **`lv_style_set_pad_hor`**(*lv_style_t* *style, lv_coord_t value)

static inline void **`lv_style_set_pad_ver`**(*lv_style_t* *style, lv_coord_t value)

static inline void **`lv_style_set_pad_gap`**(*lv_style_t* *style, lv_coord_t value)

static inline bool **`lv_style_prop_has_flag`**(*lv_style_prop_t* prop, uint8_t flag)

Check if the style property has a specified behavioral flag.

Do not pass multiple flags to this function as backwards-compatibility is not guaranteed for that.

Parameters

- **`prop`** -- Property ID
- **`flag`** -- Flag

Returns true if the flag is set for this property

Variables

const *lv_style_prop_t* **`lv_style_const_prop_id_inv`**

struct **`lv_gradient_stop_t`**

#include <lv_style.h> A gradient stop definition. This matches a color and a position in a virtual 0-255 scale.

Public Members

lv_color_t **`color`**

The stop color

uint8_t **`frac`**

The stop position in 1/255 unit

struct **`lv_grad_dsc_t`**

#include <lv_style.h> A descriptor of a gradient.

Public Members

lv_gradient_stop_t **`stops`**[LV_GRADIENT_MAX_STOPS]

A gradient stop array

uint8_t **`stops_count`**

The number of used stops in the array

lv_grad_dir_t **`dir`**

The gradient direction. Any of LV_GRAD_DIR_HOR, LV_GRAD_DIR_VER, LV_GRAD_DIR_NONE

lv_dither_mode_t **`dither`**

Whether to dither the gradient or not. Any of LV_DITHER_NONE, LV_DITHER_ORDERED, LV_DITHER_ERR_DIFF

union **`lv_style_value_t`**

#include <lv_style.h> A common type to handle all the property types in the same way.

Public Members

int32_t **`num`**

Number integer number (opacity, enums, booleans or "normal" numbers)

const void ***`ptr`**

Constant pointers (font, cone text, etc)

lv_color_t **`color`**

Colors

struct **`lv_style_transition_dsc_t`**

#include <lv_style.h> Descriptor for style transitions

Public Members

const *lv_style_prop_t* ***props***

An array with the properties to animate.

void ***user_data***

A custom user data that will be passed to the animation's user_data

lv_anim_path_cb_t **path_xcb**

A path for the animation.

uint32_t **time**

Duration of the transition in [ms]

uint32_t **delay**

Delay before the transition in [ms]

struct **lv_style_const_prop_t**

#include <lv_style.h> Descriptor of a constant style property.

Public Members

const *lv_style_prop_t* ***prop_ptr***

lv_style_value_t **value**

struct **lv_style_t**

#include <lv_style.h> Descriptor of a style (a collection of properties and values).

Public Members

uint32_t **sentinel**

lv_style_value_t **value1**

uint8_t ***values_and_props***

const *lv_style_const_prop_t* ***const_props***

union *lv_style_t*::[anonymous] **v_p**

uint16_t **prop1**

uint8_t **has_group**

uint8_t **prop_cnt**

Typedefs

typedef void (***lv_theme_apply_cb_t**)(struct *_lv_theme_t**, *lv_obj_t**)

typedef struct *_lv_theme_t* **lv_theme_t**

Functions

lv_theme_t ***lv_theme_get_from_obj**(*lv_obj_t* *obj)

Get the theme assigned to the display of the object

Parameters **obj** -- pointer to a theme object

Returns the theme of the object's display (can be NULL)

void **lv_theme_apply**(*lv_obj_t* *obj)

Apply the active theme on an object

Parameters **obj** -- pointer to an object

void **lv_theme_set_parent**(*lv_theme_t* *new_theme, *lv_theme_t* *parent)

Set a base theme for a theme. The styles from the base them will be added before the styles of the current theme. Arbitrary long chain of themes can be created by setting base themes.

Parameters

- **new_theme** -- pointer to theme which base should be set
- **parent** -- pointer to the base theme

void **lv_theme_set_apply_cb**(*lv_theme_t* *theme, *lv_theme_apply_cb_t* apply_cb)

Set an apply callback for a theme. The apply callback is used to add styles to different objects

Parameters

- **theme** -- pointer to theme which callback should be set
- **apply_cb** -- pointer to the callback

const lv_font_t ***lv_theme_get_font_small**(*lv_obj_t* *obj)

Get the small font of the theme

Parameters **obj** -- pointer to an object

Returns pointer to the font

const lv_font_t ***lv_theme_get_font_normal**(*lv_obj_t* *obj)

Get the normal font of the theme

Parameters **obj** -- pointer to an object

Returns pointer to the font

const lv_font_t ***lv_theme_get_font_large**(*lv_obj_t* *obj)

Get the subtitle font of the theme

Parameters **obj** -- pointer to an object

Returns pointer to the font

lv_color_t **lv_theme_get_color_primary**(*lv_obj_t* *obj)

Get the primary color of the theme

Parameters **obj** -- pointer to an object

Returns the color

lv_color_t **lv_theme_get_color_secondary**(*lv_obj_t* *obj)

Get the secondary color of the theme

Parameters **obj** -- pointer to an object

Returns the color

struct **_lv_theme_t**

Public Members

lv_theme_apply_cb_t **apply_cb**

struct *_lv_theme_t* ***parent**

Apply the current theme's style on top of this theme.

void ***user_data**

struct _lv_disp_t ***disp**

lv_color_t **color_primary**

lv_color_t **color_secondary**

const lv_font_t ***font_small**

const lv_font_t ***font_normal**

const lv_font_t ***font_large**

uint32_t **flags**

Functions

static inline lv_coord_t **lv_obj_get_style_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_min_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_max_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_height**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_min_height**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_max_height**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_x**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_y**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_align_t **lv_obj_get_style_align**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_transform_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_transform_height**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_translate_x**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_translate_y**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_transform_zoom**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_transform_angle**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_transform_pivot_x**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_transform_pivot_y**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_pad_top**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_pad_bottom**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_pad_left**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_pad_right**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_pad_row**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_pad_column**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_margin_top**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_margin_bottom**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_margin_left**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_margin_right**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_bg_color**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_bg_color_filtered**(const struct *_lv_obj_t* *obj, uint32_t part) static inline lv_opa_t **lv_obj_get_style_bg_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_bg_grad_color**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_bg_grad_color_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline *lv_grad_dir_t* **lv_obj_get_style_bg_grad_dir**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_bg_main_stop**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_bg_grad_stop**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline const *lv_grad_dsc_t* ***lv_obj_get_style_bg_grad**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline *lv_dither_mode_t* **lv_obj_get_style_bg_dither_mode**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline const void ***lv_obj_get_style_bg_img_src**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_bg_img_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_bg_img_recolor**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_bg_img_recolor_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_bg_img_recolor_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline bool **lv_obj_get_style_bg_img_tiled**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_border_color**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_border_color_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_border_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_border_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline *lv_border_side_t* **lv_obj_get_style_border_side**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline bool **lv_obj_get_style_border_post**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_outline_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_outline_color**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_outline_color_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_outline_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_outline_pad**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_shadow_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_shadow_ofs_x**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_shadow_ofs_y**(const struct *_lv_obj_t* *obj, uint32_t part) static inline lv_coord_t **lv_obj_get_style_shadow_spread**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_shadow_color**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_shadow_color_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_shadow_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_img_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_img_recolor**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_img_recolor_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_img_recolor_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_line_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_line_dash_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_line_dash_gap**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline bool **lv_obj_get_style_line_rounded**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_line_color**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_line_color_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_line_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_arc_width**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline bool **lv_obj_get_style_arc_rounded**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_arc_color**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_arc_color_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_arc_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline const void ***lv_obj_get_style_arc_img_src**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_text_color**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_color_t **lv_obj_get_style_text_color_filtered**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_text_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline const lv_font_t ***lv_obj_get_style_text_font**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_text_letter_space**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_text_line_space**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline *lv_text_decor_t* **lv_obj_get_style_text_decor**(const struct *_lv_obj_t* *obj, uint32_t part) static inline lv_text_align_t **lv_obj_get_style_text_align**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_radius**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline bool **lv_obj_get_style_clip_corner**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline const *lv_color_filter_dsc_t* ***lv_obj_get_style_color_filter_dsc**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_opa_t **lv_obj_get_style_color_filter_opa**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline const *lv_anim_t* ***lv_obj_get_style_anim**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline uint32_t **lv_obj_get_style_anim_time**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline uint32_t **lv_obj_get_style_anim_speed**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline const *lv_style_transition_dsc_t* ***lv_obj_get_style_transition**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline *lv_blend_mode_t* **lv_obj_get_style_blend_mode**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline uint16_t **lv_obj_get_style_layout**(const struct *_lv_obj_t* *obj, uint32_t part)

static inline lv_base_dir_t **lv_obj_get_style_base_dir**(const struct *_lv_obj_t* *obj, uint32_t part)

void **lv_obj_set_style_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_min_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_max_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_height**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_min_height**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_max_height**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_x**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_y**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_align**(struct *_lv_obj_t* *obj, lv_align_t value, lv_style_selector_t selector)

void **lv_obj_set_style_transform_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_transform_height**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_translate_x**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_translate_y**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_transform_zoom**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector) void **lv_obj_set_style_transform_angle**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_transform_pivot_x**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_transform_pivot_y**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_pad_top**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_pad_bottom**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_pad_left**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_pad_right**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_pad_row**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_pad_column**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_margin_top**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_margin_bottom**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_margin_left**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_margin_right**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_color**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_grad_color**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_grad_dir**(struct *_lv_obj_t* *obj, *lv_grad_dir_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_main_stop**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_grad_stop**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_grad**(struct *_lv_obj_t* *obj, const *lv_grad_dsc_t* *value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_dither_mode**(struct *_lv_obj_t* *obj, *lv_dither_mode_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_img_src**(struct *_lv_obj_t* *obj, const void *value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_img_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_img_recolor**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_bg_img_recolor_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector) void **lv_obj_set_style_bg_img_tiled**(struct *_lv_obj_t* *obj, bool value, lv_style_selector_t selector)

void **lv_obj_set_style_border_color**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_border_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_border_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_border_side**(struct *_lv_obj_t* *obj, *lv_border_side_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_border_post**(struct *_lv_obj_t* *obj, bool value, lv_style_selector_t selector)

void **lv_obj_set_style_outline_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_outline_color**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_outline_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_outline_pad**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_shadow_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_shadow_ofs_x**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_shadow_ofs_y**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_shadow_spread**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_shadow_color**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_shadow_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_img_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_img_recolor**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_img_recolor_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_line_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_line_dash_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_line_dash_gap**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_line_rounded**(struct *_lv_obj_t* *obj, bool value, lv_style_selector_t selector)

void **lv_obj_set_style_line_color**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_line_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_arc_width**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_arc_rounded**(struct *_lv_obj_t* *obj, bool value, lv_style_selector_t selector) void **lv_obj_set_style_arc_color**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_arc_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_arc_img_src**(struct *_lv_obj_t* *obj, const void *value, lv_style_selector_t selector)

void **lv_obj_set_style_text_color**(struct *_lv_obj_t* *obj, lv_color_t value, lv_style_selector_t selector)

void **lv_obj_set_style_text_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_text_font**(struct *_lv_obj_t* *obj, const lv_font_t *value, lv_style_selector_t selector)

void **lv_obj_set_style_text_letter_space**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_text_line_space**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_text_decor**(struct *_lv_obj_t* *obj, *lv_text_decor_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_text_align**(struct *_lv_obj_t* *obj, lv_text_align_t value, lv_style_selector_t selector)

void **lv_obj_set_style_radius**(struct *_lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_clip_corner**(struct *_lv_obj_t* *obj, bool value, lv_style_selector_t selector)

void **lv_obj_set_style_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_color_filter_dsc**(struct *_lv_obj_t* *obj, const *lv_color_filter_dsc_t* *value, lv_style_selector_t selector)

void **lv_obj_set_style_color_filter_opa**(struct *_lv_obj_t* *obj, lv_opa_t value, lv_style_selector_t selector)

void **lv_obj_set_style_anim**(struct *_lv_obj_t* *obj, const *lv_anim_t* *value, lv_style_selector_t selector)

void **lv_obj_set_style_anim_time**(struct *_lv_obj_t* *obj, uint32_t value, lv_style_selector_t selector)

void **lv_obj_set_style_anim_speed**(struct *_lv_obj_t* *obj, uint32_t value, lv_style_selector_t selector)

void **lv_obj_set_style_transition**(struct *_lv_obj_t* *obj, const *lv_style_transition_dsc_t* *value, lv_style_selector_t selector)

void **lv_obj_set_style_blend_mode**(struct *_lv_obj_t* *obj, *lv_blend_mode_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_layout**(struct *_lv_obj_t* *obj, uint16_t value, lv_style_selector_t selector)

void **lv_obj_set_style_base_dir**(struct *_lv_obj_t* *obj, lv_base_dir_t value, lv_style_selector_t selector)

Functions

void **lv_style_set_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_min_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_max_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_height**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_min_height**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_max_height**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_x**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_y**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_align**(*lv_style_t* *style, lv_align_t value)

void **lv_style_set_transform_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_transform_height**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_translate_x**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_translate_y**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_transform_zoom**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_transform_angle**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_transform_pivot_x**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_transform_pivot_y**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_pad_top**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_pad_bottom**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_pad_left**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_pad_right**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_pad_row**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_pad_column**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_margin_top**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_margin_bottom**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_margin_left**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_margin_right**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_bg_color**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_bg_opa**(*lv_style_t* *style, lv_opa_t value) void **lv_style_set_bg_grad_color**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_bg_grad_dir**(*lv_style_t* *style, *lv_grad_dir_t* value)

void **lv_style_set_bg_main_stop**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_bg_grad_stop**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_bg_grad**(*lv_style_t* *style, const *lv_grad_dsc_t* *value)

void **lv_style_set_bg_dither_mode**(*lv_style_t* *style, *lv_dither_mode_t* value)

void **lv_style_set_bg_img_src**(*lv_style_t* *style, const void *value)

void **lv_style_set_bg_img_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_bg_img_recolor**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_bg_img_recolor_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_bg_img_tiled**(*lv_style_t* *style, bool value)

void **lv_style_set_border_color**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_border_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_border_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_border_side**(*lv_style_t* *style, *lv_border_side_t* value)

void **lv_style_set_border_post**(*lv_style_t* *style, bool value)

void **lv_style_set_outline_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_outline_color**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_outline_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_outline_pad**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_shadow_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_shadow_ofs_x**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_shadow_ofs_y**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_shadow_spread**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_shadow_color**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_shadow_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_img_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_img_recolor**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_img_recolor_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_line_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_line_dash_width**(*lv_style_t* *style, lv_coord_t value) void **lv_style_set_line_dash_gap**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_line_rounded**(*lv_style_t* *style, bool value)

void **lv_style_set_line_color**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_line_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_arc_width**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_arc_rounded**(*lv_style_t* *style, bool value)

void **lv_style_set_arc_color**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_arc_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_arc_img_src**(*lv_style_t* *style, const void *value)

void **lv_style_set_text_color**(*lv_style_t* *style, lv_color_t value)

void **lv_style_set_text_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_text_font**(*lv_style_t* *style, const lv_font_t *value)

void **lv_style_set_text_letter_space**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_text_line_space**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_text_decor**(*lv_style_t* *style, *lv_text_decor_t* value)

void **lv_style_set_text_align**(*lv_style_t* *style, lv_text_align_t value)

void **lv_style_set_radius**(*lv_style_t* *style, lv_coord_t value)

void **lv_style_set_clip_corner**(*lv_style_t* *style, bool value)

void **lv_style_set_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_color_filter_dsc**(*lv_style_t* *style, const *lv_color_filter_dsc_t* *value)

void **lv_style_set_color_filter_opa**(*lv_style_t* *style, lv_opa_t value)

void **lv_style_set_anim**(*lv_style_t* *style, const *lv_anim_t* *value)

void **lv_style_set_anim_time**(*lv_style_t* *style, uint32_t value)

void **lv_style_set_anim_speed**(*lv_style_t* *style, uint32_t value)

void **lv_style_set_transition**(*lv_style_t* *style, const *lv_style_transition_dsc_t* *value)

void **lv_style_set_blend_mode**(*lv_style_t* *style, *lv_blend_mode_t* value)

void **lv_style_set_layout**(*lv_style_t* *style, uint16_t value)

void **lv_style_set_base_dir**(*lv_style_t* *style, lv_base_dir_t value)

Variables

const *lv_style_prop_t* **_lv_style_const_prop_id_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_MIN_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_MAX_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_HEIGHT**

const *lv_style_prop_t* **_lv_style_const_prop_id_MIN_HEIGHT**

const *lv_style_prop_t* **_lv_style_const_prop_id_MAX_HEIGHT**

const *lv_style_prop_t* **_lv_style_const_prop_id_X**

const *lv_style_prop_t* **_lv_style_const_prop_id_Y**

const *lv_style_prop_t* **_lv_style_const_prop_id_ALIGN**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSFORM_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSFORM_HEIGHT**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSLATE_X**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSLATE_Y**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSFORM_ZOOM**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSFORM_ANGLE**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSFORM_PIVOT_X**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSFORM_PIVOT_Y**

const *lv_style_prop_t* **_lv_style_const_prop_id_PAD_TOP**

const *lv_style_prop_t* **_lv_style_const_prop_id_PAD_BOTTOM**

const *lv_style_prop_t* **_lv_style_const_prop_id_PAD_LEFT** const *lv_style_prop_t* **_lv_style_const_prop_id_PAD_RIGHT**

const *lv_style_prop_t* **_lv_style_const_prop_id_PAD_ROW**

const *lv_style_prop_t* **_lv_style_const_prop_id_PAD_COLUMN**

const *lv_style_prop_t* **_lv_style_const_prop_id_MARGIN_TOP**

const *lv_style_prop_t* **_lv_style_const_prop_id_MARGIN_BOTTOM**

const *lv_style_prop_t* **_lv_style_const_prop_id_MARGIN_LEFT**

const *lv_style_prop_t* **_lv_style_const_prop_id_MARGIN_RIGHT**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_COLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_GRAD_COLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_GRAD_DIR**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_MAIN_STOP**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_GRAD_STOP**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_GRAD**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_DITHER_MODE**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_IMG_SRC**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_IMG_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_IMG_RECOLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_IMG_RECOLOR_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_BG_IMG_TILED**

const *lv_style_prop_t* **_lv_style_const_prop_id_BORDER_COLOR** const *lv_style_prop_t* **_lv_style_const_prop_id_BORDER_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_BORDER_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_BORDER_SIDE**

const *lv_style_prop_t* **_lv_style_const_prop_id_BORDER_POST**

const *lv_style_prop_t* **_lv_style_const_prop_id_OUTLINE_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_OUTLINE_COLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_OUTLINE_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_OUTLINE_PAD**

const *lv_style_prop_t* **_lv_style_const_prop_id_SHADOW_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_SHADOW_OFS_X**

const *lv_style_prop_t* **_lv_style_const_prop_id_SHADOW_OFS_Y**

const *lv_style_prop_t* **_lv_style_const_prop_id_SHADOW_SPREAD**

const *lv_style_prop_t* **_lv_style_const_prop_id_SHADOW_COLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_SHADOW_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_IMG_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_IMG_RECOLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_IMG_RECOLOR_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_LINE_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_LINE_DASH_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_LINE_DASH_GAP**

const *lv_style_prop_t* **_lv_style_const_prop_id_LINE_ROUNDED** const *lv_style_prop_t* **_lv_style_const_prop_id_LINE_COLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_LINE_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_ARC_WIDTH**

const *lv_style_prop_t* **_lv_style_const_prop_id_ARC_ROUNDED**

const *lv_style_prop_t* **_lv_style_const_prop_id_ARC_COLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_ARC_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_ARC_IMG_SRC**

const *lv_style_prop_t* **_lv_style_const_prop_id_TEXT_COLOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_TEXT_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_TEXT_FONT**

const *lv_style_prop_t* **_lv_style_const_prop_id_TEXT_LETTER_SPACE**

const *lv_style_prop_t* **_lv_style_const_prop_id_TEXT_LINE_SPACE**

const *lv_style_prop_t* **_lv_style_const_prop_id_TEXT_DECOR**

const *lv_style_prop_t* **_lv_style_const_prop_id_TEXT_ALIGN**

const *lv_style_prop_t* **_lv_style_const_prop_id_RADIUS**

const *lv_style_prop_t* **_lv_style_const_prop_id_CLIP_CORNER**

const *lv_style_prop_t* **_lv_style_const_prop_id_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_COLOR_FILTER_DSC**

const *lv_style_prop_t* **_lv_style_const_prop_id_COLOR_FILTER_OPA**

const *lv_style_prop_t* **_lv_style_const_prop_id_ANIM**

const *lv_style_prop_t* **_lv_style_const_prop_id_ANIM_TIME** const *lv_style_prop_t* **_lv_style_const_prop_id_ANIM_SPEED**

const *lv_style_prop_t* **_lv_style_const_prop_id_TRANSITION**

const *lv_style_prop_t* **_lv_style_const_prop_id_BLEND_MODE**

const *lv_style_prop_t* **_lv_style_const_prop_id_LAYOUT**

const *lv_style_prop_t* **_lv_style_const_prop_id_BASE_DIR**

5.4 Style properties

5.4.1 Size and position

Properties related to size, position, alignment and layout of the objects.

width

Sets the width of object. Pixel, percentage and `LV_SIZE_CONTENT` values can be used. Percentage values are relative to the width of the parent's content area.

min_width

Sets a minimal width. Pixel and percentage values can be used. Percentage values are relative to the width of the parent's content area.

max_width

Sets a maximal width. Pixel and percentage values can be used. Percentage values are relative to the width of the parent's content area.

height

Sets the height of object. Pixel, percentage and `LV_SIZE_CONTENT` can be used. Percentage values are relative to the height of the parent's content area.

min_height

Sets a minimal height. Pixel and percentage values can be used. Percentage values are relative to the width of the parent's content area.

max_height

Sets a maximal height. Pixel and percentage values can be used. Percentage values are relative to the height of the parent's content area.

x

Set the X coordinate of the object considering the set `align`. Pixel and percentage values can be used. Percentage values are relative to the width of the parent's content area.

y

Set the Y coordinate of the object considering the set `align`. Pixel and percentage values can be used. Percentage values are relative to the height of the parent's content area.

align

Set the alignment which tells from which point of the parent the X and Y coordinates should be interpreted. The possible values are: `LV_ALIGN_DEFAULT`, `LV_ALIGN_TOP_LEFT/MID/RIGHT`, `LV_ALIGN_BOTTOM_LEFT/MID/RIGHT`, `LV_ALIGN_LEFT/RIGHT_MID`, `LV_ALIGN_CENTER`. `LV_ALIGN_DEFAULT` means `LV_ALIGN_TOP_LEFT` with LTR base direction and `LV_ALIGN_TOP_RIGHT` with RTL base direction.

transform_width

Make the object wider on both sides with this value. Pixel and percentage (with `lv_pct(x)`) values can be used. Percentage values are relative to the object's width.

transform_height

Make the object higher on both sides with this value. Pixel and percentage (with `lv_pct(x)`) values can be used. Percentage values are relative to the object's height.

translate_x

Move the object with this value in X direction. Applied after layouts, aligns and other positioning. Pixel and percentage (with `lv_pct(x)`) values can be used. Percentage values are relative to the object's width.

translate_y

Move the object with this value in Y direction. Applied after layouts, aligns and other positioning. Pixel and percentage (with `lv_pct(x)`) values can be used. Percentage values are relative to the object's height.

transform_zoom

Zoom an objects. The value 256 (or `LV_ZOOM_NONE`) means normal size, 128 half size, 512 double size, and so on

transform_angle

Rotate an objects. The value is interpreted in 0.1 degree units. E.g. 450 means 45 deg.

transform_pivot_x

Set the pivot point's X coordinate for transformations. Relative to the object's top left corner'

transform_pivot_y

Set the pivot point's Y coordinate for transformations. Relative to the object's top left corner'

5.4.2 Padding

Properties to describe spacing between the parent's sides and the children and among the children. Very similar to the padding properties in HTML.

pad_top

Sets the padding on the top. It makes the content area smaller in this direction.

pad_bottom

Sets the padding on the bottom. It makes the content area smaller in this direction.

pad_left

Sets the padding on the left. It makes the content area smaller in this direction.

pad_right

Sets the padding on the right. It makes the content area smaller in this direction.

pad_row

Sets the padding between the rows. Used by the layouts.

pad_column

Sets the padding between the columns. Used by the layouts.

5.4.3 Margin

Properties to describe spacing around an object. Very similar to the margin properties in HTML.

margin_top

Sets the margin on the top. The object will keep this space from its siblings in layouts.

margin_bottom

Sets the margin on the bottom. The object will keep this space from its siblings in layouts.

margin_left

Sets the margin on the left. The object will keep this space from its siblings in layouts.

margin_right

Sets the margin on the right. The object will keep this space from its siblings in layouts.

5.4.4 Background

Properties to describe the background color and image of the objects.

bg_color

Set the background color of the object.

bg_opa

Set the opacity of the background. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

bg_grad_color

Set the gradient color of the background. Used only if `grad_dir` is not `LV_GRAD_DIR_NONE`

bg_grad_dir

Set the direction of the gradient of the background. The possible values are `LV_GRAD_DIR_NONE/HOR/VER`.

bg_main_stop

Set the point from which the background color should start for gradients. 0 means to top/left side, 255 the bottom/right side, 128 the center, and so on

bg_grad_stop

Set the point from which the background's gradient color should start. 0 means to top/left side, 255 the bottom/right side, 128 the center, and so on

bg_grad

Set the gradient definition. The pointed instance must exist while the object is alive. NULL to disable. It wraps `BG_GRAD_COLOR`, `BG_GRAD_DIR`, `BG_MAIN_STOP` and `BG_GRAD_STOP` into one descriptor and allows creating gradients with more colors too.

bg_dither_mode

Set the dithering mode of the gradient of the background. The possible values are `LV_DITHER_NONE/ORDERED/ERR_DIFF`.

bg_img_src

Set a background image. Can be a pointer to `lv_img_dsc_t`, a path to a file or an `LV_SYMBOL_...`

bg_img_opa

Set the opacity of the background image. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

bg_img_recolor

Set a color to mix to the background image.

bg_img_recolor_opa

Set the intensity of background image recoloring. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means no mixing, 255, `LV_OPA_100` or `LV_OPA_COVER` means full recoloring, other values or LV_OPA_10, LV_OPA_20, etc are interpreted proportionally.

bg_img_tiled

If enabled the background image will be tiled. The possible values are `true` or `false`.

5.4.5 Border

Properties to describe the borders

border_color

Set the color of the border

border_opa

Set the opacity of the border. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

border_width

Set hte width of the border. Only pixel values can be used.

border_side

Set only which side(s) the border should be drawn. The possible values are `LV_BORDER_SIDE_NONE/TOP/BOTTOM/LEFT/RIGHT/INTERNAL`. OR-ed values can be used as well, e.g. `LV_BORDER_SIDE_TOP | LV_BORDER_SIDE_LEFT`.

border_post

Sets whether the border should be drawn before or after the children are drawn. `true`: after children, `false`: before children

5.4.6 Outline

Properties to describe the outline. It's like a border but drawn outside of the rectangles.

outline_width

Set the width of the outline in pixels.

outline_color

Set the color of the outline.

outline_opa

Set the opacity of the outline. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

outline_pad

Set the padding of the outline, i.e. the gap between object and the outline.

5.4.7 Shadow

Properties to describe the shadow drawn under the rectangles.

shadow_width

Set the width of the shadow in pixels. The value should be >= 0.

shadow_ofs_x

Set an offset on the shadow in pixels in X direction.

shadow_ofs_y

Set an offset on the shadow in pixels in Y direction.

shadow_spread

Make the shadow calculation to use a larger or smaller rectangle as base. The value can be in pixel to make the area larger/smaller

shadow_color

Set the color of the shadow

shadow_opa

Set the opacity of the shadow. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

5.4.8 Image

Properties to describe the images

img_opa

Set the opacity of an image. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

img_recolor

Set color to mixt to the image.

img_recolor_opa

Set the intensity of the color mixing. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

5.4.9 Line

Properties to describe line-like objects

line_width

Set the width of the lines in pixel.

line_dash_width

Set the width of dashes in pixel. Note that dash works only on horizontal and vertical lines

line_dash_gap

Set the gap between dashes in pixel. Note that dash works only on horizontal and vertical lines

line_rounded

Make the end points of the lines rounded. `true`: rounded, `false`: perpendicular line ending

line_color

Set the color fo the lines.

line_opa

Set the opacity of the lines.

5.4.10 Arc

TODO

arc_width

Set the width (thickness) of the arcs in pixel.

arc_rounded

Make the end points of the arcs rounded. `true`: rounded, `false`: perpendicular line ending

arc_color

Set the color of the arc.

arc_opa

Set the opacity of the arcs.

arc_img_src

Set an image from which the arc will be masked out. It's useful to display complex effects on the arcs. Can be a pointer to `lv_img_dsc_t` or a path to a file

5.4.11 Text

Properties to describe the properties of text. All these properties are inherited.

text_color

Sets the color of the text.

text_opa

Set the opacity of the text. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

text_font

Set the font of the text (a pointer `lv_font_t *`).

text_letter_space

Set the letter space in pixels

text_line_space

Set the line space in pixels.

text_decor

Set decoration for the text. The possible values are `LV_TEXT_DECOR_NONE/UNDERLINE/STRIKETHROUGH`. OR-ed values can be used as well.

text_align

Set how to align the lines of the text. Note that it doesn't align the object itself, only the lines inside the object. The possible values are `LV_TEXT_ALIGN_LEFT/CENTER/RIGHT/AUTO`. `LV_TEXT_ALIGN_AUTO` detect the text base direction and uses left or right alignment accordingly

5.4.12 Miscellaneous

Mixed properties for various purposes.

radius

Set the radius on every corner. The value is interpreted in pixel (>= 0) or `LV_RADIUS_CIRCLE` for max. radius

clip_corner

Enable to clip the overflowed content on the rounded corner. Can be `true` or `false`.

opa

Scale down all opacity values of the object by this factor. Value 0, `LV_OPA_0` or `LV_OPA_TRANSP` means fully transparent, 255, `LV_OPA_100` or `LV_OPA_COVER` means fully covering, other values or LV_OPA_10, LV_OPA_20, etc means semi transparency.

color_filter_dsc

Mix a color to all colors of the object.

color_filter_opa

The intensity of mixing of color filter.

anim

The animation template for the object's animation. Should be a pointer to `lv_anim_t`. The animation parameters are widget specific, e.g. animation time could be the E.g. blink time of the cursor on the text area or scroll time of a roller. See the widgets' documentation to learn more.

anim_time

The animation time in milliseconds. Its meaning is widget specific. E.g. blink time of the cursor on the text area or scroll time of a roller. See the widgets' documentation to learn more.

anim_speed

The animation speed in pixel/sec. Its meaning is widget specific. E.g. scroll speed of label. See the widgets' documentation to learn more.

transition

An initialized `lv_style_transition_dsc_t` to describe a transition.

blend_mode

Describes how to blend the colors to the background. The possible values are `LV_BLEND_MODE_NORMAL/ADDITIVE/SUBTRACTIVE/MULTIPLY`

layout

Set the layout if the object. The children will be repositioned and resized according to the policies set for the layout. For the possible values see the documentation of the layouts.

base_dir

Set the base direction of the object. The possible values are `LV_BIDI_DIR_LTR/RTL/AUTO`.

5.5 Scroll

5.5.1 Overview

In LVGL scrolling works very intuitively: if an object is outside its parent content area (the size without padding), the parent becomes scrollable and scrollbar(s) will appear. That's it.

Any object can be scrollable including `lv_obj_t`, `lv_img`, `lv_btn`, `lv_meter`, etc

The object can either be scrolled horizontally or vertically in one stroke; diagonal scrolling is not possible.

Scrollbar

Mode

Scrollbars are displayed according to a configured `mode`. The following `mode`s exist:

- `LV_SCROLLBAR_MODE_OFF` Never show the scrollbars
- `LV_SCROLLBAR_MODE_ON` Always show the scrollbars
- `LV_SCROLLBAR_MODE_ACTIVE` Show scroll bars while an object is being scrolled
- `LV_SCROLLBAR_MODE_AUTO` Show scroll bars when the content is large enough to be scrolled

`lv_obj_set_scrollbar_mode(obj, LV_SCROLLBAR_MODE_...)` sets the scrollbar mode on an object.

Styling

The scrollbars have their own dedicated part, called `LV_PART_SCROLLBAR`. For example a scrollbar can turn to red like this:

```
static lv_style_t style_red;
lv_style_init(&style_red);
lv_style_set_bg_color(&style_red, lv_color_red());

...

lv_obj_add_style(obj, &style_red, LV_PART_SCROLLBAR);
```

An object goes to the `LV_STATE_SCROLLED` state while it's being scrolled. This allows adding different styles to the scrollbar or the object itself when scrolled. This code makes the scrollbar blue when the object is scrolled:

```
static lv_style_t style_blue;
lv_style_init(&style_blue);
lv_style_set_bg_color(&style_blue, lv_color_blue());

...

lv_obj_add_style(obj, &style_blue, LV_STATE_SCROLLED | LV_PART_SCROLLBAR);
```

If the base direction of the `LV_PART_SCROLLBAR` is RTL (`LV_BASE_DIR_RTL`) the vertical scrollbar will be placed on the left. Note that, the `base_dir` style property is inherited. Therefore, it can be set directly on the `LV_PART_SCROLLBAR` part of an object or on the object's or any parent's main part to make a scrollbar inherit the base direction.

`pad_left/right/top/bottom` sets the spacing around the scrollbars and `width` sets the scrollbar's width.

Events

The following events are related to scrolling:

- `LV_EVENT_SCROLL_BEGIN` Scrolling begins. The event parameter is `NULL` or an `lv_anim_t *` with a scroll animation descriptor that can be modified if required.
- `LV_EVENT_SCROLL_END` Scrolling ends.
- `LV_EVENT_SCROLL` Scroll happened. Triggered on every position change. Scroll events

5.5.2 Basic example

TODO

5.5.3 Features of scrolling

Besides, managing "normal" scrolling there are many interesting and useful additional features.

Scrollable

It's possible to make an object non-scrollable with `lv_obj_clear_flag(obj, LV_OBJ_FLAG_SCROLLABLE)`.

Non-scrollable objects can still propagate the scrolling (chain) to their parents.

The direction in which scrolling happens can be controlled by `lv_obj_set_scroll_dir(obj, LV_DIR_...)`. The following values are possible for the direction:

- `LV_DIR_TOP` only scroll up
- `LV_DIR_LEFT` only scroll left
- `LV_DIR_BOTTOM` only scroll down
- `LV_DIR_RIGHT` only scroll right
- `LV_DIR_HOR` only scroll horizontally
- `LV_DIR_VER` only scroll vertically
- `LV_DIR_ALL` scroll any directions

OR-ed values are also possible. E.g. `LV_DIR_TOP | LV_DIR_LEFT`.

Scroll chain

If an object can't be scrolled further (e.g. its content has reached the bottom-most position) additional scrolling is propagated to its parent. If the parent can be scrolled in that direction than it will be scrolled instead. It continues propagating to the grandparent and grand-grandparents as well.

The propagation on scrolling is called "scroll chaining" and it can be enabled/disabled with `LV_OBJ_FLAG_SCROLL_CHAIN_HOR/VER` flag. If chaining is disabled the propagation stops on the object and the parent(s) won't be scrolled.

Scroll momentum

When the user scrolls an object and releases it, LVGL can emulate inertial momentum for the scrolling. It's like the object was thrown and scrolling slows down smoothly.

The scroll momentum can be enabled/disabled with the `LV_OBJ_FLAG_SCROLL_MOMENTUM` flag.

Elastic scroll

Normally an object can't be scrolled past the extremeties of its content. That is the top side of the content can't be below the top side of the object.

However, with `LV_OBJ_FLAG_SCROLL_ELASTIC` a fancy effect is added when the user "over-scrolls" the content. The scrolling slows down, and the content can be scrolled inside the object. When the object is released the content scrolled in it will be animated back to the valid position.

Snapping

The children of an object can be snapped according to specific rules when scrolling ends. Children can be made snappable individually with the `LV_OBJ_FLAG_SNAPPABLE` flag.

An object can align snapped children in four ways:

- `LV_SCROLL_SNAP_NONE` Snapping is disabled. (default)
- `LV_SCROLL_SNAP_START` Align the children to the left/top side of a scrolled object
- `LV_SCROLL_SNAP_END` Align the children to the right/bottom side of a scrolled object
- `LV_SCROLL_SNAP_CENTER` Align the children to the center of a scrolled object

Snap alignment is set with `lv_obj_set_scroll_snap_x/y(obj, LV_SCROLL_SNAP_...)`:

Under the hood the following happens:

1. User scrolls an object and releases the screen
2. LVGL calculates where the scroll would end considering scroll momentum
3. LVGL finds the nearest scroll point
4. LVGL scrolls to the snap point with an animation

Scroll one

The "scroll one" feature tells LVGL to allow scrolling only one snappable child at a time. This requires making the children snappable and setting a scroll snap alignment different from `LV_SCROLL_SNAP_NONE`.

This feature can be enabled by the `LV_OBJ_FLAG_SCROLL_ONE` flag.

Scroll on focus

Imagine that there a lot of objects in a group that are on a scrollable object. Pressing the "Tab" button focuses the next object but it might be outside the visible area of the scrollable object. If the "scroll on focus" feature is enabled LVGL will automatically scroll objects to bring their children into view. The scrolling happens recursively therefore even nested scrollable objects are handled properly. The object will be scrolled into view even if it's on a different page of a tabview.

5.5.4 Scroll manually

The following API functions allow manual scrolling of objects:

- `lv_obj_scroll_by(obj, x, y, LV_ANIM_ON/OFF)` scroll by `x` and `y` values
- `lv_obj_scroll_to(obj, x, y, LV_ANIM_ON/OFF)` scroll to bring the given coordinate to the top left corner
- `lv_obj_scroll_to_x(obj, x, LV_ANIM_ON/OFF)` scroll to bring the given coordinate to the left side
- `lv_obj_scroll_to_y(obj, y, LV_ANIM_ON/OFF)` scroll to bring the given coordinate to the top side

From time to time you may need to retrieve the scroll position of an element, either to restore it later, or to display dynamically some elements according to the current scroll. Here is an example to see how to combine scroll event and store the scroll top position.

```
static int scroll_value = 0;

static void store_scroll_value_event_cb(lv_event_t* e) {
  lv_obj_t* screen = lv_event_get_target(e);
  scroll_value = lv_obj_get_scroll_top(screen);
  printf("%d pixels are scrolled out on the top\n", scroll_value);
}

lv_obj_t* container = lv_obj_create(NULL);
lv_obj_add_event(container, store_scroll_value_event_cb, LV_EVENT_SCROLL, NULL);
```

Scrool coordinates can be retrieve from differents axes with these functions:

- `lv_obj_get_scroll_x(obj)` Get the `x` coordinate of object
- `lv_obj_get_scroll_y(obj)` Get the `y` coordinate of object
- `lv_obj_get_scroll_top(obj)` Get the scroll coordinate from the top
- `lv_obj_get_scroll_bottom(obj)` Get the scroll coordinate from the bottom
- `lv_obj_get_scroll_left(obj)` Get the scroll coordinate from the left
- `lv_obj_get_scroll_right(obj)` Get the scroll coordinate from the right

5.5.5 Self size

Self size is a property of an object. Normally, the user shouldn't use this parameter but if a custom widget is created it might be useful.

In short, self size establishes the size of an object's content. To understand it better take the example of a table. Let's say it has 10 rows each with 50 px height. So the total height of the content is 500 px. In other words the "self height" is 500 px. If the user sets only 200 px height for the table LVGL will see that the self size is larger and make the table scrollable.

This means not only the children can make an object scrollable but a larger self size will too.

LVGL uses the `LV_EVENT_GET_SELF_SIZE` event to get the self size of an object. Here is an example to see how to handle the event:

```
if(event_code == LV_EVENT_GET_SELF_SIZE) {
        lv_point_t * p = lv_event_get_param(e);

  //If x or y < 0 then it doesn't neesd to be calculated now
  if(p->x >= 0) {
    p->x = 200;        //Set or calculate the self width
  }

  if(p->y >= 0) {
    p->y = 50;        //Set or calculate the self height
  }
}
```

5.5.6 Examples

Nested scrolling

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES

/**
 * Demonstrate how scrolling appears automatically
 */
void lv_example_scroll_1(void)
{
    /*Create an object with the new style*/
    lv_obj_t * panel = lv_obj_create(lv_scr_act());
    lv_obj_set_size(panel, 200, 200);
    lv_obj_center(panel);

    lv_obj_t * child;
    lv_obj_t * label;

    child = lv_obj_create(panel);
    lv_obj_set_pos(child, 0, 0);
    lv_obj_set_size(child, 70, 70);
    label = lv_label_create(child);
    lv_label_set_text(label, "Zero");
    lv_obj_center(label);

    child = lv_obj_create(panel);
    lv_obj_set_pos(child, 160, 80);
    lv_obj_set_size(child, 80, 80);

    lv_obj_t * child2 = lv_btn_create(child);
    lv_obj_set_size(child2, 100, 50);

    label = lv_label_create(child2);
    lv_label_set_text(label, "Right");
    lv_obj_center(label);

    child = lv_obj_create(panel);
    lv_obj_set_pos(child, 40, 160);
    lv_obj_set_size(child, 100, 70);
    label = lv_label_create(child);
    lv_label_set_text(label, "Bottom");
    lv_obj_center(label);
}

#endif
```

```
#
# Demonstrate how scrolling appears automatically
#
# Create an object with the new style
panel = lv.obj(lv.scr_act())
panel.set_size(200, 200)
panel.center()

child = lv.obj(panel)
```

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```
child.set_pos(0, 0)
label = lv.label(child)
label.set_text("Zero")
label.center()

child = lv.obj(panel)
child.set_pos(-40, 100)
label = lv.label(child)
label.set_text("Left")
label.center()

child = lv.obj(panel)
child.set_pos(90, -30)
label = lv.label(child)
label.set_text("Top")
label.center()

child = lv.obj(panel)
child.set_pos(150, 80)
label = lv.label(child)
label.set_text("Right")
label.center()

child = lv.obj(panel)
child.set_pos(60, 170)
label = lv.label(child)
label.set_text("Bottom")
label.center()
```

Snapping

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_FLEX

static void sw_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * sw = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        lv_obj_t * list = lv_event_get_user_data(e);

        if(lv_obj_has_state(sw, LV_STATE_CHECKED)) lv_obj_add_flag(list, LV_OBJ_FLAG_
↪SCROLL_ONE);
        else lv_obj_clear_flag(list, LV_OBJ_FLAG_SCROLL_ONE);
    }
}

/**
 * Show an example to scroll snap
 */
void lv_example_scroll_2(void)
{
    lv_obj_t * panel = lv_obj_create(lv_scr_act());
```

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```
    lv_obj_set_size(panel, 280, 120);
    lv_obj_set_scroll_snap_x(panel, LV_SCROLL_SNAP_CENTER);
    lv_obj_set_flex_flow(panel, LV_FLEX_FLOW_ROW);
    lv_obj_align(panel, LV_ALIGN_CENTER, 0, 20);

    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_obj_t * btn = lv_btn_create(panel);
        lv_obj_set_size(btn, 150, lv_pct(100));

        lv_obj_t * label = lv_label_create(btn);
        if(i == 3) {
            lv_label_set_text_fmt(label, "Panel %"LV_PRIu32"\nno snap", i);
            lv_obj_clear_flag(btn, LV_OBJ_FLAG_SNAPPABLE);
        }
        else {
            lv_label_set_text_fmt(label, "Panel %"LV_PRIu32, i);
        }

        lv_obj_center(label);
    }
    lv_obj_update_snap(panel, LV_ANIM_ON);

#if LV_USE_SWITCH
    /*Switch between "One scroll" and "Normal scroll" mode*/
    lv_obj_t * sw = lv_switch_create(lv_scr_act());
    lv_obj_align(sw, LV_ALIGN_TOP_RIGHT, -20, 10);
    lv_obj_add_event(sw, sw_event_cb, LV_EVENT_ALL, panel);
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "One scroll");
    lv_obj_align_to(label, sw, LV_ALIGN_OUT_BOTTOM_MID, 0, 5);
#endif
}

#endif
```

```
def sw_event_cb(e,panel):

    code = e.get_code()
    sw = e.get_target_obj()

    if code == lv.EVENT.VALUE_CHANGED:

        if sw.has_state(lv.STATE.CHECKED):
            panel.add_flag(lv.obj.FLAG.SCROLL_ONE)
        else:
            panel.clear_flag(lv.obj.FLAG.SCROLL_ONE)


#
# Show an example to scroll snap
#

panel = lv.obj(lv.scr_act())
panel.set_size(280, 150)
panel.set_scroll_snap_x(lv.SCROLL_SNAP.CENTER)
```

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```
panel.set_flex_flow(lv.FLEX_FLOW.ROW)
panel.center()

for i in range(10):
    btn = lv.btn(panel)
    btn.set_size(150, 100)

    label = lv.label(btn)
    if i == 3:
        label.set_text("Panel {:d}\nno snap".format(i))
        btn.clear_flag(lv.obj.FLAG.SNAPPABLE)
    else:
        label.set_text("Panel {:d}".format(i))
    label.center()

panel.update_snap(lv.ANIM.ON)


# Switch between "One scroll" and "Normal scroll" mode
sw = lv.switch(lv.scr_act())
sw.align(lv.ALIGN.TOP_RIGHT, -20, 10)
sw.add_event(lambda evt:  sw_event_cb(evt,panel), lv.EVENT.ALL, None)
label = lv.label(lv.scr_act())
label.set_text("One scroll")
label.align_to(sw, lv.ALIGN.OUT_BOTTOM_MID, 0, 5)
```

Floating button

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LIST

static uint32_t btn_cnt = 1;

static void float_btn_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * float_btn = lv_event_get_target(e);

    if(code == LV_EVENT_CLICKED) {
        lv_obj_t * list = lv_event_get_user_data(e);
        char buf[32];
        lv_snprintf(buf, sizeof(buf), "Track %d", (int)btn_cnt);
        lv_obj_t * list_btn = lv_list_add_btn(list, LV_SYMBOL_AUDIO, buf);
        btn_cnt++;

        lv_obj_move_foreground(float_btn);

        lv_obj_scroll_to_view(list_btn, LV_ANIM_ON);
    }
}

/**
 * Create a list with a floating button
```

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```
 */
void lv_example_scroll_3(void)
{
    lv_obj_t * list = lv_list_create(lv_scr_act());
    lv_obj_set_size(list, 280, 220);
    lv_obj_center(list);

    for(btn_cnt = 1; btn_cnt <= 2; btn_cnt++) {
        char buf[32];
        lv_snprintf(buf, sizeof(buf), "Track %d", (int)btn_cnt);
        lv_list_add_btn(list, LV_SYMBOL_AUDIO, buf);
    }

    lv_obj_t * float_btn = lv_btn_create(list);
    lv_obj_set_size(float_btn, 50, 50);
    lv_obj_add_flag(float_btn, LV_OBJ_FLAG_FLOATING);
    lv_obj_align(float_btn, LV_ALIGN_BOTTOM_RIGHT, 0, -lv_obj_get_style_pad_
↪right(list, LV_PART_MAIN));
    lv_obj_add_event(float_btn, float_btn_event_cb, LV_EVENT_ALL, list);
    lv_obj_set_style_radius(float_btn, LV_RADIUS_CIRCLE, 0);
    lv_obj_set_style_bg_img_src(float_btn, LV_SYMBOL_PLUS, 0);
    lv_obj_set_style_text_font(float_btn, lv_theme_get_font_large(float_btn), 0);
}

#endif
```

```
class ScrollExample_3():
    def __init__(self):
        self.btn_cnt = 1
        #
        # Create a list with a floating button
        #

        list = lv.list(lv.scr_act())
        list.set_size(280, 220)
        list.center()

        for btn_cnt in range(2):
            list.add_btn(lv.SYMBOL.AUDIO,"Track {:d}".format(btn_cnt))

        float_btn = lv.btn(list)
        float_btn.set_size(50, 50)
        float_btn.add_flag(lv.obj.FLAG.FLOATING)
        float_btn.align(lv.ALIGN.BOTTOM_RIGHT, 0, -list.get_style_pad_right(lv.PART.
↪MAIN))
        float_btn.add_event(lambda evt: self.float_btn_event_cb(evt,list), lv.EVENT.
↪ALL, None)
        float_btn.set_style_radius(lv.RADIUS_CIRCLE, 0)
        float_btn.set_style_bg_img_src(lv.SYMBOL.PLUS, 0)
        float_btn.set_style_text_font(lv.theme_get_font_large(float_btn), 0)

    def float_btn_event_cb(self,e,list):
        code = e.get_code()
        float_btn = e.get_target_obj()

        if code == lv.EVENT.CLICKED:
```

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```
            list_btn = list.add_btn(lv.SYMBOL.AUDIO, "Track {:d}".format(self.btn_
↪cnt))
            self.btn_cnt += 1

            float_btn.move_foreground()

            list_btn.scroll_to_view(lv.ANIM.ON)

scroll_example_3 = ScrollExample_3()
```

Styling the scrollbars

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_LIST


/**
 * Styling the scrollbars
 */
void lv_example_scroll_4(void)
{
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_set_size(obj, 200, 100);
    lv_obj_center(obj);

    lv_obj_t * label = lv_label_create(obj);
    lv_label_set_text(label,
                      "Lorem ipsum dolor sit amet, consectetur adipiscing elit.\n"
                      "Etiam dictum, tortor vestibulum lacinia laoreet, mi neque␣
↪consectetur neque, vel mattis odio dolor egestas ligula. \n"
                      "Sed vestibulum sapien nulla, id convallis ex porttitor nec. \n"
                      "Duis et massa eu libero accumsan faucibus a in arcu. \n"
                      "Ut pulvinar odio lorem, vel tempus turpis condimentum quis.␣
↪Nam consectetur condimentum sem in auctor. \n"
                      "Sed nisl augue, venenatis in blandit et, gravida ac tortor. \n"
                      "Etiam dapibus elementum suscipit. \n"
                      "Proin mollis sollicitudin convallis. \n"
                      "Integer dapibus tempus arcu nec viverra. \n"
                      "Donec molestie nulla enim, eu interdum velit placerat quis. \n"
                      "Donec id efficitur risus, at molestie turpis. \n"
                      "Suspendisse vestibulum consectetur nunc ut commodo. \n"
                      "Fusce molestie rhoncus nisi sit amet tincidunt. \n"
                      "Suspendisse a nunc ut magna ornare volutpat.");


    /*Remove the style of scrollbar to have clean start*/
    lv_obj_remove_style(obj, NULL, LV_PART_SCROLLBAR | LV_STATE_ANY);

    /*Create a transition the animate the some properties on state change*/
    static const lv_style_prop_t props[] = {LV_STYLE_BG_OPA, LV_STYLE_WIDTH, 0};
    static lv_style_transition_dsc_t trans;
    lv_style_transition_dsc_init(&trans, props, lv_anim_path_linear, 200, 0, NULL);
```

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```
    /*Create a style for the scrollbars*/
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_width(&style, 4);      /*Width of the scrollbar*/
    lv_style_set_pad_right(&style, 5);  /*Space from the parallel side*/
    lv_style_set_pad_top(&style, 5);    /*Space from the perpendicular side*/

    lv_style_set_radius(&style, 2);
    lv_style_set_bg_opa(&style, LV_OPA_70);
    lv_style_set_bg_color(&style, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_border_color(&style, lv_palette_darken(LV_PALETTE_BLUE, 3));
    lv_style_set_border_width(&style, 2);
    lv_style_set_shadow_width(&style, 8);
    lv_style_set_shadow_spread(&style, 2);
    lv_style_set_shadow_color(&style, lv_palette_darken(LV_PALETTE_BLUE, 1));

    lv_style_set_transition(&style, &trans);

    /*Make the scrollbars wider and use 100% opacity when scrolled*/
    static lv_style_t style_scrolled;
    lv_style_init(&style_scrolled);
    lv_style_set_width(&style_scrolled, 8);
    lv_style_set_bg_opa(&style_scrolled, LV_OPA_COVER);

    lv_obj_add_style(obj, &style, LV_PART_SCROLLBAR);
    lv_obj_add_style(obj, &style_scrolled, LV_PART_SCROLLBAR | LV_STATE_SCROLLED);
}

#endif
```

```
#
# Styling the scrollbars
#
obj = lv.obj(lv.scr_act())
obj.set_size(200, 100)
obj.center()

label = lv.label(obj)
label.set_text(
"""
Lorem ipsum dolor sit amet, consectetur adipiscing elit.
Etiam dictum, tortor vestibulum lacinia laoreet, mi neque consectetur neque, vel␣
↪mattis odio dolor egestas ligula.
Sed vestibulum sapien nulla, id convallis ex porttitor nec.
Duis et massa eu libero accumsan faucibus a in arcu.
Ut pulvinar odio lorem, vel tempus turpis condimentum quis. Nam consectetur␣
↪condimentum sem in auctor.
Sed nisl augue, venenatis in blandit et, gravida ac tortor.
Etiam dapibus elementum suscipit.
Proin mollis sollicitudin convallis.
Integer dapibus tempus arcu nec viverra.
Donec molestie nulla enim, eu interdum velit placerat quis.
Donec id efficitur risus, at molestie turpis.
Suspendisse vestibulum consectetur nunc ut commodo.
Fusce molestie rhoncus nisi sit amet tincidunt.
Suspendisse a nunc ut magna ornare volutpat.
```

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```
""")


# Remove the style of scrollbar to have clean start
obj.remove_style(None, lv.PART.SCROLLBAR | lv.STATE.ANY)

# Create a transition the animate the some properties on state change
props = [lv.STYLE.BG_OPA, lv.STYLE.WIDTH, 0]
trans = lv.style_transition_dsc_t()
trans.init(props, lv.anim_t.path_linear, 200, 0, None)

# Create a style for the scrollbars
style = lv.style_t()
style.init()
style.set_width(4)                # Width of the scrollbar
style.set_pad_right(5)            # Space from the parallel side
style.set_pad_top(5)              # Space from the perpendicular side

style.set_radius(2)
style.set_bg_opa(lv.OPA._70)
style.set_bg_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_border_color(lv.palette_darken(lv.PALETTE.BLUE, 3))
style.set_border_width(2)
style.set_shadow_width(8)
style.set_shadow_spread(2)
style.set_shadow_color(lv.palette_darken(lv.PALETTE.BLUE, 1))

style.set_transition(trans)

# Make the scrollbars wider and use 100% opacity when scrolled
style_scrolled = lv.style_t()
style_scrolled.init()
style_scrolled.set_width(8)
style_scrolled.set_bg_opa(lv.OPA.COVER)

obj.add_style(style, lv.PART.SCROLLBAR)
obj.add_style(style_scrolled, lv.PART.SCROLLBAR | lv.STATE.SCROLLED)
```

Right to left scrolling

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_FONT_DEJAVU_16_PERSIAN_HEBREW


/**
 * Scrolling with Right To Left base direction
 */
void lv_example_scroll_5(void)
{
    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_set_style_base_dir(obj, LV_BASE_DIR_RTL, 0);
    lv_obj_set_size(obj, 200, 100);
    lv_obj_center(obj);
```

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```
    lv_obj_t * label = lv_label_create(obj);
    lv_label_set_text(label,
                      "میکروکُنترولر (به انگلیسی: Microcontroller) گونه‌ای ریزپردازنده␣
↪است که دارای حافظهٔ دسترسی تصادفی (RAM) و حافظهٔ فقط‌خواندنی (ROM)، تایمر، پورت‌های␣
↪ورودی و خروجی (I/O) و درگاه ترتیبی (Serial Port پورت سریال)، درون خود تراشه است، و␣
↪می‌تواند به تنهایی ابزارهای دیگر را کنترل کند. به عبارت دیگر یک میکروکنترلر، مدار␣
↪مجتمع کوچکی است که از یک CPU کوچک و اجزای دیگری مانند تایمر، درگاه‌های ورودی و خروجی␣
↪آنالوگ و دیجیتال و حافظه تشکیل شده‌است.");
    lv_obj_set_width(label, 400);
    lv_obj_set_style_text_font(label, &lv_font_dejavu_16_persian_hebrew, 0);

}

#endif
```

```
#
# Scrolling with Right To Left base direction
#
obj = lv.obj(lv.scr_act())
obj.set_style_base_dir(lv.BASE_DIR.RTL, 0)
obj.set_size(200, 100)
obj.center()

label = lv.label(obj)
label.set_text("میکروکُنترولر (به انگلیسی: Microcontroller) گونه‌ای ریزپردازنده است که␣
↪دارای حافظهٔ دسترسی تصادفی (RAM) و حافظهٔ فقط‌خواندنی (ROM)، تایمر، پورت‌های ورودی و␣
↪خروجی (I/O) و درگاه ترتیبی (Serial Port پورت سریال)، درون خود تراشه است، و می‌تواند␣
↪به تنهایی ابزارهای دیگر را کنترل کند. به عبارت دیگر یک میکروکنترلر، مدار مجتمع␣
↪کوچکی است که از یک CPU کوچک و اجزای دیگری مانند تایمر، درگاه‌های ورودی و خروجی␣
↪آنالوگ و دیجیتال و حافظه تشکیل شده‌است.")
label.set_width(400)
label.set_style_text_font(lv.font_dejavu_16_persian_hebrew, 0)
```

Translate on scroll

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_FLEX

static void scroll_event_cb(lv_event_t * e)
{
    lv_obj_t * cont = lv_event_get_target(e);

    lv_area_t cont_a;
    lv_obj_get_coords(cont, &cont_a);
    lv_coord_t cont_y_center = cont_a.y1 + lv_area_get_height(&cont_a) / 2;

    lv_coord_t r = lv_obj_get_height(cont) * 7 / 10;
    uint32_t i;
    uint32_t child_cnt = lv_obj_get_child_cnt(cont);
    for(i = 0; i < child_cnt; i++) {
        lv_obj_t * child = lv_obj_get_child(cont, i);
        lv_area_t child_a;
        lv_obj_get_coords(child, &child_a);
```

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```
        lv_coord_t child_y_center = child_a.y1 + lv_area_get_height(&child_a) / 2;

        lv_coord_t diff_y = child_y_center - cont_y_center;
        diff_y = LV_ABS(diff_y);

        /*Get the x of diff_y on a circle.*/
        lv_coord_t x;
        /*If diff_y is out of the circle use the last point of the circle (the␣
↪radius)*/
        if(diff_y >= r) {
            x = r;
        }
        else {
            /*Use Pythagoras theorem to get x from radius and y*/
            uint32_t x_sqr = r * r - diff_y * diff_y;
            lv_sqrt_res_t res;
            lv_sqrt(x_sqr, &res, 0x8000);   /*Use lvgl's built in sqrt root function*/
            x = r - res.i;
        }

        /*Translate the item by the calculated X coordinate*/
        lv_obj_set_style_translate_x(child, x, 0);

        /*Use some opacity with larger translations*/
        lv_opa_t opa = lv_map(x, 0, r, LV_OPA_TRANSP, LV_OPA_COVER);
        lv_obj_set_style_opa(child, LV_OPA_COVER - opa, 0);
    }
}

/**
 * Translate the object as they scroll
 */
void lv_example_scroll_6(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 200, 200);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_COLUMN);
    lv_obj_add_event(cont, scroll_event_cb, LV_EVENT_SCROLL, NULL);
    lv_obj_set_style_radius(cont, LV_RADIUS_CIRCLE, 0);
    lv_obj_set_style_clip_corner(cont, true, 0);
    lv_obj_set_scroll_dir(cont, LV_DIR_VER);
    lv_obj_set_scroll_snap_y(cont, LV_SCROLL_SNAP_CENTER);
    lv_obj_set_scrollbar_mode(cont, LV_SCROLLBAR_MODE_OFF);

    uint32_t i;
    for(i = 0; i < 20; i++) {
        lv_obj_t * btn = lv_btn_create(cont);
        lv_obj_set_width(btn, lv_pct(100));

        lv_obj_t * label = lv_label_create(btn);
        lv_label_set_text_fmt(label, "Button %"LV_PRIu32, i);
    }

    /*Update the buttons position manually for first*/
    lv_obj_send_event(cont, LV_EVENT_SCROLL, NULL);
```

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```
    /*Be sure the fist button is in the middle*/
    lv_obj_scroll_to_view(lv_obj_get_child(cont, 0), LV_ANIM_OFF);
}

#endif
```

```
def scroll_event_cb(e):

    cont = e.get_target_obj()

    cont_a = lv.area_t()
    cont.get_coords(cont_a)
    cont_y_center = cont_a.y1 + cont_a.get_height() // 2

    r = cont.get_height() * 7 // 10

    child_cnt = cont.get_child_cnt()
    for i in range(child_cnt):
        child = cont.get_child(i)
        child_a = lv.area_t()
        child.get_coords(child_a)

        child_y_center = child_a.y1 + child_a.get_height() // 2

        diff_y = child_y_center - cont_y_center
        diff_y = abs(diff_y)

        # Get the x of diff_y on a circle.

        # If diff_y is out of the circle use the last point of the circle (the radius)
        if diff_y >= r:
            x = r
        else:
            # Use Pythagoras theorem to get x from radius and y
            x_sqr = r * r - diff_y * diff_y
            res = lv.sqrt_res_t()
            lv.sqrt(x_sqr, res, 0x8000)   # Use lvgl's built in sqrt root function
            x = r - res.i

        # Translate the item by the calculated X coordinate
        child.set_style_translate_x(x, 0)

        # Use some opacity with larger translations
        opa = lv.map(x, 0, r, lv.OPA.TRANSP, lv.OPA.COVER)
        child.set_style_opa(lv.OPA.COVER - opa, 0)

#
# Translate the object as they scroll
#

cont = lv.obj(lv.scr_act())
cont.set_size(200, 200)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.COLUMN)
cont.add_event(scroll_event_cb, lv.EVENT.SCROLL, None)
```

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```
cont.set_style_radius(lv.RADIUS_CIRCLE, 0)
cont.set_style_clip_corner(True, 0)
cont.set_scroll_dir(lv.DIR.VER)
cont.set_scroll_snap_y(lv.SCROLL_SNAP.CENTER)
cont.set_scrollbar_mode(lv.SCROLLBAR_MODE.OFF)

for i in range(20):
    btn = lv.btn(cont)
    btn.set_width(lv.pct(100))

    label = lv.label(btn)
    label.set_text("Button " + str(i))

    # Update the buttons position manually for first*
    cont.send_event(lv.EVENT.SCROLL, None)

    # Be sure the fist button is in the middle
    #lv.obj.scroll_to_view(cont.get_child(0), lv.ANIM.OFF)
    cont.get_child(0).scroll_to_view(lv.ANIM.OFF)
```

5.6 Layers

5.6.1 Order of creation

By default, LVGL draws new objects on top of old objects.

For example, assume we add a button to a parent object named button1 and then another button named button2. Then button1 (along with its child object(s)) will be in the background and can be covered by button2 and its children.

```
/*Create a screen*/
lv_obj_t * scr = lv_obj_create(NULL, NULL);
```

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```
lv_scr_load(scr);          /*Load the screen*/

/*Create 2 buttons*/
lv_obj_t * btn1 = lv_btn_create(scr, NULL);         /*Create a button on the screen*/
lv_btn_set_fit(btn1, true, true);                   /*Enable automatically setting␣
↪the size according to content*/
lv_obj_set_pos(btn1, 60, 40);                         /*Set the position of the␣
↪button*/

lv_obj_t * btn2 = lv_btn_create(scr, btn1);         /*Copy the first button*/
lv_obj_set_pos(btn2, 180, 80);                    /*Set the position of the button*/

/*Add labels to the buttons*/
lv_obj_t * label1 = lv_label_create(btn1, NULL);        /*Create a label on the first␣
↪button*/
lv_label_set_text(label1, "Button 1");                  /*Set the text of the label*/

lv_obj_t * label2 = lv_label_create(btn2, NULL);          /*Create a label on the␣
↪second button*/
lv_label_set_text(label2, "Button 2");                    /*Set the text of the␣
↪label*/

/*Delete the second label*/
lv_obj_del(label2);
```

5.6.2 Change order

There are four explicit ways to bring an object to the foreground:

- Use `lv_obj_move_foreground(obj)` to bring an object to the foreground. Similarly, use `lv_obj_move_background(obj)` to move it to the background.
- Use `lv_obj_move_to_index(obj, idx)` to move an object to a given index in the order of children. (0: background, child_num - 1: foreground, <0: count from the top, to move forward (up): `lv_obj_move_to_index(obj, lv_obj_get_index(obj) - 1)`)
- Use `lv_obj_swap(obj1, obj2)` to swap the relative layer position of two objects.
- When `lv_obj_set_parent(obj, new_parent)` is used, `obj` will be on the foreground of the `new_parent`.

5.6.3 Top and sys layers

LVGL uses two special layers named `layer_top` and `layer_sys`. Both are visible and common on all screens of a display. **They are not, however, shared among multiple physical displays.** The `layer_top` is always on top of the default screen (`lv_scr_act()`), and `layer_sys` is on top of `layer_top`.

The `layer_top` can be used by the user to create some content visible everywhere. For example, a menu bar, a pop-up, etc. If the `click` attribute is enabled, then `layer_top` will absorb all user clicks and acts as a modal.

```
lv_obj_add_flag(lv_layer_top(), LV_OBJ_FLAG_CLICKABLE);
```

The `layer_sys` is also used for similar purposes in LVGL. For example, it places the mouse cursor above all layers to be sure it's always visible.

5.7 Events

Events are triggered in LVGL when something happens which might be interesting to the user, e.g. when an object

- is clicked
- is scrolled
- has its value changed
- is redrawn, etc.

5.7.1 Add events to the object

The user can assign callback functions to an object to see its events. In practice, it looks like this:

```
lv_obj_t * btn = lv_btn_create(lv_scr_act());
lv_obj_add_event(btn, my_event_cb, LV_EVENT_CLICKED, NULL);   /*Assign an event␣
↪callback*/

...

static void my_event_cb(lv_event_t * event)
{
    printf("Clicked\n");
}
```

In the example `LV_EVENT_CLICKED` means that only the click event will call `my_event_cb`. See the *list of event codes* for all the options. `LV_EVENT_ALL` can be used to receive all events.

The last parameter of `lv_obj_add_event` is a pointer to any custom data that will be available in the event. It will be described later in more detail.

More events can be added to an object, like this:

```
lv_obj_add_event(obj, my_event_cb_1, LV_EVENT_CLICKED, NULL);
lv_obj_add_event(obj, my_event_cb_2, LV_EVENT_PRESSED, NULL);
lv_obj_add_event(obj, my_event_cb_3, LV_EVENT_ALL, NULL);          /*No␣
↪filtering, receive all events*/
```

Even the same event callback can be used on an object with different `user_data`. For example:

```
lv_obj_add_event(obj, increment_on_click, LV_EVENT_CLICKED, &num1);
lv_obj_add_event(obj, increment_on_click, LV_EVENT_CLICKED, &num2);
```

The events will be called in the order as they were added.

Other objects can use the same *event callback*.

5.7.2 Remove event(s) from an object

Events can be removed from an object with the `lv_obj_remove_event_cb(obj, event_cb)` function or `lv_obj_remove_event_dsc(obj, event_dsc)`. `event_dsc` is a pointer returned by `lv_obj_add_event`.

5.7.3 Event codes

The event codes can be grouped into these categories:

- Input device events
- Drawing events
- Other events
- Special events
- Custom events

All objects (such as Buttons/Labels/Sliders etc.) regardless their type receive the *Input device*, *Drawing* and *Other* events.

However, the *Special events* are specific to a particular widget type. See the *widgets' documentation* to learn when they are sent,

Custom events are added by the user and are never sent by LVGL.

The following event codes exist:

Input device events

- `LV_EVENT_PRESSED` An object has been pressed
- `LV_EVENT_PRESSING` An object is being pressed (called continuously while pressing)
- `LV_EVENT_PRESS_LOST` An object is still being pressed but slid cursor/finger off of the object
- `LV_EVENT_SHORT_CLICKED` An object was pressed for a short period of time, then released. Not called if scrolled.
- `LV_EVENT_LONG_PRESSED` An object has been pressed for at least the `long_press_time` specified in the input device driver. Not called if scrolled.
- `LV_EVENT_LONG_PRESSED_REPEAT` Called after `long_press_time` in every `long_press_repeat_time` ms. Not called if scrolled.
- `LV_EVENT_CLICKED` Called on release if an object did not scroll (regardless of long press)
- `LV_EVENT_RELEASED` Called in every case when an object has been released
- `LV_EVENT_SCROLL_BEGIN` Scrolling begins. The event parameter is `NULL` or an `lv_anim_t *` with a scroll animation descriptor that can be modified if required.
- `LV_EVENT_SCROLL_THROW_BEGIN` Sent once when the object is released while scrolling but the "momentum" still keeps the content scrolling.
- `LV_EVENT_SCROLL_END` Scrolling ends.
- `LV_EVENT_SCROLL` An object was scrolled
- `LV_EVENT_GESTURE` A gesture is detected. Get the gesture with `lv_indev_get_gesture_dir(lv_indev_get_act());`

- `LV_EVENT_KEY` A key is sent to an object. Get the key with `lv_indev_get_key(lv_indev_get_act());`
- `LV_EVENT_FOCUSED` An object is focused
- `LV_EVENT_DEFOCUSED` An object is unfocused
- `LV_EVENT_LEAVE` An object is unfocused but still selected
- `LV_EVENT_HIT_TEST` Perform advanced hit-testing. Use `lv_hit_test_info_t * a = lv_event_get_hit_test_info(e)` and check if `a->point` can click the object or not. If not set `a->res = false`

Drawing events

- `LV_EVENT_COVER_CHECK` Check if an object fully covers an area. The event parameter is `lv_cover_check_info_t *`.
- `LV_EVENT_REFR_EXT_DRAW_SIZE` Get the required extra draw area around an object (e.g. for a shadow). The event parameter is `lv_coord_t *` to store the size. Only overwrite it with a larger value.
- `LV_EVENT_DRAW_MAIN_BEGIN` Starting the main drawing phase.
- `LV_EVENT_DRAW_MAIN` Perform the main drawing
- `LV_EVENT_DRAW_MAIN_END` Finishing the main drawing phase
- `LV_EVENT_DRAW_POST_BEGIN` Starting the post draw phase (when all children are drawn)
- `LV_EVENT_DRAW_POST` Perform the post draw phase (when all children are drawn)
- `LV_EVENT_DRAW_POST_END` Finishing the post draw phase (when all children are drawn)
- `LV_EVENT_DRAW_PART_BEGIN` Starting to draw a part. The event parameter is `lv_obj_draw_dsc_t *`. Learn more *here*.
- `LV_EVENT_DRAW_PART_END` Finishing to draw a part. The event parameter is `lv_obj_draw_dsc_t *`. Learn more *here*.

In `LV_EVENT_DRAW_...` events it's not allowed to adjust the widgets' properties. E.g. you can not call `lv_obj_set_width()`. In other words only `get` functions can be called.

Other events

- `LV_EVENT_DELETE` Object is being deleted
- `LV_EVENT_CHILD_CHANGED` Child was removed/added
- `LV_EVENT_CHILD_CREATED` Child was created, always bubbles up to all parents
- `LV_EVENT_CHILD_DELETED` Child was deleted, always bubbles up to all parents
- `LV_EVENT_SIZE_CHANGED` Object coordinates/size have changed
- `LV_EVENT_STYLE_CHANGED` Object's style has changed
- `LV_EVENT_BASE_DIR_CHANGED` The base dir has changed
- `LV_EVENT_GET_SELF_SIZE` Get the internal size of a widget
- `LV_EVENT_SCREEN_UNLOAD_START` A screen unload started, fired immediately when lv_scr_load/lv_scr_load_anim is called
- `LV_EVENT_SCREEN_LOAD_START` A screen load started, fired when the screen change delay is expired

- `LV_EVENT_SCREEN_LOADED` A screen was loaded, called when all animations are finished
- `LV_EVENT_SCREEN_UNLOADED` A screen was unloaded, called when all animations are finished

Special events

- `LV_EVENT_VALUE_CHANGED` The object's value has changed (i.e. slider moved)
- `LV_EVENT_INSERT` Text is being inserted into the object. The event data is `char *` being inserted.
- `LV_EVENT_REFRESH` Notify the object to refresh something on it (for the user)
- `LV_EVENT_READY` A process has finished
- `LV_EVENT_CANCEL` A process has been canceled

Custom events

Any custom event codes can be registered by `uint32_t MY_EVENT_1 = lv_event_register_id();`

They can be sent to any object with `lv_event_send(obj, MY_EVENT_1, &some_data)`

5.7.4 Sending events

To manually send events to an object, use `lv_event_send(obj, <EVENT_CODE> &some_data)`.

For example, this can be used to manually close a message box by simulating a button press (although there are simpler ways to do this):

```
/*Simulate the press of the first button (indexes start from zero)*/
uint32_t btn_id = 0;
lv_event_send(mbox, LV_EVENT_VALUE_CHANGED, &btn_id);
```

Refresh event

`LV_EVENT_REFRESH` is a special event because it's designed to let the user notify an object to refresh itself. Some examples:

- notify a label to refresh its text according to one or more variables (e.g. current time)
- refresh a label when the language changes
- enable a button if some conditions are met (e.g. the correct PIN is entered)
- add/remove styles to/from an object if a limit is exceeded, etc

5.7.5 Fields of lv_event_t

`lv_event_t` is the only parameter passed to the event callback and it contains all data about the event. The following values can be gotten from it:

- `lv_event_get_code(e)` get the event code
- `lv_event_get_current_target(e)` get the object to which an event was sent. I.e. the object whose event handler is being called.
- `lv_event_get_target(e)` get the object that originally triggered the event (different from `lv_event_get_target` if *event bubbling* is enabled)
- `lv_event_get_user_data(e)` get the pointer passed as the last parameter of `lv_obj_add_event`.
- `lv_event_get_param(e)` get the parameter passed as the last parameter of `lv_event_send`

5.7.6 Event bubbling

If `lv_obj_add_flag(obj, LV_OBJ_FLAG_EVENT_BUBBLE)` is enabled all events will be sent to an object's parent too. If the parent also has `LV_OBJ_FLAG_EVENT_BUBBLE` enabled the event will be sent to its parent and so on.

The *target* parameter of the event is always the current target object, not the original object. To get the original target call `lv_event_get_original_target(e)` in the event handler.

5.7.7 Examples

Button click event

```c
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SWITCH

static void event_cb(lv_event_t * e)
{
    LV_LOG_USER("Clicked");

    static uint32_t cnt = 1;
    lv_obj_t * btn = lv_event_get_target(e);
    lv_obj_t * label = lv_obj_get_child(btn, 0);
    lv_label_set_text_fmt(label, "%"LV_PRIu32, cnt);
    cnt++;
}

/**
 * Add click event to a button
 */
void lv_example_event_1(void)
{
    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 50);
    lv_obj_center(btn);
    lv_obj_add_event(btn, event_cb, LV_EVENT_CLICKED, NULL);

    lv_obj_t * label = lv_label_create(btn);
    lv_label_set_text(label, "Click me!");
```

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```
    lv_obj_center(label);
}

#endif
```

```
class Event_1():
    def __init__(self):
        self.cnt = 1
        #
        # Add click event to a button
        #

        btn = lv.btn(lv.scr_act())
        btn.set_size(100, 50)
        btn.center()
        btn.add_event(self.event_cb, lv.EVENT.CLICKED, None)

        label = lv.label(btn)
        label.set_text("Click me!")
        label.center()

    def event_cb(self,e):
        print("Clicked")

        btn = e.get_target_obj()
        label = btn.get_child(0)
        label.set_text(str(self.cnt))
        self.cnt += 1

evt1 = Event_1()
```

Handle multiple events

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SWITCH

static void event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * label = lv_event_get_user_data(e);

    switch(code) {
        case LV_EVENT_PRESSED:
            lv_label_set_text(label, "The last button event:\nLV_EVENT_PRESSED");
            break;
        case LV_EVENT_CLICKED:
            lv_label_set_text(label, "The last button event:\nLV_EVENT_CLICKED");
            break;
        case LV_EVENT_LONG_PRESSED:
            lv_label_set_text(label, "The last button event:\nLV_EVENT_LONG_PRESSED");
            break;
        case LV_EVENT_LONG_PRESSED_REPEAT:
            lv_label_set_text(label, "The last button event:\nLV_EVENT_LONG_PRESSED_
↪REPEAT");
```

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```
            break;
        default:
            break;
    }
}

/**
 * Handle multiple events
 */
void lv_example_event_2(void)
{
    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, 100, 50);
    lv_obj_center(btn);

    lv_obj_t * btn_label = lv_label_create(btn);
    lv_label_set_text(btn_label, "Click me!");
    lv_obj_center(btn_label);

    lv_obj_t * info_label = lv_label_create(lv_scr_act());
    lv_label_set_text(info_label, "The last button event:\nNone");

    lv_obj_add_event(btn, event_cb, LV_EVENT_ALL, info_label);
}

#endif
```

```
def event_cb(e,label):
    code = e.get_code()
    if code == lv.EVENT.PRESSED:
        label.set_text("The last button event:\nLV_EVENT_PRESSED")
    elif code == lv.EVENT.CLICKED:
        label.set_text("The last button event:\nLV_EVENT_CLICKED")
    elif code == lv.EVENT.LONG_PRESSED:
        label.set_text("The last button event:\nLV_EVENT_LONG_PRESSED")
    elif code == lv.EVENT.LONG_PRESSED_REPEAT:
        label.set_text("The last button event:\nLV_EVENT_LONG_PRESSED_REPEAT")
btn = lv.btn(lv.scr_act())
btn.set_size(100, 50)
btn.center()

btn_label = lv.label(btn)
btn_label.set_text("Click me!")
btn_label.center()

info_label = lv.label(lv.scr_act())
info_label.set_text("The last button event:\nNone")

btn.add_event(lambda e: event_cb(e,info_label), lv.EVENT.ALL, None)
```

Event bubbling

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_FLEX

static void event_cb(lv_event_t * e)
{
    /*The original target of the event. Can be the buttons or the container*/
    lv_obj_t * target = lv_event_get_target(e);

    /*The current target is always the container as the event is added to it*/
    lv_obj_t * cont = lv_event_get_current_target(e);

    /*If container was clicked do nothing*/
    if(target == cont) return;

    /*Make the clicked buttons red*/
    lv_obj_set_style_bg_color(target, lv_palette_main(LV_PALETTE_RED), 0);
}

/**
 * Demonstrate event bubbling
 */
void lv_example_event_3(void)
{

    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 290, 200);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_ROW_WRAP);

    uint32_t i;
    for(i = 0; i < 30; i++) {
        lv_obj_t * btn = lv_btn_create(cont);
        lv_obj_set_size(btn, 80, 50);
        lv_obj_add_flag(btn, LV_OBJ_FLAG_EVENT_BUBBLE);

        lv_obj_t * label = lv_label_create(btn);
        lv_label_set_text_fmt(label, "%"LV_PRIu32, i);
        lv_obj_center(label);
    }

    lv_obj_add_event(cont, event_cb, LV_EVENT_CLICKED, NULL);
}

#endif
```

```
def event_cb(e):

    # The original target of the event. Can be the buttons or the container
    target = e.get_target_obj()
    # print(type(target))

    # If container was clicked do nothing
    if type(target) != type(lv.btn()):
        return

```

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```
    # Make the clicked buttons red
    target.set_style_bg_color(lv.palette_main(lv.PALETTE.RED), 0)

#
# Demonstrate event bubbling
#

cont = lv.obj(lv.scr_act())
cont.set_size(320, 200)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)

for i in range(30):
    btn = lv.btn(cont)
    btn.set_size(80, 50)
    btn.add_flag(lv.obj.FLAG.EVENT_BUBBLE)

    label = lv.label(btn)
    label.set_text(str(i))
    label.center()

cont.add_event(event_cb, lv.EVENT.CLICKED, None)
```

Draw event

```
#include "../lv_examples.h"

#if LV_BUILD_EXAMPLES

static uint32_t size = 0;
static bool size_dec = false;

static void timer_cb(lv_timer_t * timer)
{
    lv_obj_invalidate(timer->user_data);
    if(size_dec) size--;
    else size++;

    if(size == 50) size_dec = true;
    else if(size == 0) size_dec = false;
}

static void event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->class_p == &lv_obj_class && dsc->part == LV_PART_MAIN) {
        lv_draw_rect_dsc_t draw_dsc;
        lv_draw_rect_dsc_init(&draw_dsc);
        draw_dsc.bg_color = lv_color_hex(0xffaaaa);
        draw_dsc.radius = LV_RADIUS_CIRCLE;
        draw_dsc.border_color = lv_color_hex(0xff5555);
        draw_dsc.border_width = 2;
        draw_dsc.outline_color = lv_color_hex(0xff0000);
        draw_dsc.outline_pad = 3;
```

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```
        draw_dsc.outline_width = 2;

        lv_area_t a;
        a.x1 = 0;
        a.y1 = 0;
        a.x2 = size;
        a.y2 = size;
        lv_area_align(&obj->coords, &a, LV_ALIGN_CENTER, 0, 0);

        lv_draw_rect(dsc->draw_ctx, &draw_dsc, &a);
    }
}

/**
 * Demonstrate the usage of draw event
 */
void lv_example_event_4(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 200, 200);
    lv_obj_center(cont);
    lv_obj_add_event(cont, event_cb, LV_EVENT_DRAW_PART_END, NULL);
    lv_timer_create(timer_cb, 30, cont);
}

#endif
```

```
class LV_Example_Event_4:

    def __init__(self):
        #
        # Demonstrate the usage of draw event
        #
        self.size = 0
        self.size_dec = False
        self.cont = lv.obj(lv.scr_act())
        self.cont.set_size(200, 200)
        self.cont.center()
        self.cont.add_event(self.event_cb, lv.EVENT.DRAW_PART_END, None)
        lv.timer_create(self.timer_cb, 30, None)

    def timer_cb(self,timer) :
        self.cont.invalidate()
        if self.size_dec :
            self.size -= 1
        else :
            self.size += 1

        if self.size == 50 :
            self.size_dec = True
        elif self.size == 0:
            self.size_dec = False

    def event_cb(self,e) :
        obj = e.get_target_obj()
        dsc = e.get_draw_part_dsc()
```

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```
        if dsc.class_p == lv.obj_class and dsc.part == lv.PART.MAIN :
            draw_dsc = lv.draw_rect_dsc_t()
            draw_dsc.init()
            draw_dsc.bg_color = lv.color_hex(0xffaaaa)
            draw_dsc.radius = lv.RADIUS_CIRCLE
            draw_dsc.border_color = lv.color_hex(0xff5555)
            draw_dsc.border_width = 2
            draw_dsc.outline_color = lv.color_hex(0xff0000)
            draw_dsc.outline_pad = 3
            draw_dsc.outline_width = 2

            a = lv.area_t()
            a.x1 = 0
            a.y1 = 0
            a.x2 = self.size
            a.y2 = self.size
            coords = lv.area_t()
            obj.get_coords(coords)
            coords.align(a, lv.ALIGN.CENTER, 0, 0)

            dsc.draw_ctx.rect(draw_dsc, a)

lv_example_event_4 = LV_Example_Event_4()
```

5.7.8 API

Typedefs

typedef struct _lv_event_dsc_t **lv_event_dsc_t**

typedef struct *_lv_event_t* **lv_event_t**

typedef void (***lv_event_cb_t**)(*lv_event_t* *e)

Event callback. Events are used to notify the user of some action being taken on the object. For details, see ::lv_event_t.

Enums

enum **lv_event_code_t**

Type of event being sent to the object.

Values:

enumerator **LV_EVENT_ALL**

enumerator **LV_EVENT_PRESSED**

Input device events The object has been pressed enumerator **`LV_EVENT_PRESSING`**

The object is being pressed (called continuously while pressing)

enumerator **`LV_EVENT_PRESS_LOST`**

The object is still being pressed but slid cursor/finger off of the object

enumerator **`LV_EVENT_SHORT_CLICKED`**

The object was pressed for a short period of time, then released it. Not called if scrolled.

enumerator **`LV_EVENT_LONG_PRESSED`**

Object has been pressed for at least `long_press_time`. Not called if scrolled.

enumerator **`LV_EVENT_LONG_PRESSED_REPEAT`**

Called after `long_press_time` in every `long_press_repeat_time` ms. Not called if scrolled.

enumerator **`LV_EVENT_CLICKED`**

Called on release if not scrolled (regardless to long press)

enumerator **`LV_EVENT_RELEASED`**

Called in every cases when the object has been released

enumerator **`LV_EVENT_SCROLL_BEGIN`**

Scrolling begins. The event parameter is a pointer to the animation of the scroll. Can be modified

enumerator **`LV_EVENT_SCROLL_THROW_BEGIN`**

enumerator **`LV_EVENT_SCROLL_END`**

Scrolling ends

enumerator **`LV_EVENT_SCROLL`**

Scrolling

enumerator **`LV_EVENT_GESTURE`**

A gesture is detected. Get the gesture with `lv_indev_get_gesture_dir(lv_indev_get_act());`

enumerator **`LV_EVENT_KEY`**

A key is sent to the object. Get the key with `lv_indev_get_key(lv_indev_get_act());`

enumerator **`LV_EVENT_FOCUSED`**

The object is focused

enumerator **`LV_EVENT_DEFOCUSED`**

The object is defocused

enumerator **`LV_EVENT_LEAVE`**

The object is defocused but still selected

enumerator **`LV_EVENT_HIT_TEST`**

Perform advanced hit-testing

enumerator **`LV_EVENT_COVER_CHECK`**

Drawing events Check if the object fully covers an area. The event parameter is `lv_cover_check_info_t *`.

enumerator **`LV_EVENT_REFR_EXT_DRAW_SIZE`**

Get the required extra draw area around the object (e.g. for shadow). The event parameter is `lv_coord_t *` to store the size.

enumerator **`LV_EVENT_DRAW_MAIN_BEGIN`**

Starting the main drawing phase

enumerator **`LV_EVENT_DRAW_MAIN`**

Perform the main drawing

enumerator **`LV_EVENT_DRAW_MAIN_END`**

Finishing the main drawing phase

enumerator **`LV_EVENT_DRAW_POST_BEGIN`**

Starting the post draw phase (when all children are drawn)

enumerator **`LV_EVENT_DRAW_POST`**

Perform the post draw phase (when all children are drawn)

enumerator **`LV_EVENT_DRAW_POST_END`**

Finishing the post draw phase (when all children are drawn)

enumerator **`LV_EVENT_DRAW_PART_BEGIN`**

Starting to draw a part. The event parameter is `lv_obj_draw_dsc_t *`.

enumerator **`LV_EVENT_DRAW_PART_END`**

Finishing to draw a part. The event parameter is `lv_obj_draw_dsc_t *`.

enumerator **`LV_EVENT_VALUE_CHANGED`**

Special events The object's value has changed (i.e. slider moved)

enumerator **`LV_EVENT_INSERT`**

A text is inserted to the object. The event data is `char *` being inserted.

enumerator **`LV_EVENT_REFRESH`**

Notify the object to refresh something on it (for the user) enumerator **`LV_EVENT_READY`**

A process has finished

enumerator **`LV_EVENT_CANCEL`**

A process has been cancelled

enumerator **`LV_EVENT_DELETE`**

Other events Object is being deleted

enumerator **`LV_EVENT_CHILD_CHANGED`**

Child was removed, added, or its size, position were changed

enumerator **`LV_EVENT_CHILD_CREATED`**

Child was created, always bubbles up to all parents

enumerator **`LV_EVENT_CHILD_DELETED`**

Child was deleted, always bubbles up to all parents

enumerator **`LV_EVENT_SCREEN_UNLOAD_START`**

A screen unload started, fired immediately when scr_load is called

enumerator **`LV_EVENT_SCREEN_LOAD_START`**

A screen load started, fired when the screen change delay is expired

enumerator **`LV_EVENT_SCREEN_LOADED`**

A screen was loaded

enumerator **`LV_EVENT_SCREEN_UNLOADED`**

A screen was unloaded

enumerator **`LV_EVENT_SIZE_CHANGED`**

Object coordinates/size have changed

enumerator **`LV_EVENT_STYLE_CHANGED`**

Object's style has changed

enumerator **`LV_EVENT_LAYOUT_CHANGED`**

The children position has changed due to a layout recalculation

enumerator **`LV_EVENT_GET_SELF_SIZE`**

Get the internal size of a widget

enumerator **`LV_EVENT_MSG_RECEIVED`**

Events of optional LVGL components

enumerator **`LV_EVENT_INVALIDATE_AREA`**

enumerator **`LV_EVENT_RENDER_START`**

enumerator **`LV_EVENT_RENDER_READY`**

enumerator **`LV_EVENT_RESOLUTION_CHANGED`**

enumerator **`LV_EVENT_REFR_START`**

enumerator **`LV_EVENT_REFR_FINISH`**

enumerator **`_LV_EVENT_LAST`**

enumerator **`LV_EVENT_PREPROCESS`**

Number of default events

Functions

void **`_lv_event_push`**(*lv_event_t* *e)

void **`_lv_event_pop`**(*lv_event_t* *e)

lv_res_t **`lv_event_send`**(*lv_event_list_t* *list, *lv_event_t* *e, bool prerpocess)

void **`lv_event_add`**(*lv_event_list_t* *list, *lv_event_cb_t* cb, *lv_event_code_t* filter, void *user_data)

uint32_t **`lv_event_get_count`**(*lv_event_list_t* *list)

lv_event_dsc_t ***`lv_event_get_dsc`**(*lv_event_list_t* *list, uint32_t index)

lv_event_cb_t **`lv_event_dsc_get_cb`**(*lv_event_dsc_t* *dsc)

void ***`lv_event_dsc_get_user_data`**(*lv_event_dsc_t* *dsc)

bool **`lv_event_remove`**(*lv_event_list_t* *list, uint32_t index)

void ***`lv_event_get_target`**(*lv_event_t* *e)

Get the object originally targeted by the event. It's the same even if the event is bubbled.

Parameters **`e`** -- pointer to the event descriptor

Returns the target of the event_code

void ***`lv_event_get_current_target`**(*lv_event_t* *e)

Get the current target of the event. It's the object which event handler being called. If the event is not bubbled it's the same as "normal" target.

Parameters **`e`** -- pointer to the event descriptor

Returns pointer to the current target of the event_code *lv_event_code_t* **`lv_event_get_code`**(*lv_event_t* *e)

Get the event code of an event

Parameters **`e`** -- pointer to the event descriptor

Returns the event code. (E.g. `LV_EVENT_CLICKED`, `LV_EVENT_FOCUSED`, etc)

void ***`lv_event_get_param`**(*lv_event_t* *e)

Get the parameter passed when the event was sent

Parameters **`e`** -- pointer to the event descriptor

Returns pointer to the parameter

void ***`lv_event_get_user_data`**(*lv_event_t* *e)

Get the user_data passed when the event was registered on the object

Parameters **`e`** -- pointer to the event descriptor

Returns pointer to the user_data

void **`lv_event_stop_bubbling`**(*lv_event_t* *e)

Stop the event from bubbling. This is only valid when called in the middle of an event processing chain.

Parameters **`e`** -- pointer to the event descriptor

void **`lv_event_stop_processing`**(*lv_event_t* *e)

Stop processing this event. This is only valid when called in the middle of an event processing chain.

Parameters **`e`** -- pointer to the event descriptor

uint32_t **`lv_event_register_id`**(void)

void **`_lv_event_mark_deleted`**(void *target)

Nested events can be called and one of them might belong to an object that is being deleted. Mark this object's `event_temp_data` deleted to know that its `lv_obj_send_event` should return `LV_RES_INV`

Parameters **`target`** -- pointer to an event target which was deleted

struct **`lv_event_list_t`**

Public Members

lv_event_dsc_t ***`dsc`**

uint32_t **`cnt`**

struct **`_lv_event_t`**

Public Members

void ***target**

void ***current_target**

lv_event_code_t **code**

void ***user_data**

void ***param**

struct *_lv_event_t* ***prev**

uint8_t **deleted**

uint8_t **stop_processing**

uint8_t **stop_bubbling**

5.8 Input devices

An input device usually means:

- Pointer-like input device like touchpad or mouse
- Keypads like a normal keyboard or simple numeric keypad
- Encoders with left/right turn and push options
- External hardware buttons which are assigned to specific points on the screen

Important: Before reading further, please read the [Porting](/porting/indev) section of Input devices

5.8.1 Pointers

Cursor

Pointer input devices (like a mouse) can have a cursor.

```
...
lv_indev_t * mouse_indev = lv_indev_create();
...
LV_IMG_DECLARE(mouse_cursor_icon);                          /*Declare the image␣
↪source.*/
lv_obj_t * cursor_obj = lv_img_create(lv_scr_act());       /*Create an image object␣
↪for the cursor */
```

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```
lv_img_set_src(cursor_obj, &mouse_cursor_icon);           /*Set the image source*/
lv_indev_set_cursor(mouse_indev, cursor_obj);             /*Connect the image ␣
↪object to the driver*/
```

Note that the cursor object should have `lv_obj_clear_flag(cursor_obj, LV_OBJ_FLAG_CLICKABLE)`. For images, *clicking* is disabled by default.

Gestures

Pointer input devices can detect basic gestures. By default, most of the widgets send the gestures to its parent, so finally the gestures can be detected on the screen object in a form of an `LV_EVENT_GESTURE` event. For example:

```
void my_event(lv_event_t * e)
{
  lv_obj_t * screen = lv_event_get_current_target(e);
  lv_dir_t dir = lv_indev_get_gesture_dir(lv_indev_act());
  switch(dir) {
    case LV_DIR_LEFT:
      ...
      break;
    case LV_DIR_RIGHT:
      ...
      break;
    case LV_DIR_TOP:
      ...
      break;
    case LV_DIR_BOTTOM:
      ...
      break;
  }
}

...

lv_obj_add_event(screen1, my_event, LV_EVENT_GESTURE, NULL);
```

To prevent passing the gesture event to the parent from an object use `lv_obj_clear_flag(obj, LV_OBJ_FLAG_GESTURE_BUBBLE)`.

Note that, gestures are not triggered if an object is being scrolled.

If you did some action on a gesture you can call `lv_indev_wait_release(lv_indev_get_act())` in the event handler to prevent LVGL sending further input device related events.

5.8.2 Keypad and encoder

You can fully control the user interface without a touchpad or mouse by using a keypad or encoder(s). It works similar to the *TAB* key on the PC to select an element in an application or a web page.

Groups

Objects you want to control with a keypad or encoder need to be added to a *Group*. In every group there is exactly one focused object which receives the pressed keys or the encoder actions. For example, if a *Text area* is focused and you press some letter on a keyboard, the keys will be sent and inserted into the text area. Similarly, if a *Slider* is focused and you press the left or right arrows, the slider's value will be changed.

You need to associate an input device with a group. An input device can send key events to only one group but a group can receive data from more than one input device.

To create a group use `lv_group_t * g = lv_group_create()` and to add an object to the group use `lv_group_add_obj(g, obj)`.

To associate a group with an input device use `lv_indev_set_group(indev, g)`.

Keys

There are some predefined keys which have special meaning:

- **LV_KEY_NEXT** Focus on the next object
- **LV_KEY_PREV** Focus on the previous object
- **LV_KEY_ENTER** Triggers `LV_EVENT_PRESSED/CLICKED/LONG_PRESSED` etc. events
- **LV_KEY_UP** Increase value or move upwards
- **LV_KEY_DOWN** Decrease value or move downwards
- **LV_KEY_RIGHT** Increase value or move to the right
- **LV_KEY_LEFT** Decrease value or move to the left
- **LV_KEY_ESC** Close or exit (E.g. close a *Drop down list*)
- **LV_KEY_DEL** Delete (E.g. a character on the right in a *Text area*)
- **LV_KEY_BACKSPACE** Delete a character on the left (E.g. in a *Text area*)
- **LV_KEY_HOME** Go to the beginning/top (E.g. in a *Text area*)
- **LV_KEY_END** Go to the end (E.g. in a *Text area*)

The most important special keys are `LV_KEY_NEXT/PREV`, `LV_KEY_ENTER` and `LV_KEY_UP/DOWN/LEFT/RIGHT`. In your `read_cb` function, you should translate some of your keys to these special keys to support navigation in a group and interact with selected objects.

Usually, it's enough to use only `LV_KEY_LEFT/RIGHT` because most objects can be fully controlled with them.

With an encoder you should use only `LV_KEY_LEFT`, `LV_KEY_RIGHT`, and `LV_KEY_ENTER`.

Edit and navigate mode

Since a keypad has plenty of keys, it's easy to navigate between objects and edit them using the keypad. But encoders have a limited number of "keys" and hence it is difficult to navigate using the default options. *Navigate* and *Edit* modes are used to avoid this problem with encoders.

In *Navigate* mode, an encoder's `LV_KEY_LEFT/RIGHT` is translated to `LV_KEY_NEXT/PREV`. Therefore, the next or previous object will be selected by turning the encoder. Pressing `LV_KEY_ENTER` will change to *Edit* mode.

In *Edit* mode, `LV_KEY_NEXT/PREV` is usually used to modify an object. Depending on the object's type, a short or long press of `LV_KEY_ENTER` changes back to *Navigate* mode. Usually, an object which cannot be pressed (like a

Slider) leaves *Edit* mode upon a short click. But with objects where a short click has meaning (e.g. *Button*), a long press is required.

Default group

Interactive widgets - such as buttons, checkboxes, sliders, etc. - can be automatically added to a default group. Just create a group with `lv_group_t * g = lv_group_create();` and set the default group with `lv_group_set_default(g);`

Don't forget to assign one or more input devices to the default group with `lv_indev_set_group(my_indev, g);`.

Styling

If an object is focused either by clicking it via touchpad or focused via an encoder or keypad it goes to the `LV_STATE_FOCUSED` state. Hence, focused styles will be applied to it.

If an object switches to edit mode it enters the `LV_STATE_FOCUSED | LV_STATE_EDITED` states so these style properties will be shown.

For a more detailed description read the Style section.

5.8.3 API

Input device

Typedefs

typedef struct _lv_indev_t **`lv_indev_t`**

Enums

enum **`lv_indev_type_t`**

Possible input device types

Values:

enumerator **`LV_INDEV_TYPE_NONE`**

Uninitialized state

enumerator **`LV_INDEV_TYPE_POINTER`**

Touch pad, mouse, external button

enumerator **`LV_INDEV_TYPE_KEYPAD`**

Keypad or keyboard

enumerator **`LV_INDEV_TYPE_BUTTON`**

External (hardware button) which is assigned to a specific point of the screen enumerator **`LV_INDEV_TYPE_ENCODER`**

Encoder with only Left, Right turn and a Button

enum **`lv_indev_state_t`**

States for input devices

Values:

enumerator **`LV_INDEV_STATE_RELEASED`**

enumerator **`LV_INDEV_STATE_PRESSED`**

Functions

lv_indev_t ***`lv_indev_create`**(void)

void **`lv_indev_delete`**(*lv_indev_t* *indev)

Remove the provided input device. Make sure not to use the provided input device afterwards anymore.

Parameters **`indev`** -- pointer to delete

lv_indev_t ***`lv_indev_get_next`**(*lv_indev_t* *indev)

Get the next input device.

Parameters **`indev`** -- pointer to the current input device. NULL to initialize.

Returns the next input device or NULL if there are no more. Provide the first input device when the parameter is NULL

void **`_lv_indev_read`**(*lv_indev_t* *indev, *lv_indev_data_t* *data)

Read data from an input device.

Parameters

- **`indev`** -- pointer to an input device
- **`data`** -- input device will write its data here

void **`lv_indev_read_timer_cb`**(*lv_timer_t* *timer)

Called periodically to read the input devices

Parameters **`timer`** -- pointer to a timer to read

void **`lv_indev_enable`**(*lv_indev_t* *indev, bool en)

Enable or disable one or all input devices (default enabled)

Parameters

- **`indev`** -- pointer to an input device or NULL to enable/disable all of them
- **`en`** -- true to enable, false to disable

lv_indev_t ***`lv_indev_get_act`**(void)

Get the currently processed input device. Can be used in action functions too.

Returns pointer to the currently processed input device or NULL if no input device processing right now void **`lv_indev_set_type`**(*lv_indev_t* *indev, *lv_indev_type_t* indev_type)

Set the type of an input device

Parameters

- **`indev`** -- pointer to an input device
- **`indev_type`** -- the type of the input device from `lv_indev_type_t` (`LV_INDEV_TYPE_...`)

void **`lv_indev_set_read_cb`**(*lv_indev_t* *indev, void (*read_cb)(struct _lv_indev_t *indev, *lv_indev_data_t* *data))

void **`lv_indev_set_user_data`**(*lv_indev_t* *indev, void *user_data)

void **`lv_indev_set_driver_data`**(*lv_indev_t* *indev, void *driver_data)

lv_indev_type_t **`lv_indev_get_type`**(const *lv_indev_t* *indev)

Get the type of an input device

Parameters **`indev`** -- pointer to an input device

Returns the type of the input device from `lv_hal_indev_type_t` (`LV_INDEV_TYPE_...`)

lv_indev_state_t **`lv_indev_get_state`**(const *lv_indev_t* *indev)

lv_group_t ***`lv_indev_get_group`**(const *lv_indev_t* *indev)

struct _lv_disp_t ***`lv_indev_get_disp`**(const *lv_indev_t* *indev)

void **`lv_indev_set_disp`**(*lv_indev_t* *indev, struct _lv_disp_t *disp)

void ***`lv_indev_get_user_data`**(const *lv_indev_t* *indev)

void ***`lv_indev_get_driver_data`**(const *lv_indev_t* *indev)

void **`lv_indev_reset`**(*lv_indev_t* *indev, struct *_lv_obj_t* *obj)

Reset one or all input devices

Parameters

- **`indev`** -- pointer to an input device to reset or NULL to reset all of them
- **`obj`** -- pointer to an object which triggers the reset.

void **`lv_indev_reset_long_press`**(*lv_indev_t* *indev)

Reset the long press state of an input device

Parameters **`indev`** -- pointer to an input device

void **`lv_indev_set_cursor`**(*lv_indev_t* *indev, struct *_lv_obj_t* *cur_obj)

Set a cursor for a pointer input device (for LV_INPUT_TYPE_POINTER and LV_INPUT_TYPE_BUTTON)

Parameters

- **`indev`** -- pointer to an input device
- **`cur_obj`** -- pointer to an object to be used as cursor

void **`lv_indev_set_group`**(*lv_indev_t* *indev, *lv_group_t* *group)

Set a destination group for a keypad input device (for LV_INDEV_TYPE_KEYPAD)

Parameters

- **indev** -- pointer to an input device
- **group** -- point to a group

void **lv_indev_set_button_points**(*lv_indev_t* *indev, const lv_point_t points[])

Set the an array of points for LV_INDEV_TYPE_BUTTON. These points will be assigned to the buttons to press a specific point on the screen

Parameters

- **indev** -- pointer to an input device
- **group** -- point to a group

void **lv_indev_get_point**(const *lv_indev_t* *indev, lv_point_t *point)

Get the last point of an input device (for LV_INDEV_TYPE_POINTER and LV_INDEV_TYPE_BUTTON)

Parameters

- **indev** -- pointer to an input device
- **point** -- pointer to a point to store the result

lv_dir_t **lv_indev_get_gesture_dir**(const *lv_indev_t* *indev)

Get the current gesture direct

Parameters **indev** -- pointer to an input device

Returns current gesture direct

uint32_t **lv_indev_get_key**(const *lv_indev_t* *indev)

Get the last pressed key of an input device (for LV_INDEV_TYPE_KEYPAD)

Parameters **indev** -- pointer to an input device

Returns the last pressed key (0 on error)

lv_dir_t **lv_indev_get_scroll_dir**(const *lv_indev_t* *indev)

Check the current scroll direction of an input device (for LV_INDEV_TYPE_POINTER and LV_INDEV_TYPE_BUTTON)

Parameters **indev** -- pointer to an input device

Returns LV_DIR_NONE: no scrolling now LV_DIR_HOR/VER

struct *_lv_obj_t* ***lv_indev_get_scroll_obj**(const *lv_indev_t* *indev)

Get the currently scrolled object (for LV_INDEV_TYPE_POINTER and LV_INDEV_TYPE_BUTTON)

Parameters **indev** -- pointer to an input device

Returns pointer to the currently scrolled object or NULL if no scrolling by this indev

void **lv_indev_get_vect**(const *lv_indev_t* *indev, lv_point_t *point)

Get the movement vector of an input device (for LV_INDEV_TYPE_POINTER and LV_INDEV_TYPE_BUTTON)

Parameters

- **indev** -- pointer to an input device
- **point** -- pointer to a point to store the types.pointer.vector

void **lv_indev_wait_release**(*lv_indev_t* *indev)

Do nothing until the next release

Parameters **indev** -- pointer to an input device

struct *_lv_obj_t* ***lv_indev_get_obj_act**(void)

Gets a pointer to the currently active object in the currently processed input device.

Returns pointer to currently active object or NULL if no active object

lv_timer_t ***lv_indev_get_read_timer**(*lv_indev_t* *indev)

Get a pointer to the indev read timer to modify its parameters with `lv_timer_...` functions.

Parameters **indev** -- pointer to an input device

Returns pointer to the indev read refresher timer. (NULL on error)

struct *_lv_obj_t* ***lv_indev_search_obj**(struct *_lv_obj_t* *obj, lv_point_t *point)

Search the most top, clickable object by a point

Parameters

- **obj** -- pointer to a start object, typically the screen
- **point** -- pointer to a point for searching the most top child

Returns pointer to the found object or NULL if there was no suitable object

struct **lv_indev_data_t**

#include <lv_indev.h> Data structure passed to an input driver to fill

Public Members

lv_point_t **point**

For LV_INDEV_TYPE_POINTER the currently pressed point

uint32_t **key**

For LV_INDEV_TYPE_KEYPAD the currently pressed key

uint32_t **btn_id**

For LV_INDEV_TYPE_BUTTON the currently pressed button

int16_t **enc_diff**

For LV_INDEV_TYPE_ENCODER number of steps since the previous read

lv_indev_state_t **state**

LV_INDEV_STATE_REL or LV_INDEV_STATE_PR

bool **continue_reading**

If set to true, the read callback is invoked again

Groups

Typedefs

typedef uint8_t **`lv_key_t`**

typedef void (***`lv_group_focus_cb_t`**)(struct *_lv_group_t**)

typedef void (***`lv_group_edge_cb_t`**)(struct *_lv_group_t**, bool)

typedef struct *_lv_group_t* **`lv_group_t`**

Groups can be used to logically hold objects so that they can be individually focused. They are NOT for laying out objects on a screen (try layouts for that).

Enums

enum **`[anonymous]`**

Values:

enumerator **`LV_KEY_UP`**

enumerator **`LV_KEY_DOWN`**

enumerator **`LV_KEY_RIGHT`**

enumerator **`LV_KEY_LEFT`**

enumerator **`LV_KEY_ESC`**

enumerator **`LV_KEY_DEL`**

enumerator **`LV_KEY_BACKSPACE`**

enumerator **`LV_KEY_ENTER`**

enumerator **`LV_KEY_NEXT`**

enumerator **`LV_KEY_PREV`**

enumerator **`LV_KEY_HOME`**

enumerator **`LV_KEY_END`**

enum **`lv_group_refocus_policy_t`**

Values:

enumerator **`LV_GROUP_REFOCUS_POLICY_NEXT`**

enumerator **`LV_GROUP_REFOCUS_POLICY_PREV`**

Functions

void **`_lv_group_init`**(void)

Init. the group module

Remark Internal function, do not call directly.

lv_group_t ***`lv_group_create`**(void)

Create a new object group

Returns pointer to the new object group

void **`lv_group_del`**(*lv_group_t* *group)

Delete a group object

Parameters **`group`** -- pointer to a group

void **`lv_group_set_default`**(*lv_group_t* *group)

Set a default group. New object are added to this group if it's enabled in their class with `add_to_def_group = true`

Parameters **`group`** -- pointer to a group (can be `NULL`)

lv_group_t ***`lv_group_get_default`**(void)

Get the default group

Returns pointer to the default group

void **`lv_group_add_obj`**(*lv_group_t* *group, struct *_lv_obj_t* *obj)

Add an object to a group

Parameters

- **`group`** -- pointer to a group
- **`obj`** -- pointer to an object to add

void **`lv_group_swap_obj`**(struct *_lv_obj_t* *obj1, struct *_lv_obj_t* *obj2)

Swap 2 object in a group. The object must be in the same group

Parameters

- **`obj1`** -- pointer to an object
- **`obj2`** -- pointer to an other object

void **`lv_group_remove_obj`**(struct *_lv_obj_t* *obj)

Remove an object from its group

Parameters **`obj`** -- pointer to an object to remove

void **`lv_group_remove_all_objs`**(*lv_group_t* *group)
Remove all objects from a group

Parameters **`group`** -- pointer to a group

void **`lv_group_focus_obj`**(struct *_lv_obj_t* *obj)
Focus on an object (defocus the current)

Parameters **`obj`** -- pointer to an object to focus on

void **`lv_group_focus_next`**(*lv_group_t* *group)
Focus the next object in a group (defocus the current)

Parameters **`group`** -- pointer to a group

void **`lv_group_focus_prev`**(*lv_group_t* *group)
Focus the previous object in a group (defocus the current)

Parameters **`group`** -- pointer to a group

void **`lv_group_focus_freeze`**(*lv_group_t* *group, bool en)
Do not let to change the focus from the current object

Parameters

- **`group`** -- pointer to a group
- **`en`** -- true: freeze, false: release freezing (normal mode)

lv_res_t **`lv_group_send_data`**(*lv_group_t* *group, uint32_t c)
Send a control character to the focuses object of a group

Parameters

- **`group`** -- pointer to a group
- **`c`** -- a character (use LV_KEY_.. to navigate)

Returns result of focused object in group.

void **`lv_group_set_focus_cb`**(*lv_group_t* *group, *lv_group_focus_cb_t* focus_cb)
Set a function for a group which will be called when a new object is focused

Parameters

- **`group`** -- pointer to a group
- **`focus_cb`** -- the call back function or NULL if unused

void **`lv_group_set_edge_cb`**(*lv_group_t* *group, *lv_group_edge_cb_t* edge_cb)
Set a function for a group which will be called when a focus edge is reached

Parameters

- **`group`** -- pointer to a group
- **`edge_cb`** -- the call back function or NULL if unused

void **`lv_group_set_refocus_policy`**(*lv_group_t* *group, *lv_group_refocus_policy_t* policy)
Set whether the next or previous item in a group is focused if the currently focused obj is deleted.

Parameters

- **`group`** -- pointer to a group
- **`policy`** -- new refocus policy enum

void **`lv_group_set_editing`**(*lv_group_t* *group, bool edit)

Manually set the current mode (edit or navigate).

Parameters

- **`group`** -- pointer to group
- **`edit`** -- true: edit mode; false: navigate mode

void **`lv_group_set_wrap`**(*lv_group_t* *group, bool en)

Set whether focus next/prev will allow wrapping from first->last or last->first object.

Parameters

- **`group`** -- pointer to group
- **`en`** -- true: wrapping enabled; false: wrapping disabled

struct *_lv_obj_t* ***`lv_group_get_focused`**(const *lv_group_t* *group)

Get the focused object or NULL if there isn't one

Parameters **`group`** -- pointer to a group

Returns pointer to the focused object

lv_group_focus_cb_t **`lv_group_get_focus_cb`**(const *lv_group_t* *group)

Get the focus callback function of a group

Parameters **`group`** -- pointer to a group

Returns the call back function or NULL if not set

lv_group_edge_cb_t **`lv_group_get_edge_cb`**(const *lv_group_t* *group)

Get the edge callback function of a group

Parameters **`group`** -- pointer to a group

Returns the call back function or NULL if not set

bool **`lv_group_get_editing`**(const *lv_group_t* *group)

Get the current mode (edit or navigate).

Parameters **`group`** -- pointer to group

Returns true: edit mode; false: navigate mode

bool **`lv_group_get_wrap`**(*lv_group_t* *group)

Get whether focus next/prev will allow wrapping from first->last or last->first object.

Parameters

- **`group`** -- pointer to group
- **`en`** -- true: wrapping enabled; false: wrapping disabled

uint32_t **`lv_group_get_obj_count`**(*lv_group_t* *group)

Get the number of object in the group

Parameters **`group`** -- pointer to a group

Returns number of objects in the group

struct **`_lv_group_t`**

#include <lv_group.h> Groups can be used to logically hold objects so that they can be individually focused. They are NOT for laying out objects on a screen (try layouts for that).

Public Members

lv_ll_t **`obj_ll`**

Linked list to store the objects in the group

struct *_lv_obj_t* ****`obj_focus`**

The object in focus

lv_group_focus_cb_t **`focus_cb`**

A function to call when a new object is focused (optional)

lv_group_edge_cb_t **`edge_cb`**

A function to call when an edge is reached, no more focus targets are available in this direction (to allow edge feedback like a sound or a scroll bounce)

void ***`user_data`**

uint8_t **`frozen`**

1: can't focus to new object

uint8_t **`editing`**

1: Edit mode, 0: Navigate mode

uint8_t **`refocus_policy`**

1: Focus prev if focused on deletion. 0: Focus next if focused on deletion.

uint8_t **`wrap`**

1: Focus next/prev can wrap at end of list. 0: Focus next/prev stops at end of list.

5.9 Displays

Important: The basic concept of a *display* in LVGL is explained in the [Porting](/porting/display) section. So before reading further, please read the [Porting](/porting/display) section first.

5.9.1 Multiple display support

In LVGL you can have multiple displays, each with their own driver and objects. The only limitation is that every display needs to have the same color depth (as defined in `LV_COLOR_DEPTH`). If the displays are different in this regard the rendered image can be converted to the correct format in the drivers `flush_cb`.

Creating more displays is easy: just initialize more display buffers and register another driver for every display. When you create the UI, use `lv_disp_set_default(disp)` to tell the library on which display to create objects.

Why would you want multi-display support? Here are some examples:

- Have a "normal" TFT display with local UI and create "virtual" screens on VNC on demand. (You need to add your VNC driver).
- Have a large TFT display and a small monochrome display.
- Have some smaller and simple displays in a large instrument or technology.
- Have two large TFT displays: one for a customer and one for the shop assistant.

Using only one display

Using more displays can be useful but in most cases it's not required. Therefore, the whole concept of multi-display handling is completely hidden if you register only one display. By default, the last created (and only) display is used.

`lv_scr_act()`, `lv_scr_load(scr)`, `lv_layer_top()`, `lv_layer_sys()`, `LV_HOR_RES` and `LV_VER_RES` are always applied on the most recently created (default) display. If you pass `NULL` as `disp` parameter to display related functions the default display will usually be used. E.g. `lv_disp_trig_activity(NULL)` will trigger a user activity on the default display. (See below in *Inactivity*).

Duplicate display

To duplicate the image of a display to another display, you don't need to the use multi-display support. Just transfer the buffer received in `flush_cb` to the other display too.

Split image

You can create a larger virtual display from an array of smaller ones. You can create it as below:

1. Set the resolution of the displays to the large display's resolution.
2. In `flush_cb`, truncate and modify the `area` parameter for each display.
3. Send the buffer's content to each real display with the truncated area.

5.9.2 Screens

Every display has its own set of screens and the objects on each screen.

Be sure not to confuse displays and screens:

- **Displays** are the physical hardware drawing the pixels.
- **Screens** are the high-level root objects associated with a particular display. One display can have multiple screens associated with it, but not vice versa.

Screens can be considered the highest level containers which have no parent. A screen's size is always equal to its display and their origin is (0;0). Therefore, a screen's coordinates can't be changed, i.e. `lv_obj_set_pos()`, `lv_obj_set_size()` or similar functions can't be used on screens.

A screen can be created from any object type but the two most typical types are *Base object* and *Image* (to create a wallpaper).

To create a screen, use `lv_obj_t * scr = lv_<type>_create(NULL, copy)`. `copy` can be an existing screen copied into the new screen.

To load a screen, use `lv_scr_load(scr)`. To get the active screen, use `lv_scr_act()`. These functions work on the default display. If you want to specify which display to work on, use `lv_disp_get_scr_act(disp)` and `lv_disp_load_scr(disp, scr)`. A screen can be loaded with animations too. Read more here.

Screens can be deleted with `lv_obj_del(scr)`, but ensure that you do not delete the currently loaded screen.

Transparent screens

Usually, the opacity of the screen is `LV_OPA_COVER` to provide a solid background for its children. If this is not the case (opacity < 100%) the display's `bottom_layer` will be visible. If the bottom layer's opacity is also not `LV_OPA_COVER` LVGL has no solid background to draw.

This configuration (transparent screen and display) could be used to create for example OSD menus where a video is played on a lower layer, and a menu is overlaid on an upper layer.

To properly render the screen the display's color format needs to be set to one with alpha channel.

In summary, to enable transparent screens and displays for OSD menu-like UIs:

- Set the screen's `bg_opa` to transparent: `lv_obj_set_style_local_bg_opa(lv_scr_act(), LV_OPA_TRANSP, 0)`
- Set the bottom layer's `bg_opa` to transparent: `lv_obj_set_style_local_bg_opa(lv_bottom_layer(), LV_OPA_TRANSP, 0)`
- Set a color format with alpha channel. E.g. `lv_disp_set_color_format(disp, LV_COLOR_FORMAT_NATIVE_ALPHA)`

5.9.3 Features of displays

Inactivity

A user's inactivity time is measured on each display. Every use of an *Input device* (if associated with the display) counts as an activity. To get time elapsed since the last activity, use `lv_disp_get_inactive_time(disp)`. If `NULL` is passed, the lowest inactivity time among all displays will be returned (**NULL isn't just the default display**).

You can manually trigger an activity using `lv_disp_trig_activity(disp)`. If `disp` is `NULL`, the default screen will be used (**and not all displays**).

Background

Every display has a background color, background image and background opacity properties. They become visible when the current screen is transparent or not positioned to cover the whole display.

The background color is a simple color to fill the display. It can be adjusted with `lv_disp_set_bg_color(disp, color)`;

The display background image is a path to a file or a pointer to an `lv_img_dsc_t` variable (converted image data) to be used as wallpaper. It can be set with `lv_disp_set_bg_image(disp, &my_img)`; If a background image is configured the background won't be filled with `bg_color`.

The opacity of the background color or image can be adjusted with `lv_disp_set_bg_opa(disp, opa)`.

The `disp` parameter of these functions can be `NULL` to select the default display.

5.9.4 API

Typedefs

typedef struct _lv_disp_t **`lv_disp_t`**

Enums

enum **`lv_disp_rotation_t`**

Values:

enumerator **`LV_DISP_ROTATION_0`**

enumerator **`LV_DISP_ROTATION_90`**

enumerator **`LV_DISP_ROTATION_180`**

enumerator **`LV_DISP_ROTATION_270`**

enum **`lv_disp_render_mode_t`**

Values:

enumerator **`LV_DISP_RENDER_MODE_PARTIAL`**

Use the buffer(s) to render the screen is smaller parts. This way the buffers can be smaller then the display to save RAM. At least 1/10 sceen size buffer(s) are recommended.

enumerator **`LV_DISP_RENDER_MODE_DIRECT`**

The buffer(s) has to be screen sized and LVGL will render into the correct location of the buffer. This way the buffer always contain the whole image. Only the changed ares will be updated. With 2 buffers the buffers' content are kept in sync automatically and in flush_cb only address change is required.

enumerator **`LV_DISP_RENDER_MODE_FULL`**

Always redraw the whole screen even if only one pixel has been changed. With 2 buffers in flush_cb only and address change is required.

enum **`lv_scr_load_anim_t`**

Values:

enumerator **`LV_SCR_LOAD_ANIM_NONE`**

enumerator **`LV_SCR_LOAD_ANIM_OVER_LEFT`**

enumerator **`LV_SCR_LOAD_ANIM_OVER_RIGHT`** enumerator **`LV_SCR_LOAD_ANIM_OVER_TOP`**

enumerator **`LV_SCR_LOAD_ANIM_OVER_BOTTOM`**

enumerator **`LV_SCR_LOAD_ANIM_MOVE_LEFT`**

enumerator **`LV_SCR_LOAD_ANIM_MOVE_RIGHT`**

enumerator **`LV_SCR_LOAD_ANIM_MOVE_TOP`**

enumerator **`LV_SCR_LOAD_ANIM_MOVE_BOTTOM`**

enumerator **`LV_SCR_LOAD_ANIM_FADE_IN`**

enumerator **`LV_SCR_LOAD_ANIM_FADE_ON`**

enumerator **`LV_SCR_LOAD_ANIM_FADE_OUT`**

enumerator **`LV_SCR_LOAD_ANIM_OUT_LEFT`**

enumerator **`LV_SCR_LOAD_ANIM_OUT_RIGHT`**

enumerator **`LV_SCR_LOAD_ANIM_OUT_TOP`**

enumerator **`LV_SCR_LOAD_ANIM_OUT_BOTTOM`**

Functions

lv_disp_t ***`lv_disp_create`**(lv_coord_t hor_res, lv_coord_t ver_res)

Create a new display with the given resolution

Parameters

- **`hor_res`** -- horizontal resolution in pixels
- **`ver_res`** -- vertical resolution in pixels

Returns pointer to a display object or `NULL` on error

void **`lv_disp_remove`**(*lv_disp_t* *disp)

Remove a display

Parameters **`disp`** -- pointer to display

void **`lv_disp_set_default`**(*lv_disp_t* *disp)

Set a default display. The new screens will be created on it by default.

Parameters **`disp`** -- pointer to a display *lv_disp_t* ***lv_disp_get_default**(void)*

Get the default display

Returns pointer to the default display

lv_disp_t ***lv_disp_get_next**(*lv_disp_t* *disp)

Get the next display.

Parameters **disp** -- pointer to the current display. NULL to initialize.

Returns the next display or NULL if no more. Gives the first display when the parameter is NULL.

void **lv_disp_set_res**(*lv_disp_t* *disp, lv_coord_t hor_res, lv_coord_t ver_res)

Sets the resolution of a display. `LV_EVENT_RESOLUTION_CHANGED` event will be sent. Here the native resolution of the device should be set. If the display will be rotated later with `lv_disp_set_rotation` LVGL will swap the hor. and ver. resolution automatically.

Parameters

- **disp** -- pointer to a display
- **hor_res** -- the new horizontal resolution
- **ver_res** -- the new vertical resolution

void **lv_disp_set_physical_res**(*lv_disp_t* *disp, lv_coord_t hor_res, lv_coord_t ver_res)

It's not mandatory to use the whole display for LVGL, however in some cases physical resolution is important. For example the touchpad still sees whole resolution and the values needs to be converted to the active LVGL display area.

Parameters

- **disp** -- pointer to a display
- **hor_res** -- the new physical horizontal resolution, or -1 to assume it's the same as the normal hor. res.
- **ver_res** -- the new physical vertical resolution, or -1 to assume it's the same as the normal hor. res.

void **lv_disp_set_offset**(*lv_disp_t* *disp, lv_coord_t x, lv_coord_t y)

If physical resolution is not the same as the normal resolution the offset of the active display area can be set here.

Parameters

- **disp** -- pointer to a display
- **x** -- X offset
- **y** -- Y offset

void **lv_disp_set_rotation**(*lv_disp_t* *disp, *lv_disp_rotation_t* rotation, bool sw_rotate)

Set the rotation of this display. LVGL will swap the horizontal and vertical resolutions internally.

Parameters

- **disp** -- pointer to a display (NULL to use the default display)
- **rotation** -- `LV_DISP_ROTATION_0/90/180/270`
- **sw_rotate** -- true: make LVGL rotate the rendered image; false: the display driver should rotate the rendered image

void **lv_disp_set_dpi**(*lv_disp_t* *disp, lv_coord_t dpi)

Set the DPI (dot per inch) of the display. dpi = sqrt(hor_res^2 + ver_res^2) / diagonal"

Parameters

- **disp** -- pointer to a display
- **dpi** -- the new DPI

lv_coord_t **lv_disp_get_hor_res**(const *lv_disp_t* *disp)

Get the horizontal resolution of a display.

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns the horizontal resolution of the display.

lv_coord_t **lv_disp_get_ver_res**(const *lv_disp_t* *disp)

Get the vertical resolution of a display

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns the vertical resolution of the display

lv_coord_t **lv_disp_get_physical_hor_res**(const *lv_disp_t* *disp)

Get the physical horizontal resolution of a display

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns the physical horizontal resolution of the display

lv_coord_t **lv_disp_get_physical_ver_res**(const *lv_disp_t* *disp)

Get the physical vertical resolution of a display

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns the physical vertical resolution of the display

lv_coord_t **lv_disp_get_offset_x**(const *lv_disp_t* *disp)

Get the horizontal offset from the full / physical display

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns the horizontal offset from the physical display

lv_coord_t **lv_disp_get_offset_y**(const *lv_disp_t* *disp)

Get the vertical offset from the full / physical display

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns the horizontal offset from the physical display

lv_disp_rotation_t **lv_disp_get_rotation**(*lv_disp_t* *disp)

Get the current rotation of this display.

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns the current rotation

lv_coord_t **lv_disp_get_dpi**(const *lv_disp_t* *disp)

Get the DPI of the display

Parameters **disp** -- pointer to a display (NULL to use the default display)

Returns dpi of the display

void **`lv_disp_set_draw_buffers`**(*lv_disp_t* *disp, void *buf1, void *buf2, uint32_t buf_size_px, *lv_disp_render_mode_t* render_mode)

Set the buffers for a display

Parameters

- **`disp`** -- pointer to a display
- **`buf1`** -- first buffer
- **`buf2`** -- second buffer (can be `NULL`)
- **`buf_size_px`** -- size of the buffer in pixels
- **`render_mode`** -- LV_DISP_RENDER_MODE_PARTIAL/DIRECT/FULL

void **`lv_disp_set_flush_cb`**(*lv_disp_t* *disp, void (*flush_cb)(struct _lv_disp_t *disp, const lv_area_t *area, lv_color_t *color_p))

Set the flush callback whcih will be called to copy the rendered image to the display.

Parameters

- **`disp`** -- pointer to a display
- **`flush_cb`** -- the flush callback

void **`lv_disp_set_color_format`**(*lv_disp_t* *disp, *lv_color_format_t* color_format)

Set the color format of the display. If set to other than `LV_COLOR_FORMAT_NATIVE` the draw_ctx's `buffer_convert` function will be used to convert the rendered content to the desired color format.

Parameters

- **`disp`** -- pointer to a display
- **`color_format`** -- By default `LV_COLOR_FORMAT_NATIVE` to render with L8, RGB565, RGB888 or ARGB8888. `LV_COLOR_FORMAT_NATIVE_REVERSE` to change endianess.

lv_color_format_t **`lv_disp_get_color_format`**(*lv_disp_t* *disp)

Get the color format of the display

Parameters **`disp`** -- pointer to a display

Returns the color format

void **`lv_disp_set_antialaising`**(*lv_disp_t* *disp, bool en)

Enable anti-aliasing for the render engine

Parameters

- **`disp`** -- pointer to a display
- **`en`** -- true/false

bool **`lv_disp_get_antialiasing`**(*lv_disp_t* *disp)

Get if anti-aliasing is enabled for a display or not

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns true/false

bool **`lv_disp_is_double_buffered`**(*lv_disp_t* *disp) void **`lv_disp_set_draw_ctx`**(*lv_disp_t* *disp, void (*draw_ctx_init)(*lv_disp_t* *disp, struct _lv_draw_ctx_t *draw_ctx), void (*draw_ctx_deinit)(*lv_disp_t* *disp, struct _lv_draw_ctx_t *draw_ctx), size_t draw_ctx_size)

Initialize a new draw context for the display

Parameters

- **`disp`** -- pointer to a display
- **`draw_ctx_init`** -- init callback
- **`draw_ctx_deinit`** -- deinit callback
- **`draw_ctx_size`** -- size of the draw context instance

struct *_lv_obj_t* ***`lv_disp_get_scr_act`**(*lv_disp_t* *disp)

Return a pointer to the active screen on a display

Parameters **`disp`** -- pointer to display which active screen should be get. (NULL to use the default screen)

Returns pointer to the active screen object (loaded by 'lv_scr_load()')

struct *_lv_obj_t* ***`lv_disp_get_scr_prev`**(*lv_disp_t* *disp)

Return with a pointer to the previous screen. Only used during screen transitions.

Parameters **`disp`** -- pointer to display which previous screen should be get. (NULL to use the default screen)

Returns pointer to the previous screen object or NULL if not used now

void **`lv_disp_load_scr`**(struct *_lv_obj_t* *scr)

Make a screen active

Parameters **`scr`** -- pointer to a screen

struct *_lv_obj_t* ***`lv_disp_get_layer_top`**(*lv_disp_t* *disp)

Return the top layer. The top layer is the same on all screens and it is above the normal screen layer.

Parameters **`disp`** -- pointer to display which top layer should be get. (NULL to use the default screen)

Returns pointer to the top layer object

struct *_lv_obj_t* ***`lv_disp_get_layer_sys`**(*lv_disp_t* *disp)

Return the sys. layer. The system layer is the same on all screen and it is above the normal screen and the top layer.

Parameters **`disp`** -- pointer to display which sys. layer should be retrieved. (NULL to use the default screen)

Returns pointer to the sys layer object

struct *_lv_obj_t* ***`lv_disp_get_layer_bottom`**(*lv_disp_t* *disp)

Return the bottom layer. The bottom layer is the same on all screen and it is under the normal screen layer. It's visble only if the the screen is transparent.

Parameters **`disp`** -- pointer to display (NULL to use the default screen)

Returns pointer to the bottom layer object

void **`lv_scr_load_anim`**(struct *_lv_obj_t* *scr, *lv_scr_load_anim_t* anim_type, uint32_t time, uint32_t delay, bool auto_del)

Switch screen with animation

Parameters

- **scr** -- pointer to the new screen to load
- **anim_type** -- type of the animation from lv_scr_load_anim_t, e.g. LV_SCR_LOAD_ANIM_MOVE_LEFT
- **time** -- time of the animation
- **delay** -- delay before the transition
- **auto_del** -- true: automatically delete the old screen

static inline struct *_lv_obj_t* ***lv_scr_act**(void)

Get the active screen of the default display

Returns pointer to the active screen

static inline struct *_lv_obj_t* ***lv_layer_top**(void)

Get the top layer of the default display

Returns pointer to the top layer

static inline struct *_lv_obj_t* ***lv_layer_sys**(void)

Get the system layer of the default display

Returns pointer to the sys layer

static inline struct *_lv_obj_t* ***lv_layer_bottom**(void)

Get the bottom layer of the default display

Returns pointer to the bottom layer

static inline void **lv_scr_load**(struct *_lv_obj_t* *scr)

Load a screen on the default display

Parameters **scr** -- pointer to a screen

void **lv_disp_add_event**(*lv_disp_t* *disp, *lv_event_cb_t* event_cb, *lv_event_code_t* filter, void *user_data)

Add an event handler to the display

Parameters

- **disp** -- pointer to a display
- **event_cb** -- an event callback
- **filter** -- event code to react or LV_EVENT_ALL
- **user_data** -- optional user_data

uint32_t **lv_disp_get_event_count**(*lv_disp_t* *disp)

lv_event_dsc_t ***lv_disp_get_event_dsc**(*lv_disp_t* *disp, uint32_t index)

bool **lv_disp_remove_event**(*lv_disp_t* *disp, uint32_t index)

lv_res_t **lv_disp_send_event**(*lv_disp_t* *disp, *lv_event_code_t* code, void *user_data)

Send amn event to a display

Parameters

- **disp** -- pointer to a display
- **code** -- an event code. LV_EVENT_...
- **user_data** -- optional user_data

Returns LV_RES_OK: disp wasn't deleted in the event.

void **`lv_disp_set_theme`**(*lv_disp_t* *disp, struct *_lv_theme_t* *th)

Set the theme of a display. If there are no user created widgets yet the screens' theme will be updated

Parameters

- **`disp`** -- pointer to a display
- **`th`** -- pointer to a theme

struct *_lv_theme_t* ***`lv_disp_get_theme`**(*lv_disp_t* *disp)

Get the theme of a display

Parameters **`disp`** -- pointer to a display

Returns the display's theme (can be NULL)

uint32_t **`lv_disp_get_inactive_time`**(const *lv_disp_t* *disp)

Get elapsed time since last user activity on a display (e.g. click)

Parameters **`disp`** -- pointer to a display (NULL to get the overall smallest inactivity)

Returns elapsed ticks (milliseconds) since the last activity

void **`lv_disp_trig_activity`**(*lv_disp_t* *disp)

Manually trigger an activity on a display

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

void **`lv_disp_enable_invalidation`**(*lv_disp_t* *disp, bool en)

Temporarily enable and disable the invalidation of the display.

Parameters

- **`disp`** -- pointer to a display (NULL to use the default display)
- **`en`** -- true: enable invalidation; false: invalidation

bool **`lv_disp_is_invalidation_enabled`**(*lv_disp_t* *disp)

Get display invalidation is enabled.

Parameters **`disp`** -- pointer to a display (NULL to use the default display)

Returns return true if invalidation is enabled

lv_timer_t ***`_lv_disp_get_refr_timer`**(*lv_disp_t* *disp)

Get a pointer to the screen refresher timer to modify its parameters with `lv_timer_...` functions.

Parameters **`disp`** -- pointer to a display

Returns pointer to the display refresher timer. (NULL on error)

lv_color_t **`lv_disp_get_chroma_key_color`**(*lv_disp_t* *disp)

void **`lv_disp_set_user_data`**(*lv_disp_t* *disp, void *user_data)

void **`lv_disp_set_driver_data`**(*lv_disp_t* *disp, void *driver_data)

void ***`lv_disp_get_user_data`**(*lv_disp_t* *disp)

void ***`lv_disp_get_driver_data`**(*lv_disp_t* *disp) static inline lv_coord_t **lv_dpx**(lv_coord_t n)

Scale the given number of pixels (a distance or size) relative to a 160 DPI display considering the DPI of the default display. It ensures that e.g. `lv_dpx(100)` will have the same physical size regardless to the DPI of the display.

Parameters **n** -- the number of pixels to scale

Returns `n x current_dpi/160`

static inline lv_coord_t **lv_disp_dpx**(const *lv_disp_t* *disp, lv_coord_t n)

Scale the given number of pixels (a distance or size) relative to a 160 DPI display considering the DPI of the given display. It ensures that e.g. `lv_dpx(100)` will have the same physical size regardless to the DPI of the display.

Parameters

- **obj** -- a display whose dpi should be considered
- **n** -- the number of pixels to scale

Returns `n x current_dpi/160`

5.10 Colors

The color module handles all color-related functions like changing color depth, creating colors from hex code, converting between color depths, mixing colors, etc.

The type `lv_color_t` is used to store a color. Its fields are set according to `LV_COLOR_DEPTH` in `lv_conf.h`. (See below)

5.10.1 Creating colors

RGB

Create colors from Red, Green and Blue channel values:

```
//All channels are 0-255
lv_color_t c = lv_color_make(red, green, blue);

//From hex code 0x000000..0xFFFFFF interpreted as RED + GREEN + BLUE
lv_color_t c = lv_color_hex(0x123456);

//From 3 digits. Same as lv_color_hex(0x112233)
lv_color_t c = lv_color_hex3(0x123);
```

HSV

Create colors from Hue, Saturation and Value values:

```
//h = 0..359, s = 0..100, v = 0..100
lv_color_t c = lv_color_hsv_to_rgb(h, s, v);

//All channels are 0-255
lv_color_hsv_t c_hsv = lv_color_rgb_to_hsv(r, g, b);
```

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```
//From lv_color_t variable
lv_color_hsv_t c_hsv = lv_color_to_hsv(color);
```

Palette

LVGL includes Material Design's palette of colors. In this system all named colors have a nominal main color as well as four darker and five lighter variants.

The names of the colors are as follows:

- `LV_PALETTE_RED`
- `LV_PALETTE_PINK`
- `LV_PALETTE_PURPLE`
- `LV_PALETTE_DEEP_PURPLE`
- `LV_PALETTE_INDIGO`
- `LV_PALETTE_BLUE`
- `LV_PALETTE_LIGHT_BLUE`
- `LV_PALETTE_CYAN`
- `LV_PALETTE_TEAL`
- `LV_PALETTE_GREEN`
- `LV_PALETTE_LIGHT_GREEN`
- `LV_PALETTE_LIME`
- `LV_PALETTE_YELLOW`
- `LV_PALETTE_AMBER`
- `LV_PALETTE_ORANGE`
- `LV_PALETTE_DEEP_ORANGE`
- `LV_PALETTE_BROWN`
- `LV_PALETTE_BLUE_GREY`
- `LV_PALETTE_GREY`

To get the main color use `lv_color_t c = lv_palette_main(LV_PALETTE_...)`.

For the lighter variants of a palette color use `lv_color_t c = lv_palette_lighten(LV_PALETTE_..., v)`. `v` can be 1..5. For the darker variants of a palette color use `lv_color_t c = lv_palette_darken(LV_PALETTE_..., v)`. `v` can be 1..4.

Modify and mix colors

The following functions can modify a color:

```
// Lighten a color. 0: no change, 255: white
lv_color_t c = lv_color_lighten(c, lvl);

// Darken a color. 0: no change, 255: black
lv_color_t c = lv_color_darken(lv_color_t c, lv_opa_t lvl);

// Lighten or darken a color. 0: black, 128: no change 255: white
lv_color_t c = lv_color_change_lightness(lv_color_t c, lv_opa_t lvl);


// Mix two colors with a given ratio 0: full c2, 255: full c1, 128: half c1 and half␣
↪c2
lv_color_t c = lv_color_mix(c1, c2, ratio);
```

Built-in colors

`lv_color_white()` and `lv_color_black()` return `0xFFFFFF` and `0x000000` respectively.

5.10.2 Opacity

To describe opacity the `lv_opa_t` type is created from `uint8_t`. Some special purpose defines are also introduced:

- `LV_OPA_TRANSP` Value: 0, means no opacity making the color completely transparent
- `LV_OPA_10` Value: 25, means the color covers only a little
- `LV_OPA_20 ... OPA_80` follow logically
- `LV_OPA_90` Value: 229, means the color near completely covers
- `LV_OPA_COVER` Value: 255, means the color completely covers (full opacity)

You can also use the `LV_OPA_*` defines in `lv_color_mix()` as a mixing *ratio*.

5.10.3 Color types

The following variable types are defined by the color module:

- `lv_color1_t` Monochrome color. Also has R, G, B fields for compatibility but they are always the same value (1 byte)
- `lv_color8_t` A structure to store R (3 bit),G (3 bit),B (2 bit) components for 8-bit colors (1 byte)
- `lv_color16_t` A structure to store R (5 bit),G (6 bit),B (5 bit) components for 16-bit colors (2 byte)
- `lv_color32_t` A structure to store R (8 bit),G (8 bit), B (8 bit) components for 24-bit colors (4 byte)
- `lv_color_t` Equal to `lv_color1/8/16/24_t` depending on the configured color depth setting
- `lv_color_int_t` `uint8_t`, `uint16_t` or `uint32_t` depending on the color depth setting. Used to build color arrays from plain numbers.
- `lv_opa_t` A simple `uint8_t` type to describe opacity.

The `lv_color_t`, `lv_color1_t`, `lv_color8_t`, `lv_color16_t` and `lv_color32_t` types have four fields:

- `ch.red` red channel
- `ch.green` green channel
- `ch.blue` blue channel
- `full*` red + green + blue as one number

You can set the current color depth in *lv_conf.h*, by setting the `LV_COLOR_DEPTH` define to 1 (monochrome), 8, 16 or 32.

Convert color

You can convert a color from the current color depth to another. The converter functions return with a number, so you have to use the `full` field to map a converted color back into a structure:

```
lv_color_t c;
c.red   = 0x38;
c.green = 0x70;
c.blue  = 0xCC;

lv_color1_t c1;
c1.full = lv_color_to1(c);       /*Return 1 for light colors, 0 for dark colors*/

lv_color8_t c8;
c8.full = lv_color_to8(c);       /*Give a 8 bit number with the converted color*/

lv_color16_t c16;
c16.full = lv_color_to16(c); /*Give a 16 bit number with the converted color*/

lv_color32_t c24;
c32.full = lv_color_to32(c);       /*Give a 32 bit number with the converted color*/
```

5.10.4 API

Typedefs

typedef lv_color_t (***lv_color_filter_cb_t**)(const struct *_lv_color_filter_dsc_t**, lv_color_t, lv_opa_t)

typedef struct *_lv_color_filter_dsc_t* **lv_color_filter_dsc_t**

Enums

enum **[anonymous]**

Opacity percentages.

Values:

enumerator **LV_OPA_TRANSP**

enumerator **LV_OPA_0**

enumerator **LV_OPA_10**

enumerator **LV_OPA_20**

enumerator **LV_OPA_30**

enumerator **LV_OPA_40**

enumerator **LV_OPA_50**

enumerator **LV_OPA_60**

enumerator **LV_OPA_70**

enumerator **LV_OPA_80**

enumerator **LV_OPA_90**

enumerator **LV_OPA_100**

enumerator **LV_OPA_COVER**

enum **lv_color_format_t**

Values:

enumerator **LV_COLOR_FORMAT_UNKNOWN**

enumerator **LV_COLOR_FORMAT_L8**

enumerator **LV_COLOR_FORMAT_A8**

enumerator **LV_COLOR_FORMAT_I1**

enumerator **LV_COLOR_FORMAT_I2**

enumerator **LV_COLOR_FORMAT_I4**

enumerator **LV_COLOR_FORMAT_I8**

enumerator **LV_COLOR_FORMAT_A8L8**

enumerator **LV_COLOR_FORMAT_ARGB2222**

enumerator **`LV_COLOR_FORMAT_RGB565`**

enumerator **`LV_COLOR_FORMAT_RGB565_CHROMA_KEYED`**

enumerator **`LV_COLOR_FORMAT_ARGB1555`**

enumerator **`LV_COLOR_FORMAT_ARGB4444`**

enumerator **`LV_COLOR_FORMAT_RGB565A8`**

Color array followed by Alpha array

enumerator **`LV_COLOR_FORMAT_ARGB8565`**

enumerator **`LV_COLOR_FORMAT_RGB888`**

enumerator **`LV_COLOR_FORMAT_RGB888_CHROMA_KEYED`**

enumerator **`LV_COLOR_FORMAT_ARGB8888`**

enumerator **`LV_COLOR_FORMAT_XRGB8888`**

enumerator **`LV_COLOR_FORMAT_XRGB8888_CHROMA_KEYED`**

enumerator **`LV_COLOR_FORMAT_NATIVE`**

enumerator **`LV_COLOR_FORMAT_NATIVE_CHROMA_KEYED`**

enumerator **`LV_COLOR_FORMAT_NATIVE_ALPHA`**

enumerator **`LV_COLOR_FORMAT_NATIVE`**

enumerator **`LV_COLOR_FORMAT_NATIVE_CHROMA_KEYED`**

enumerator **`LV_COLOR_FORMAT_NATIVE_ALPHA`**

enumerator **`LV_COLOR_FORMAT_NATIVE`**

enumerator **`LV_COLOR_FORMAT_NATIVE_CHROMA_KEYED`**

enumerator **`LV_COLOR_FORMAT_NATIVE_ALPHA`**

enumerator **`LV_COLOR_FORMAT_NATIVE`**

enumerator **LV_COLOR_FORMAT_NATIVE_CHROMA_KEYED**

enumerator **LV_COLOR_FORMAT_NATIVE_ALPHA**

enumerator **LV_COLOR_FORMAT_NATIVE_REVERSED**

enumerator **LV_COLOR_FORMAT_NATIVE_ALPHA_REVERSED**

enumerator **LV_COLOR_FORMAT_RAW**

enumerator **LV_COLOR_FORMAT_RAW_ALPHA**

enum **lv_palette_t**

Values:

enumerator **LV_PALETTE_RED**

enumerator **LV_PALETTE_PINK**

enumerator **LV_PALETTE_PURPLE**

enumerator **LV_PALETTE_DEEP_PURPLE**

enumerator **LV_PALETTE_INDIGO**

enumerator **LV_PALETTE_BLUE**

enumerator **LV_PALETTE_LIGHT_BLUE**

enumerator **LV_PALETTE_CYAN**

enumerator **LV_PALETTE_TEAL**

enumerator **LV_PALETTE_GREEN**

enumerator **LV_PALETTE_LIGHT_GREEN**

enumerator **LV_PALETTE_LIME**

enumerator **LV_PALETTE_YELLOW**

enumerator **LV_PALETTE_AMBER**

enumerator **`LV_PALETTE_ORANGE`**

enumerator **`LV_PALETTE_DEEP_ORANGE`**

enumerator **`LV_PALETTE_BROWN`**

enumerator **`LV_PALETTE_BLUE_GREY`**

enumerator **`LV_PALETTE_GREY`**

enumerator **`_LV_PALETTE_LAST`**

enumerator **`LV_PALETTE_NONE`**

Functions

`LV_EXPORT_CONST_INT`(LV_COLOR_DEPTH)

`typedef LV_CONCAT3 (lv_color, LV_COLOR_DEPTH, _t) lv_color_t`

void **`lv_color_to_native`**(const uint8_t *src_buf, *lv_color_format_t* src_cf, lv_color_t *c_out, lv_opa_t *a_out, lv_color_t alpha_color, uint32_t px_cnt)

void **`lv_color_from_native`**(const lv_color_t *src_buf, uint8_t *dest_buf, *lv_color_format_t* dest_cf, uint32_t px_cnt)

void **`lv_color_from_native_alpha`**(const uint8_t *src_buf, uint8_t *dest_buf, *lv_color_format_t* dest_cf, uint32_t px_cnt)

uint8_t **`lv_color_format_get_size`**(*lv_color_format_t* src_cf)

Get the pixel size of a color format in bits

Parameters **`cf`** -- a color format (`LV_IMG_CF_...`)

Returns the pixel size in bits

bool **`lv_color_format_has_alpha`**(*lv_color_format_t* src_cf)

Check if a color format has alpha channel or not

Parameters **`cf`** -- a color format (`LV_IMG_CF_...`)

Returns true: has alpha channel; false: doesn't have alpha channel

static inline void **`lv_color8_set_int`**(*lv_color8_t* *c, uint8_t v)

static inline void **`lv_color16_set_int`**(*lv_color16_t* *c, uint16_t v)

static inline void **`lv_color24_set_int`**(*lv_color24_t* *c, uint32_t v)

static inline void **`lv_color32_set_int`**(*lv_color32_t* *c, uint32_t v)

static inline void **`lv_color_set_int`**(lv_color_t *c, uint32_t v) static inline uint8_t **`lv_color8_to_int`**(*lv_color8_t* c)

static inline uint16_t **`lv_color16_to_int`**(*lv_color16_t* c)

static inline uint32_t **`lv_color24_to_int`**(*lv_color24_t* c)

static inline uint32_t **`lv_color32_to_int`**(*lv_color32_t* c)

static inline uint32_t **`lv_color_to_int`**(lv_color_t c)

static inline *lv_color8_t* **`lv_color8_from_buf`**(const uint8_t *buf)

static inline *lv_color16_t* **`lv_color16_from_buf`**(const uint8_t *buf)

static inline *lv_color24_t* **`lv_color24_from_buf`**(const uint8_t *buf)

static inline *lv_color32_t* **`lv_color32_from_buf`**(const uint8_t *buf)

static inline lv_color_t **`lv_color_from_buf`**(const uint8_t *buf)

static inline bool **`lv_color_eq`**(lv_color_t c1, lv_color_t c2)

static inline *lv_color8_t* **`lv_color_to8`**(lv_color_t color)

static inline *lv_color16_t* **`lv_color_to16`**(lv_color_t color)

static inline *lv_color24_t* **`lv_color_to24`**(lv_color_t color)

static inline *lv_color32_t* **`lv_color_to32`**(lv_color_t color)

static inline uint8_t **`lv_color_brightness`**(lv_color_t color)

Get the brightness of a color

Parameters **`color`** -- a color

Returns the brightness [0..255]

static inline lv_color_t **`lv_color_make`**(uint8_t r, uint8_t g, uint8_t b)

static inline lv_color_t **`lv_color_hex`**(uint32_t c)

static inline lv_color_t **`lv_color_hex3`**(uint32_t c)

static inline void **`lv_color_filter_dsc_init`**(*lv_color_filter_dsc_t* *dsc, *lv_color_filter_cb_t* cb)

lv_color_t **`lv_color_lighten`**(lv_color_t c, lv_opa_t lvl)

lv_color_t **`lv_color_darken`**(lv_color_t c, lv_opa_t lvl)

lv_color_t **`lv_color_change_lightness`**(lv_color_t c, lv_opa_t lvl)

lv_color_t **`lv_color_hsv_to_rgb`**(uint16_t h, uint8_t s, uint8_t v)

Convert a HSV color to RGB

Parameters

- **`h`** -- hue [0..359]
- **`s`** -- saturation [0..100]
- **`v`** -- value [0..100]

Returns the given RGB color in RGB (with LV_COLOR_DEPTH depth) *lv_color_hsv_t* **`lv_color_rgb_to_hsv`**(uint8_t r8, uint8_t g8, uint8_t b8)

Convert a 32-bit RGB color to HSV

Parameters

- **`r8`** -- 8-bit red
- **`g8`** -- 8-bit green
- **`b8`** -- 8-bit blue

Returns the given RGB color in HSV

lv_color_hsv_t **`lv_color_to_hsv`**(lv_color_t color)

Convert a color to HSV

Parameters **`color`** -- color

Returns the given color in HSV

static inline lv_color_t **`lv_color_chroma_key`**(void)

Just a wrapper around LV_COLOR_CHROMA_KEY because it might be more convenient to use a function in some cases

Returns LV_COLOR_CHROMA_KEY

lv_color_t **`lv_palette_main`**(*lv_palette_t* p)

static inline lv_color_t **`lv_color_white`**(void)

static inline lv_color_t **`lv_color_black`**(void)

lv_color_t **`lv_palette_lighten`**(*lv_palette_t* p, uint8_t lvl)

lv_color_t **`lv_palette_darken`**(*lv_palette_t* p, uint8_t lvl)

union **`lv_color1_t`**

Public Members

uint8_t **`blue`**

uint8_t **`green`**

uint8_t **`red`**

union **`lv_color8_t`**

Public Members

uint8_t **blue**

uint8_t **green**

uint8_t **red**

uint8_t **level**

struct **lv_color16_t**

Public Members

uint16_t **blue**

uint16_t **green**

uint16_t **red**

struct **lv_color24_t**

Public Members

uint8_t **blue**

uint8_t **green**

uint8_t **red**

struct **lv_color32_t**

Public Members

uint8_t **blue**

uint8_t **green**

uint8_t **red**

uint8_t **alpha**

struct **lv_color_hsv_t**

Public Members

uint16_t **h**

uint8_t **s**

uint8_t **v**

struct **_lv_color_filter_dsc_t**

Public Members

lv_color_filter_cb_t **filter_cb**

void ***user_data**

5.11 Fonts

In LVGL fonts are collections of bitmaps and other information required to render images of individual letters (glyph). A font is stored in a `lv_font_t` variable and can be set in a style's *text_font* field. For example:

```
lv_style_set_text_font(&my_style, &lv_font_montserrat_28);  /*Set a larger font*/
```

Fonts have a **bpp (bits per pixel)** property. It shows how many bits are used to describe a pixel in a font. The value stored for a pixel determines the pixel's opacity. This way, with higher *bpp*, the edges of the letter can be smoother. The possible *bpp* values are 1, 2, 4 and 8 (higher values mean better quality).

The *bpp* property also affects the amount of memory needed to store a font. For example, *bpp = 4* makes a font nearly four times larger compared to *bpp = 1*.

5.11.1 Unicode support

LVGL supports **UTF-8** encoded Unicode characters. Your editor needs to be configured to save your code/text as UTF-8 (usually this the default) and be sure that, `LV_TXT_ENC` is set to `LV_TXT_ENC_UTF8` in *lv_conf.h*. (This is the default value)

To test it try

```
lv_obj_t * label1 = lv_label_create(lv_scr_act(), NULL);
lv_label_set_text(label1, LV_SYMBOL_OK);
```

If all works well, a ✓ character should be displayed.

5.11.2 Built-in fonts

There are several built-in fonts in different sizes, which can be enabled in `lv_conf.h` with *LV_FONT_...* defines.

Normal fonts

Containing all the ASCII characters, the degree symbol (U+00B0), the bullet symbol (U+2022) and the built-in symbols (see below).

- `LV_FONT_MONTSERRAT_12` 12 px font
- `LV_FONT_MONTSERRAT_14` 14 px font
- `LV_FONT_MONTSERRAT_16` 16 px font
- `LV_FONT_MONTSERRAT_18` 18 px font
- `LV_FONT_MONTSERRAT_20` 20 px font
- `LV_FONT_MONTSERRAT_22` 22 px font
- `LV_FONT_MONTSERRAT_24` 24 px font
- `LV_FONT_MONTSERRAT_26` 26 px font
- `LV_FONT_MONTSERRAT_28` 28 px font
- `LV_FONT_MONTSERRAT_30` 30 px font
- `LV_FONT_MONTSERRAT_32` 32 px font
- `LV_FONT_MONTSERRAT_34` 34 px font
- `LV_FONT_MONTSERRAT_36` 36 px font
- `LV_FONT_MONTSERRAT_38` 38 px font
- `LV_FONT_MONTSERRAT_40` 40 px font
- `LV_FONT_MONTSERRAT_42` 42 px font
- `LV_FONT_MONTSERRAT_44` 44 px font
- `LV_FONT_MONTSERRAT_46` 46 px font
- `LV_FONT_MONTSERRAT_48` 48 px font

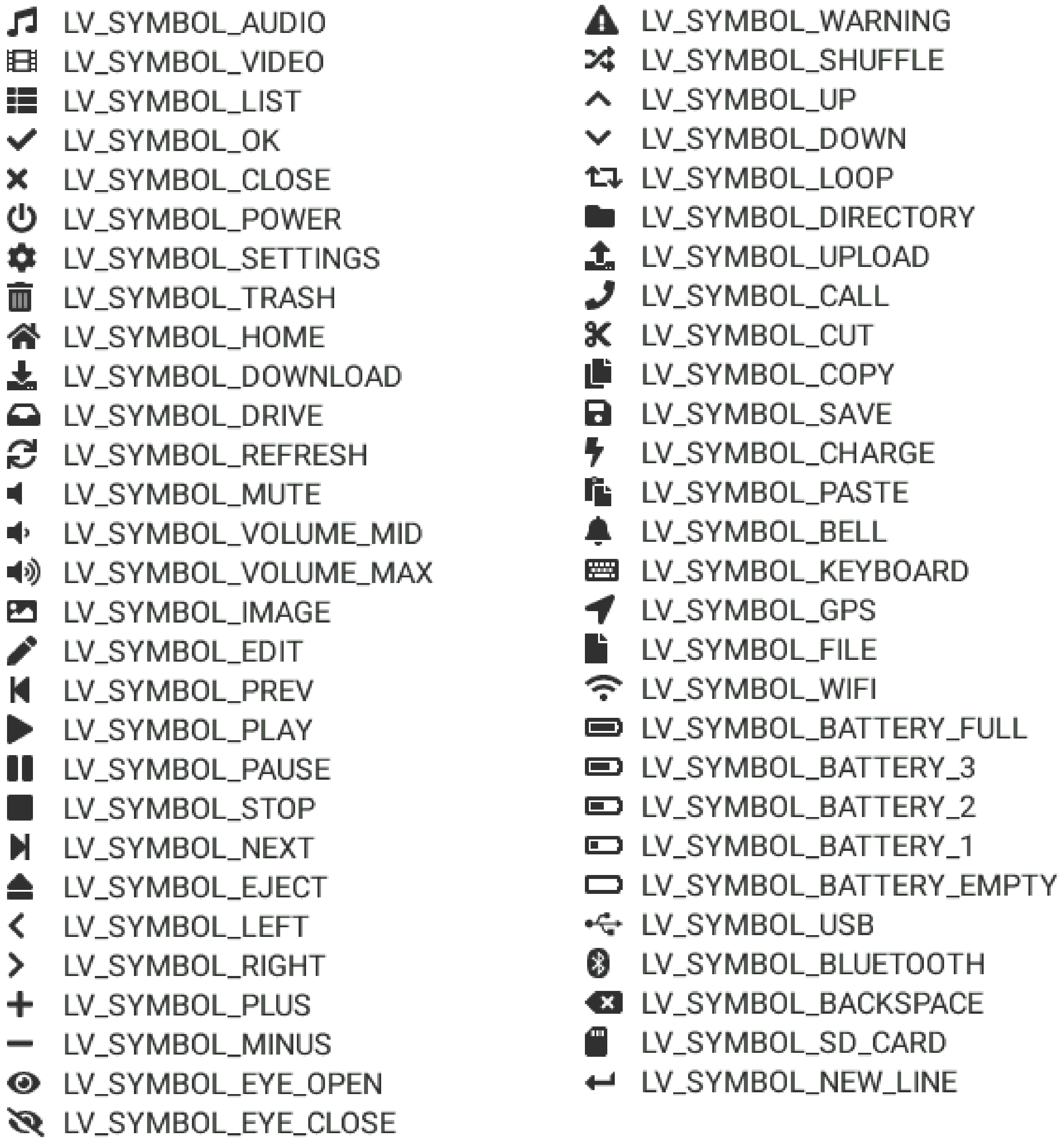
Special fonts

- `LV_FONT_MONTSERRAT_12_SUBPX` Same as normal 12 px font but with *subpixel rendering*
- `LV_FONT_MONTSERRAT_28_COMPRESSED` Same as normal 28 px font but stored as a *compressed font* with 3 bpp
- `LV_FONT_DEJAVU_16_PERSIAN_HEBREW` 16 px font with normal range + Hebrew, Arabic, Persian letters and all their forms
- `LV_FONT_SIMSUN_16_CJK`16 px font with normal range plus 1000 of the most common CJK radicals
- `LV_FONT_UNSCII_8` 8 px pixel perfect font with only ASCII characters
- `LV_FONT_UNSCII_16` 16 px pixel perfect font with only ASCII characters

The built-in fonts are **global variables** with names like `lv_font_montserrat_16` for a 16 px height font. To use them in a style, just add a pointer to a font variable like shown above.

The built-in fonts with *bpp = 4* contain the ASCII characters and use the Montserrat font.

In addition to the ASCII range, the following symbols are also added to the built-in fonts from the FontAwesome font.



LV_SYMBOL_AUDIO
LV_SYMBOL_VIDEO
LV_SYMBOL_LIST
LV_SYMBOL_OK
LV_SYMBOL_CLOSE
LV_SYMBOL_POWER
LV_SYMBOL_SETTINGS
LV_SYMBOL_TRASH
LV_SYMBOL_HOME
LV_SYMBOL_DOWNLOAD
LV_SYMBOL_DRIVE
LV_SYMBOL_REFRESH
LV_SYMBOL_MUTE
LV_SYMBOL_VOLUME_MID
LV_SYMBOL_VOLUME_MAX
LV_SYMBOL_IMAGE
LV_SYMBOL_EDIT
LV_SYMBOL_PREV
LV_SYMBOL_PLAY
LV_SYMBOL_PAUSE
LV_SYMBOL_STOP
LV_SYMBOL_NEXT
LV_SYMBOL_EJECT
LV_SYMBOL_LEFT
LV_SYMBOL_RIGHT
LV_SYMBOL_PLUS
LV_SYMBOL_MINUS
LV_SYMBOL_EYE_OPEN
LV_SYMBOL_EYE_CLOSE
LV_SYMBOL_WARNING
LV_SYMBOL_SHUFFLE
LV_SYMBOL_UP
LV_SYMBOL_DOWN
LV_SYMBOL_LOOP
LV_SYMBOL_DIRECTORY
LV_SYMBOL_UPLOAD
LV_SYMBOL_CALL
LV_SYMBOL_CUT
LV_SYMBOL_COPY
LV_SYMBOL_SAVE
LV_SYMBOL_CHARGE
LV_SYMBOL_PASTE
LV_SYMBOL_BELL
LV_SYMBOL_KEYBOARD
LV_SYMBOL_GPS
LV_SYMBOL_FILE
LV_SYMBOL_WIFI
LV_SYMBOL_BATTERY_FULL
LV_SYMBOL_BATTERY_3
LV_SYMBOL_BATTERY_2
LV_SYMBOL_BATTERY_1
LV_SYMBOL_BATTERY_EMPTY
LV_SYMBOL_USB
LV_SYMBOL_BLUETOOTH
LV_SYMBOL_BACKSPACE
LV_SYMBOL_SD_CARD
LV_SYMBOL_NEW_LINE

The symbols can be used singly as:

```
lv_label_set_text(my_label, LV_SYMBOL_OK);
```

Or together with strings (compile time string concatenation):

```
lv_label_set_text(my_label, LV_SYMBOL_OK "Apply");
```

Or more symbols together:

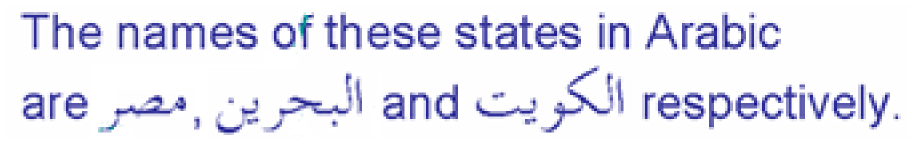
```
lv_label_set_text(my_label, LV_SYMBOL_OK LV_SYMBOL_WIFI LV_SYMBOL_PLAY);
```

5.11.3 Special features

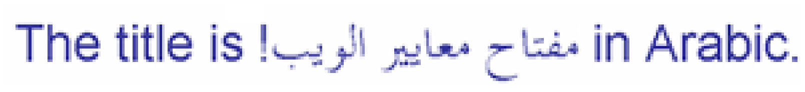
Bidirectional support

Most languages use a Left-to-Right (LTR for short) writing direction, however some languages (such as Hebrew, Persian or Arabic) use Right-to-Left (RTL for short) direction.

LVGL not only supports RTL texts but supports mixed (a.k.a. bidirectional, BiDi) text rendering too. Some examples:



The names of these states in Arabic are مصر, البحرين and الكويت respectively.



The title is مفتاح معايير الويب! in Arabic.

BiDi support is enabled by `LV_USE_BIDI` in *lv_conf.h*

All texts have a base direction (LTR or RTL) which determines some rendering rules and the default alignment of the text (Left or Right). However, in LVGL, the base direction is not only applied to labels. It's a general property which can be set for every object. If not set then it will be inherited from the parent. This means it's enough to set the base direction of a screen and every object will inherit it.

The default base direction for screens can be set by `LV_BIDI_BASE_DIR_DEF` in *lv_conf.h* and other objects inherit the base direction from their parent.

To set an object's base direction use `lv_obj_set_base_dir(obj, base_dir)`. The possible base directions are:

- `LV_BIDI_DIR_LTR`: Left to Right base direction
- `LV_BIDI_DIR_RTL`: Right to Left base direction
- `LV_BIDI_DIR_AUTO`: Auto detect base direction
- `LV_BIDI_DIR_INHERIT`: Inherit base direction from the parent (or a default value for non-screen objects)

This list summarizes the effect of RTL base direction on objects:

- Create objects by default on the right
- `lv_tabview`: Displays tabs from right to left
- `lv_checkbox`: Shows the box on the right
- `lv_btnmatrix`: Shows buttons from right to left
- `lv_list`: Shows icons on the right

- `lv_dropdown`: Aligns options to the right
- The texts in `lv_table`, `lv_btnmatrix`, `lv_keyboard`, `lv_tabview`, `lv_dropdown`, `lv_roller` are "BiDi processed" to be displayed correctly

Arabic and Persian support

There are some special rules to display Arabic and Persian characters: the *form* of a character depends on its position in the text. A different form of the same letter needs to be used when it is isolated, at start, middle or end positions. Besides these, some conjunction rules should also be taken into account.

LVGL supports these rules if `LV_USE_ARABIC_PERSIAN_CHARS` is enabled.

However, there are some limitations:

- Only displaying text is supported (e.g. on labels), text inputs (e.g. text area) don't support this feature.
- Static text (i.e. const) is not processed. E.g. texts set by `lv_label_set_text()` will be "Arabic processed" but `lv_lable_set_text_static()` won't.
- Text get functions (e.g. `lv_label_get_text()`) will return the processed text.

Subpixel rendering

Subpixel rendering allows for tripling the horizontal resolution by rendering anti-aliased edges on Red, Green and Blue channels instead of at pixel level granularity. This takes advantage of the position of physical color channels of each pixel, resulting in higher quality letter anti-aliasing. Learn more here.

For subpixel rendering, the fonts need to be generated with special settings:

- In the online converter tick the `Subpixel` box
- In the command line tool use `--lcd` flag. Note that the generated font needs about three times more memory.

Subpixel rendering works only if the color channels of the pixels have a horizontal layout. That is the R, G, B channels are next to each other and not above each other. The order of color channels also needs to match with the library settings. By default, LVGL assumes `RGB` order, however this can be swapped by setting `LV_SUBPX_BGR 1` in *lv_conf.h*.

Compressed fonts

The bitmaps of fonts can be compressed by

- ticking the `Compressed` check box in the online converter
- not passing the `--no-compress` flag to the offline converter (compression is applied by default)

Compression is more effective with larger fonts and higher bpp. However, it's about 30% slower to render compressed fonts. Therefore, it's recommended to compress only the largest fonts of a user interface, because

- they need the most memory
- they can be compressed better
- and probably they are used less frequently then the medium-sized fonts, so the performance cost is smaller.

5.11.4 Add a new font

There are several ways to add a new font to your project:

1. The simplest method is to use the Online font converter. Just set the parameters, click the *Convert* button, copy the font to your project and use it. **Be sure to carefully read the steps provided on that site or you will get an error while converting.**
2. Use the Offline font converter. (Requires Node.js to be installed)
3. If you want to create something like the built-in fonts (Montserrat font and symbols) but in a different size and/or ranges, you can use the `built_in_font_gen.py` script in `lvgl/scripts/built_in_font` folder. (This requires Python and `lv_font_conv` to be installed)

To declare a font in a file, use `LV_FONT_DECLARE(my_font_name)`.

To make fonts globally available (like the built-in fonts), add them to `LV_FONT_CUSTOM_DECLARE` in *lv_conf.h*.

5.11.5 Add new symbols

The built-in symbols are created from the FontAwesome font.

1. Search for a symbol on https://fontawesome.com. For example the USB symbol. Copy its Unicode ID which is `0xf287` in this case.
2. Open the Online font converter. Add FontAwesome.woff. .
3. Set the parameters such as Name, Size, BPP. You'll use this name to declare and use the font in your code.
4. Add the Unicode ID of the symbol to the range field. E.g. `0xf287` for the USB symbol. More symbols can be enumerated with `,`.
5. Convert the font and copy the generated source code to your project. Make sure to compile the .c file of your font.
6. Declare the font using `extern lv_font_t my_font_name;` or simply use `LV_FONT_DECLARE(my_font_name);`.

Using the symbol

1. Convert the Unicode value to UTF8, for example on this site. For `0xf287` the *Hex UTF-8 bytes* are `EF 8A 87`.
2. Create a `define` string from the UTF8 values: `#define MY_USB_SYMBOL "\xEF\x8A\x87"`
3. Create a label and set the text. Eg. `lv_label_set_text(label, MY_USB_SYMBOL)`

Note - `lv_label_set_text(label, MY_USB_SYMBOL)` searches for this symbol in the font defined in `style.text.font` properties. To use the symbol you may need to change it. Eg `style.text.font = my_font_name`

5.11.6 Load a font at run-time

`lv_font_load` can be used to load a font from a file. The font needs to have a special binary format. (Not TTF or WOFF). Use lv_font_conv with the `--format bin` option to generate an LVGL compatible font file.

Note that to load a font *LVGL's filesystem* needs to be enabled and a driver must be added.

Example

```
lv_font_t * my_font;
my_font = lv_font_load(X/path/to/my_font.bin);

/*Use the font*/
```

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```
/*Free the font if not required anymore*/
lv_font_free(my_font);
```

5.11.7 Add a new font engine

LVGL's font interface is designed to be very flexible but, even so, you can add your own font engine in place of LVGL's internal one. For example, you can use FreeType to real-time render glyphs from TTF fonts or use an external flash to store the font's bitmap and read them when the library needs them.

A ready to use FreeType can be found in lv_freetype repository.

To do this, a custom `lv_font_t` variable needs to be created:

```
/*Describe the properties of a font*/
lv_font_t my_font;
my_font.get_glyph_dsc = my_get_glyph_dsc_cb;        /*Set a callback to get info␣
↪about glyphs*/
my_font.get_glyph_bitmap = my_get_glyph_bitmap_cb;  /*Set a callback to get bitmap of␣
↪a glyph*/
my_font.line_height = height;                       /*The real line height where any␣
↪text fits*/
my_font.base_line = base_line;                      /*Base line measured from the top␣
↪of line_height*/
my_font.dsc = something_required;                   /*Store any implementation␣
↪specific data here*/
my_font.user_data = user_data;                      /*Optionally some extra user␣
↪data*/

...

/* Get info about glyph of `unicode_letter` in `font` font.
 * Store the result in `dsc_out`.
 * The next letter (`unicode_letter_next`) might be used to calculate the width␣
↪required by this glyph (kerning)
 */
bool my_get_glyph_dsc_cb(const lv_font_t * font, lv_font_glyph_dsc_t * dsc_out,␣
↪uint32_t unicode_letter, uint32_t unicode_letter_next)
{
    /*Your code here*/

    /* Store the result.
     * For example ...
     */
    dsc_out->adv_w = 12;        /*Horizontal space required by the glyph in [px]*/
    dsc_out->box_h = 8;         /*Height of the bitmap in [px]*/
    dsc_out->box_w = 6;         /*Width of the bitmap in [px]*/
    dsc_out->ofs_x = 0;         /*X offset of the bitmap in [pf]*/
    dsc_out->ofs_y = 3;         /*Y offset of the bitmap measured from the as line*/
    dsc_out->bpp   = 2;         /*Bits per pixel: 1/2/4/8*/

    return true;                /*true: glyph found; false: glyph was not found*/
}
```

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```
/* Get the bitmap of `unicode_letter` from `font`. */
const uint8_t * my_get_glyph_bitmap_cb(const lv_font_t * font, uint32_t unicode_
↪letter)
{
    /* Your code here */

    /* The bitmap should be a continuous bitstream where
     * each pixel is represented by `bpp` bits */

    return bitmap;    /*Or NULL if not found*/
}
```

5.11.8 Use font fallback

You can specify `fallback` in `lv_font_t` to provide fallback to the font. When the font fails to find glyph to a letter, it will try to let font from `fallback` to handle.

`fallback` can be chained, so it will try to solve until there is no `fallback` set.

```
/* Roboto font doesn't have support for CJK glyphs */
lv_font_t *roboto = my_font_load_function();
/* Droid Sans Fallback has more glyphs but its typeface doesn't look good as Roboto */
lv_font_t *droid_sans_fallback = my_font_load_function();
/* So now we can display Roboto for supported characters while having wider␣
↪characters set support */
roboto->fallback = droid_sans_fallback;
```

5.12 Images

An image can be a file or a variable which stores the bitmap itself and some metadata.

5.12.1 Store images

You can store images in two places

- as a variable in internal memory (RAM or ROM)
- as a file

Variables

Images stored internally in a variable are composed mainly of an `lv_img_dsc_t` structure with the following fields:

- **header**
  - *cf* Color format. See *below*
  - *w* width in pixels (<= 2048)
  - *h* height in pixels (<= 2048)
  - *always zero* 3 bits which need to be always zero

  - *reserved* reserved for future use
- **data** pointer to an array where the image itself is stored
- **data_size** length of `data` in bytes

These are usually stored within a project as C files. They are linked into the resulting executable like any other constant data.

Files

To deal with files you need to add a storage *Drive* to LVGL. In short, a *Drive* is a collection of functions (*open*, *read*, *close*, etc.) registered in LVGL to make file operations. You can add an interface to a standard file system (FAT32 on SD card) or you create your simple file system to read data from an SPI Flash memory. In every case, a *Drive* is just an abstraction to read and/or write data to memory. See the *File system* section to learn more.

Images stored as files are not linked into the resulting executable, and must be read into RAM before being drawn. As a result, they are not as resource-friendly as images linked at compile time. However, they are easier to replace without needing to rebuild the main program.

5.12.2 Color formats

Various built-in color formats are supported:

- **LV_IMG_CF_TRUE_COLOR** Simply stores the RGB colors (in whatever color depth LVGL is configured for).
- **LV_IMG_CF_TRUE_COLOR_ALPHA** Like `LV_IMG_CF_TRUE_COLOR` but it also adds an alpha (transparency) byte for every pixel.
- **LV_IMG_CF_TRUE_COLOR_CHROMA_KEYED** Like `LV_IMG_CF_TRUE_COLOR` but if a pixel has the `LV_COLOR_TRANSP` color (set in *lv_conf.h*) it will be transparent.
- **LV_IMG_CF_INDEXED_1/2/4/8BIT** Uses a palette with 2, 4, 16 or 256 colors and stores each pixel in 1, 2, 4 or 8 bits.
- **LV_IMG_CF_ALPHA_1/2/4/8BIT Only stores the Alpha value with 1, 2, 4 or 8 bits.** The pixels take the color of `style.img_recolor` and the set opacity. The source image has to be an alpha channel. This is ideal for bitmaps similar to fonts where the whole image is one color that can be altered.

The bytes of `LV_IMG_CF_TRUE_COLOR` images are stored in the following order.

For 32-bit color depth:

- Byte 0: Blue
- Byte 1: Green
- Byte 2: Red
- Byte 3: Alpha

For 16-bit color depth:

- Byte 0: Green 3 lower bit, Blue 5 bit
- Byte 1: Red 5 bit, Green 3 higher bit
- Byte 2: Alpha byte (only with LV_IMG_CF_TRUE_COLOR_ALPHA)

For 8-bit color depth:

- Byte 0: Red 3 bit, Green 3 bit, Blue 2 bit

- Byte 2: Alpha byte (only with LV_IMG_CF_TRUE_COLOR_ALPHA)

You can store images in a *Raw* format to indicate that it's not encoded with one of the built-in color formats and an external *Image decoder* needs to be used to decode the image.

- **LV_IMG_CF_RAW** Indicates a basic raw image (e.g. a PNG or JPG image).
- **LV_IMG_CF_RAW_ALPHA** Indicates that an image has alpha and an alpha byte is added for every pixel.
- **LV_IMG_CF_RAW_CHROMA_KEYED** Indicates that an image is chroma-keyed as described in `LV_IMG_CF_TRUE_COLOR_CHROMA_KEYED` above.

5.12.3 Add and use images

You can add images to LVGL in two ways:

- using the online converter
- manually create images

Online converter

The online Image converter is available here: https://lvgl.io/tools/imageconverter

Adding an image to LVGL via the online converter is easy.

1. You need to select a *BMP*, *PNG* or *JPG* image first.
2. Give the image a name that will be used within LVGL.
3. Select the *Color format*.
4. Select the type of image you want. Choosing a binary will generate a `.bin` file that must be stored separately and read using the *file support*. Choosing a variable will generate a standard C file that can be linked into your project.
5. Hit the *Convert* button. Once the conversion is finished, your browser will automatically download the resulting file.

In the generated C arrays (variables), bitmaps for all the color depths (1, 8, 16 or 32) are included in the C file, but only the color depth that matches `LV_COLOR_DEPTH` in *lv_conf.h* will actually be linked into the resulting executable.

In the case of binary files, you need to specify the color format you want:

- RGB332 for 8-bit color depth
- RGB565 for 16-bit color depth
- RGB565 Swap for 16-bit color depth (two bytes are swapped)
- RGB888 for 32-bit color depth

Manually create an image

If you are generating an image at run-time, you can craft an image variable to display it using LVGL. For example:

```
uint8_t my_img_data[] = {0x00, 0x01, 0x02, ...};

static lv_img_dsc_t my_img_dsc = {
    .header.always_zero = 0,
    .header.w = 80,
    .header.h = 60,
    .data_size = 80 * 60 * LV_COLOR_DEPTH / 8,
    .header.cf = LV_IMG_CF_TRUE_COLOR,          /*Set the color format*/
    .data = my_img_data,
};
```

If the color format is `LV_IMG_CF_TRUE_COLOR_ALPHA` you can set `data_size` like `80 * 60 * LV_IMG_PX_SIZE_ALPHA_BYTE`.

Another (possibly simpler) option to create and display an image at run-time is to use the *Canvas* object.

Use images

The simplest way to use an image in LVGL is to display it with an *lv_img* object:

```
lv_obj_t * icon = lv_img_create(lv_scr_act(), NULL);

/*From variable*/
lv_img_set_src(icon, &my_icon_dsc);

/*From file*/
lv_img_set_src(icon, "S:my_icon.bin");
```

If the image was converted with the online converter, you should use `LV_IMG_DECLARE(my_icon_dsc)` to declare the image in the file where you want to use it.

5.12.4 Image decoder

As you can see in the *Color formats* section, LVGL supports several built-in image formats. In many cases, these will be all you need. LVGL doesn't directly support, however, generic image formats like PNG or JPG.

To handle non-built-in image formats, you need to use external libraries and attach them to LVGL via the *Image decoder* interface.

An image decoder consists of 4 callbacks:

- **info** get some basic info about the image (width, height and color format).
- **open** open an image: either store a decoded image or set it to `NULL` to indicate the image can be read line-by-line.
- **read** if *open* didn't fully open an image this function should give some decoded data (max 1 line) from a given position.
- **close** close an opened image, free the allocated resources.

You can add any number of image decoders. When an image needs to be drawn, the library will try all the registered image decoders until it finds one which can open the image, i.e. one which knows that format.

The `LV_IMG_CF_TRUE_COLOR_...`, `LV_IMG_INDEXED_...` and `LV_IMG_ALPHA_...` formats (essentially, all non-`RAW` formats) are understood by the built-in decoder.

Custom image formats

The easiest way to create a custom image is to use the online image converter and select `Raw`, `Raw with alpha` or `Raw with chroma-keyed` format. It will just take every byte of the binary file you uploaded and write it as an image "bitmap". You then need to attach an image decoder that will parse that bitmap and generate the real, renderable bitmap.

`header.cf` will be `LV_IMG_CF_RAW`, `LV_IMG_CF_RAW_ALPHA` or `LV_IMG_CF_RAW_CHROMA_KEYED` accordingly. You should choose the correct format according to your needs: a fully opaque image, using an alpha channel or using a chroma key.

After decoding, the *raw* formats are considered *True color* by the library. In other words, the image decoder must decode the *Raw* images to *True color* according to the format described in the *Color formats* section.

If you want to create a custom image, you should use `LV_IMG_CF_USER_ENCODED_0..7` color formats. However, the library can draw images only in *True color* format (or *Raw* but ultimately it will be in *True color* format). The `LV_IMG_CF_USER_ENCODED_...` formats are not known by the library and therefore they should be decoded to one of the known formats from the *Color formats* section. It's possible to decode an image to a non-true color format first (for example: `LV_IMG_INDEXED_4BITS`) and then call the built-in decoder functions to convert it to *True color*.

With *User encoded* formats, the color format in the open function (`dsc->header.cf`) should be changed according to the new format.

Register an image decoder

Here's an example of getting LVGL to work with PNG images.

First, you need to create a new image decoder and set some functions to open/close the PNG files. It should look like this:

```
/*Create a new decoder and register functions */
lv_img_decoder_t * dec = lv_img_decoder_create();
lv_img_decoder_set_info_cb(dec, decoder_info);
lv_img_decoder_set_open_cb(dec, decoder_open);
lv_img_decoder_set_close_cb(dec, decoder_close);


/**
 * Get info about a PNG image
 * @param decoder pointer to the decoder where this function belongs
 * @param src can be file name or pointer to a C array
 * @param header store the info here
 * @return LV_RES_OK: no error; LV_RES_INV: can't get the info
 */
static lv_res_t decoder_info(lv_img_decoder_t * decoder, const void * src, lv_img_
↪header_t * header)
{
  /*Check whether the type `src` is known by the decoder*/
  if(is_png(src) == false) return LV_RES_INV;

  /* Read the PNG header and find `width` and `height` */
  ...

  header->cf = LV_IMG_CF_RAW_ALPHA;
  header->w = width;
  header->h = height;
}
```

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```
/**
 * Open a PNG image and return the decided image
 * @param decoder pointer to the decoder where this function belongs
 * @param dsc pointer to a descriptor which describes this decoding session
 * @return LV_RES_OK: no error; LV_RES_INV: can't get the info
 */
static lv_res_t decoder_open(lv_img_decoder_t * decoder, lv_img_decoder_dsc_t * dsc)
{

  /*Check whether the type `src` is known by the decoder*/
  if(is_png(src) == false) return LV_RES_INV;

  /*Decode and store the image. If `dsc->img_data` is `NULL`, the `read_line`␣
↪function will be called to get the image data line-by-line*/
  dsc->img_data = my_png_decoder(src);

  /*Change the color format if required. For PNG usually 'Raw' is fine*/
  dsc->header.cf = LV_IMG_CF_...

  /*Call a built in decoder function if required. It's not required if`my_png_
↪decoder` opened the image in true color format.*/
  lv_res_t res = lv_img_decoder_built_in_open(decoder, dsc);

  return res;
}

/**
 * Decode `len` pixels starting from the given `x`, `y` coordinates and store them in␣
↪`buf`.
 * Required only if the "open" function can't open the whole decoded pixel array.␣
↪(dsc->img_data == NULL)
 * @param decoder pointer to the decoder the function associated with
 * @param dsc pointer to decoder descriptor
 * @param x start x coordinate
 * @param y start y coordinate
 * @param len number of pixels to decode
 * @param buf a buffer to store the decoded pixels
 * @return LV_RES_OK: ok; LV_RES_INV: failed
 */
lv_res_t decoder_built_in_read_line(lv_img_decoder_t * decoder, lv_img_decoder_dsc_t␣
↪* dsc, lv_coord_t x,
                                                       lv_coord_t y, lv_coord_t len, uint8_
↪t * buf)
{
   /*With PNG it's usually not required*/

   /*Copy `len` pixels from `x` and `y` coordinates in True color format to `buf` */

}

/**
 * Free the allocated resources
 * @param decoder pointer to the decoder where this function belongs
 * @param dsc pointer to a descriptor which describes this decoding session
 */
static void decoder_close(lv_img_decoder_t * decoder, lv_img_decoder_dsc_t * dsc)
{
```

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```
  /*Free all allocated data*/

  /*Call the built-in close function if the built-in open/read_line was used*/
  lv_img_decoder_built_in_close(decoder, dsc);

}
```

So in summary:

- In `decoder_info`, you should collect some basic information about the image and store it in `header`.
- In `decoder_open`, you should try to open the image source pointed by `dsc->src`. Its type is already in `dsc->src_type == LV_IMG_SRC_FILE/VARIABLE`. If this format/type is not supported by the decoder, return `LV_RES_INV`. However, if you can open the image, a pointer to the decoded *True color* image should be set in `dsc->img_data`. If the format is known, but you don't want to decode the entire image (e.g. no memory for it), set `dsc->img_data = NULL` and use `read_line` to get the pixel data.
- In `decoder_close` you should free all allocated resources.
- `decoder_read` is optional. Decoding the whole image requires extra memory and some computational overhead. However, it can decode one line of the image without decoding the whole image, you can save memory and time. To indicate that the *line read* function should be used, set `dsc->img_data = NULL` in the open function.

Manually use an image decoder

LVGL will use registered image decoders automatically if you try and draw a raw image (i.e. using the `lv_img` object) but you can use them manually too. Create an `lv_img_decoder_dsc_t` variable to describe the decoding session and call `lv_img_decoder_open()`.

The `color` parameter is used only with `LV_IMG_CF_ALPHA_1/2/4/8BIT` images to tell color of the image. `frame_id` can be used if the image to open is an animation.

```

lv_res_t res;
lv_img_decoder_dsc_t dsc;
res = lv_img_decoder_open(&dsc, &my_img_dsc, color, frame_id);

if(res == LV_RES_OK) {
  /*Do something with `dsc->img_data`*/
  lv_img_decoder_close(&dsc);
}
```

5.12.5 Image caching

Sometimes it takes a lot of time to open an image. Continuously decoding a PNG image or loading images from a slow external memory would be inefficient and detrimental to the user experience.

Therefore, LVGL caches a given number of images. Caching means some images will be left open, hence LVGL can quickly access them from `dsc->img_data` instead of needing to decode them again.

Of course, caching images is resource intensive as it uses more RAM to store the decoded image. LVGL tries to optimize the process as much as possible (see below), but you will still need to evaluate if this would be beneficial for your platform or not. Image caching may not be worth it if you have a deeply embedded target which decodes small images from a relatively fast storage medium.

Cache size

The number of cache entries can be defined with `LV_IMG_CACHE_DEF_SIZE` in *lv_conf.h*. The default value is 1 so only the most recently used image will be left open.

The size of the cache can be changed at run-time with `lv_img_cache_set_size(entry_num)`.

Value of images

When you use more images than cache entries, LVGL can't cache all the images. Instead, the library will close one of the cached images to free space.

To decide which image to close, LVGL uses a measurement it previously made of how long it took to open the image. Cache entries that hold slower-to-open images are considered more valuable and are kept in the cache as long as possible.

If you want or need to override LVGL's measurement, you can manually set the *time to open* value in the decoder open function in `dsc->time_to_open = time_ms` to give a higher or lower value. (Leave it unchanged to let LVGL control it.)

Every cache entry has a *"life"* value. Every time an image is opened through the cache, the *life* value of all entries is decreased to make them older. When a cached image is used, its *life* value is increased by the *time to open* value to make it more alive.

If there is no more space in the cache, the entry with the lowest life value will be closed.

Memory usage

Note that a cached image might continuously consume memory. For example, if three PNG images are cached, they will consume memory while they are open.

Therefore, it's the user's responsibility to be sure there is enough RAM to cache even the largest images at the same time.

Clean the cache

Let's say you have loaded a PNG image into a `lv_img_dsc_t my_png` variable and use it in an `lv_img` object. If the image is already cached and you then change the underlying PNG file, you need to notify LVGL to cache the image again. Otherwise, there is no easy way of detecting that the underlying file changed and LVGL will still draw the old image from cache.

To do this, use `lv_img_cache_invalidate_src(&my_png)`. If `NULL` is passed as a parameter, the whole cache will be cleaned.

Custom cache algorithm

If you want to implement your own cache algorithm, you can refer to the following code to replace the LVGL built-in image cache manager:

```
static _lv_img_cache_entry_t * my_img_cache_open(const void * src, lv_color_t color,␣
↪int32_t frame_id)
{
  ...
}

static void my_img_cache_set_size(uint16_t new_entry_cnt)
```

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```c
{
  ...
}

static void my_img_cache_invalidate_src(const void * src)
{
  ...
}

void my_img_cache_init(void)
{
  /* Before replacing the image cache manager,
   * you should ensure that all caches are cleared to prevent memory leaks.
   */
  lv_img_cache_invalidate_src(NULL);

  /*Initialize image cache manager.*/
  lv_img_cache_manager_t manager;
  lv_img_cache_manager_init(&manager);
  manager.open_cb = my_img_cache_open;
  manager.set_size_cb = my_img_cache_set_size;
  manager.invalidate_src_cb = my_img_cache_invalidate_src;

  /*Apply image cache manager to LVGL.*/
  lv_img_cache_manager_apply(&manager);
}
```

5.12.6 API

Image buffer

Functions

void **`lv_img_buf_set_palette`**(*lv_img_dsc_t* *dsc, uint8_t id, *lv_color32_t* c)

Set the palette color of an indexed image. Valid only for `LV_IMG_CF_INDEXED1/2/4/8`

Parameters

- **`dsc`** -- pointer to an image descriptor
- **`id`** -- the palette color to set:
  - for `LV_IMG_CF_INDEXED1`: 0..1
  - for `LV_IMG_CF_INDEXED2`: 0..3
  - for `LV_IMG_CF_INDEXED4`: 0..15
  - for `LV_IMG_CF_INDEXED8`: 0..255
- **`c`** -- the color to set in *lv_color32_t* format

void **`lv_img_buf_free`**(*lv_img_dsc_t* *dsc)

Free an allocated image buffer

Parameters **`dsc`** -- image buffer to free void **`_lv_img_buf_get_transformed_area`**(lv_area_t *res, lv_coord_t w, lv_coord_t h, int16_t angle, uint16_t zoom, const lv_point_t *pivot)

Get the area of a rectangle if its rotated and scaled

Parameters

- **`res`** -- store the coordinates here
- **`w`** -- width of the rectangle to transform
- **`h`** -- height of the rectangle to transform
- **`angle`** -- angle of rotation
- **`zoom`** -- zoom, (256 no zoom)
- **`pivot`** -- x,y pivot coordinates of rotation

struct **`lv_img_header_t`**

#include <lv_img_buf.h> The first 8 bit is very important to distinguish the different source types. For more info see `lv_img_get_src_type()` in lv_img.c On big endian systems the order is reversed so cf and always_zero must be at the end of the struct.

Public Members

uint32_t **`h`**

uint32_t **`w`**

uint32_t **`reserved`**

uint32_t **`always_zero`**

uint32_t **`cf`**

uint32_t **`chroma_keyed`**

struct **`lv_img_dsc_t`**

#include <lv_img_buf.h> Image header it is compatible with the result from image converter utility

Public Members

lv_img_header_t **`header`**

A header describing the basics of the image

uint32_t **`data_size`**

Size of the image in bytes

const uint8_t ***`data`**

Pointer to the data of the image

5.13 File system

LVGL has a 'File system' abstraction module that enables you to attach any type of file system. A file system is identified by an assigned drive letter. For example, if an SD card is associated with the letter `'S'`, a file can be reached using `"S:path/to/file.txt"`.

5.13.1 Ready to use drivers

LVGL contains prepared drivers for the API of POSIX, standard C, Windows, and FATFS. Learn more *here*.

5.13.2 Adding a driver

Registering a driver

To add a driver, a `lv_fs_drv_t` needs to be initialized like below. The `lv_fs_drv_t` needs to be static, global or dynamically allocated and not a local variable.

```
static lv_fs_drv_t drv;                   /*Needs to be static or global*/
lv_fs_drv_init(&drv);                     /*Basic initialization*/

drv.letter = 'S';                         /*An uppercase letter to identify the drive␣
↪*/
drv.cache_size = my_cache_size;           /*Cache size for reading in bytes. 0 to not␣
↪cache.*/

drv.ready_cb = my_ready_cb;               /*Callback to tell if the drive is ready to␣
↪use */
drv.open_cb = my_open_cb;                 /*Callback to open a file */
drv.close_cb = my_close_cb;               /*Callback to close a file */
drv.read_cb = my_read_cb;                 /*Callback to read a file */
drv.write_cb = my_write_cb;               /*Callback to write a file */
drv.seek_cb = my_seek_cb;                 /*Callback to seek in a file (Move cursor)␣
↪*/
drv.tell_cb = my_tell_cb;                 /*Callback to tell the cursor position  */

drv.dir_open_cb = my_dir_open_cb;         /*Callback to open directory to read its␣
↪content */
drv.dir_read_cb = my_dir_read_cb;         /*Callback to read a directory's content */
drv.dir_close_cb = my_dir_close_cb;       /*Callback to close a directory */

drv.user_data = my_user_data;             /*Any custom data if required*/

lv_fs_drv_register(&drv);                 /*Finally register the drive*/
```

Any of the callbacks can be `NULL` to indicate that operation is not supported.

Implementing the callbacks

Open callback

The prototype of `open_cb` looks like this:

```
void * (*open_cb)(lv_fs_drv_t * drv, const char * path, lv_fs_mode_t mode);
```

`path` is the path after the drive letter (e.g. "S:path/to/file.txt" -> "path/to/file.txt"). `mode` can be `LV_FS_MODE_WR` or `LV_FS_MODE_RD` to open for writes or reads.

The return value is a pointer to a *file object* that describes the opened file or `NULL` if there were any issues (e.g. the file wasn't found). The returned file object will be passed to other file system related callbacks. (see below)

Other callbacks

The other callbacks are quite similar. For example `write_cb` looks like this:

```
lv_fs_res_t (*write_cb)(lv_fs_drv_t * drv, void * file_p, const void * buf, uint32_t␣
↪btw, uint32_t * bw);
```

For `file_p`, LVGL passes the return value of `open_cb`, `buf` is the data to write, `btw` is the Bytes To Write, `bw` is the actually written bytes.

For a template of these callbacks see lv_fs_template.c.

5.13.3 Usage example

The example below shows how to read from a file:

```
lv_fs_file_t f;
lv_fs_res_t res;
res = lv_fs_open(&f, "S:folder/file.txt", LV_FS_MODE_RD);
if(res != LV_FS_RES_OK) my_error_handling();

uint32_t read_num;
uint8_t buf[8];
res = lv_fs_read(&f, buf, 8, &read_num);
if(res != LV_FS_RES_OK || read_num != 8) my_error_handling();

lv_fs_close(&f);
```

The mode in `lv_fs_open` can be `LV_FS_MODE_WR` to open for writes only or `LV_FS_MODE_RD | LV_FS_MODE_WR` for both

This example shows how to read a directory's content. It's up to the driver how to mark directories in the result but it can be a good practice to insert a `'/'` in front of each directory name.

```
lv_fs_dir_t dir;
lv_fs_res_t res;
res = lv_fs_dir_open(&dir, "S:/folder");
if(res != LV_FS_RES_OK) my_error_handling();

char fn[256];
while(1) {
```

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```
    res = lv_fs_dir_read(&dir, fn);
    if(res != LV_FS_RES_OK) {
        my_error_handling();
        break;
    }

    /*fn is empty, if not more files to read*/
    if(strlen(fn) == 0) {
        break;
    }

    printf("%s\n", fn);
}

lv_fs_dir_close(&dir);
```

5.13.4 Use drives for images

Image objects can be opened from files too (besides variables stored in the compiled program).

To use files in image widgets the following callbacks are required:

- open
- close
- read
- seek
- tell

5.13.5 API

Typedefs

typedef uint8_t **`lv_fs_res_t`**

typedef uint8_t **`lv_fs_mode_t`**

typedef struct *_lv_fs_drv_t* **`lv_fs_drv_t`**

Enums

enum **`[anonymous]`**

Errors in the file system module.

Values:

enumerator **`LV_FS_RES_OK`**

enumerator **`LV_FS_RES_HW_ERR`**

enumerator **`LV_FS_RES_FS_ERR`**

enumerator **`LV_FS_RES_NOT_EX`**

enumerator **`LV_FS_RES_FULL`**

enumerator **`LV_FS_RES_LOCKED`**

enumerator **`LV_FS_RES_DENIED`**

enumerator **`LV_FS_RES_BUSY`**

enumerator **`LV_FS_RES_TOUT`**

enumerator **`LV_FS_RES_NOT_IMP`**

enumerator **`LV_FS_RES_OUT_OF_MEM`**

enumerator **`LV_FS_RES_INV_PARAM`**

enumerator **`LV_FS_RES_UNKNOWN`**

enum **`[anonymous]`**

File open mode.

Values:

enumerator **`LV_FS_MODE_WR`**

enumerator **`LV_FS_MODE_RD`**

enum **`lv_fs_whence_t`**

Seek modes.

Values:

enumerator **`LV_FS_SEEK_SET`**

Set the position from absolutely (from the start of file)

enumerator **`LV_FS_SEEK_CUR`**

Set the position from the current position

enumerator **`LV_FS_SEEK_END`**

Set the position from the end of the file

Functions

void **`_lv_fs_init`**(void)

Initialize the File system interface

void **`lv_fs_drv_init`**(*lv_fs_drv_t* *drv)

Initialize a file system driver with default values. It is used to ensure all fields have known values and not memory junk. After it you can set the fields.

Parameters **`drv`** -- pointer to driver variable to initialize

void **`lv_fs_drv_register`**(*lv_fs_drv_t* *drv)

Add a new drive

Parameters **`drv`** -- pointer to an lv_fs_drv_t structure which is inited with the corresponding function pointers. Only pointer is saved, so the driver should be static or dynamically allocated.

lv_fs_drv_t ***`lv_fs_get_drv`**(char letter)

Give a pointer to a driver from its letter

Parameters **`letter`** -- the driver letter

Returns pointer to a driver or NULL if not found

bool **`lv_fs_is_ready`**(char letter)

Test if a drive is ready or not. If the `ready` function was not initialized `true` will be returned.

Parameters **`letter`** -- letter of the drive

Returns true: drive is ready; false: drive is not ready

lv_fs_res_t **`lv_fs_open`**(*lv_fs_file_t* *file_p, const char *path, *lv_fs_mode_t* mode)

Open a file

Parameters

- **`file_p`** -- pointer to a *lv_fs_file_t* variable
- **`path`** -- path to the file beginning with the driver letter (e.g. S:/folder/file.txt)
- **`mode`** -- read: FS_MODE_RD, write: FS_MODE_WR, both: FS_MODE_RD | FS_MODE_WR

Returns LV_FS_RES_OK or any error from lv_fs_res_t enum

lv_fs_res_t **`lv_fs_close`**(*lv_fs_file_t* *file_p)

Close an already opened file

Parameters **`file_p`** -- pointer to a *lv_fs_file_t* variable

Returns LV_FS_RES_OK or any error from lv_fs_res_t enum

lv_fs_res_t **lv_fs_read**(*lv_fs_file_t* *file_p, void *buf, uint32_t btr, uint32_t *br)

Read from a file

Parameters

- **file_p** -- pointer to a *lv_fs_file_t* variable
- **buf** -- pointer to a buffer where the read bytes are stored
- **btr** -- Bytes To Read
- **br** -- the number of real read bytes (Bytes Read). NULL if unused.

Returns LV_FS_RES_OK or any error from lv_fs_res_t enum

lv_fs_res_t **lv_fs_write**(*lv_fs_file_t* *file_p, const void *buf, uint32_t btw, uint32_t *bw)

Write into a file

Parameters

- **file_p** -- pointer to a *lv_fs_file_t* variable
- **buf** -- pointer to a buffer with the bytes to write
- **btw** -- Bytes To Write
- **bw** -- the number of real written bytes (Bytes Written). NULL if unused.

Returns LV_FS_RES_OK or any error from lv_fs_res_t enum

lv_fs_res_t **lv_fs_seek**(*lv_fs_file_t* *file_p, uint32_t pos, *lv_fs_whence_t* whence)

Set the position of the 'cursor' (read write pointer) in a file

Parameters

- **file_p** -- pointer to a *lv_fs_file_t* variable
- **pos** -- the new position expressed in bytes index (0: start of file)
- **whence** -- tells from where set the position. See @lv_fs_whence_t

Returns LV_FS_RES_OK or any error from lv_fs_res_t enum

lv_fs_res_t **lv_fs_tell**(*lv_fs_file_t* *file_p, uint32_t *pos)

Give the position of the read write pointer

Parameters

- **file_p** -- pointer to a *lv_fs_file_t* variable
- **pos_p** -- pointer to store the position of the read write pointer

Returns LV_FS_RES_OK or any error from 'fs_res_t'

lv_fs_res_t **lv_fs_dir_open**(*lv_fs_dir_t* *rddir_p, const char *path)

Initialize a 'fs_dir_t' variable for directory reading

Parameters

- **rddir_p** -- pointer to a '*lv_fs_dir_t*' variable
- **path** -- path to a directory

Returns LV_FS_RES_OK or any error from lv_fs_res_t enum *lv_fs_res_t* **`lv_fs_dir_read`**(*lv_fs_dir_t* *rddir_p, char *fn)

Read the next filename form a directory. The name of the directories will begin with '/'

Parameters

- **`rddir_p`** -- pointer to an initialized 'fs_dir_t' variable
- **`fn`** -- pointer to a buffer to store the filename

Returns LV_FS_RES_OK or any error from lv_fs_res_t enum

lv_fs_res_t **`lv_fs_dir_close`**(*lv_fs_dir_t* *rddir_p)

Close the directory reading

Parameters **`rddir_p`** -- pointer to an initialized 'fs_dir_t' variable

Returns LV_FS_RES_OK or any error from lv_fs_res_t enum

char ***`lv_fs_get_letters`**(char *buf)

Fill a buffer with the letters of existing drivers

Parameters **`buf`** -- buffer to store the letters ('\0' added after the last letter)

Returns the buffer

const char ***`lv_fs_get_ext`**(const char *fn)

Return with the extension of the filename

Parameters **`fn`** -- string with a filename

Returns pointer to the beginning extension or empty string if no extension

char ***`lv_fs_up`**(char *path)

Step up one level

Parameters **`path`** -- pointer to a file name

Returns the truncated file name

const char ***`lv_fs_get_last`**(const char *path)

Get the last element of a path (e.g. U:/folder/file -> file)

Parameters **`path`** -- pointer to a file name

Returns pointer to the beginning of the last element in the path

struct **`_lv_fs_drv_t`**

Public Members

char **`letter`**

uint16_t **`cache_size`**

bool (***`ready_cb`**)(struct *_lv_fs_drv_t* *drv)

void *(***`open_cb`**)(struct *_lv_fs_drv_t* *drv, const char *path, *lv_fs_mode_t* mode) *lv_fs_res_t* (***close_cb**)(struct *_lv_fs_drv_t* *drv, void *file_p)

lv_fs_res_t (***read_cb**)(struct *_lv_fs_drv_t* *drv, void *file_p, void *buf, uint32_t btr, uint32_t *br)

lv_fs_res_t (***write_cb**)(struct *_lv_fs_drv_t* *drv, void *file_p, const void *buf, uint32_t btw, uint32_t *bw)

lv_fs_res_t (***seek_cb**)(struct *_lv_fs_drv_t* *drv, void *file_p, uint32_t pos, *lv_fs_whence_t* whence)

lv_fs_res_t (***tell_cb**)(struct *_lv_fs_drv_t* *drv, void *file_p, uint32_t *pos_p)

void *(***dir_open_cb**)(struct *_lv_fs_drv_t* *drv, const char *path)

lv_fs_res_t (***dir_read_cb**)(struct *_lv_fs_drv_t* *drv, void *rddir_p, char *fn)

lv_fs_res_t (***dir_close_cb**)(struct *_lv_fs_drv_t* *drv, void *rddir_p)

void ***user_data**

Custom file user data

struct **lv_fs_file_cache_t**

Public Members

uint32_t **start**

uint32_t **end**

uint32_t **file_position**

void ***buffer**

struct **lv_fs_file_t**

Public Members

void ***file_d**

lv_fs_drv_t ***drv**

lv_fs_file_cache_t ***cache**

struct **lv_fs_dir_t**

Public Members

void ***dir_d**

lv_fs_drv_t ***drv**

5.14 Animations

You can automatically change the value of a variable between a start and an end value using animations. Animation will happen by periodically calling an "animator" function with the corresponding value parameter.

The *animator* functions have the following prototype:

```
void func(void * var, lv_anim_var_t value);
```

This prototype is compatible with the majority of the property *set* functions in LVGL. For example `lv_obj_set_x(obj, value)` or `lv_obj_set_width(obj, value)`

5.14.1 Create an animation

To create an animation an `lv_anim_t` variable has to be initialized and configured with `lv_anim_set_...()` functions.

```

/* INITIALIZE AN ANIMATION
 *-----------------------*/

lv_anim_t a;
lv_anim_init(&a);

/* MANDATORY SETTINGS
 *------------------*/

/*Set the "animator" function*/
lv_anim_set_exec_cb(&a, (lv_anim_exec_xcb_t) lv_obj_set_x);

/*Set target of the animation*/
lv_anim_set_var(&a, obj);

/*Length of the animation [ms]*/
lv_anim_set_time(&a, duration);

/*Set start and end values. E.g. 0, 150*/
lv_anim_set_values(&a, start, end);

/* OPTIONAL SETTINGS
 *------------------*/

/*Time to wait before starting the animation [ms]*/
lv_anim_set_delay(&a, delay);

/*Set path (curve). Default is linear*/
```

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```
lv_anim_set_path(&a, lv_anim_path_ease_in);

/*Set a callback to indicate when the animation is ready (idle).*/
lv_anim_set_ready_cb(&a, ready_cb);

/*Set a callback to indicate when the animation is deleted (idle).*/
lv_anim_set_deleted_cb(&a, deleted_cb);

/*Set a callback to indicate when the animation is started (after delay).*/
lv_anim_set_start_cb(&a, start_cb);

/*When ready, play the animation backward with this duration. Default is 0 (disabled)␣
↪[ms]*/
lv_anim_set_playback_time(&a, time);

/*Delay before playback. Default is 0 (disabled) [ms]*/
lv_anim_set_playback_delay(&a, delay);

/*Number of repetitions. Default is 1. LV_ANIM_REPEAT_INFINITE for infinite␣
↪repetition*/
lv_anim_set_repeat_count(&a, cnt);

/*Delay before repeat. Default is 0 (disabled) [ms]*/
lv_anim_set_repeat_delay(&a, delay);

/*true (default): apply the start value immediately, false: apply start value after␣
↪delay when the anim. really starts. */
lv_anim_set_early_apply(&a, true/false);

/* START THE ANIMATION
 *------------------*/
lv_anim_start(&a);                             /*Start the animation*/
```

You can apply multiple different animations on the same variable at the same time. For example, animate the x and y coordinates with `lv_obj_set_x` and `lv_obj_set_y`. However, only one animation can exist with a given variable and function pair and `lv_anim_start()` will remove any existing animations for such a pair.

5.14.2 Animation path

You can control the path of an animation. The most simple case is linear, meaning the current value between *start* and *end* is changed with fixed steps. A *path* is a function which calculates the next value to set based on the current state of the animation. Currently, there are the following built-in path functions:

- `lv_anim_path_linear` linear animation
- `lv_anim_path_step` change in one step at the end
- `lv_anim_path_ease_in` slow at the beginning
- `lv_anim_path_ease_out` slow at the end
- `lv_anim_path_ease_in_out` slow at the beginning and end
- `lv_anim_path_overshoot` overshoot the end value
- `lv_anim_path_bounce` bounce back a little from the end value (like hitting a wall)

5.14.3 Speed vs time

By default, you set the animation time directly. But in some cases, setting the animation speed is more practical.

The `lv_anim_speed_to_time(speed, start, end)` function calculates the required time in milliseconds to reach the end value from a start value with the given speed. The speed is interpreted in *unit/sec* dimension. For example, `lv_anim_speed_to_time(20,0,100)` will yield 5000 milliseconds. For example, in the case of `lv_obj_set_x` *unit* is pixels so *20* means *20 px/sec* speed.

5.14.4 Delete animations

You can delete an animation with `lv_anim_del(var, func)` if you provide the animated variable and its animator function.

5.14.5 Timeline

A timeline is a collection of multiple animations which makes it easy to create complex composite animations.

Firstly, create an animation element but don't call `lv_anim_start()`.

Secondly, create an animation timeline object by calling `lv_anim_timeline_create()`.

Thirdly, add animation elements to the animation timeline by calling `lv_anim_timeline_add(at, start_time, &a)`. `start_time` is the start time of the animation on the timeline. Note that `start_time` will override the value of `delay`.

Finally, call `lv_anim_timeline_start(at)` to start the animation timeline.

It supports forward and backward playback of the entire animation group, using `lv_anim_timeline_set_reverse(at, reverse)`.

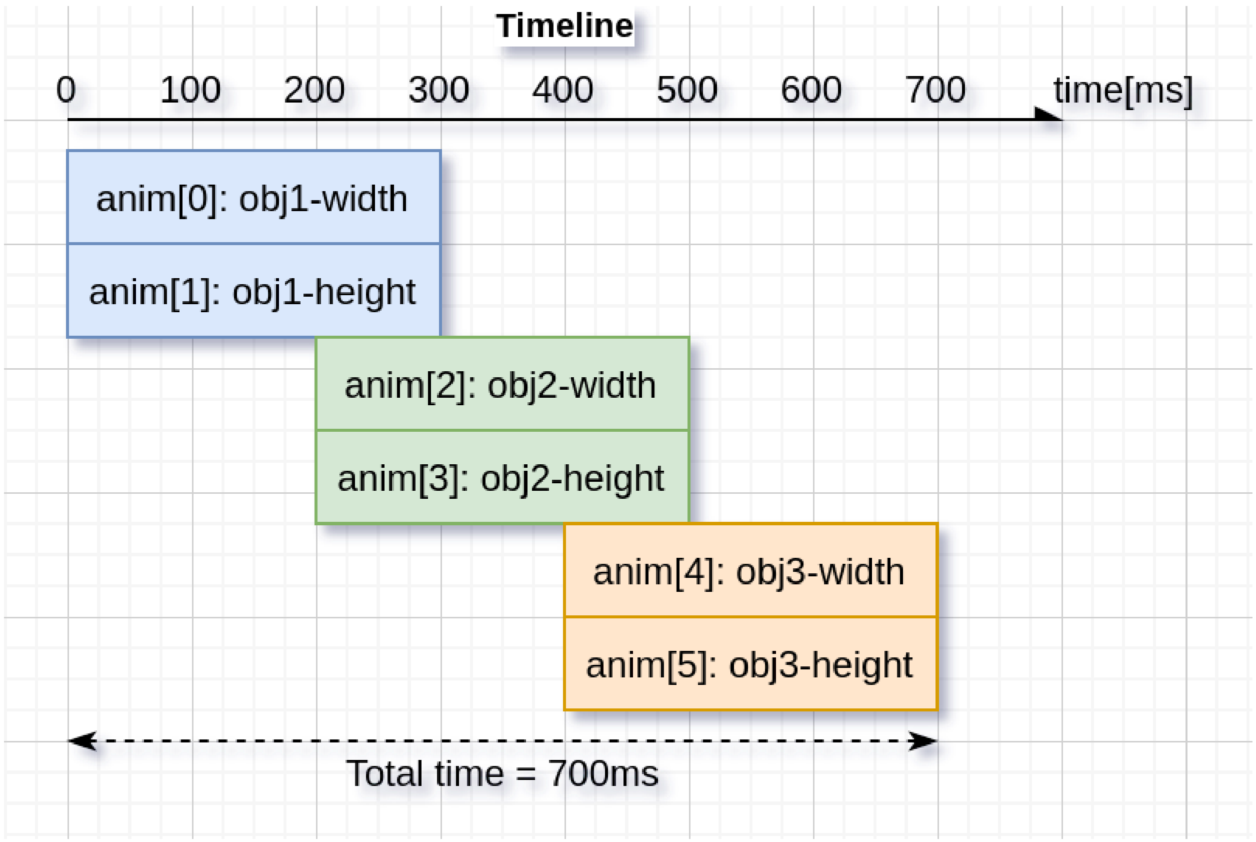
Call `lv_anim_timeline_stop(at)` to stop the animation timeline.

Call `lv_anim_timeline_set_progress(at, progress)` function to set the state of the object corresponding to the progress of the timeline.

Call `lv_anim_timeline_get_playtime(at)` function to get the total duration of the entire animation timeline.

Call `lv_anim_timeline_get_reverse(at)` function to get whether to reverse the animation timeline.

Call `lv_anim_timeline_del(at)` function to delete the animation timeline.



5.14.6 Examples

Start animation on an event

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SWITCH

static void anim_x_cb(void * var, int32_t v)
{
    lv_obj_set_x(var, v);
}

static void sw_event_cb(lv_event_t * e)
{
    lv_obj_t * sw = lv_event_get_target(e);
    lv_obj_t * label = lv_event_get_user_data(e);

    if(lv_obj_has_state(sw, LV_STATE_CHECKED)) {
        lv_anim_t a;
        lv_anim_init(&a);
        lv_anim_set_var(&a, label);
        lv_anim_set_values(&a, lv_obj_get_x(label), 100);
        lv_anim_set_time(&a, 500);
        lv_anim_set_exec_cb(&a, anim_x_cb);
        lv_anim_set_path_cb(&a, lv_anim_path_overshoot);
        lv_anim_start(&a);
```

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```
    }
    else {
        lv_anim_t a;
        lv_anim_init(&a);
        lv_anim_set_var(&a, label);
        lv_anim_set_values(&a, lv_obj_get_x(label), -lv_obj_get_width(label));
        lv_anim_set_time(&a, 500);
        lv_anim_set_exec_cb(&a, anim_x_cb);
        lv_anim_set_path_cb(&a, lv_anim_path_ease_in);
        lv_anim_start(&a);
    }

}

/**
 * Start animation on an event
 */
void lv_example_anim_1(void)
{
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Hello animations!");
    lv_obj_set_pos(label, 100, 10);


    lv_obj_t * sw = lv_switch_create(lv_scr_act());
    lv_obj_center(sw);
    lv_obj_add_state(sw, LV_STATE_CHECKED);
    lv_obj_add_event(sw, sw_event_cb, LV_EVENT_VALUE_CHANGED, label);
}

#endif
```

```
def anim_x_cb(label, v):
    label.set_x(v)

def sw_event_cb(e,label):
    sw = e.get_target_obj()

    if sw.has_state(lv.STATE.CHECKED):
        a = lv.anim_t()
        a.init()
        a.set_var(label)
        a.set_values(label.get_x(), 100)
        a.set_time(500)
        a.set_path_cb(lv.anim_t.path_overshoot)
        a.set_custom_exec_cb(lambda a,val: anim_x_cb(label,val))
        lv.anim_t.start(a)
    else:
        a = lv.anim_t()
        a.init()
        a.set_var(label)
        a.set_values(label.get_x(), -label.get_width())
        a.set_time(500)
        a.set_path_cb(lv.anim_t.path_ease_in)
        a.set_custom_exec_cb(lambda a,val: anim_x_cb(label,val))
        lv.anim_t.start(a)
```

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```
#
# Start animation on an event
#

label = lv.label(lv.scr_act())
label.set_text("Hello animations!")
label.set_pos(100, 10)


sw = lv.switch(lv.scr_act())
sw.center()
sw.add_state(lv.STATE.CHECKED)
sw.add_event(lambda e: sw_event_cb(e,label), lv.EVENT.VALUE_CHANGED, None)
```

Playback animation

```
#include "../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_SWITCH


static void anim_x_cb(void * var, int32_t v)
{
    lv_obj_set_x(var, v);
}

static void anim_size_cb(void * var, int32_t v)
{
    lv_obj_set_size(var, v, v);
}

/**
 * Create a playback animation
 */
void lv_example_anim_2(void)
{

    lv_obj_t * obj = lv_obj_create(lv_scr_act());
    lv_obj_set_style_bg_color(obj, lv_palette_main(LV_PALETTE_RED), 0);
    lv_obj_set_style_radius(obj, LV_RADIUS_CIRCLE, 0);

    lv_obj_align(obj, LV_ALIGN_LEFT_MID, 10, 0);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, obj);
    lv_anim_set_values(&a, 10, 50);
    lv_anim_set_time(&a, 1000);
    lv_anim_set_playback_delay(&a, 100);
    lv_anim_set_playback_time(&a, 300);
    lv_anim_set_repeat_delay(&a, 500);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
```

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```
    lv_anim_set_path_cb(&a, lv_anim_path_ease_in_out);

    lv_anim_set_exec_cb(&a, anim_size_cb);
    lv_anim_start(&a);
    lv_anim_set_exec_cb(&a, anim_x_cb);
    lv_anim_set_values(&a, 10, 240);
    lv_anim_start(&a);
}

#endif
```

```
def anim_x_cb(obj, v):
    obj.set_x(v)

def anim_size_cb(obj, v):
    obj.set_size(v, v)


#
# Create a playback animation
#
obj = lv.obj(lv.scr_act())
obj.set_style_bg_color(lv.palette_main(lv.PALETTE.RED), 0)
obj.set_style_radius(lv.RADIUS_CIRCLE, 0)

obj.align(lv.ALIGN.LEFT_MID, 10, 0)

a1 = lv.anim_t()
a1.init()
a1.set_var(obj)
a1.set_values(10, 50)
a1.set_time(1000)
a1.set_playback_delay(100)
a1.set_playback_time(300)
a1.set_repeat_delay(500)
a1.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a1.set_path_cb(lv.anim_t.path_ease_in_out)
a1.set_custom_exec_cb(lambda a1,val: anim_size_cb(obj,val))
lv.anim_t.start(a1)

a2 = lv.anim_t()
a2.init()
a2.set_var(obj)
a2.set_values(10, 240)
a2.set_time(1000)
a2.set_playback_delay(100)
a2.set_playback_time(300)
a2.set_repeat_delay(500)
a2.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a2.set_path_cb(lv.anim_t.path_ease_in_out)
a2.set_custom_exec_cb(lambda a1,val: anim_x_cb(obj,val))
lv.anim_t.start(a2)
```

Animation timeline

```
#include "../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

static lv_anim_timeline_t * anim_timeline = NULL;

static lv_obj_t * obj1 = NULL;
static lv_obj_t * obj2 = NULL;
static lv_obj_t * obj3 = NULL;

static const lv_coord_t obj_width = 90;
static const lv_coord_t obj_height = 70;

static void set_width(void * var, int32_t v)
{
    lv_obj_set_width((lv_obj_t *)var, v);
}

static void set_height(void * var, int32_t v)
{
    lv_obj_set_height((lv_obj_t *)var, v);
}

static void anim_timeline_create(void)
{
    /* obj1 */
    lv_anim_t a1;
    lv_anim_init(&a1);
    lv_anim_set_var(&a1, obj1);
    lv_anim_set_values(&a1, 0, obj_width);
    lv_anim_set_early_apply(&a1, false);
    lv_anim_set_exec_cb(&a1, (lv_anim_exec_xcb_t)set_width);
    lv_anim_set_path_cb(&a1, lv_anim_path_overshoot);
    lv_anim_set_time(&a1, 300);

    lv_anim_t a2;
    lv_anim_init(&a2);
    lv_anim_set_var(&a2, obj1);
    lv_anim_set_values(&a2, 0, obj_height);
    lv_anim_set_early_apply(&a2, false);
    lv_anim_set_exec_cb(&a2, (lv_anim_exec_xcb_t)set_height);
    lv_anim_set_path_cb(&a2, lv_anim_path_ease_out);
    lv_anim_set_time(&a2, 300);

    /* obj2 */
    lv_anim_t a3;
    lv_anim_init(&a3);
    lv_anim_set_var(&a3, obj2);
    lv_anim_set_values(&a3, 0, obj_width);
    lv_anim_set_early_apply(&a3, false);
    lv_anim_set_exec_cb(&a3, (lv_anim_exec_xcb_t)set_width);
    lv_anim_set_path_cb(&a3, lv_anim_path_overshoot);
    lv_anim_set_time(&a3, 300);

    lv_anim_t a4;
    lv_anim_init(&a4);
```

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```
    lv_anim_set_var(&a4, obj2);
    lv_anim_set_values(&a4, 0, obj_height);
    lv_anim_set_early_apply(&a4, false);
    lv_anim_set_exec_cb(&a4, (lv_anim_exec_xcb_t)set_height);
    lv_anim_set_path_cb(&a4, lv_anim_path_ease_out);
    lv_anim_set_time(&a4, 300);

    /* obj3 */
    lv_anim_t a5;
    lv_anim_init(&a5);
    lv_anim_set_var(&a5, obj3);
    lv_anim_set_values(&a5, 0, obj_width);
    lv_anim_set_early_apply(&a5, false);
    lv_anim_set_exec_cb(&a5, (lv_anim_exec_xcb_t)set_width);
    lv_anim_set_path_cb(&a5, lv_anim_path_overshoot);
    lv_anim_set_time(&a5, 300);

    lv_anim_t a6;
    lv_anim_init(&a6);
    lv_anim_set_var(&a6, obj3);
    lv_anim_set_values(&a6, 0, obj_height);
    lv_anim_set_early_apply(&a6, false);
    lv_anim_set_exec_cb(&a6, (lv_anim_exec_xcb_t)set_height);
    lv_anim_set_path_cb(&a6, lv_anim_path_ease_out);
    lv_anim_set_time(&a6, 300);

    /* Create anim timeline */
    anim_timeline = lv_anim_timeline_create();
    lv_anim_timeline_add(anim_timeline, 0, &a1);
    lv_anim_timeline_add(anim_timeline, 0, &a2);
    lv_anim_timeline_add(anim_timeline, 200, &a3);
    lv_anim_timeline_add(anim_timeline, 200, &a4);
    lv_anim_timeline_add(anim_timeline, 400, &a5);
    lv_anim_timeline_add(anim_timeline, 400, &a6);
}

static void btn_start_event_handler(lv_event_t * e)
{
    lv_obj_t * btn = lv_event_get_target(e);

    if(!anim_timeline) {
        anim_timeline_create();
    }

    bool reverse = lv_obj_has_state(btn, LV_STATE_CHECKED);
    lv_anim_timeline_set_reverse(anim_timeline, reverse);
    lv_anim_timeline_start(anim_timeline);
}

static void btn_del_event_handler(lv_event_t * e)
{
    LV_UNUSED(e);
    if(anim_timeline) {
        lv_anim_timeline_del(anim_timeline);
        anim_timeline = NULL;
    }
}
```

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```
static void btn_stop_event_handler(lv_event_t * e)
{
    LV_UNUSED(e);
    if(anim_timeline) {
        lv_anim_timeline_stop(anim_timeline);
    }
}

static void slider_prg_event_handler(lv_event_t * e)
{
    lv_obj_t * slider = lv_event_get_target(e);

    if(!anim_timeline) {
        anim_timeline_create();
    }

    int32_t progress = lv_slider_get_value(slider);
    lv_anim_timeline_set_progress(anim_timeline, progress);
}

/**
 * Create an animation timeline
 */
void lv_example_anim_timeline_1(void)
{
    lv_obj_t * par = lv_scr_act();
    lv_obj_set_flex_flow(par, LV_FLEX_FLOW_ROW);
    lv_obj_set_flex_align(par, LV_FLEX_ALIGN_SPACE_AROUND, LV_FLEX_ALIGN_CENTER, LV_
↪FLEX_ALIGN_CENTER);

    /* create btn_start */
    lv_obj_t * btn_start = lv_btn_create(par);
    lv_obj_add_event(btn_start, btn_start_event_handler, LV_EVENT_VALUE_CHANGED,␣
↪NULL);
    lv_obj_add_flag(btn_start, LV_OBJ_FLAG_IGNORE_LAYOUT);
    lv_obj_add_flag(btn_start, LV_OBJ_FLAG_CHECKABLE);
    lv_obj_align(btn_start, LV_ALIGN_TOP_MID, -100, 20);

    lv_obj_t * label_start = lv_label_create(btn_start);
    lv_label_set_text(label_start, "Start");
    lv_obj_center(label_start);

    /* create btn_del */
    lv_obj_t * btn_del = lv_btn_create(par);
    lv_obj_add_event(btn_del, btn_del_event_handler, LV_EVENT_CLICKED, NULL);
    lv_obj_add_flag(btn_del, LV_OBJ_FLAG_IGNORE_LAYOUT);
    lv_obj_align(btn_del, LV_ALIGN_TOP_MID, 0, 20);

    lv_obj_t * label_del = lv_label_create(btn_del);
    lv_label_set_text(label_del, "Delete");
    lv_obj_center(label_del);

    /* create btn_stop */
    lv_obj_t * btn_stop = lv_btn_create(par);
    lv_obj_add_event(btn_stop, btn_stop_event_handler, LV_EVENT_CLICKED, NULL);
    lv_obj_add_flag(btn_stop, LV_OBJ_FLAG_IGNORE_LAYOUT);
```

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```
    lv_obj_align(btn_stop, LV_ALIGN_TOP_MID, 100, 20);

    lv_obj_t * label_stop = lv_label_create(btn_stop);
    lv_label_set_text(label_stop, "Stop");
    lv_obj_center(label_stop);

    /* create slider_prg */
    lv_obj_t * slider_prg = lv_slider_create(par);
    lv_obj_add_event(slider_prg, slider_prg_event_handler, LV_EVENT_VALUE_CHANGED,␣
↪NULL);
    lv_obj_add_flag(slider_prg, LV_OBJ_FLAG_IGNORE_LAYOUT);
    lv_obj_align(slider_prg, LV_ALIGN_BOTTOM_MID, 0, -20);
    lv_slider_set_range(slider_prg, 0, 65535);

    /* create 3 objects */
    obj1 = lv_obj_create(par);
    lv_obj_set_size(obj1, obj_width, obj_height);

    obj2 = lv_obj_create(par);
    lv_obj_set_size(obj2, obj_width, obj_height);

    obj3 = lv_obj_create(par);
    lv_obj_set_size(obj3, obj_width, obj_height);
}

#endif
```

```
class LV_ExampleAnimTimeline_1(object):

    def __init__(self):
        self.obj_width = 120
        self.obj_height = 150
        #
        # Create an animation timeline
        #

        self.par = lv.scr_act()
        self.par.set_flex_flow(lv.FLEX_FLOW.ROW)
        self.par.set_flex_align(lv.FLEX_ALIGN.SPACE_AROUND, lv.FLEX_ALIGN.CENTER, lv.
↪FLEX_ALIGN.CENTER)

        self.btn_run = lv.btn(self.par)
        self.btn_run.add_event(self.btn_run_event_handler, lv.EVENT.VALUE_CHANGED,␣
↪None)
        self.btn_run.add_flag(lv.obj.FLAG.IGNORE_LAYOUT)
        self.btn_run.add_flag(lv.obj.FLAG.CHECKABLE)
        self.btn_run.align(lv.ALIGN.TOP_MID, -50, 20)

        self.label_run = lv.label(self.btn_run)
        self.label_run.set_text("Run")
        self.label_run.center()

        self.btn_del = lv.btn(self.par)
        self.btn_del.add_event(self.btn_del_event_handler, lv.EVENT.CLICKED, None)
        self.btn_del.add_flag(lv.obj.FLAG.IGNORE_LAYOUT)
        self.btn_del.align(lv.ALIGN.TOP_MID, 50, 20)
```

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```
        self.label_del = lv.label(self.btn_del)
        self.label_del.set_text("Stop")
        self.label_del.center()

        self.slider = lv.slider(self.par)
        self.slider.add_event(self.slider_prg_event_handler, lv.EVENT.VALUE_CHANGED,␣
↪None)
        self.slider.add_flag(lv.obj.FLAG.IGNORE_LAYOUT)
        self.slider.align(lv.ALIGN.BOTTOM_RIGHT, -20, -20)
        self.slider.set_range(0, 65535)

        self.obj1 = lv.obj(self.par)
        self.obj1.set_size(self.obj_width, self.obj_height)

        self.obj2 = lv.obj(self.par)
        self.obj2.set_size(self.obj_width, self.obj_height)

        self.obj3 = lv.obj(self.par)
        self.obj3.set_size(self.obj_width, self.obj_height)

        self.anim_timeline = None

    def set_width(self,obj, v):
        obj.set_width(v)

    def set_height(self,obj, v):
        obj.set_height(v)

    def anim_timeline_create(self):
        # obj1
        self.a1 = lv.anim_t()
        self.a1.init()
        self.a1.set_values(0, self.obj_width)
        self.a1.set_early_apply(False)
        self.a1.set_custom_exec_cb(lambda a,v: self.set_width(self.obj1,v))
        self.a1.set_path_cb(lv.anim_t.path_overshoot)
        self.a1.set_time(300)

        self.a2 = lv.anim_t()
        self.a2.init()
        self.a2.set_values(0, self.obj_height)
        self.a2.set_early_apply(False)
        self.a2.set_custom_exec_cb(lambda a,v: self.set_height(self.obj1,v))
        self.a2.set_path_cb(lv.anim_t.path_ease_out)
        self.a2.set_time(300)

        # obj2
        self.a3=lv.anim_t()
        self.a3.init()
        self.a3.set_values(0, self.obj_width)
        self.a3.set_early_apply(False)
        self.a3.set_custom_exec_cb(lambda a,v: self.set_width(self.obj2,v))
        self.a3.set_path_cb(lv.anim_t.path_overshoot)
        self.a3.set_time(300)

        self.a4 = lv.anim_t()
```

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```
        self.a4.init()
        self.a4.set_values(0, self.obj_height)
        self.a4.set_early_apply(False)
        self.a4.set_custom_exec_cb(lambda a,v: self.set_height(self.obj2,v))
        self.a4.set_path_cb(lv.anim_t.path_ease_out)
        self.a4.set_time(300)

        # obj3
        self.a5 = lv.anim_t()
        self.a5.init()
        self.a5.set_values(0, self.obj_width)
        self.a5.set_early_apply(False)
        self.a5.set_custom_exec_cb(lambda a,v: self.set_width(self.obj3,v))
        self.a5.set_path_cb(lv.anim_t.path_overshoot)
        self.a5.set_time(300)

        self.a6 = lv.anim_t()
        self.a6.init()
        self.a6.set_values(0, self.obj_height)
        self.a6.set_early_apply(False)
        self.a6.set_custom_exec_cb(lambda a,v: self.set_height(self.obj3,v))
        self.a6.set_path_cb(lv.anim_t.path_ease_out)
        self.a6.set_time(300)

        # Create anim timeline
        print("Create new anim_timeline")
        self.anim_timeline = lv.anim_timeline_create()
        self.anim_timeline.add(0, self.a1)
        self.anim_timeline.add(0, self.a2)
        self.anim_timeline.add(200, self.a3)
        self.anim_timeline.add(200, self.a4)
        self.anim_timeline.add(400, self.a5)
        self.anim_timeline.add(400, self.a6)

    def slider_prg_event_handler(self,e):
        slider = e.get_target_obj()

        if  not self.anim_timeline:
            self.anim_timeline_create()

        progress = slider.get_value()
        self.anim_timeline.set_progress(progress)


    def btn_run_event_handler(self,e):
        btn = e.get_target_obj()
        if not self.anim_timeline:
            self.anim_timeline_create()

        reverse = btn.has_state(lv.STATE.CHECKED)
        self.anim_timeline.set_reverse(reverse)
        self.anim_timeline.start()

    def btn_del_event_handler(self,e):
        if self.anim_timeline:
            self.anim_timeline._del()
        self.anim_timeline = None
```

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```

lv_example_anim_timeline_1 = LV_ExampleAnimTimeline_1()
```

5.14.7 API

Typedefs

typedef int32_t (***lv_anim_path_cb_t**)(const struct *_lv_anim_t**)

Get the current value during an animation

typedef void (***lv_anim_exec_xcb_t**)(void*, int32_t)

Generic prototype of "animator" functions. First parameter is the variable to animate. Second parameter is the value to set. Compatible with `lv_xxx_set_yyy(obj, value)` functions The `x` in `_xcb_t` means it's not a fully generic prototype because it doesn't receive `lv_anim_t *` as its first argument

typedef void (***lv_anim_custom_exec_cb_t**)(struct *_lv_anim_t**, int32_t)

Same as `lv_anim_exec_xcb_t` but receives `lv_anim_t *` as the first parameter. It's more consistent but less convenient. Might be used by binding generator functions.

typedef void (***lv_anim_ready_cb_t**)(struct *_lv_anim_t**)

Callback to call when the animation is ready

typedef void (***lv_anim_start_cb_t**)(struct *_lv_anim_t**)

Callback to call when the animation really stars (considering `delay`)

typedef int32_t (***lv_anim_get_value_cb_t**)(struct *_lv_anim_t**)

Callback used when the animation values are relative to get the current value

typedef void (***lv_anim_deleted_cb_t**)(struct *_lv_anim_t**)

Callback used when the animation is deleted

typedef struct *_lv_anim_t* **lv_anim_t**

Describes an animation

Enums

enum **lv_anim_enable_t**

Can be used to indicate if animations are enabled or disabled in a case

Values:

enumerator **LV_ANIM_OFF**

enumerator **LV_ANIM_ON**

Functions

`LV_EXPORT_CONST_INT`(LV_ANIM_REPEAT_INFINITE)

`LV_EXPORT_CONST_INT`(LV_ANIM_PLAYTIME_INFINITE)

void **`_lv_anim_core_init`**(void)

Init. the animation module

void **`lv_anim_init`**(*lv_anim_t* *a)

Initialize an animation variable. E.g.: lv_anim_t a; lv_anim_init(&a); lv_anim_set_...(&a); lv_anim_start(&a);

Parameters **`a`** -- pointer to an `lv_anim_t` variable to initialize

static inline void **`lv_anim_set_var`**(*lv_anim_t* *a, void *var)

Set a variable to animate

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`var`** -- pointer to a variable to animate

static inline void **`lv_anim_set_exec_cb`**(*lv_anim_t* *a, *lv_anim_exec_xcb_t* exec_cb)

Set a function to animate `var`

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`exec_cb`** -- a function to execute during animation LVGL's built-in functions can be used. E.g. lv_obj_set_x

static inline void **`lv_anim_set_time`**(*lv_anim_t* *a, uint32_t duration)

Set the duration of an animation

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`duration`** -- duration of the animation in milliseconds

static inline void **`lv_anim_set_delay`**(*lv_anim_t* *a, uint32_t delay)

Set a delay before starting the animation

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`delay`** -- delay before the animation in milliseconds

static inline void **`lv_anim_set_values`**(*lv_anim_t* *a, int32_t start, int32_t end)

Set the start and end values of an animation

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`start`** -- the start value
- **`end`** -- the end value

static inline void **`lv_anim_set_custom_exec_cb`**(*lv_anim_t* *a, *lv_anim_custom_exec_cb_t* exec_cb)

Similar to `lv_anim_set_exec_cb` but `lv_anim_custom_exec_cb_t` receives `lv_anim_t *` as its first parameter instead of `void *`. This function might be used when LVGL is bound to other languages because it's more consistent to have `lv_anim_t *` as first parameter. The variable to animate can be stored in the animation's `user_data`

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`exec_cb`** -- a function to execute.

static inline void **`lv_anim_set_path_cb`**(*lv_anim_t* *a, *lv_anim_path_cb_t* path_cb)

Set the path (curve) of the animation.

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`path_cb`** -- a function to set the current value of the animation.

static inline void **`lv_anim_set_start_cb`**(*lv_anim_t* *a, *lv_anim_start_cb_t* start_cb)

Set a function call when the animation really starts (considering `delay`)

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`start_cb`** -- a function call when the animation starts

static inline void **`lv_anim_set_get_value_cb`**(*lv_anim_t* *a, *lv_anim_get_value_cb_t* get_value_cb)

Set a function to use the current value of the variable and make start and end value relative to the returned current value.

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`get_value_cb`** -- a function call when the animation starts

static inline void **`lv_anim_set_ready_cb`**(*lv_anim_t* *a, *lv_anim_ready_cb_t* ready_cb)

Set a function call when the animation is ready

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`ready_cb`** -- a function call when the animation is ready

static inline void **`lv_anim_set_deleted_cb`**(*lv_anim_t* *a, *lv_anim_deleted_cb_t* deleted_cb)

Set a function call when the animation is deleted.

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`deleted_cb`** -- a function call when the animation is deleted

static inline void **`lv_anim_set_playback_time`**(*lv_anim_t* *a, uint32_t time)

Make the animation to play back to when the forward direction is ready

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`time`** -- the duration of the playback animation in milliseconds. 0: disable playback

static inline void **`lv_anim_set_playback_delay`**(*lv_anim_t* *a, uint32_t delay)

Make the animation to play back to when the forward direction is ready

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`delay`** -- delay in milliseconds before starting the playback animation.

static inline void **`lv_anim_set_repeat_count`**(*lv_anim_t* *a, uint16_t cnt)

Make the animation repeat itself.

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`cnt`** -- repeat count or `LV_ANIM_REPEAT_INFINITE` for infinite repetition. 0: to disable repetition.

static inline void **`lv_anim_set_repeat_delay`**(*lv_anim_t* *a, uint32_t delay)

Set a delay before repeating the animation.

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`delay`** -- delay in milliseconds before repeating the animation.

static inline void **`lv_anim_set_early_apply`**(*lv_anim_t* *a, bool en)

Set a whether the animation's should be applied immediately or only when the delay expired.

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`en`** -- true: apply the start value immediately in `lv_anim_start`; false: apply the start value only when `delay` ms is elapsed and the animations really starts

static inline void **`lv_anim_set_user_data`**(*lv_anim_t* *a, void *user_data)

Set the custom user data field of the animation.

Parameters

- **`a`** -- pointer to an initialized `lv_anim_t` variable
- **`user_data`** -- pointer to the new user_data.

lv_anim_t ***`lv_anim_start`**(const *lv_anim_t* *a)

Create an animation

Parameters **`a`** -- an initialized 'anim_t' variable. Not required after call.

Returns pointer to the created animation (different from the `a` parameter)

static inline uint32_t **`lv_anim_get_delay`**(*lv_anim_t* *a)

Get a delay before starting the animation

Parameters **`a`** -- pointer to an initialized `lv_anim_t` variable

Returns delay before the animation in milliseconds

uint32_t **`lv_anim_get_playtime`**(*lv_anim_t* *a)

Get the time used to play the animation.

Parameters **`a`** -- pointer to an animation.

Returns the play time in milliseconds.

static inline uint32_t **`lv_anim_get_time`**(*lv_anim_t* *a)

Get the duration of an animation

Parameters **`a`** -- pointer to an initialized `lv_anim_t` variable

Returns the duration of the animation in milliseconds

static inline uint16_t **`lv_anim_get_repeat_count`**(*lv_anim_t* *a)

Get the repeat count of the animation.

Parameters **`a`** -- pointer to an initialized `lv_anim_t` variable

Returns the repeat count or `LV_ANIM_REPEAT_INFINITE` for infinite repetition. 0: disabled repetition.

static inline void ***`lv_anim_get_user_data`**(*lv_anim_t* *a)

Get the user_data field of the animation

Parameters **`a`** -- pointer to an initialized `lv_anim_t` variable

Returns the pointer to the custom user_data of the animation

bool **`lv_anim_del`**(void *var, *lv_anim_exec_xcb_t* exec_cb)

Delete an animation of a variable with a given animator function

Parameters

- **`var`** -- pointer to variable
- **`exec_cb`** -- a function pointer which is animating 'var', or NULL to ignore it and delete all the animations of 'var

Returns true: at least 1 animation is deleted, false: no animation is deleted

void **`lv_anim_del_all`**(void)

Delete all the animations

lv_anim_t ***`lv_anim_get`**(void *var, *lv_anim_exec_xcb_t* exec_cb)

Get the animation of a variable and its `exec_cb`.

Parameters

- **`var`** -- pointer to variable
- **`exec_cb`** -- a function pointer which is animating 'var', or NULL to return first matching 'var'

Returns pointer to the animation.

struct *_lv_timer_t* ***`lv_anim_get_timer`**(void)

Get global animation refresher timer.

Returns pointer to the animation refresher timer.

static inline bool **`lv_anim_custom_del`**(*lv_anim_t* *a, *lv_anim_custom_exec_cb_t* exec_cb)

Delete an animation by getting the animated variable from `a`. Only animations with `exec_cb` will be deleted. This function exists because it's logical that all anim. functions receives an `lv_anim_t` as their first parameter. It's not practical in C but might make the API more consequent and makes easier to generate bindings.

Parameters

- **`a`** -- pointer to an animation.

- **exec_cb** -- a function pointer which is animating 'var', or NULL to ignore it and delete all the animations of 'var

Returns true: at least 1 animation is deleted, false: no animation is deleted

static inline *lv_anim_t* ***lv_anim_custom_get**(*lv_anim_t* *a, *lv_anim_custom_exec_cb_t* exec_cb)

Get the animation of a variable and its `exec_cb`. This function exists because it's logical that all anim. functions receives an `lv_anim_t` as their first parameter. It's not practical in C but might make the API more consequent and makes easier to generate bindings.

Parameters

- **a** -- pointer to an animation.
- **exec_cb** -- a function pointer which is animating 'var', or NULL to return first matching 'var'

Returns pointer to the animation.

uint16_t **lv_anim_count_running**(void)

Get the number of currently running animations

Returns the number of running animations

uint32_t **lv_anim_speed_to_time**(uint32_t speed, int32_t start, int32_t end)

Calculate the time of an animation with a given speed and the start and end values

Parameters

- **speed** -- speed of animation in unit/sec
- **start** -- start value of the animation
- **end** -- end value of the animation

Returns the required time [ms] for the animation with the given parameters

void **lv_anim_refr_now**(void)

Manually refresh the state of the animations. Useful to make the animations running in a blocking process where `lv_timer_handler` can't run for a while. Shouldn't be used directly because it is called in `lv_refr_now()`.

int32_t **lv_anim_path_linear**(const *lv_anim_t* *a)

Calculate the current value of an animation applying linear characteristic

Parameters **a** -- pointer to an animation

Returns the current value to set

int32_t **lv_anim_path_ease_in**(const *lv_anim_t* *a)

Calculate the current value of an animation slowing down the start phase

Parameters **a** -- pointer to an animation

Returns the current value to set

int32_t **lv_anim_path_ease_out**(const *lv_anim_t* *a)

Calculate the current value of an animation slowing down the end phase

Parameters **a** -- pointer to an animation

Returns the current value to set

int32_t **lv_anim_path_ease_in_out**(const *lv_anim_t* *a)

Calculate the current value of an animation applying an "S" characteristic (cosine)

Parameters **a** -- pointer to an animation

Returns the current value to set

int32_t **`lv_anim_path_overshoot`**(const *lv_anim_t* *a)

Calculate the current value of an animation with overshoot at the end

Parameters **`a`** -- pointer to an animation

Returns the current value to set

int32_t **`lv_anim_path_bounce`**(const *lv_anim_t* *a)

Calculate the current value of an animation with 3 bounces

Parameters **`a`** -- pointer to an animation

Returns the current value to set

int32_t **`lv_anim_path_step`**(const *lv_anim_t* *a)

Calculate the current value of an animation applying step characteristic. (Set end value on the end of the animation)

Parameters **`a`** -- pointer to an animation

Returns the current value to set

struct **`_lv_anim_t`**

#include <lv_anim.h> Describes an animation

Public Members

void ***`var`**

Variable to animate

lv_anim_exec_xcb_t **`exec_cb`**

Function to execute to animate

lv_anim_start_cb_t **`start_cb`**

Call it when the animation is starts (considering `delay`)

lv_anim_ready_cb_t **`ready_cb`**

Call it when the animation is ready

lv_anim_deleted_cb_t **`deleted_cb`**

Call it when the animation is deleted

lv_anim_get_value_cb_t **`get_value_cb`**

Get the current value in relative mode

void ***`user_data`**

Custom user data

lv_anim_path_cb_t **`path_cb`**

Describe the path (curve) of animations

int32_t **`start_value`**
    Start value

int32_t **`current_value`**
    Current value

int32_t **`end_value`**
    End value

int32_t **`time`**
    Animation time in ms

int32_t **`act_time`**
    Current time in animation. Set to negative to make delay.

uint32_t **`playback_delay`**
    Wait before play back

uint32_t **`playback_time`**
    Duration of playback animation

uint32_t **`repeat_delay`**
    Wait before repeat

uint16_t **`repeat_cnt`**
    Repeat count for the animation

uint8_t **`early_apply`**
    1: Apply start value immediately even is there is `delay`

uint32_t **`last_timer_run`**

uint8_t **`playback_now`**
    Play back is in progress

uint8_t **`run_round`**
    Indicates the animation has run in this round

uint8_t **`start_cb_called`**
    Indicates that the `start_cb` was already called

5.15 Timers

LVGL has a built-in timer system. You can register a function to have it be called periodically. The timers are handled and called in `lv_timer_handler()`, which needs to be called every few milliseconds. See *Porting* for more information.

Timers are non-preemptive, which means a timer cannot interrupt another timer. Therefore, you can call any LVGL related function in a timer.

5.15.1 Create a timer

To create a new timer, use `lv_timer_create(timer_cb, period_ms, user_data)`. It will create an `lv_timer_t *` variable, which can be used later to modify the parameters of the timer. `lv_timer_create_basic()` can also be used. This allows you to create a new timer without specifying any parameters.

A timer callback should have a `void (*lv_timer_cb_t)(lv_timer_t *);` prototype.

For example:

```
void my_timer(lv_timer_t * timer)
{
  /*Use the user_data*/
  uint32_t * user_data = timer->user_data;
  printf("my_timer called with user data: %d\n", *user_data);

  /*Do something with LVGL*/
  if(something_happened) {
    something_happened = false;
    lv_btn_create(lv_scr_act(), NULL);
  }
}

...

static uint32_t user_data = 10;
lv_timer_t * timer = lv_timer_create(my_timer, 500,  &user_data);
```

5.15.2 Ready and Reset

`lv_timer_ready(timer)` makes a timer run on the next call of `lv_timer_handler()`.

`lv_timer_reset(timer)` resets the period of a timer. It will be called again after the defined period of milliseconds has elapsed.

5.15.3 Set parameters

You can modify some timer parameters later:

- `lv_timer_set_cb(timer, new_cb)`
- `lv_timer_set_period(timer, new_period)`

5.15.4 Repeat count

You can make a timer repeat only a given number of times with `lv_timer_set_repeat_count(timer, count)`. The timer will automatically be deleted after it's called the defined number of times. Set the count to `-1` to repeat indefinitely.

5.15.5 Measure idle time

You can get the idle percentage time of `lv_timer_handler` with `lv_timer_get_idle()`. Note that, it doesn't measure the idle time of the overall system, only `lv_timer_handler`. It can be misleading if you use an operating system and call `lv_timer_handler` in a timer, as it won't actually measure the time the OS spends in an idle thread.

5.15.6 Asynchronous calls

In some cases, you can't perform an action immediately. For example, you can't delete an object because something else is still using it, or you don't want to block the execution now. For these cases, `lv_async_call(my_function, data_p)` can be used to call `my_function` on the next invocation of `lv_timer_handler`. `data_p` will be passed to the function when it's called. Note that only the data pointer is saved, so you need to ensure that the variable will be "alive" while the function is called. It can be *static*, global or dynamically allocated data. If you want to cancel an asynchronous call, call `lv_async_call_cancel(my_function, data_p)`, which will clear all asynchronous calls matching `my_function` and `data_p`.

For example:

```c
void my_screen_clean_up(void * scr)
{
  /*Free some resources related to `scr`*/

  /*Finally delete the screen*/
  lv_obj_del(scr);
}

...

/*Do something with the object on the current screen*/

/*Delete screen on next call of `lv_timer_handler`, not right now.*/
lv_async_call(my_screen_clean_up, lv_scr_act());
```

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```
/*The screen is still valid so you can do other things with it*/
```

If you just want to delete an object and don't need to clean anything up in `my_screen_cleanup` you could just use `lv_obj_del_async` which will delete the object on the next call to `lv_timer_handler`.

5.15.7 API

Typedefs

typedef void (***lv_timer_cb_t**)(struct *_lv_timer_t**)

Timers execute this type of functions.

typedef struct *_lv_timer_t* **lv_timer_t**

Descriptor of a lv_timer

Functions

void **_lv_timer_core_init**(void)

Init the lv_timer module

static inline LV_ATTRIBUTE_TIMER_HANDLER uint32_t lv_timer_handler_run_in_period (uint32_t ms)

Call it in the super-loop of main() or threads. It will run lv_timer_handler() with a given period in ms. You can use it with sleep or delay in OS environment. This function is used to simplify the porting.

Parameters **__ms** -- the period for running lv_timer_handler()

lv_timer_t ***lv_timer_create_basic**(void)

Create an "empty" timer. It needs to be initialized with at least `lv_timer_set_cb` and `lv_timer_set_period`

Returns pointer to the created timer

lv_timer_t ***lv_timer_create**(*lv_timer_cb_t* timer_xcb, uint32_t period, void *user_data)

Create a new lv_timer

Parameters

- **timer_xcb** -- a callback to call periodically. (the 'x' in the argument name indicates that it's not a fully generic function because it not follows the `func_name(object, callback, ...)` convention)
- **period** -- call period in ms unit
- **user_data** -- custom parameter

Returns pointer to the new timer

void **lv_timer_del**(*lv_timer_t* *timer)

Delete a lv_timer

Parameters **timer** -- pointer to an lv_timer void **`lv_timer_pause`**(*lv_timer_t* *timer)

Pause/resume a timer.

Parameters **`timer`** -- pointer to an lv_timer

void **`lv_timer_resume`**(*lv_timer_t* *timer)

void **`lv_timer_set_cb`**(*lv_timer_t* *timer, *lv_timer_cb_t* timer_cb)

Set the callback to the timer (the function to call periodically)

Parameters

- **`timer`** -- pointer to a timer
- **`timer_cb`** -- the function to call periodically

void **`lv_timer_set_period`**(*lv_timer_t* *timer, uint32_t period)

Set new period for a lv_timer

Parameters

- **`timer`** -- pointer to a lv_timer
- **`period`** -- the new period

void **`lv_timer_ready`**(*lv_timer_t* *timer)

Make a lv_timer ready. It will not wait its period.

Parameters **`timer`** -- pointer to a lv_timer.

void **`lv_timer_set_repeat_count`**(*lv_timer_t* *timer, int32_t repeat_count)

Set the number of times a timer will repeat.

Parameters

- **`timer`** -- pointer to a lv_timer.
- **`repeat_count`** -- -1 : infinity; 0 : stop ; n>0: residual times

void **`lv_timer_reset`**(*lv_timer_t* *timer)

Reset a lv_timer. It will be called the previously set period milliseconds later.

Parameters **`timer`** -- pointer to a lv_timer.

void **`lv_timer_enable`**(bool en)

Enable or disable the whole lv_timer handling

Parameters **`en`** -- true: lv_timer handling is running, false: lv_timer handling is suspended

uint8_t **`lv_timer_get_idle`**(void)

Get idle percentage

Returns the lv_timer idle in percentage

lv_timer_t ***`lv_timer_get_next`**(*lv_timer_t* *timer)

Iterate through the timers

Parameters **`timer`** -- NULL to start iteration or the previous return value to get the next timer

Returns the next timer or NULL if there is no more timer static inline void ***lv_timer_get_user_data**(*lv_timer_t* *timer)

Get the user_data passed when the timer was created

Parameters **timer** -- pointer to the lv_timer

Returns pointer to the user_data

struct **_lv_timer_t**

#include <lv_timer.h> Descriptor of a lv_timer

Public Members

uint32_t **period**

How often the timer should run

uint32_t **last_run**

Last time the timer ran

lv_timer_cb_t **timer_cb**

Timer function

void ***user_data**

Custom user data

int32_t **repeat_count**

1: One time; -1 : infinity; n>0: residual times

uint32_t **paused**

Typedefs

typedef void (***lv_async_cb_t**)(void*)

Type for async callback.

Functions

lv_res_t **lv_async_call**(*lv_async_cb_t* async_xcb, void *user_data)

Call an asynchronous function the next time lv_timer_handler() is run. This function is likely to return **before** the call actually happens!

Parameters

- **async_xcb** -- a callback which is the task itself. (the 'x' in the argument name indicates that it's not a fully generic function because it not follows the `func_name(object, callback, ...)` convention)
- **user_data** -- custom parameter

lv_res_t **lv_async_call_cancel**(*lv_async_cb_t* async_xcb, void *user_data)

Cancel an asynchronous function call

Parameters

- **async_xcb** -- a callback which is the task itself.
- **user_data** -- custom parameter

5.16 Drawing

With LVGL, you don't need to draw anything manually. Just create objects (like buttons, labels, arc, etc.), move and change them, and LVGL will refresh and redraw what is required.

However, it can be useful to have a basic understanding of how drawing happens in LVGL to add customization, make it easier to find bugs or just out of curiosity.

The basic concept is to not draw directly onto the display but rather to first draw on an internal draw buffer. When a drawing (rendering) is ready that buffer is copied to the display.

The draw buffer can be smaller than a display's size. LVGL will simply render in "tiles" that fit into the given draw buffer.

This approach has two main advantages compared to directly drawing to the display:

1. It avoids flickering while the layers of the UI are drawn. For example, if LVGL drew directly onto the display, when drawing a *background* + *button* + *text*, each "stage" would be visible for a short time.
2. It's faster to modify a buffer in internal RAM and finally write one pixel only once than reading/writing the display directly on each pixel access. (e.g. via a display controller with SPI interface).

Note that this concept is different from "traditional" double buffering where there are two display sized frame buffers: one holds the current image to show on the display, and rendering happens to the other (inactive) frame buffer, and they are swapped when the rendering is finished. The main difference is that with LVGL you don't have to store two frame buffers (which usually requires external RAM) but only smaller draw buffer(s) that can easily fit into internal RAM.

5.16.1 Mechanism of screen refreshing

Be sure to get familiar with the *Buffering modes of LVGL* first.

LVGL refreshes the screen in the following steps:

1. Something happens in the UI which requires redrawing. For example, a button is pressed, a chart is changed, an animation happened, etc.
2. LVGL saves the changed object's old and new area into a buffer, called an *Invalid area buffer*. For optimization, in some cases, objects are not added to the buffer:
   - Hidden objects are not added.
   - Objects completely out of their parent are not added.
   - Areas partially out of the parent are cropped to the parent's area.
   - Objects on other screens are not added.
3. In every `LV_DEF_REFR_PERIOD` (set in `lv_hal_disp.h`) the following happens:
   - LVGL checks the invalid areas and joins those that are adjacent or intersecting.
   - Takes the first joined area, if it's smaller than the *draw buffer*, then simply renders the area's content into the *draw buffer*. If the area doesn't fit into the buffer, draw as many lines as possible to the *draw buffer*.

- When the area is rendered, call `flush_cb` from the display driver to refresh the display.
- If the area was larger than the buffer, render the remaining parts too.
- Repeat the same with remaining joined areas.

When an area is redrawn the library searches the top-most object which covers that area and starts drawing from that object. For example, if a button's label has changed, the library will see that it's enough to draw the button under the text and it's not necessary to redraw the display under the rest of the button too.

The difference between buffering modes regarding the drawing mechanism is the following:

1. **One buffer** - LVGL needs to wait for `lv_disp_flush_ready()` (called from `flush_cb`) before starting to redraw the next part.
2. **Two buffers** - LVGL can immediately draw to the second buffer when the first is sent to `flush_cb` because the flushing should be done by DMA (or similar hardware) in the background.
3. **Double buffering** - `flush_cb` should only swap the addresses of the frame buffers.

5.16.2 Masking

Masking is the basic concept of LVGL's draw engine. To use LVGL it's not required to know about the mechanisms described here but you might find interesting to know how drawing works under hood. Knowing about masking comes in handy if you want to customize drawing.

To learn about masking let's see the steps of drawing first. LVGL performs the following steps to render any shape, image or text. It can be considered as a drawing pipeline.

1. **Prepare the draw descriptors** Create a draw descriptor from an object's styles (e.g. `lv_draw_rect_dsc_t`). This gives us the parameters for drawing, for example colors, widths, opacity, fonts, radius, etc.
2. **Call the draw function** Call the draw function with the draw descriptor and some other parameters (e.g. `lv_draw_rect()`). It will render the primitive shape to the current draw buffer.
3. **Create masks** If the shape is very simple and doesn't require masks, go to #5. Otherwise, create the required masks in the draw function. (e.g. a rounded rectangle mask)
4. **Calculate all the added mask** It composites opacity values into a *mask buffer* with the "shape" of the created masks. E.g. in case of a "line mask" according to the parameters of the mask, keep one side of the buffer as it is (255 by default) and set the rest to 0 to indicate that this side should be removed.
5. **Blend a color or image** During blending, masking (make some pixels transparent or opaque), blending modes (additive, subtractive, etc.) and color/image opacity are handled.

LVGL has the following built-in mask types which can be calculated and applied real-time:

- `LV_DRAW_MASK_TYPE_LINE` Removes a side from a line (top, bottom, left or right). `lv_draw_line` uses four instances of it. Essentially, every (skew) line is bounded with four line masks forming a rectangle.
- `LV_DRAW_MASK_TYPE_RADIUS` Removes the inner or outer corners of a rectangle with a radiused transition. It's also used to create circles by setting the radius to large value (`LV_RADIUS_CIRCLE`)
- `LV_DRAW_MASK_TYPE_ANGLE` Removes a circular sector. It is used by `lv_draw_arc` to remove the "empty" sector.
- `LV_DRAW_MASK_TYPE_FADE` Create a vertical fade (change opacity)
- `LV_DRAW_MASK_TYPE_MAP` The mask is stored in a bitmap array and the necessary parts are applied

Masks are used to create almost every basic primitive:

- **letters** Create a mask from the letter and draw a rectangle with the letter's color using the mask.

- **line** Created from four "line masks" to mask out the left, right, top and bottom part of the line to get a perfectly perpendicular perimeter.
- **rounded rectangle** A mask is created real-time to add a radius to the corners.
- **clip corner** To clip overflowing content (usually children) on rounded corners, a rounded rectangle mask is also applied.
- **rectangle border** Same as a rounded rectangle but the inner part is masked out too.
- **arc drawing** A circular border is drawn but an arc mask is applied too.
- **ARGB images** The alpha channel is separated into a mask and the image is drawn as a normal RGB image.

Using masks

Every mask type has a related parameter structure to describe the mask's data. The following parameter types exist:

- `lv_draw_mask_line_param_t`
- `lv_draw_mask_radius_param_t`
- `lv_draw_mask_angle_param_t`
- `lv_draw_mask_fade_param_t`
- `lv_draw_mask_map_param_t`

1. Initialize a mask parameter with `lv_draw_mask_<type>_init`. See `lv_draw_mask.h` for the whole API.
2. Add the mask parameter to the draw engine with `int16_t mask_id = lv_draw_mask_add(&param, ptr)`. `ptr` can be any pointer to identify the mask, (`NULL` if unused).
3. Call the draw functions
4. Remove the mask from the draw engine with `lv_draw_mask_remove_id(mask_id)` or `lv_draw_mask_remove_custom(ptr)`.
5. Free the parameter with `lv_draw_mask_free_param(&param)`.

A parameter can be added and removed any number of times, but it needs to be freed when not required anymore.

`lv_draw_mask_add` saves only the pointer of the mask so the parameter needs to be valid while in use.

5.16.3 Hook drawing

Although widgets can be easily customized by styles there might be cases when something more custom is required. To ensure a great level of flexibility LVGL sends a lot of events during drawing with parameters that tell what LVGL is about to draw. Some fields of these parameters can be modified to draw something else or any custom drawing operations can be added manually.

A good use case for this is the *Button matrix* widget. By default, its buttons can be styled in different states, but you can't style the buttons one by one. However, an event is sent for every button and you can, for example, tell LVGL to use different colors on a specific button or to manually draw an image on some buttons.

Each of these events is described in detail below.

Main drawing

These events are related to the actual drawing of an object. E.g. the drawing of buttons, texts, etc. happens here.

`lv_event_get_clip_area(event)` can be used to get the current clip area. The clip area is required in draw functions to make them draw only on a limited area.

LV_EVENT_DRAW_MAIN_BEGIN

Sent before starting to draw an object. This is a good place to add masks manually. E.g. add a line mask that "removes" the right side of an object.

LV_EVENT_DRAW_MAIN

The actual drawing of an object happens in this event. E.g. a rectangle for a button is drawn here. First, the widgets' internal events are called to perform drawing and after that you can draw anything on top of them. For example you can add a custom text or an image.

LV_EVENT_DRAW_MAIN_END

Called when the main drawing is finished. You can draw anything here as well and it's also a good place to remove any masks created in `LV_EVENT_DRAW_MAIN_BEGIN`.

Post drawing

Post drawing events are called when all the children of an object are drawn. For example LVGL use the post drawing phase to draw scrollbars because they should be above all of the children.

`lv_event_get_clip_area(event)` can be used to get the current clip area.

LV_EVENT_DRAW_POST_BEGIN

Sent before starting the post draw phase. Masks can be added here too to mask out the post drawn content.

LV_EVENT_DRAW_POST

The actual drawing should happen here.

LV_EVENT_DRAW_POST_END

Called when post drawing has finished. If masks were not removed in `LV_EVENT_DRAW_MAIN_END` they should be removed here.

Part drawing

When LVGL draws a part of an object (e.g. a slider's indicator, a table's cell or a button matrix's button) it sends events before and after drawing that part with some context of the drawing. This allows changing the parts on a very low level with masks, extra drawing, or changing the parameters that LVGL is planning to use for drawing.

In these events an `lv_obj_draw_part_t` structure is used to describe the context of the drawing. Not all fields are set for every part and widget. To see which fields are set for a widget refer to the widget's documentation.

`lv_obj_draw_part_t` has the following fields:

```
// Always set
const lv_area_t * clip_area;        // The current clip area, required if you need to␣
↪draw something in the event
uint32_t part;                      // The current part for which the event is sent
uint32_t id;                        // The index of the part. E.g. a button's index␣
↪on button matrix or table cell index.

// Draw desciptors, set only if related
lv_draw_rect_dsc_t * rect_dsc;      // A draw descriptor that can be modified to␣
↪changed what LVGL will draw. Set only for rectangle-like parts
lv_draw_label_dsc_t * label_dsc;    // A draw descriptor that can be modified to␣
↪changed what LVGL will draw. Set only for text-like parts
lv_draw_line_dsc_t * line_dsc;      // A draw descriptor that can be modified to␣
↪changed what LVGL will draw. Set only for line-like parts
lv_draw_img_dsc_t *  img_dsc;       // A draw descriptor that can be modified to␣
↪changed what LVGL will draw. Set only for image-like parts
lv_draw_arc_dsc_t *  arc_dsc;       // A draw descriptor that can be modified to␣
↪changed what LVGL will draw. Set only for arc-like parts

// Other parameters
lv_area_t * draw_area;              // The area of the part being drawn
const lv_point_t * p1;              // A point calculated during drawing. E.g. a␣
↪point of a chart or the center of an arc.
const lv_point_t * p2;              // A point calculated during drawing. E.g. a␣
↪point of a chart.
char text[16];                      // A text calculated during drawing. Can be␣
↪modified. E.g. tick labels on a chart axis.
lv_coord_t radius;                  // E.g. the radius of an arc (not the corner␣
↪radius).
int32_t value;                      // A value calculated during drawing. E.g. Chart
↪'s tick line value.
const void * sub_part_ptr;          // A pointer the identifies something in the part.
↪ E.g. chart series.
```

`lv_event_get_draw_part_dsc(event)` can be used to get a pointer to `lv_obj_draw_part_t`.

LV_EVENT_DRAW_PART_BEGIN

Start the drawing of a part. This is a good place to modify the draw descriptors (e.g. `rect_dsc`), or add masks.

LV_EVENT_DRAW_PART_END

Finish the drawing of a part. This is a good place to draw extra content on the part or remove masks added in `LV_EVENT_DRAW_PART_BEGIN`.

Others

LV_EVENT_COVER_CHECK

This event is used to check whether an object fully covers an area or not.

`lv_event_get_cover_area(event)` returns a pointer to an area to check and `lv_event_set_cover_res(event, res)` can be used to set one of these results:

- `LV_COVER_RES_COVER` the area is fully covered by the object
- `LV_COVER_RES_NOT_COVER` the area is not covered by the object
- `LV_COVER_RES_MASKED` there is a mask on the object, so it does not fully cover the area

Here are some reasons why an object would be unable to fully cover an area:

- It's simply not fully in area
- It has a radius
- It doesn't have 100% background opacity
- It's an ARGB or chroma keyed image
- It does not have normal blending mode. In this case LVGL needs to know the colors under the object to apply blending properly
- It's a text, etc

In short if for any reason the area below an object is visible than the object doesn't cover that area.

Before sending this event LVGL checks if at least the widget's coordinates fully cover the area or not. If not the event is not called.

You need to check only the drawing you have added. The existing properties known by a widget are handled in its internal events. E.g. if a widget has > 0 radius it might not cover an area, but you need to handle `radius` only if you will modify it and the widget won't know about it.

LV_EVENT_REFR_EXT_DRAW_SIZE

If you need to draw outside a widget, LVGL needs to know about it to provide extra space for drawing. Let's say you create an event which writes the current value of a slider above its knob. In this case LVGL needs to know that the slider's draw area should be larger with the size required for the text.

You can simply set the required draw area with `lv_event_set_ext_draw_size(e, size)`.

5.17 Renderers and GPUs

5.17.1 Software renderer

TODO

5.17.2 SDL renderer

TODO

5.17.3 Arm-2D GPU

Arm-2D is not a GPU but **an abstraction layer for 2D GPUs dedicated to Microcontrollers**. It supports all Cortex-M processors ranging from Cortex-M0 to the latest Cortex-M85.

Arm-2D is an open-source project on Github. For more, please refer to: https://github.com/ARM-software/Arm-2D.

How to Use

In general, you can set the macro `LV_USE_GPU_ARM2D` to `1`in `lv_conf.h` to enable Arm-2D acceleration for LVGL.

If you are using **CMSIS-Pack** to deploy the LVGL. You don't have to define the macro `LV_USE_GPU_ARM2D` manually, instead, please select the component `GPU Arm-2D` in the **RTE** dialog. This step will define the macro for us.

Design Considerations

As mentioned before, Arm-2D is an abstraction layer for 2D GPU; hence if there is no accelerator or dedicated instruction set (such as Helium or ACI) available for Arm-2D, it provides negligible performance boost for LVGL (sometimes worse) for regular Cortex-M processors.

We highly recommend you enable Arm-2D acceleration for LVGL when:

- The target processors are **Cortex-M55** and/or **Cortex-M85**
- The target processors support **Helium**.
- The device vendor provides an arm-2d compliant driver for their propriotory 2D accelerators and/or customized instruction set.
- The target device contains DMA-350

Examples

5.17.4 NXP PXP and VGLite GPU

TODO

5.17.5 DMA2D GPU

TODO

5.18 New widget

CHAPTER

SIX

WIDGETS

6.1 Base object (lv_obj)

6.1.1 Overview

The 'Base Object' implements the basic properties of widgets on a screen, such as:

- coordinates
- parent object
- children
- contains the styles
- attributes like *Clickable*, *Scrollable*, etc.

In object-oriented thinking, it is the base class from which all other objects in LVGL are inherited.

The functions and functionalities of the Base object can be used with other widgets too. For example `lv_obj_set_width(slider, 100)`

The Base object can be directly used as a simple widget: it's nothing more than a rectangle. In HTML terms, think of it as a `<div>`.

Coordinates

Only a small subset of coordinate settings is described here. To see all the features of LVGL (padding, coordinates in styles, layouts, etc) visit the *Coordinates* page.

Size

The object size can be modified on individual axes with `lv_obj_set_width(obj, new_width)` and `lv_obj_set_height(obj, new_height)`, or both axes can be modified at the same time with `lv_obj_set_size(obj, new_width, new_height)`.

Position

You can set the position relative to the parent with `lv_obj_set_x(obj, new_x)` and `lv_obj_set_y(obj, new_y)`, or both axes at the same time with `lv_obj_set_pos(obj, new_x, new_y)`.

Alignment

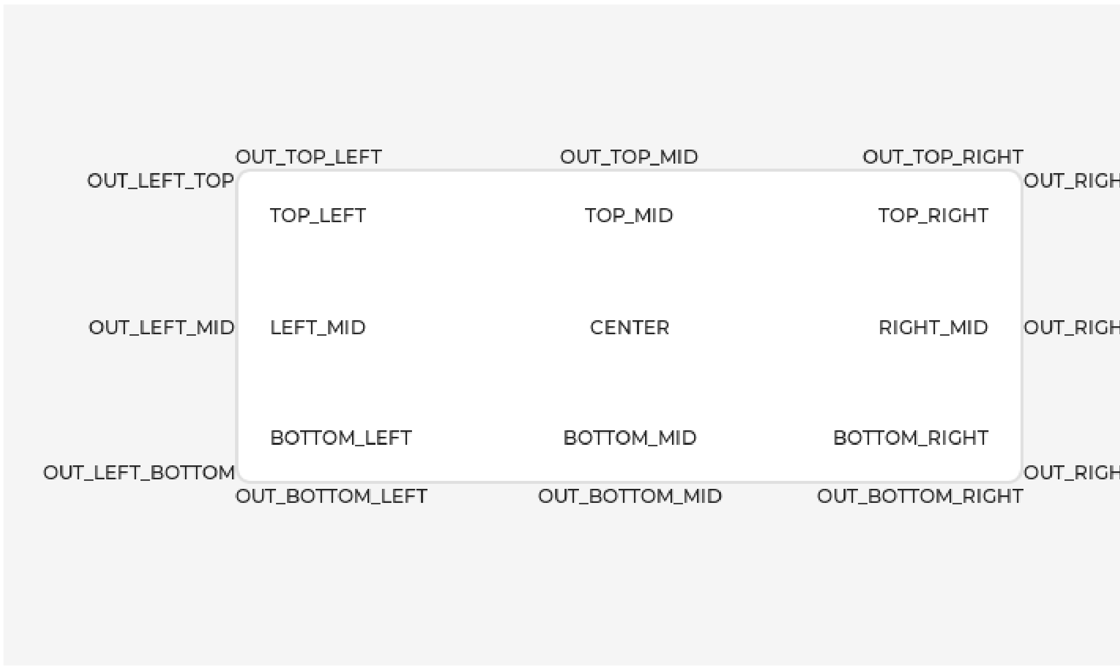
You can align the object on its parent with `lv_obj_set_align(obj, LV_ALIGN_...)`. After this every x and y setting will be relative to the set alignment mode. For example, this will shift the object by 10;20 px from the center of its parent:

```
lv_obj_set_align(obj, LV_ALIGN_CENTER);
lv_obj_set_pos(obj, 10, 20);

//Or in one function
lv_obj_align(obj, LV_ALIGN_CENTER, 10, 20);
```

To align one object to another use: `lv_obj_align_to(obj_to_align, obj_referece, LV_ALIGN_..., x, y)`

For example, to align a text below an image: `lv_obj_align_to(text, image, LV_ALIGN_OUT_BOTTOM_MID, 0, 10)`.



The following align types exist:

Parents and children

You can set a new parent for an object with `lv_obj_set_parent(obj, new_parent)`. To get the current parent, use `lv_obj_get_parent(obj)`.

To get a specific child of a parent use `lv_obj_get_child(parent, idx)`. Some examples for `idx`:

- `0` get the child created first
- `1` get the child created second
- `-1` get the child created last

The children can be iterated lke this:

```
uint32_t i;
for(i = 0; i < lv_obj_get_child_cnt(parent); i++) {
  lv_obj_t * child = lv_obj_get_child(parent, i);
  /*Do something with child*/
}
```

`lv_obj_get_index(obj)` returns the index of the object in its parent. It is equivalent to the number of younger children in the parent.

You can bring an object to the foreground or send it to the background with `lv_obj_move_foreground(obj)` and `lv_obj_move_background(obj)`.

You can change the index of an object in its parent using `lv_obj_move_to_index(obj, index)`.

You can swap the position of two objects with `lv_obj_swap(obj1, obj2)`.

Display and Screens

At the highest level of the LVGL object hierarchy is the *display* which represents the driver for a display device (physical display or simulator). A display can have one or more screens associated with it. Each screen contains a hierarchy of objects for graphical widgets representing a layout that covers the entire display.

When you have created a screen like `lv_obj_t * screen = lv_obj_create(NULL)`, you can make it active with `lv_scr_load(screen)`. The `lv_scr_act()` function gives you a pointer to the active screen.

If you have multiple displays, it's important to know that the screen functions operate on the most recently created display or the one explicitly selected with `lv_disp_set_default`.

To get an object's screen use the `lv_obj_get_screen(obj)` function.

Events

To set an event callback for an object, use `lv_obj_add_event(obj, event_cb, LV_EVENT_..., user_data)`,

To manually send an event to an object, use `lv_event_send(obj, LV_EVENT_..., param)`

Read the *Event overview* to learn more about events.

Styles

Be sure to read the *Style overview*. Here only the most essential functions are described.

A new style can be added to an object with the `lv_obj_add_style(obj, &new_style, selector)` function. `selector` is an ORed combination of part and state(s). E.g. `LV_PART_SCROLLBAR | LV_STATE_PRESSED`.

The base objects use `LV_PART_MAIN` style properties and `LV_PART_SCROLLBAR` with the typical background style properties.

Flags

There are some attributes which can be enabled/disabled by `lv_obj_add/clear_flag(obj, LV_OBJ_FLAG_...)`:

- `LV_OBJ_FLAG_HIDDEN` Make the object hidden. (Like it wasn't there at all)
- `LV_OBJ_FLAG_CLICKABLE` Make the object clickable by input devices
- `LV_OBJ_FLAG_CLICK_FOCUSABLE` Add focused state to the object when clicked
- `LV_OBJ_FLAG_CHECKABLE` Toggle checked state when the object is clicked
- `LV_OBJ_FLAG_SCROLLABLE` Make the object scrollable
- `LV_OBJ_FLAG_SCROLL_ELASTIC` Allow scrolling inside but with slower speed
- `LV_OBJ_FLAG_SCROLL_MOMENTUM` Make the object scroll further when "thrown"
- `LV_OBJ_FLAG_SCROLL_ONE` Allow scrolling only one snappable children
- `LV_OBJ_FLAG_SCROLL_CHAIN_HOR` Allow propagating the horizontal scroll to a parent
- `LV_OBJ_FLAG_SCROLL_CHAIN_VER` Allow propagating the vertical scroll to a parent
- `LV_OBJ_FLAG_SCROLL_CHAIN` Simple packaging for (`LV_OBJ_FLAG_SCROLL_CHAIN_HOR | LV_OBJ_FLAG_SCROLL_CHAIN_VER`)
- `LV_OBJ_FLAG_SCROLL_ON_FOCUS` Automatically scroll object to make it visible when focused
- `LV_OBJ_FLAG_SCROLL_WITH_ARROW` Allow scrolling the focused object with arrow keys
- `LV_OBJ_FLAG_SNAPPABLE` If scroll snap is enabled on the parent it can snap to this object
- `LV_OBJ_FLAG_PRESS_LOCK` Keep the object pressed even if the press slid from the object
- `LV_OBJ_FLAG_EVENT_BUBBLE` Propagate the events to the parent too
- `LV_OBJ_FLAG_GESTURE_BUBBLE` Propagate the gestures to the parent
- `LV_OBJ_FLAG_ADV_HITTEST` Allow performing more accurate hit (click) test. E.g. accounting for rounded corners
- `LV_OBJ_FLAG_IGNORE_LAYOUT` Make the object positionable by the layouts
- `LV_OBJ_FLAG_FLOATING` Do not scroll the object when the parent scrolls and ignore layout
- `LV_OBJ_FLAG_OVERFLOW_VISIBLE` Do not clip the children's content to the parent's boundary
- `LV_OBJ_FLAG_LAYOUT_1` Custom flag, free to use by layouts
- `LV_OBJ_FLAG_LAYOUT_2` Custom flag, free to use by layouts
- `LV_OBJ_FLAG_WIDGET_1` Custom flag, free to use by widget
- `LV_OBJ_FLAG_WIDGET_2` Custom flag, free to use by widget

- `LV_OBJ_FLAG_USER_1` Custom flag, free to use by user
- `LV_OBJ_FLAG_USER_2` Custom flag, free to use by user
- `LV_OBJ_FLAG_USER_3` Custom flag, free to use by user
- `LV_OBJ_FLAG_USER_4` Custom flag, free to use by user

Some examples:

```
/*Hide on object*/
lv_obj_add_flag(obj, LV_OBJ_FLAG_HIDDEN);

/*Make an object non-clickable*/
lv_obj_clear_flag(obj, LV_OBJ_FLAG_CLICKABLE);
```

Groups

Read the *Input devices overview* to learn more about *Groups*.

Objects are added to a *group* with `lv_group_add_obj(group, obj)`, and you can use `lv_obj_get_group(obj)` to see which group an object belongs to.

`lv_obj_is_focused(obj)` returns if the object is currently focused on its group or not. If the object is not added to a group, `false` will be returned.

Extended click area

By default, the objects can be clicked only within their bounding area. However, this can be extended with `lv_obj_set_ext_click_area(obj, size)`.

6.1.2 Events

- `LV_EVENT_VALUE_CHANGED` when the `LV_OBJ_FLAG_CHECKABLE` flag is enabled and the object clicked (on transition to/from the checked state)
- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` is sent for the following types:
  - `LV_OBJ_DRAW_PART_RECTANGLE` The main rectangle
    - `part`: `LV_PART_MAIN`
    - `rect_dsc`
    - `draw_area`: the area of the rectangle
  - `LV_OBJ_DRAW_PART_BORDER_POST` The border if the `border_post` style property is `true`
    - `part`: `LV_PART_MAIN`
    - `rect_dsc`
    - `draw_area`: the area of the rectangle
  - `LV_OBJ_DRAW_PART_SCROLLBAR` the scrollbars
    - `part`: `LV_PART_SCROLLBAR`
    - `rect_dsc`
    - `draw_area`: the area of the rectangle

Learn more about *Events*.

6.1.3 Keys

If `LV_OBJ_FLAG_CHECKABLE` is enabled, `LV_KEY_RIGHT` and `LV_KEY_UP` make the object checked, and `LV_KEY_LEFT` and `LV_KEY_DOWN` make it unchecked.

If `LV_OBJ_FLAG_SCROLLABLE` is enabled, but the object is not editable (as declared by the widget class), the arrow keys (`LV_KEY_UP`, `LV_KEY_DOWN`, `LV_KEY_LEFT`, `LV_KEY_RIGHT`) scroll the object. If the object can only scroll vertically, `LV_KEY_LEFT` and `LV_KEY_RIGHT` will scroll up/down instead, making it compatible with an encoder input device. See *Input devices overview* for more on encoder behaviors and the edit mode.

Learn more about *Keys*.

6.1.4 Example

Base objects with custom styles

```c
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES

void lv_example_obj_1(void)
{
    lv_obj_t * obj1;
    obj1 = lv_obj_create(lv_scr_act());
    lv_obj_set_size(obj1, 100, 50);
    lv_obj_align(obj1, LV_ALIGN_CENTER, -60, -30);

    static lv_style_t style_shadow;
    lv_style_init(&style_shadow);
    lv_style_set_shadow_width(&style_shadow, 10);
    lv_style_set_shadow_spread(&style_shadow, 5);
    lv_style_set_shadow_color(&style_shadow, lv_palette_main(LV_PALETTE_BLUE));

    lv_obj_t * obj2;
    obj2 = lv_obj_create(lv_scr_act());
    lv_obj_add_style(obj2, &style_shadow, 0);
    lv_obj_align(obj2, LV_ALIGN_CENTER, 60, 30);
}
#endif
```

```python
obj1 = lv.obj(lv.scr_act())
obj1.set_size(100, 50)
obj1.align(lv.ALIGN.CENTER, -60, -30)

style_shadow = lv.style_t()
style_shadow.init()
style_shadow.set_shadow_width(10)
style_shadow.set_shadow_spread(5)
style_shadow.set_shadow_color(lv.palette_main(lv.PALETTE.BLUE))

obj2 = lv.obj(lv.scr_act())
obj2.add_style(style_shadow, 0)
obj2.align(lv.ALIGN.CENTER, 60, 30)
```

Make an object draggable

```c
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES

static void drag_event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);

    lv_indev_t * indev = lv_indev_get_act();
    if(indev == NULL)  return;

    lv_point_t vect;
    lv_indev_get_vect(indev, &vect);

    lv_coord_t x = lv_obj_get_x(obj) + vect.x;
    lv_coord_t y = lv_obj_get_y(obj) + vect.y;
    lv_obj_set_pos(obj, x, y);
}


/**
 * Make an object dragable.
 */
void lv_example_obj_2(void)
{
    lv_obj_t * obj;
    obj = lv_obj_create(lv_scr_act());
    lv_obj_set_size(obj, 150, 100);
    lv_obj_add_event(obj, drag_event_handler, LV_EVENT_PRESSING, NULL);

    lv_obj_t * label = lv_label_create(obj);
    lv_label_set_text(label, "Drag me");
    lv_obj_center(label);

}
#endif
```

```python
def drag_event_handler(e):

    obj = e.get_target_obj()

    indev = lv.indev_get_act()

    vect = lv.point_t()
    indev.get_vect(vect)
    x = obj.get_x() + vect.x
    y = obj.get_y() + vect.y
    obj.set_pos(x, y)


#
# Make an object dragable.
#

obj = lv.obj(lv.scr_act())
obj.set_size(150, 100)
```

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```
obj.add_event(drag_event_handler, lv.EVENT.PRESSING, None)

label = lv.label(obj)
label.set_text("Drag me")
label.center()
```

6.1.5 API

Typedefs

typedef uint16_t **lv_state_t**

typedef uint32_t **lv_part_t**

typedef uint32_t **lv_obj_flag_t**

typedef struct *_lv_obj_t* **lv_obj_t**

Enums

enum **[anonymous]**

Possible states of a widget. OR-ed values are possible

Values:

enumerator **LV_STATE_DEFAULT**

enumerator **LV_STATE_CHECKED**

enumerator **LV_STATE_FOCUSED**

enumerator **LV_STATE_FOCUS_KEY**

enumerator **LV_STATE_EDITED**

enumerator **LV_STATE_HOVERED**

enumerator **LV_STATE_PRESSED**

enumerator **LV_STATE_SCROLLED**

enumerator **`LV_STATE_DISABLED`**

enumerator **`LV_STATE_USER_1`**

enumerator **`LV_STATE_USER_2`**

enumerator **`LV_STATE_USER_3`**

enumerator **`LV_STATE_USER_4`**

enumerator **`LV_STATE_ANY`**

Special value can be used in some functions to target all states

enum **`[anonymous]`**

The possible parts of widgets. The parts can be considered as the internal building block of the widgets. E.g. slider = background + indicator + knob Not all parts are used by every widget

Values:

enumerator **`LV_PART_MAIN`**

A background like rectangle

enumerator **`LV_PART_SCROLLBAR`**

The scrollbar(s)

enumerator **`LV_PART_INDICATOR`**

Indicator, e.g. for slider, bar, switch, or the tick box of the checkbox

enumerator **`LV_PART_KNOB`**

Like handle to grab to adjust the value

enumerator **`LV_PART_SELECTED`**

Indicate the currently selected option or section

enumerator **`LV_PART_ITEMS`**

Used if the widget has multiple similar elements (e.g. table cells)

enumerator **`LV_PART_TICKS`**

Ticks on scale e.g. for a chart or meter

enumerator **`LV_PART_CURSOR`**

Mark a specific place e.g. for text area's cursor or on a chart

enumerator **`LV_PART_CUSTOM_FIRST`**

Extension point for custom widgets

enumerator **`LV_PART_ANY`**

Special value can be used in some functions to target all parts

enum **`[anonymous]`**

On/Off features controlling the object's behavior. OR-ed values are possible

Values:

enumerator **`LV_OBJ_FLAG_HIDDEN`**

Make the object hidden. (Like it wasn't there at all)

enumerator **`LV_OBJ_FLAG_CLICKABLE`**

Make the object clickable by the input devices

enumerator **`LV_OBJ_FLAG_CLICK_FOCUSABLE`**

Add focused state to the object when clicked

enumerator **`LV_OBJ_FLAG_CHECKABLE`**

Toggle checked state when the object is clicked

enumerator **`LV_OBJ_FLAG_SCROLLABLE`**

Make the object scrollable

enumerator **`LV_OBJ_FLAG_SCROLL_ELASTIC`**

Allow scrolling inside but with slower speed

enumerator **`LV_OBJ_FLAG_SCROLL_MOMENTUM`**

Make the object scroll further when "thrown"

enumerator **`LV_OBJ_FLAG_SCROLL_ONE`**

Allow scrolling only one snappable children

enumerator **`LV_OBJ_FLAG_SCROLL_CHAIN_HOR`**

Allow propagating the horizontal scroll to a parent

enumerator **`LV_OBJ_FLAG_SCROLL_CHAIN_VER`**

Allow propagating the vertical scroll to a parent

enumerator **`LV_OBJ_FLAG_SCROLL_CHAIN`**

enumerator **`LV_OBJ_FLAG_SCROLL_ON_FOCUS`**

Automatically scroll object to make it visible when focused

enumerator **`LV_OBJ_FLAG_SCROLL_WITH_ARROW`**

Allow scrolling the focused object with arrow keys enumerator **`LV_OBJ_FLAG_SNAPPABLE`**

If scroll snap is enabled on the parent it can snap to this object

enumerator **`LV_OBJ_FLAG_PRESS_LOCK`**

Keep the object pressed even if the press slid from the object

enumerator **`LV_OBJ_FLAG_EVENT_BUBBLE`**

Propagate the events to the parent too

enumerator **`LV_OBJ_FLAG_GESTURE_BUBBLE`**

Propagate the gestures to the parent

enumerator **`LV_OBJ_FLAG_ADV_HITTEST`**

Allow performing more accurate hit (click) test. E.g. consider rounded corners.

enumerator **`LV_OBJ_FLAG_IGNORE_LAYOUT`**

Make the object position-able by the layouts

enumerator **`LV_OBJ_FLAG_FLOATING`**

Do not scroll the object when the parent scrolls and ignore layout

enumerator **`LV_OBJ_FLAG_OVERFLOW_VISIBLE`**

Do not clip the children's content to the parent's boundary

enumerator **`LV_OBJ_FLAG_LAYOUT_1`**

Custom flag, free to use by layouts

enumerator **`LV_OBJ_FLAG_LAYOUT_2`**

Custom flag, free to use by layouts

enumerator **`LV_OBJ_FLAG_WIDGET_1`**

Custom flag, free to use by widget

enumerator **`LV_OBJ_FLAG_WIDGET_2`**

Custom flag, free to use by widget

enumerator **`LV_OBJ_FLAG_USER_1`**

Custom flag, free to use by user

enumerator **`LV_OBJ_FLAG_USER_2`**

Custom flag, free to use by user

enumerator **`LV_OBJ_FLAG_USER_3`**

Custom flag, free to use by user

enumerator **`LV_OBJ_FLAG_USER_4`**

Custom flag, free to use by user

enum **`lv_obj_draw_part_type_t`**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_obj_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **`LV_OBJ_DRAW_PART_RECTANGLE`**

The main rectangle

enumerator **`LV_OBJ_DRAW_PART_BORDER_POST`**

The border if style_border_post = true

enumerator **`LV_OBJ_DRAW_PART_SCROLLBAR`**

The scrollbar

Functions

void **`lv_init`**(void)

Initialize LVGL library. Should be called before any other LVGL related function.

void **`lv_deinit`**(void)

Deinit the 'lv' library Currently only implemented when not using custom allocators, or GC is enabled.

bool **`lv_is_initialized`**(void)

Returns whether the 'lv' library is currently initialized

lv_obj_t ***`lv_obj_create`**(*lv_obj_t* *parent)

Create a base object (a rectangle)

Parameters **`parent`** -- pointer to a parent object. If NULL then a screen will be created.

Returns pointer to the new object

void **`lv_obj_add_flag`**(*lv_obj_t* *obj, *lv_obj_flag_t* f)

Set one or more flags

Parameters

- **`obj`** -- pointer to an object
- **`f`** -- R-ed values from `lv_obj_flag_t` to set.

void **`lv_obj_clear_flag`**(*lv_obj_t* *obj, *lv_obj_flag_t* f)

Clear one or more flags

Parameters

- **`obj`** -- pointer to an object
- **`f`** -- OR-ed values from `lv_obj_flag_t` to set.

void **`lv_obj_add_state`**(*lv_obj_t* *obj, *lv_state_t* state)

Add one or more states to the object. The other state bits will remain unchanged. If specified in the styles, transition animation will be started from the previous state to the current.

Parameters

- **`obj`** -- pointer to an object
- **`state`** -- the states to add. E.g `LV_STATE_PRESSED | LV_STATE_FOCUSED`

void **`lv_obj_clear_state`**(*lv_obj_t* *obj, *lv_state_t* state)

Remove one or more states to the object. The other state bits will remain unchanged. If specified in the styles, transition animation will be started from the previous state to the current.

Parameters

- **`obj`** -- pointer to an object
- **`state`** -- the states to add. E.g `LV_STATE_PRESSED | LV_STATE_FOCUSED`

static inline void **`lv_obj_set_user_data`**(*lv_obj_t* *obj, void *user_data)

Set the user_data field of the object

Parameters

- **`obj`** -- pointer to an object
- **`user_data`** -- pointer to the new user_data.

bool **`lv_obj_has_flag`**(const *lv_obj_t* *obj, *lv_obj_flag_t* f)

Check if a given flag or all the given flags are set on an object.

Parameters

- **`obj`** -- pointer to an object
- **`f`** -- the flag(s) to check (OR-ed values can be used)

Returns true: all flags are set; false: not all flags are set

bool **`lv_obj_has_flag_any`**(const *lv_obj_t* *obj, *lv_obj_flag_t* f)

Check if a given flag or any of the flags are set on an object.

Parameters

- **`obj`** -- pointer to an object
- **`f`** -- the flag(s) to check (OR-ed values can be used)

Returns true: at lest one flag flag is set; false: none of the flags are set

lv_state_t **`lv_obj_get_state`**(const *lv_obj_t* *obj)

Get the state of an object

Parameters **`obj`** -- pointer to an object

Returns the state (OR-ed values from `lv_state_t`)

bool **`lv_obj_has_state`**(const *lv_obj_t* *obj, *lv_state_t* state)

Check if the object is in a given state or not.

Parameters

- **`obj`** -- pointer to an object
- **`state`** -- a state or combination of states to check

Returns true: `obj` is in `state`; false: `obj` is not in `state`

lv_group_t ***`lv_obj_get_group`**(const *lv_obj_t* *obj)

Get the group of the object

Parameters **`obj`** -- pointer to an object

Returns the pointer to group of the object

static inline void ***`lv_obj_get_user_data`**(*lv_obj_t* *obj)

Get the user_data field of the object

Parameters **`obj`** -- pointer to an object

Returns the pointer to the user_data of the object

void **`lv_obj_allocate_spec_attr`**(*lv_obj_t* *obj)

Allocate special data for an object if not allocated yet.

Parameters **`obj`** -- pointer to an object

bool **`lv_obj_check_type`**(const *lv_obj_t* *obj, const lv_obj_class_t *class_p)

Check the type of obj.

Parameters

- **`obj`** -- pointer to an object
- **`class_p`** -- a class to check (e.g. `lv_slider_class`)

Returns true: `class_p` is the `obj` class.

bool **`lv_obj_has_class`**(const *lv_obj_t* *obj, const lv_obj_class_t *class_p)

Check if any object has a given class (type). It checks the ancestor classes too.

Parameters

- **`obj`** -- pointer to an object
- **`class_p`** -- a class to check (e.g. `lv_slider_class`)

Returns true: `obj` has the given class

const lv_obj_class_t ***`lv_obj_get_class`**(const *lv_obj_t* *obj)

Get the class (type) of the object

Parameters **`obj`** -- pointer to an object

Returns the class (type) of the object

bool **`lv_obj_is_valid`**(const *lv_obj_t* *obj)

Check if any object is still "alive".

Parameters **`obj`** -- pointer to an object

Returns true: valid

Variables

const lv_obj_class_t **`lv_obj_class`**

Make the base object's class publicly available.

struct **`_lv_obj_spec_attr_t`**

#include <lv_obj.h> Special, rarely used attributes. They are allocated automatically if any elements is set.

Public Members

struct *_lv_obj_t* ****`children`**

Store the pointer of the children in an array.

uint32_t **`child_cnt`**

Number of children

lv_group_t ***`group_p`**

lv_event_list_t **`event_list`**

lv_point_t **`scroll`**

The current X/Y scroll offset

lv_coord_t **`ext_click_pad`**

Extra click padding in all direction

lv_coord_t **`ext_draw_size`**

EXTend the size in every direction for drawing.

lv_scrollbar_mode_t **`scrollbar_mode`**

How to display scrollbars

lv_scroll_snap_t **`scroll_snap_x`**

Where to align the snappable children horizontally

lv_scroll_snap_t **`scroll_snap_y`**

Where to align the snappable children vertically

lv_dir_t **`scroll_dir`**

The allowed scroll direction(s)

uint8_t **`layer_type`**

Cache the layer type here. Element of @lv_intermediate_layer_type_t

struct **`_lv_obj_t`**

Public Members

const lv_obj_class_t ***class_p**

struct *_lv_obj_t* ***parent**

_lv_obj_spec_attr_t ***spec_attr**

_lv_obj_style_t ***styles**

void ***user_data**

lv_area_t **coords**

lv_obj_flag_t **flags**

lv_state_t **state**

uint16_t **layout_inv**

uint16_t **scr_layout_inv**

uint16_t **skip_trans**

uint16_t **style_cnt**

uint16_t **h_layout**

uint16_t **w_layout**

6.2 Arc (lv_arc)

6.2.1 Overview

The Arc consists of a background and a foreground arc. The foreground (indicator) can be touch-adjusted.

6.2.2 Parts and Styles

- `LV_PART_MAIN` Draws a background using the typical background style properties and an arc using the arc style properties. The arc's size and position will respect the *padding* style properties.
- `LV_PART_INDICATOR` Draws another arc using the *arc* style properties. Its padding values are interpreted relative to the background arc.
- `LV_PART_KNOB` Draws a handle on the end of the indicator using all background properties and padding values. With zero padding the knob size is the same as the indicator's width. Larger padding makes it larger, smaller padding makes it smaller.

6.2.3 Usage

Value and range

A new value can be set using `lv_arc_set_value(arc, new_value)`. The value is interpreted in a range (minimum and maximum values) which can be modified with `lv_arc_set_range(arc, min, max)`. The default range is 0..100.

The indicator arc is drawn on the main part's arc. This if the value is set to maximum the indicator arc will cover the entire "background" arc. To set the start and end angle of the background arc use the `lv_arc_set_bg_angles(arc, start_angle, end_angle)` functions or `lv_arc_set_bg_start/end_angle(arc, angle)`.

Zero degrees is at the middle right (3 o'clock) of the object and the degrees are increasing in clockwise direction. The angles should be in the [0;360] range.

Rotation

An offset to the 0 degree position can be added with `lv_arc_set_rotation(arc, deg)`.

Mode

The arc can be one of the following modes:

- `LV_ARC_MODE_NORMAL` The indicator arc is drawn from the minimum value to the current.
- `LV_ARC_MODE_REVERSE` The indicator arc is drawn counter-clockwise from the maximum value to the current.
- `LV_ARC_MODE_SYMMETRICAL` The indicator arc is drawn from the middle point to the current value.

The mode can be set by `lv_arc_set_mode(arc, LV_ARC_MODE_...)` and used only if the angle is set by `lv_arc_set_value()` or the arc is adjusted by finger.

Change rate

If the arc is pressed the current value will set with a limited speed according to the set *change rate*. The change rate is defined in degree/second unit and can be set with `lv_arc_set_change_rage(arc, rate)`

Knob offset

Changing the knob offset allows the location of the knob to be moved relative to the end of the arc The knob offset can be set by `lv_arc_set_knob_offset(arc, offset_angle)`, will only be visible if LV_PART_KNOB is visible

Setting the indicator manually

It's also possible to set the angles of the indicator arc directly with `lv_arc_set_angles(arc, start_angle, end_angle)` function or `lv_arc_set_start/end_angle(arc, start_angle)`. In this case the set "value" and "mode" are ignored.

In other words, the angle and value settings are independent. You should exclusively use one or the other. Mixing the two might result in unintended behavior.

To make the arc non-adjustable, remove the style of the knob and make the object non-clickable:

```
lv_obj_remove_style(arc, NULL, LV_PART_KNOB);
lv_obj_clear_flag(arc, LV_OBJ_FLAG_CLICKABLE);
```

Advanced hit test

If the `LV_OBJ_FLAG_ADV_HITTEST` flag is enabled the arc can be clicked through in the middle. Clicks are recognized only on the ring of the background arc. `lv_obj_set_ext_click_size()` makes the sensitive area larger inside and outside with the given number of pixels.

Place another object to the knob

Another object can be positioned according to the current position of the arc in order to follow the arc's current value (angle). To do this use `lv_arc_align_obj_to_angle(arc, obj_to_align, radius_offset)`.

Similarly `lv_arc_rotate_obj_to_angle(arc, obj_to_rotate, radius_offset)` can be used to rotate the object to the current value of the arc.

It's a typical use case to call these functions in the `VALUE_CHANGED` event of the arc.

6.2.4 Events

- `LV_EVENT_VALUE_CHANGED` sent when the arc is pressed/dragged to set a new value.
- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` are sent with the following types:
  - `LV_ARC_DRAW_PART_BACKGROUND` The background arc.
    - `part`: `LV_PART_MAIN`
    - `p1`: center of the arc
    - `radius`: radius of the arc
    - `arc_dsc`
  - `LV_ARC_DRAW_PART_FOREGROUND` The foreground arc.
    - `part`: `LV_PART_INDICATOR`
    - `p1`: center of the arc

        * `radius`: radius of the arc
        * `arc_dsc`
    - LV_ARC_DRAW_PART_KNOB The knob
        * `part`: `LV_PART_KNOB`
        * `draw_area`: the area of the knob
        * `rect_dsc`:

See the events of the *Base object* too.

Learn more about *Events*.

6.2.5 Keys

- `LV_KEY_RIGHT/UP` Increases the value by one.
- `LV_KEY_LEFT/DOWN` Decreases the value by one.

Learn more about *Keys*.

6.2.6 Example

Simple Arc

```
#include "../../lv_examples.h"

#if LV_USE_ARC && LV_BUILD_EXAMPLES

static void value_changed_event_cb(lv_event_t * e);

void lv_example_arc_1(void)
{
    lv_obj_t * label = lv_label_create(lv_scr_act());

    /*Create an Arc*/
    lv_obj_t * arc = lv_arc_create(lv_scr_act());
    lv_obj_set_size(arc, 150, 150);
    lv_arc_set_rotation(arc, 135);
    lv_arc_set_bg_angles(arc, 0, 270);
    lv_arc_set_value(arc, 10);
    lv_obj_center(arc);
    lv_obj_add_event(arc, value_changed_event_cb, LV_EVENT_VALUE_CHANGED, label);

    /*Manually update the label for the first time*/
    lv_obj_send_event(arc, LV_EVENT_VALUE_CHANGED, NULL);
}

static void value_changed_event_cb(lv_event_t * e)
{
    lv_obj_t * arc = lv_event_get_target(e);
    lv_obj_t * label = lv_event_get_user_data(e);

    lv_label_set_text_fmt(label, "%d%%", lv_arc_get_value(arc));
```

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```
    /*Rotate the label to the current position of the arc*/
    lv_arc_rotate_obj_to_angle(arc, label, 25);
}

#endif
```

```
# Create an Arc
arc = lv.arc(lv.scr_act())
arc.set_end_angle(200)
arc.set_size(150, 150)
arc.center()
```

Loader with Arc

```
#include "../../lv_examples.h"

#if LV_USE_ARC && LV_BUILD_EXAMPLES

static void set_angle(void * obj, int32_t v)
{
    lv_arc_set_value(obj, v);
}

/**
 * Create an arc which acts as a loader.
 */
void lv_example_arc_2(void)
{
    /*Create an Arc*/
    lv_obj_t * arc = lv_arc_create(lv_scr_act());
    lv_arc_set_rotation(arc, 270);
    lv_arc_set_bg_angles(arc, 0, 360);
    lv_obj_remove_style(arc, NULL, LV_PART_KNOB);   /*Be sure the knob is not␣
↪displayed*/
    lv_obj_clear_flag(arc, LV_OBJ_FLAG_CLICKABLE);  /*To not allow adjusting by␣
↪click*/
    lv_obj_center(arc);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, arc);
    lv_anim_set_exec_cb(&a, set_angle);
    lv_anim_set_time(&a, 1000);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);    /*Just for the demo*/
    lv_anim_set_repeat_delay(&a, 500);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_start(&a);



}
```

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```
#endif
```

```
#
# An `lv_timer` to call periodically to set the angles of the arc
#
class ArcLoader():
    def __init__(self):
        self.a = 270

    def arc_loader_cb(self,tim,arc):
        # print(tim,arc)
        self.a += 5

        arc.set_end_angle(self.a)

        if self.a >= 270 + 360:
            tim._del()


#
# Create an arc which acts as a loader.
#

# Create an Arc
arc = lv.arc(lv.scr_act())
arc.set_bg_angles(0, 360)
arc.set_angles(270, 270)
arc.center()

# create the loader
arc_loader = ArcLoader()

# Create an `lv_timer` to update the arc.

timer = lv.timer_create_basic()
timer.set_period(20)
timer.set_cb(lambda src: arc_loader.arc_loader_cb(timer,arc))
```

6.2.7 API

Typedefs

typedef uint8_t **`lv_arc_mode_t`**

Enums

enum **[anonymous]**

Values:

enumerator **LV_ARC_MODE_NORMAL**

enumerator **LV_ARC_MODE_SYMMETRICAL**

enumerator **LV_ARC_MODE_REVERSE**

enum **lv_arc_draw_part_type_t**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_arc_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **LV_ARC_DRAW_PART_BACKGROUND**

The background arc

enumerator **LV_ARC_DRAW_PART_FOREGROUND**

The foreground arc

enumerator **LV_ARC_DRAW_PART_KNOB**

The knob

Functions

lv_obj_t ***lv_arc_create**(*lv_obj_t* *parent)

Create an arc object

Parameters **parent** -- pointer to an object, it will be the parent of the new arc

Returns pointer to the created arc

void **lv_arc_set_start_angle**(*lv_obj_t* *obj, uint16_t start)

Set the start angle of an arc. 0 deg: right, 90 bottom, etc.

Parameters

- **obj** -- pointer to an arc object
- **start** -- the start angle

void **lv_arc_set_end_angle**(*lv_obj_t* *obj, uint16_t end)

Set the end angle of an arc. 0 deg: right, 90 bottom, etc.

Parameters

- **obj** -- pointer to an arc object
- **end** -- the end angle

void **`lv_arc_set_angles`**(*lv_obj_t* *obj, uint16_t start, uint16_t end)

Set the start and end angles

Parameters

- **`obj`** -- pointer to an arc object
- **`start`** -- the start angle
- **`end`** -- the end angle

void **`lv_arc_set_bg_start_angle`**(*lv_obj_t* *obj, uint16_t start)

Set the start angle of an arc background. 0 deg: right, 90 bottom, etc.

Parameters

- **`obj`** -- pointer to an arc object
- **`start`** -- the start angle

void **`lv_arc_set_bg_end_angle`**(*lv_obj_t* *obj, uint16_t end)

Set the start angle of an arc background. 0 deg: right, 90 bottom etc.

Parameters

- **`obj`** -- pointer to an arc object
- **`end`** -- the end angle

void **`lv_arc_set_bg_angles`**(*lv_obj_t* *obj, uint16_t start, uint16_t end)

Set the start and end angles of the arc background

Parameters

- **`obj`** -- pointer to an arc object
- **`start`** -- the start angle
- **`end`** -- the end angle

void **`lv_arc_set_rotation`**(*lv_obj_t* *obj, uint16_t rotation)

Set the rotation for the whole arc

Parameters

- **`obj`** -- pointer to an arc object
- **`rotation`** -- rotation angle

void **`lv_arc_set_mode`**(*lv_obj_t* *obj, *lv_arc_mode_t* type)

Set the type of arc.

Parameters

- **`obj`** -- pointer to arc object
- **`mode`** -- arc's mode

void **`lv_arc_set_value`**(*lv_obj_t* *obj, int16_t value)

Set a new value on the arc

Parameters

- **`obj`** -- pointer to an arc object
- **`value`** -- new value

void **`lv_arc_set_range`**(*lv_obj_t* *obj, int16_t min, int16_t max)

Set minimum and the maximum values of an arc

Parameters

- **`obj`** -- pointer to the arc object
- **`min`** -- minimum value
- **`max`** -- maximum value

void **`lv_arc_set_change_rate`**(*lv_obj_t* *obj, uint16_t rate)

Set a change rate to limit the speed how fast the arc should reach the pressed point.

Parameters

- **`obj`** -- pointer to an arc object
- **`rate`** -- the change rate

void **`lv_arc_set_knob_offset`**(*lv_obj_t* *arc, int16_t offset)

Set an offset for the knob from the main arc object

Parameters

- **`arc`** -- pointer to an arc object
- **`offset`** -- knob offset from main arc

uint16_t **`lv_arc_get_angle_start`**(*lv_obj_t* *obj)

Get the start angle of an arc.

Parameters **`obj`** -- pointer to an arc object

Returns the start angle [0..360]

uint16_t **`lv_arc_get_angle_end`**(*lv_obj_t* *obj)

Get the end angle of an arc.

Parameters **`obj`** -- pointer to an arc object

Returns the end angle [0..360]

uint16_t **`lv_arc_get_bg_angle_start`**(*lv_obj_t* *obj)

Get the start angle of an arc background.

Parameters **`obj`** -- pointer to an arc object

Returns the start angle [0..360]

uint16_t **`lv_arc_get_bg_angle_end`**(*lv_obj_t* *obj)

Get the end angle of an arc background.

Parameters **`obj`** -- pointer to an arc object

Returns the end angle [0..360]

int16_t **`lv_arc_get_value`**(const *lv_obj_t* *obj)

Get the value of an arc

Parameters **`obj`** -- pointer to an arc object

Returns the value of the arc

int16_t **`lv_arc_get_min_value`**(const *lv_obj_t* *obj)

Get the minimum value of an arc

Parameters **`obj`** -- pointer to an arc object

Returns the minimum value of the arc

int16_t **`lv_arc_get_max_value`**(const *lv_obj_t* *obj)

Get the maximum value of an arc

Parameters **`obj`** -- pointer to an arc object

Returns the maximum value of the arc

lv_arc_mode_t **`lv_arc_get_mode`**(const *lv_obj_t* *obj)

Get whether the arc is type or not.

Parameters **`obj`** -- pointer to an arc object

Returns arc's mode

int16_t **`lv_arc_get_rotation`**(const *lv_obj_t* *obj)

Get the rotation for the whole arc

Parameters **`arc`** -- pointer to an arc object

Returns arc's current rotation

int16_t **`lv_arc_get_knob_offset`**(const *lv_obj_t* *obj)

Get the current knob offset

Parameters **`arc`** -- pointer to an arc object

Returns arc's current knob offset

void **`lv_arc_align_obj_to_angle`**(const *lv_obj_t* *obj, *lv_obj_t* *obj_to_align, lv_coord_t r_offset)

Align an object to the current position of the arc (knob)

Parameters

- **`obj`** -- pointer to an arc object
- **`obj_to_align`** -- pointer to an object to align
- **`r_offset`** -- consider the radius larger with this value (< 0: for smaller radius)

void **`lv_arc_rotate_obj_to_angle`**(const *lv_obj_t* *obj, *lv_obj_t* *obj_to_rotate, lv_coord_t r_offset)

Rotate an object to the current position of the arc (knob)

Parameters

- **`obj`** -- pointer to an arc object
- **`obj_to_align`** -- pointer to an object to rotate
- **`r_offset`** -- consider the radius larger with this value (< 0: for smaller radius)

Variables

const lv_obj_class_t **`lv_arc_class`**

struct **`lv_arc_t`**

Public Members

lv_obj_t **`obj`**

uint16_t **`rotation`**

uint16_t **`indic_angle_start`**

uint16_t **`indic_angle_end`**

uint16_t **`bg_angle_start`**

uint16_t **`bg_angle_end`**

int16_t **`value`**

int16_t **`min_value`**

int16_t **`max_value`**

uint16_t **`dragging`**

uint16_t **`type`**

uint16_t **`min_close`**

uint16_t **`chg_rate`**

uint32_t **`last_tick`**

int16_t **`last_angle`**

int16_t **`knob_offset`**

6.3 Animation Image (lv_animimg)

6.3.1 Overview

The animation image is similar to the normal 'Image' object. The only difference is that instead of one source image, you set an array of multiple source images.

You can specify a duration and repeat count.

6.3.2 Parts and Styles

- `LV_PART_MAIN` A background rectangle that uses the typical background style properties and the image itself using the image style properties.

6.3.3 Usage

Image sources

To set the image in a state, use the `lv_animimg_set_src(imgbtn, dsc[], num)`.

6.3.4 Events

No special events are sent by image objects.

See the events of the Base object too.

Learn more about *Events*.

6.3.5 Keys

No Keys are processed by the object type.

Learn more about *Keys*.

6.3.6 Example

Simple Animation Image

```
#include "../../lv_examples.h"
#if LV_USE_ANIMIMG && LV_BUILD_EXAMPLES
LV_IMG_DECLARE(animimg001)
LV_IMG_DECLARE(animimg002)
LV_IMG_DECLARE(animimg003)

static const lv_img_dsc_t * anim_imgs[3] = {
    &animimg001,
    &animimg002,
    &animimg003,
};
```

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```
void lv_example_animimg_1(void)
{
    lv_obj_t * animimg0 = lv_animimg_create(lv_scr_act());
    lv_obj_center(animimg0);
    lv_animimg_set_src(animimg0, (const void **) anim_imgs, 3);
    lv_animimg_set_duration(animimg0, 1000);
    lv_animimg_set_repeat_count(animimg0, LV_ANIM_REPEAT_INFINITE);
    lv_animimg_start(animimg0);
}

#endif
```

```
anim_imgs = [None]*3
# Create an image from the png file
try:
    with open('../../assets/animimg001.png','rb') as f:
        anim001_data = f.read()
except:
    print("Could not find animimg001.png")
    sys.exit()

anim_imgs[0] = lv.img_dsc_t({
  'data_size': len(anim001_data),
  'data': anim001_data
})

try:
    with open('../../assets/animimg002.png','rb') as f:
        anim002_data = f.read()
except:
    print("Could not find animimg002.png")
    sys.exit()

anim_imgs[1] = lv.img_dsc_t({
  'data_size': len(anim002_data),
  'data': anim002_data
})

try:
    with open('../../assets/animimg003.png','rb') as f:
        anim003_data = f.read()
except:
    print("Could not find animimg003.png")
    sys.exit()

anim_imgs[2] = lv.img_dsc_t({
  'data_size': len(anim003_data),
  'data': anim003_data
})

animimg0 = lv.animimg(lv.scr_act())
animimg0.center()
animimg0.set_src(anim_imgs, 3)
animimg0.set_duration(1000)
animimg0.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
animimg0.start()
```

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```
```

6.3.7 API

Typedefs

typedef uint8_t **`lv_animimg_part_t`**

Enums

enum **`[anonymous]`**

Values:

enumerator **`LV_ANIM_IMG_PART_MAIN`**

Functions

lv_obj_t ***`lv_animimg_create`**(*lv_obj_t* *parent)

Create an animation image objects

Parameters **`parent`** -- pointer to an object, it will be the parent of the new button

Returns pointer to the created animation image object

void **`lv_animimg_set_src`**(*lv_obj_t* *img, const void *dsc[], uint8_t num)

Set the image animation images source.

Parameters

- **`img`** -- pointer to an animation image object
- **`dsc`** -- pointer to a series images
- **`num`** -- images' number

void **`lv_animimg_start`**(*lv_obj_t* *obj)

Startup the image animation.

Parameters **`obj`** -- pointer to an animation image object

void **`lv_animimg_set_duration`**(*lv_obj_t* *img, uint32_t duration)

Set the image animation duration time. unit:ms

Parameters **`img`** -- pointer to an animation image object

void **`lv_animimg_set_repeat_count`**(*lv_obj_t* *img, uint16_t count)

Set the image animation repeatly play times.

Parameters

- **`img`** -- pointer to an animation image object

- **count** -- the number of times to repeat the animation

const void ****lv_animimg_get_src**(*lv_obj_t* *img)

Get the image animation images source.

Parameters **img** -- pointer to an animation image object

Returns a pointer that will point to a series images

uint8_t **lv_animimg_get_src_count**(*lv_obj_t* *img)

Get the image animation images source.

Parameters **img** -- pointer to an animation image object

Returns the number of source images

uint32_t **lv_animimg_get_duration**(*lv_obj_t* *img)

Get the image animation duration time. unit:ms

Parameters **img** -- pointer to an animation image object

Returns the animation duration time

uint16_t **lv_animimg_get_repeat_count**(*lv_obj_t* *img)

Get the image animation repeat play times.

Parameters **img** -- pointer to an animation image object

Returns the repeat count

Variables

const lv_obj_class_t **lv_animimg_class**

struct **lv_animimg_t**

Public Members

lv_img_t **img**

lv_anim_t **anim**

const void ****dsc**

int8_t **pic_count**

6.4 Bar (lv_bar)

6.4.1 Overview

The bar object has a background and an indicator on it. The width of the indicator is set according to the current value of the bar.

Vertical bars can be created if the width of the object is smaller than its height.

Not only the end, but also the start value of the bar can be set, which changes the start position of the indicator.

6.4.2 Parts and Styles

- `LV_PART_MAIN` The background of the bar and it uses the typical background style properties. Adding padding makes the indicator smaller or larger. The `anim_time` style property sets the animation time if the values set with `LV_ANIM_ON`.
- `LV_PART_INDICATOR` The indicator itself; also uses all the typical background properties.

6.4.3 Usage

Value and range

A new value can be set by `lv_bar_set_value(bar, new_value, LV_ANIM_ON/OFF)`. The value is interpreted in a range (minimum and maximum values) which can be modified with `lv_bar_set_range(bar, min, max)`. The default range is 0..100.

The new value in `lv_bar_set_value` can be set with or without an animation depending on the last parameter (`LV_ANIM_ON/OFF`).

Modes

The bar can be one of the following modes:

- `LV_BAR_MODE_NORMAL` A normal bar as described above
- `LV_BAR_MODE_SYMMETRICAL` Draw the indicator from the zero value to current value. Requires a negative minimum range and positive maximum range.
- `LV_BAR_MODE_RANGE` Allows setting the start value too by `lv_bar_set_start_value(bar, new_value, LV_ANIM_ON/OFF)`. The start value always has to be smaller than the end value.

6.4.4 Events

- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` are sent for the following parts:
  - `LV_BAR_DRAW_PART_INDICATOR` The indicator of the bar
    - `part`: `LV_PART_INDICATOR`
    - `draw_area`: area of the indicator
    - `rect_dsc`

See the events of the *Base object* too.

Learn more about *Events*.

6.4.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.4.6 Example

Simple Bar

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

void lv_example_bar_1(void)
{
    lv_obj_t * bar1 = lv_bar_create(lv_scr_act());
    lv_obj_set_size(bar1, 200, 20);
    lv_obj_center(bar1);
    lv_bar_set_value(bar1, 70, LV_ANIM_OFF);
}

#endif
```

```
bar1 = lv.bar(lv.scr_act())
bar1.set_size(200, 20)
bar1.center()
bar1.set_value(70, lv.ANIM.OFF)
```

Styling a bar

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

/**
 * Example of styling the bar
 */
void lv_example_bar_2(void)
{
    static lv_style_t style_bg;
    static lv_style_t style_indic;

    lv_style_init(&style_bg);
    lv_style_set_border_color(&style_bg, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_border_width(&style_bg, 2);
    lv_style_set_pad_all(&style_bg, 6); /*To make the indicator smaller*/
    lv_style_set_radius(&style_bg, 6);
    lv_style_set_anim_time(&style_bg, 1000);
```

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```
    lv_style_init(&style_indic);
    lv_style_set_bg_opa(&style_indic, LV_OPA_COVER);
    lv_style_set_bg_color(&style_indic, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_radius(&style_indic, 3);

    lv_obj_t * bar = lv_bar_create(lv_scr_act());
    lv_obj_remove_style_all(bar);  /*To have a clean start*/
    lv_obj_add_style(bar, &style_bg, 0);
    lv_obj_add_style(bar, &style_indic, LV_PART_INDICATOR);

    lv_obj_set_size(bar, 200, 20);
    lv_obj_center(bar);
    lv_bar_set_value(bar, 100, LV_ANIM_ON);
}

#endif
```

```
#
# Example of styling the bar
#
style_bg = lv.style_t()
style_indic = lv.style_t()

style_bg.init()
style_bg.set_border_color(lv.palette_main(lv.PALETTE.BLUE))
style_bg.set_border_width(2)
style_bg.set_pad_all(6)            # To make the indicator smaller
style_bg.set_radius(6)
style_bg.set_anim_time(1000)

style_indic.init()
style_indic.set_bg_opa(lv.OPA.COVER)
style_indic.set_bg_color(lv.palette_main(lv.PALETTE.BLUE))
style_indic.set_radius(3)

bar = lv.bar(lv.scr_act())
bar.remove_style_all()   # To have a clean start
bar.add_style(style_bg, 0)
bar.add_style(style_indic, lv.PART.INDICATOR)

bar.set_size(200, 20)
bar.center()
bar.set_value(100, lv.ANIM.ON)
```

Temperature meter

```c
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

static void set_temp(void * bar, int32_t temp)
{
    lv_bar_set_value(bar, temp, LV_ANIM_ON);
}

/**
 * A temperature meter example
 */
void lv_example_bar_3(void)
{
    static lv_style_t style_indic;

    lv_style_init(&style_indic);
    lv_style_set_bg_opa(&style_indic, LV_OPA_COVER);
    lv_style_set_bg_color(&style_indic, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_bg_grad_color(&style_indic, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_bg_grad_dir(&style_indic, LV_GRAD_DIR_VER);

    lv_obj_t * bar = lv_bar_create(lv_scr_act());
    lv_obj_add_style(bar, &style_indic, LV_PART_INDICATOR);
    lv_obj_set_size(bar, 20, 200);
    lv_obj_center(bar);
    lv_bar_set_range(bar, -20, 40);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_exec_cb(&a, set_temp);
    lv_anim_set_time(&a, 3000);
    lv_anim_set_playback_time(&a, 3000);
    lv_anim_set_var(&a, bar);
    lv_anim_set_values(&a, -20, 40);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);
}


#endif
```

```python
def set_temp(bar, temp):
    bar.set_value(temp, lv.ANIM.ON)

#
# A temperature meter example
#


style_indic = lv.style_t()

style_indic.init()
style_indic.set_bg_opa(lv.OPA.COVER)
style_indic.set_bg_color(lv.palette_main(lv.PALETTE.RED))
style_indic.set_bg_grad_color(lv.palette_main(lv.PALETTE.BLUE))
```

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```
style_indic.set_bg_grad_dir(lv.GRAD_DIR.VER)

bar = lv.bar(lv.scr_act())
bar.add_style(style_indic, lv.PART.INDICATOR)
bar.set_size(20, 200)
bar.center()
bar.set_range(-20, 40)

a = lv.anim_t()
a.init()
a.set_time(3000)
a.set_playback_time(3000)
a.set_var(bar)
a.set_values(-20, 40)
a.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a.set_custom_exec_cb(lambda a, val: set_temp(bar,val))
lv.anim_t.start(a)
```

Stripe pattern and range value

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

/**
 * Bar with stripe pattern and ranged value
 */
void lv_example_bar_4(void)
{
    LV_IMG_DECLARE(img_skew_strip);
    static lv_style_t style_indic;

    lv_style_init(&style_indic);
    lv_style_set_bg_img_src(&style_indic, &img_skew_strip);
    lv_style_set_bg_img_tiled(&style_indic, true);
    lv_style_set_bg_img_opa(&style_indic, LV_OPA_30);

    lv_obj_t * bar = lv_bar_create(lv_scr_act());
    lv_obj_add_style(bar, &style_indic, LV_PART_INDICATOR);

    lv_obj_set_size(bar, 260, 20);
    lv_obj_center(bar);
    lv_bar_set_mode(bar, LV_BAR_MODE_RANGE);
    lv_bar_set_value(bar, 90, LV_ANIM_OFF);
    lv_bar_set_start_value(bar, 20, LV_ANIM_OFF);
}

#endif
```

```
#
# get an icon
#
def get_icon(filename,xres,yres):
    try:
```

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```
        sdl_filename = "../../assets/" + filename + "_" + str(xres) + "x" + str(yres)␣
↪+ "_argb8888.fnt"
        print("file name: ", sdl_filename)
        with open(sdl_filename,'rb') as f:
            icon_data = f.read()
    except:
        print("Could not find image file: " + filename)
        return None

    icon_dsc = lv.img_dsc_t(
        {
            "header": {"always_zero": 0, "w": xres, "h": yres, "cf": lv.COLOR_FORMAT.
↪NATIVE_ALPHA},
            "data": icon_data,
            "data_size": len(icon_data),
        }
    )
    return icon_dsc

#
# Bar with stripe pattern and ranged value
#

img_skew_strip_dsc = get_icon("img_skew_strip",80,20)
style_indic = lv.style_t()

style_indic.init()
style_indic.set_bg_img_src(img_skew_strip_dsc)
style_indic.set_bg_img_tiled(True)
style_indic.set_bg_img_opa(lv.OPA._30)

bar = lv.bar(lv.scr_act())
bar.add_style(style_indic, lv.PART.INDICATOR)

bar.set_size(260, 20)
bar.center()
bar.set_mode(lv.bar.MODE.RANGE)
bar.set_value(90, lv.ANIM.OFF)
bar.set_start_value(20, lv.ANIM.OFF)
```

Bar with LTR and RTL base direction

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

/**
 * Bar with LTR and RTL base direction
 */
void lv_example_bar_5(void)
{
    lv_obj_t * label;
```

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```
    lv_obj_t * bar_ltr = lv_bar_create(lv_scr_act());
    lv_obj_set_size(bar_ltr, 200, 20);
    lv_bar_set_value(bar_ltr, 70, LV_ANIM_OFF);
    lv_obj_align(bar_ltr, LV_ALIGN_CENTER, 0, -30);

    label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Left to Right base direction");
    lv_obj_align_to(label, bar_ltr, LV_ALIGN_OUT_TOP_MID, 0, -5);

    lv_obj_t * bar_rtl = lv_bar_create(lv_scr_act());
    lv_obj_set_style_base_dir(bar_rtl, LV_BASE_DIR_RTL, 0);
    lv_obj_set_size(bar_rtl, 200, 20);
    lv_bar_set_value(bar_rtl, 70, LV_ANIM_OFF);
    lv_obj_align(bar_rtl, LV_ALIGN_CENTER, 0, 30);

    label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Right to Left base direction");
    lv_obj_align_to(label, bar_rtl, LV_ALIGN_OUT_TOP_MID, 0, -5);
}

#endif
```

```
#
# Bar with LTR and RTL base direction
#

bar_ltr = lv.bar(lv.scr_act())
bar_ltr.set_size(200, 20)
bar_ltr.set_value(70, lv.ANIM.OFF)
bar_ltr.align(lv.ALIGN.CENTER, 0, -30)

label = lv.label(lv.scr_act())
label.set_text("Left to Right base direction")
label.align_to(bar_ltr, lv.ALIGN.OUT_TOP_MID, 0, -5)

bar_rtl = lv.bar(lv.scr_act())
bar_rtl.set_style_base_dir(lv.BASE_DIR.RTL,0)
bar_rtl.set_size(200, 20)
bar_rtl.set_value(70, lv.ANIM.OFF)
bar_rtl.align(lv.ALIGN.CENTER, 0, 30)

label = lv.label(lv.scr_act())
label.set_text("Right to Left base direction")
label.align_to(bar_rtl, lv.ALIGN.OUT_TOP_MID, 0, -5)
```

Custom drawer to show the current value

```
#include "../../lv_examples.h"
#if LV_USE_BAR && LV_BUILD_EXAMPLES

static void set_value(void * bar, int32_t v)
{
    lv_bar_set_value(bar, v, LV_ANIM_OFF);
}

static void event_cb(lv_event_t * e)
{
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->part != LV_PART_INDICATOR) return;

    lv_obj_t * obj = lv_event_get_target(e);

    lv_draw_label_dsc_t label_dsc;
    lv_draw_label_dsc_init(&label_dsc);
    label_dsc.font = LV_FONT_DEFAULT;

    char buf[8];
    lv_snprintf(buf, sizeof(buf), "%d", (int)lv_bar_get_value(obj));

    lv_point_t txt_size;
    lv_txt_get_size(&txt_size, buf, label_dsc.font, label_dsc.letter_space, label_dsc.
↪line_space, LV_COORD_MAX,
                    label_dsc.flag);

    lv_area_t txt_area;
    /*If the indicator is long enough put the text inside on the right*/
    if(lv_area_get_width(dsc->draw_area) > txt_size.x + 20) {
        txt_area.x2 = dsc->draw_area->x2 - 5;
        txt_area.x1 = txt_area.x2 - txt_size.x + 1;
        label_dsc.color = lv_color_white();
    }
    /*If the indicator is still short put the text out of it on the right*/
    else {
        txt_area.x1 = dsc->draw_area->x2 + 5;
        txt_area.x2 = txt_area.x1 + txt_size.x - 1;
        label_dsc.color = lv_color_black();
    }

    txt_area.y1 = dsc->draw_area->y1 + (lv_area_get_height(dsc->draw_area) - txt_size.
↪y) / 2;
    txt_area.y2 = txt_area.y1 + txt_size.y - 1;

    lv_draw_label(dsc->draw_ctx, &label_dsc, &txt_area, buf, NULL);
}

/**
 * Custom drawer on the bar to display the current value
 */
void lv_example_bar_6(void)
{
    lv_obj_t * bar = lv_bar_create(lv_scr_act());
    lv_obj_add_event(bar, event_cb, LV_EVENT_DRAW_PART_END, NULL);
```

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```
    lv_obj_set_size(bar, 200, 20);
    lv_obj_center(bar);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, bar);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_set_exec_cb(&a, set_value);
    lv_anim_set_time(&a, 2000);
    lv_anim_set_playback_time(&a, 2000);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);

}

#endif
```

```
def set_value(bar, v):
    bar.set_value(v, lv.ANIM.OFF)

def event_cb(e):
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    if dsc.part != lv.PART.INDICATOR:
        return

    obj= e.get_target_obj()

    label_dsc = lv.draw_label_dsc_t()
    label_dsc.init()
    # label_dsc.font = LV_FONT_DEFAULT;

    value_txt = str(obj.get_value())
    txt_size = lv.point_t()
    lv.txt_get_size(txt_size, value_txt, label_dsc.font, label_dsc.letter_space,␣
↪label_dsc.line_space, lv.COORD.MAX, label_dsc.flag)

    txt_area = lv.area_t()
    # If the indicator is long enough put the text inside on the right
    if dsc.draw_area.get_width() > txt_size.x + 20:
        txt_area.x2 = dsc.draw_area.x2 - 5
        txt_area.x1 = txt_area.x2 - txt_size.x + 1
        label_dsc.color = lv.color_white()
    # If the indicator is still short put the text out of it on the right*/
    else:
        txt_area.x1 = dsc.draw_area.x2 + 5
        txt_area.x2 = txt_area.x1 + txt_size.x - 1
        label_dsc.color = lv.color_black()

    txt_area.y1 = dsc.draw_area.y1 + (dsc.draw_area.get_height() - txt_size.y) // 2
    txt_area.y2 = txt_area.y1 + txt_size.y - 1

    dsc.draw_ctx.label(label_dsc, txt_area, value_txt, None)

#
# Custom drawer on the bar to display the current value
#
```

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```
bar = lv.bar(lv.scr_act())
bar.add_event(event_cb, lv.EVENT.DRAW_PART_END, None)
bar.set_size(200, 20)
bar.center()

a = lv.anim_t()
a.init()
a.set_var(bar)
a.set_values(0, 100)
a.set_custom_exec_cb(lambda a,val: set_value(bar,val))
a.set_time(2000)
a.set_playback_time(2000)
a.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
lv.anim_t.start(a)
```

6.4.7 API

Typedefs

typedef uint8_t **`lv_bar_mode_t`**

Enums

enum **`[anonymous]`**

Values:

enumerator **`LV_BAR_MODE_NORMAL`**

enumerator **`LV_BAR_MODE_SYMMETRICAL`**

enumerator **`LV_BAR_MODE_RANGE`**

enum **`lv_bar_draw_part_type_t`**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_bar_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **`LV_BAR_DRAW_PART_INDICATOR`**

The indicator

Functions

lv_obj_t ***lv_bar_create**(*lv_obj_t* *parent)

Create a bar object

Parameters **parent** -- pointer to an object, it will be the parent of the new bar

Returns pointer to the created bar

void **lv_bar_set_value**(*lv_obj_t* *obj, int32_t value, *lv_anim_enable_t* anim)

Set a new value on the bar

Parameters

- **bar** -- pointer to a bar object
- **value** -- new value
- **anim** -- LV_ANIM_ON: set the value with an animation; LV_ANIM_OFF: change the value immediately

void **lv_bar_set_start_value**(*lv_obj_t* *obj, int32_t start_value, *lv_anim_enable_t* anim)

Set a new start value on the bar

Parameters

- **obj** -- pointer to a bar object
- **value** -- new start value
- **anim** -- LV_ANIM_ON: set the value with an animation; LV_ANIM_OFF: change the value immediately

void **lv_bar_set_range**(*lv_obj_t* *obj, int32_t min, int32_t max)

Set minimum and the maximum values of a bar

Parameters

- **obj** -- pointer to the bar object
- **min** -- minimum value
- **max** -- maximum value

void **lv_bar_set_mode**(*lv_obj_t* *obj, *lv_bar_mode_t* mode)

Set the type of bar.

Parameters

- **obj** -- pointer to bar object
- **mode** -- bar type from ::lv_bar_mode_t

int32_t **lv_bar_get_value**(const *lv_obj_t* *obj)

Get the value of a bar

Parameters **obj** -- pointer to a bar object

Returns the value of the bar

int32_t **lv_bar_get_start_value**(const *lv_obj_t* *obj)

Get the start value of a bar

Parameters **obj** -- pointer to a bar object

Returns the start value of the bar

int32_t **`lv_bar_get_min_value`**(const *lv_obj_t* *obj)

Get the minimum value of a bar

Parameters **`obj`** -- pointer to a bar object

Returns the minimum value of the bar

int32_t **`lv_bar_get_max_value`**(const *lv_obj_t* *obj)

Get the maximum value of a bar

Parameters **`obj`** -- pointer to a bar object

Returns the maximum value of the bar

lv_bar_mode_t **`lv_bar_get_mode`**(*lv_obj_t* *obj)

Get the type of bar.

Parameters **`obj`** -- pointer to bar object

Returns bar type from ::lv_bar_mode_t

Variables

const lv_obj_class_t **`lv_bar_class`**

struct **`_lv_bar_anim_t`**

Public Members

lv_obj_t ***`bar`**

int32_t **`anim_start`**

int32_t **`anim_end`**

int32_t **`anim_state`**

struct **`lv_bar_t`**

Public Members

lv_obj_t **`obj`**

int32_t **`cur_value`**

Current value of the bar

int32_t **`min_value`**

Minimum value of the bar

int32_t **`max_value`**

Maximum value of the bar

int32_t **`start_value`**

Start value of the bar

lv_area_t **`indic_area`**

Save the indicator area. Might be used by derived types

_lv_bar_anim_t **`cur_value_anim`**

_lv_bar_anim_t **`start_value_anim`**

lv_bar_mode_t **`mode`**

Type of bar

6.5 Button (lv_btn)

6.5.1 Overview

Buttons have no new features compared to the *Base object*. They are useful for semantic purposes and have slightly different default settings.

Buttons, by default, differ from Base object in the following ways:

- Not scrollable
- Added to the default group
- Default height and width set to `LV_SIZE_CONTENT`

6.5.2 Parts and Styles

- `LV_PART_MAIN` The background of the button. Uses the typical background style properties.

6.5.3 Usage

There are no new features compared to *Base object*.

6.5.4 Events

- `LV_EVENT_VALUE_CHANGED` when the `LV_OBJ_FLAG_CHECKABLE` flag is enabled and the object is clicked. The event happens on transition to/from the checked state.

Learn more about *Events*.

6.5.5 Keys

Note that the state of `LV_KEY_ENTER` is translated to `LV_EVENT_PRESSED/PRESSING/RELEASED` etc.

See the events of the *Base object* too.

Learn more about *Keys*.

6.5.6 Example

Simple Buttons

```
#include "../../lv_examples.h"
#if LV_USE_BTN && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);

    if(code == LV_EVENT_CLICKED) {
        LV_LOG_USER("Clicked");
    }
    else if(code == LV_EVENT_VALUE_CHANGED) {
        LV_LOG_USER("Toggled");
    }
}

void lv_example_btn_1(void)
{
    lv_obj_t * label;

    lv_obj_t * btn1 = lv_btn_create(lv_scr_act());
    lv_obj_add_event(btn1, event_handler, LV_EVENT_ALL, NULL);
    lv_obj_align(btn1, LV_ALIGN_CENTER, 0, -40);

    label = lv_label_create(btn1);
    lv_label_set_text(label, "Button");
    lv_obj_center(label);

    lv_obj_t * btn2 = lv_btn_create(lv_scr_act());
    lv_obj_add_event(btn2, event_handler, LV_EVENT_ALL, NULL);
    lv_obj_align(btn2, LV_ALIGN_CENTER, 0, 40);
    lv_obj_add_flag(btn2, LV_OBJ_FLAG_CHECKABLE);
    lv_obj_set_height(btn2, LV_SIZE_CONTENT);

    label = lv_label_create(btn2);
    lv_label_set_text(label, "Toggle");
    lv_obj_center(label);
```

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```
}
#endif
```

```
def event_handler(evt):
    code = evt.get_code()

    if code == lv.EVENT.CLICKED:
            print("Clicked event seen")
    elif code == lv.EVENT.VALUE_CHANGED:
        print("Value changed seen")

# create a simple button
btn1 = lv.btn(lv.scr_act())

# attach the callback
btn1.add_event(event_handler,lv.EVENT.ALL, None)

btn1.align(lv.ALIGN.CENTER,0,-40)
label=lv.label(btn1)
label.set_text("Button")

# create a toggle button
btn2 = lv.btn(lv.scr_act())

# attach the callback
#btn2.add_event(event_handler,lv.EVENT.VALUE_CHANGED,None)
btn2.add_event(event_handler,lv.EVENT.ALL, None)

btn2.align(lv.ALIGN.CENTER,0,40)
btn2.add_flag(lv.obj.FLAG.CHECKABLE)
btn2.set_height(lv.SIZE_CONTENT)

label=lv.label(btn2)
label.set_text("Toggle")
label.center()
```

Styling buttons

```
#include "../../lv_examples.h"
#if LV_USE_BTN && LV_BUILD_EXAMPLES

/**
 * Style a button from scratch
 */
void lv_example_btn_2(void)
{
    /*Init the style for the default state*/
    static lv_style_t style;
    lv_style_init(&style);

    lv_style_set_radius(&style, 3);

    lv_style_set_bg_opa(&style, LV_OPA_100);
    lv_style_set_bg_color(&style, lv_palette_main(LV_PALETTE_BLUE));
```

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```
    lv_style_set_bg_grad_color(&style, lv_palette_darken(LV_PALETTE_BLUE, 2));
    lv_style_set_bg_grad_dir(&style, LV_GRAD_DIR_VER);

    lv_style_set_border_opa(&style, LV_OPA_40);
    lv_style_set_border_width(&style, 2);
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_GREY));

    lv_style_set_shadow_width(&style, 8);
    lv_style_set_shadow_color(&style, lv_palette_main(LV_PALETTE_GREY));
    lv_style_set_shadow_ofs_y(&style, 8);

    lv_style_set_outline_opa(&style, LV_OPA_COVER);
    lv_style_set_outline_color(&style, lv_palette_main(LV_PALETTE_BLUE));

    lv_style_set_text_color(&style, lv_color_white());
    lv_style_set_pad_all(&style, 10);

    /*Init the pressed style*/
    static lv_style_t style_pr;
    lv_style_init(&style_pr);

    /*Add a large outline when pressed*/
    lv_style_set_outline_width(&style_pr, 30);
    lv_style_set_outline_opa(&style_pr, LV_OPA_TRANSP);

    lv_style_set_translate_y(&style_pr, 5);
    lv_style_set_shadow_ofs_y(&style_pr, 3);
    lv_style_set_bg_color(&style_pr, lv_palette_darken(LV_PALETTE_BLUE, 2));
    lv_style_set_bg_grad_color(&style_pr, lv_palette_darken(LV_PALETTE_BLUE, 4));

    /*Add a transition to the outline*/
    static lv_style_transition_dsc_t trans;
    static lv_style_prop_t props[] = {LV_STYLE_OUTLINE_WIDTH, LV_STYLE_OUTLINE_OPA, 0}
↪;
    lv_style_transition_dsc_init(&trans, props, lv_anim_path_linear, 300, 0, NULL);

    lv_style_set_transition(&style_pr, &trans);

    lv_obj_t * btn1 = lv_btn_create(lv_scr_act());
    lv_obj_remove_style_all(btn1);                          /*Remove the style coming␣
↪from the theme*/
    lv_obj_add_style(btn1, &style, 0);
    lv_obj_add_style(btn1, &style_pr, LV_STATE_PRESSED);
    lv_obj_set_size(btn1, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_center(btn1);

    lv_obj_t * label = lv_label_create(btn1);
    lv_label_set_text(label, "Button");
    lv_obj_center(label);
}
#endif
```

```
#
# Style a button from scratch
#

```

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```
# Init the style for the default state
style = lv.style_t()
style.init()

style.set_radius(3)

style.set_bg_opa(lv.OPA.COVER)
style.set_bg_color(lv.palette_main(lv.PALETTE.BLUE))
style.set_bg_grad_color(lv.palette_darken(lv.PALETTE.BLUE, 2))
style.set_bg_grad_dir(lv.GRAD_DIR.VER)

style.set_border_opa(lv.OPA._40)
style.set_border_width(2)
style.set_border_color(lv.palette_main(lv.PALETTE.GREY))

style.set_shadow_width(8)
style.set_shadow_color(lv.palette_main(lv.PALETTE.GREY))
style.set_shadow_ofs_y(8)

style.set_outline_opa(lv.OPA.COVER)
style.set_outline_color(lv.palette_main(lv.PALETTE.BLUE))

style.set_text_color(lv.color_white())
style.set_pad_all(10)

# Init the pressed style
style_pr = lv.style_t()
style_pr.init()

# Add a large outline when pressed
style_pr.set_outline_width(30)
style_pr.set_outline_opa(lv.OPA.TRANSP)

style_pr.set_translate_y(5)
style_pr.set_shadow_ofs_y(3)
style_pr.set_bg_color(lv.palette_darken(lv.PALETTE.BLUE, 2))
style_pr.set_bg_grad_color(lv.palette_darken(lv.PALETTE.BLUE, 4))

# Add a transition to the outline
trans = lv.style_transition_dsc_t()
props = [lv.STYLE.OUTLINE_WIDTH, lv.STYLE.OUTLINE_OPA, 0]
trans.init(props, lv.anim_t.path_linear, 300, 0, None)

style_pr.set_transition(trans)

btn1 = lv.btn(lv.scr_act())
btn1.remove_style_all()                          # Remove the style coming from the␣
↪theme
btn1.add_style(style, 0)
btn1.add_style(style_pr, lv.STATE.PRESSED)
btn1.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
btn1.center()

label = lv.label(btn1)
label.set_text("Button")
label.center()
```

Gummy button

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES && LV_USE_BTN

/**
 * Create a style transition on a button to act like a gum when clicked
 */
void lv_example_btn_3(void)
{
    /*Properties to transition*/
    static lv_style_prop_t props[] = {
        LV_STYLE_TRANSFORM_WIDTH, LV_STYLE_TRANSFORM_HEIGHT, LV_STYLE_TEXT_LETTER_
↪SPACE, 0
    };

    /*Transition descriptor when going back to the default state.
     *Add some delay to be sure the press transition is visible even if the press was␣
↪very short*/
    static lv_style_transition_dsc_t transition_dsc_def;
    lv_style_transition_dsc_init(&transition_dsc_def, props, lv_anim_path_overshoot,␣
↪250, 100, NULL);

    /*Transition descriptor when going to pressed state.
     *No delay, go to presses state immediately*/
    static lv_style_transition_dsc_t transition_dsc_pr;
    lv_style_transition_dsc_init(&transition_dsc_pr, props, lv_anim_path_ease_in_out,␣
↪250, 0, NULL);

    /*Add only the new transition to he default state*/
    static lv_style_t style_def;
    lv_style_init(&style_def);
    lv_style_set_transition(&style_def, &transition_dsc_def);

    /*Add the transition and some transformation to the presses state.*/
    static lv_style_t style_pr;
    lv_style_init(&style_pr);
    lv_style_set_transform_width(&style_pr, 10);
    lv_style_set_transform_height(&style_pr, -10);
    lv_style_set_text_letter_space(&style_pr, 10);
    lv_style_set_transition(&style_pr, &transition_dsc_pr);

    lv_obj_t * btn1 = lv_btn_create(lv_scr_act());
    lv_obj_align(btn1, LV_ALIGN_CENTER, 0, -80);
    lv_obj_add_style(btn1, &style_pr, LV_STATE_PRESSED);
    lv_obj_add_style(btn1, &style_def, 0);

    lv_obj_t * label = lv_label_create(btn1);
    lv_label_set_text(label, "Gum");
}
#endif
```

```
#
# Create a style transition on a button to act like a gum when clicked
#

# Properties to transition
```

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```
props = [lv.STYLE.TRANSFORM_WIDTH, lv.STYLE.TRANSFORM_HEIGHT, lv.STYLE.TEXT_LETTER_
↪SPACE, 0]

# Transition descriptor when going back to the default state.
# Add some delay to be sure the press transition is visible even if the press was␣
↪very short*/
transition_dsc_def = lv.style_transition_dsc_t()
transition_dsc_def.init(props, lv.anim_t.path_overshoot, 250, 100, None)

# Transition descriptor when going to pressed state.
# No delay, go to pressed state immediately
transition_dsc_pr = lv.style_transition_dsc_t()
transition_dsc_pr.init(props, lv.anim_t.path_ease_in_out, 250, 0, None)

# Add only the new transition to the default state
style_def = lv.style_t()
style_def.init()
style_def.set_transition(transition_dsc_def)

# Add the transition and some transformation to the presses state.
style_pr = lv.style_t()
style_pr.init()
style_pr.set_transform_width(10)
style_pr.set_transform_height(-10)
style_pr.set_text_letter_space(10)
style_pr.set_transition(transition_dsc_pr)

btn1 = lv.btn(lv.scr_act())
btn1.align(lv.ALIGN.CENTER, 0, -80)
btn1.add_style(style_pr, lv.STATE.PRESSED)
btn1.add_style(style_def, 0)

label = lv.label(btn1)
label.set_text("Gum")
```

6.5.7 API

Functions

lv_obj_t ***lv_btn_create**(*lv_obj_t* *parent)

Create a button object

Parameters **parent** -- pointer to an object, it will be the parent of the new button

Returns pointer to the created button

Variables

const lv_obj_class_t **`lv_btn_class`**

struct **`lv_btn_t`**

Public Members

lv_obj_t **`obj`**

6.6 Button matrix (lv_btnmatrix)

6.6.1 Overview

The Button Matrix object is a lightweight way to display multiple buttons in rows and columns. Lightweight because the buttons are not actually created but just virtually drawn on the fly. This way, one button use only eight extra bytes of memory instead of the ~100-150 bytes a normal *Button* object plus the 100 or so bytes for the *Label* object.

The Button matrix is added to the default group (if one is set). Besides the Button matrix is an editable object to allow selecting and clicking the buttons with encoder navigation too.

6.6.2 Parts and Styles

- `LV_PART_MAIN` The background of the button matrix, uses the typical background style properties. `pad_row` and `pad_column` sets the space between the buttons.
- `LV_PART_ITEMS` The buttons all use the text and typical background style properties except translations and transformations.

6.6.3 Usage

Button's text

There is a text on each button. To specify them a descriptor string array, called *map*, needs to be used. The map can be set with `lv_btnmatrix_set_map(btnm, my_map)`. The declaration of a map should look like `const char * map[] = {"btn1", "btn2", "btn3", NULL}`. Note that the last element has to be either `NULL` or an empty string (`""`)!

Use `"\n"` in the map to insert a **line break**. E.g. `{"btn1", "btn2", "\n", "btn3", ""}`. Each line's buttons have their width calculated automatically. So in the example the first row will have 2 buttons each with 50% width and a second row with 1 button having 100% width.

Control buttons

The buttons' width can be set relative to the other button in the same row with `lv_btnmatrix_set_btn_width(btnm, btn_id, width)` E.g. in a line with two buttons: *btnA, width = 1* and *btnB, width = 2*, *btnA* will have 33 % width and *btnB* will have 66 % width. It's similar to how the `flex-grow` property works in CSS. The width must be in the [1..7] range and the default width is 1.

In addition to the width, each button can be customized with the following parameters:

- `LV_BTNMATRIX_CTRL_HIDDEN` Makes a button hidden (hidden buttons still take up space in the layout, they are just not visible or clickable)
- `LV_BTNMATRIX_CTRL_NO_REPEAT` Disable repeating when the button is long pressed
- `LV_BTNMATRIX_CTRL_DISABLED` Makes a button disabled Like `LV_STATE_DISABLED` on normal objects
- `LV_BTNMATRIX_CTRL_CHECKABLE` Enable toggling of a button. I.e. `LV_STATE_CHECHED` will be added/removed as the button is clicked
- `LV_BTNMATRIX_CTRL_CHECKED` Make the button checked. It will use the `LV_STATE_CHECHKED` styles.
- `LV_BTNMATRIX_CTRL_CLICK_TRIG` Enabled: send LV_EVENT_VALUE_CHANGE on CLICK, Disabled: send LV_EVENT_VALUE_CHANGE on PRESS
- `LV_BTNMATRIX_CTRL_POPOVER` Show the button label in a popover when pressing this key
- `LV_BTNMATRIX_CTRL_RECOLOR` Enable recoloring of button texts with `#`. E.g. `"It's #ff0000 red#"`
- `LV_BTNMATRIX_CTRL_CUSTOM_1` Custom free to use flag
- `LV_BTNMATRIX_CTRL_CUSTOM_2` Custom free to use flag

By default, all flags are disabled.

To set or clear a button's control attribute, use `lv_btnmatrix_set_btn_ctrl(btnm, btn_id, LV_BTNM_CTRL_...)` and `lv_btnmatrix_clear_btn_ctrl(btnm, btn_id, LV_BTNMATRIX_CTRL_...)` respectively. More `LV_BTNM_CTRL_...` values can be OR-ed

To set/clear the same control attribute for all buttons of a button matrix, use `lv_btnmatrix_set_btn_ctrl_all(btnm, LV_BTNM_CTRL_...)` and `lv_btnmatrix_clear_btn_ctrl_all(btnm, LV_BTNMATRIX_CTRL_...)`.

The set a control map for a button matrix (similarly to the map for the text), use `lv_btnmatrix_set_ctrl_map(btnm, ctrl_map)`. An element of `ctrl_map` should look like `ctrl_map[0] = width | LV_BTNM_CTRL_NO_REPEAT | LV_BTNM_CTRL_CHECHKABLE`. The number of elements should be equal to the number of buttons (excluding newlines characters).

One check

The "One check" feature can be enabled with `lv_btnmatrix_set_one_checked(btnm, true)` to allow only one button to be checked at a time.

6.6.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when a button is pressed/released or repeated after long press. The event parameter is set to the ID of the pressed/released button.
- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` are sent for the following types:
  - `LV_BTNMATRIX_DRAW_PART_BTN` The individual buttons.
    - `part`: `LV_PART_ITEMS`
    - `id`:index of the button being drawn
    - `draw_area`: the area of teh button
    - `rect_dsc`

See the events of the *Base object* too.

`lv_btnmatrix_get_selected_btn(btnm)` returns the index of the most recently released or focused button or `LV_BTNMATRIX_BTN_NONE` if no such button.

`lv_btnmatrix_get_btn_text(btnm, btn_id)` returns a pointer to the text of `btn_id`th button.

Learn more about *Events*.

6.6.5 Keys

- `LV_KEY_RIGHT/UP/LEFT/RIGHT` To navigate among the buttons to select one
- `LV_KEY_ENTER` To press/release the selected button

Note that long pressing the button matrix with an encoder can mean to enter/leave edit mode and simply long pressing a button to make it repeat as well. To avoid this contradiction it's suggested to add `lv_btnmatrix_set_btn_ctrl_all(btnm, LV_BTNMATRIX_CTRL_CLICK_TRIG | LV_BTNMATRIX_CTRL_NO_REPEAT);` to the button matrix if used with encoder. This way, the pressed button repeat feature is disabled and on leaving edit mode the selected button won't be activated.

Learn more about *Keys*.

6.6.6 Example

Simple Button matrix

```c
#include "../../lv_examples.h"
#if LV_USE_BTNMATRIX && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        uint32_t id = lv_btnmatrix_get_selected_btn(obj);
        const char * txt = lv_btnmatrix_get_btn_text(obj, id);
        LV_UNUSED(txt);
        LV_LOG_USER("%s was pressed\n", txt);
    }
}
```

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```
static const char * btnm_map[] = {"1", "2", "3", "4", "5", "\n",
                                  "6", "7", "8", "9", "0", "\n",
                                  "Action1", "Action2", ""
                                 };

void lv_example_btnmatrix_1(void)
{
    lv_obj_t * btnm1 = lv_btnmatrix_create(lv_scr_act());
    lv_btnmatrix_set_map(btnm1, btnm_map);
    lv_btnmatrix_set_btn_width(btnm1, 10, 2);        /*Make "Action1" twice as wide␣
↪as "Action2"*/
    lv_btnmatrix_set_btn_ctrl(btnm1, 10, LV_BTNMATRIX_CTRL_CHECKABLE);
    lv_btnmatrix_set_btn_ctrl(btnm1, 11, LV_BTNMATRIX_CTRL_CHECKED);
    lv_obj_align(btnm1, LV_ALIGN_CENTER, 0, 0);
    lv_obj_add_event(btnm1, event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj  = e.get_target_obj()

    if code == lv.EVENT.VALUE_CHANGED :
        id = obj.get_selected_btn()
        txt = obj.get_btn_text(id)

        print("%s was pressed"%txt)

btnm_map = ["1", "2", "3", "4", "5", "\n",
            "6", "7", "8", "9", "0", "\n",
            "Action1", "Action2", ""]

btnm1 = lv.btnmatrix(lv.scr_act())
btnm1.set_map(btnm_map)
btnm1.set_btn_width(10, 2)        # Make "Action1" twice as wide as "Action2"
btnm1.set_btn_ctrl(10, lv.btnmatrix.CTRL.CHECKABLE)
btnm1.set_btn_ctrl(11, lv.btnmatrix.CTRL.CHECKED)
btnm1.align(lv.ALIGN.CENTER, 0, 0)
btnm1.add_event(event_handler, lv.EVENT.ALL, None)


#endif
```

Custom buttons

```
#include "../../lv_examples.h"
#if LV_USE_BTNMATRIX && LV_BUILD_EXAMPLES


static void event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_DRAW_PART_BEGIN) {
        lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);

        /*When the button matrix draws the buttons...*/
        if(dsc->class_p == &lv_btnmatrix_class && dsc->type == LV_BTNMATRIX_DRAW_PART_
↪BTN) {
            /*Change the draw descriptor of the 2nd button*/
            if(dsc->id == 1) {
                dsc->rect_dsc->radius = 0;
                if(lv_btnmatrix_get_selected_btn(obj) == dsc->id)  dsc->rect_dsc->bg_
↪color = lv_palette_darken(LV_PALETTE_BLUE, 3);
                else dsc->rect_dsc->bg_color = lv_palette_main(LV_PALETTE_BLUE);

                dsc->rect_dsc->shadow_width = 6;
                dsc->rect_dsc->shadow_ofs_x = 3;
                dsc->rect_dsc->shadow_ofs_y = 3;
                dsc->label_dsc->color = lv_color_white();
            }
            /*Change the draw descriptor of the 3rd button*/
            else if(dsc->id == 2) {
                dsc->rect_dsc->radius = LV_RADIUS_CIRCLE;
                if(lv_btnmatrix_get_selected_btn(obj) == dsc->id)  dsc->rect_dsc->bg_
↪color = lv_palette_darken(LV_PALETTE_RED, 3);
                else dsc->rect_dsc->bg_color = lv_palette_main(LV_PALETTE_RED);

                dsc->label_dsc->color = lv_color_white();
            }
            else if(dsc->id == 3) {
                dsc->label_dsc->opa = LV_OPA_TRANSP; /*Hide the text if any*/

            }
        }
    }
    if(code == LV_EVENT_DRAW_PART_END) {
        lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);

        /*When the button matrix draws the buttons...*/
        if(dsc->class_p == &lv_btnmatrix_class && dsc->type == LV_BTNMATRIX_DRAW_PART_
↪BTN) {
            /*Add custom content to the 4th button when the button itself was drawn*/
            if(dsc->id == 3) {
                LV_IMG_DECLARE(img_star);
                lv_img_header_t header;
                lv_res_t res = lv_img_decoder_get_info(&img_star, &header);
                if(res != LV_RES_OK) return;

                lv_area_t a;
```

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```
                a.x1 = dsc->draw_area->x1 + (lv_area_get_width(dsc->draw_area) -␣
↪header.w) / 2;
                a.x2 = a.x1 + header.w - 1;
                a.y1 = dsc->draw_area->y1 + (lv_area_get_height(dsc->draw_area) -␣
↪header.h) / 2;
                a.y2 = a.y1 + header.h - 1;

                lv_draw_img_dsc_t img_draw_dsc;
                lv_draw_img_dsc_init(&img_draw_dsc);
                img_draw_dsc.recolor = lv_color_black();
                if(lv_btnmatrix_get_selected_btn(obj) == dsc->id)  img_draw_dsc.
↪recolor_opa = LV_OPA_30;

                lv_draw_img(dsc->draw_ctx, &img_draw_dsc, &a, &img_star);
            }
        }
    }
}

/**
 * Add custom drawer to the button matrix to customize buttons one by one
 */
void lv_example_btnmatrix_2(void)
{
    lv_obj_t * btnm = lv_btnmatrix_create(lv_scr_act());
    lv_obj_add_event(btnm, event_cb, LV_EVENT_ALL, NULL);
    lv_obj_center(btnm);
}

#endif
```

```
# Create an image from the png file
try:
    with open('../../assets/img_star.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find star.png")
    sys.exit()

img_star_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def event_cb(e):
    code = e.get_code()
    obj = e.get_target_obj()
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    if code == lv.EVENT.DRAW_PART_BEGIN:
        # Change the draw descriptor the 2nd button
        if dsc.id == 1:
            dsc.rect_dsc.radius = 0
            if obj.get_selected_btn() == dsc.id:
                dsc.rect_dsc.bg_color = lv.palette_darken(lv.PALETTE.GREY, 3)
            else:
                dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.BLUE)
```

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```
            dsc.rect_dsc.shadow_width = 6
            dsc.rect_dsc.shadow_ofs_x = 3
            dsc.rect_dsc.shadow_ofs_y = 3
            dsc.label_dsc.color = lv.color_white()

        # Change the draw descriptor the 3rd button

        elif dsc.id == 2:
            dsc.rect_dsc.radius = lv.RADIUS_CIRCLE
            if obj.get_selected_btn() == dsc.id:
                dsc.rect_dsc.bg_color = lv.palette_darken(lv.PALETTE.RED, 3)
            else:
                dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.RED)

                dsc.label_dsc.color = lv.color_white()
        elif dsc.id == 3:
            dsc.label_dsc.opa = lv.OPA.TRANSP  # Hide the text if any

    if code == lv.EVENT.DRAW_PART_END:
        # Add custom content to the 4th button when the button itself was drawn
        if dsc.id == 3:
            # LV_IMG_DECLARE(img_star)
            header = lv.img_header_t()
            res = lv.img.decoder_get_info(img_star_argb, header)
            if res != lv.RES.OK:
                print("error when getting image header")
                return
            else:
                a = lv.area_t()
                a.x1 = dsc.draw_area.x1 + (dsc.draw_area.get_width() - header.w) // 2
                a.x2 = a.x1 + header.w - 1
                a.y1 = dsc.draw_area.y1 + (dsc.draw_area.get_height() - header.h) // 2
                a.y2 = a.y1 + header.h - 1
                img_draw_dsc = lv.draw_img_dsc_t()
                img_draw_dsc.init()
                img_draw_dsc.recolor = lv.color_black()
                if obj.get_selected_btn() == dsc.id:
                    img_draw_dsc.recolor_opa = lv.OPA._30

                dsc.draw_ctx.img(img_draw_dsc, a, img_star_argb)

#
# Add custom drawer to the button matrix to c
#
btnm = lv.btnmatrix(lv.scr_act())
btnm.add_event(event_cb, lv.EVENT.ALL, None)
btnm.center()
```

Pagination

```
#include "../../lv_examples.h"
#if LV_USE_BTNMATRIX  && LV_BUILD_EXAMPLES

static void event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    uint32_t id = lv_btnmatrix_get_selected_btn(obj);
    bool prev = id == 0 ? true : false;
    bool next = id == 6 ? true : false;
    if(prev || next) {
        /*Find the checked button*/
        uint32_t i;
        for(i = 1; i < 7; i++) {
            if(lv_btnmatrix_has_btn_ctrl(obj, i, LV_BTNMATRIX_CTRL_CHECKED)) break;
        }

        if(prev && i > 1) i--;
        else if(next && i < 5) i++;

        lv_btnmatrix_set_btn_ctrl(obj, i, LV_BTNMATRIX_CTRL_CHECKED);
    }
}

/**
 * Make a button group (pagination)
 */
void lv_example_btnmatrix_3(void)
{
    static lv_style_t style_bg;
    lv_style_init(&style_bg);
    lv_style_set_pad_all(&style_bg, 0);
    lv_style_set_pad_gap(&style_bg, 0);
    lv_style_set_clip_corner(&style_bg, true);
    lv_style_set_radius(&style_bg, LV_RADIUS_CIRCLE);
    lv_style_set_border_width(&style_bg, 0);


    static lv_style_t style_btn;
    lv_style_init(&style_btn);
    lv_style_set_radius(&style_btn, 0);
    lv_style_set_border_width(&style_btn, 1);
    lv_style_set_border_opa(&style_btn, LV_OPA_50);
    lv_style_set_border_color(&style_btn, lv_palette_main(LV_PALETTE_GREY));
    lv_style_set_border_side(&style_btn, LV_BORDER_SIDE_INTERNAL);
    lv_style_set_radius(&style_btn, 0);

    static const char * map[] = {LV_SYMBOL_LEFT, "1", "2", "3", "4", "5", LV_SYMBOL_
↪RIGHT, ""};

    lv_obj_t * btnm = lv_btnmatrix_create(lv_scr_act());
    lv_btnmatrix_set_map(btnm, map);
    lv_obj_add_style(btnm, &style_bg, 0);
    lv_obj_add_style(btnm, &style_btn, LV_PART_ITEMS);
    lv_obj_add_event(btnm, event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_obj_set_size(btnm, 225, 35);
```

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```
    /*Allow selecting on one number at time*/
    lv_btnmatrix_set_btn_ctrl_all(btnm, LV_BTNMATRIX_CTRL_CHECKABLE);
    lv_btnmatrix_clear_btn_ctrl(btnm, 0, LV_BTNMATRIX_CTRL_CHECKABLE);
    lv_btnmatrix_clear_btn_ctrl(btnm, 6, LV_BTNMATRIX_CTRL_CHECKABLE);

    lv_btnmatrix_set_one_checked(btnm, true);
    lv_btnmatrix_set_btn_ctrl(btnm, 1, LV_BTNMATRIX_CTRL_CHECKED);

    lv_obj_center(btnm);

}

#endif
```

```
def event_cb(e):
    obj = e.get_target_obj()
    id = obj.get_selected_btn()
    if id == 0:
        prev = True
    else:
        prev = False
    if id == 6:
        next = True
    else:
        next = False
    if prev or next:
        # Find the checked butto
        for i in range(7):
            if obj.has_btn_ctrl(i, lv.btnmatrix.CTRL.CHECKED):
                break
        if prev and i > 1:
            i-=1
        elif next and i < 5:
            i+=1

        obj.set_btn_ctrl(i, lv.btnmatrix.CTRL.CHECKED)

#
# Make a button group
#

style_bg = lv.style_t()
style_bg.init()
style_bg.set_pad_all(0)
style_bg.set_pad_gap(0)
style_bg.set_clip_corner(True)
style_bg.set_radius(lv.RADIUS_CIRCLE)
style_bg.set_border_width(0)


style_btn = lv.style_t()
style_btn.init()
style_btn.set_radius(0)
style_btn.set_border_width(1)
style_btn.set_border_opa(lv.OPA._50)
```

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```
style_btn.set_border_color(lv.palette_main(lv.PALETTE.GREY))
style_btn.set_border_side(lv.BORDER_SIDE.INTERNAL)
style_btn.set_radius(0)

map = [lv.SYMBOL.LEFT,"1","2", "3", "4", "5",lv.SYMBOL.RIGHT, ""]

btnm = lv.btnmatrix(lv.scr_act())
btnm.set_map(map)
btnm.add_style(style_bg, 0)
btnm.add_style(style_btn, lv.PART.ITEMS)
btnm.add_event(event_cb, lv.EVENT.VALUE_CHANGED, None)
btnm.set_size(225, 35)

# Allow selecting on one number at time
btnm.set_btn_ctrl_all(lv.btnmatrix.CTRL.CHECKABLE)
btnm.clear_btn_ctrl(0, lv.btnmatrix.CTRL.CHECKABLE)
btnm.clear_btn_ctrl(6, lv.btnmatrix.CTRL.CHECKABLE)

btnm.set_one_checked(True)
btnm.set_btn_ctrl(1, lv.btnmatrix.CTRL.CHECKED)

btnm.center()
```

6.6.7 API

Typedefs

typedef uint16_t **lv_btnmatrix_ctrl_t**

typedef bool (***lv_btnmatrix_btn_draw_cb_t**)(*lv_obj_t* *btnm, uint32_t btn_id, const lv_area_t *draw_area, const lv_area_t *clip_area)

Enums

enum **[anonymous]**

Type to store button control bits (disabled, hidden etc.) The first 3 bits are used to store the width

Values:

enumerator **_LV_BTNMATRIX_WIDTH**

Reserved to stire the size units

enumerator **LV_BTNMATRIX_CTRL_HIDDEN**

Button hidden

enumerator **LV_BTNMATRIX_CTRL_NO_REPEAT**

Do not repeat press this button.

enumerator **`LV_BTNMATRIX_CTRL_DISABLED`**

Disable this button.

enumerator **`LV_BTNMATRIX_CTRL_CHECKABLE`**

The button can be toggled.

enumerator **`LV_BTNMATRIX_CTRL_CHECKED`**

Button is currently toggled (e.g. checked).

enumerator **`LV_BTNMATRIX_CTRL_CLICK_TRIG`**

1: Send LV_EVENT_VALUE_CHANGE on CLICK, 0: Send LV_EVENT_VALUE_CHANGE on PRESS

enumerator **`LV_BTNMATRIX_CTRL_POPOVER`**

Show a popover when pressing this key

enumerator **`LV_BTNMATRIX_CTRL_RECOLOR`**

Enable text recoloring with `#color`

enumerator **`_LV_BTNMATRIX_CTRL_RESERVED`**

Reserved for later use

enumerator **`LV_BTNMATRIX_CTRL_CUSTOM_1`**

Custom free to use flag

enumerator **`LV_BTNMATRIX_CTRL_CUSTOM_2`**

Custom free to use flag

enum **`lv_btnmatrix_draw_part_type_t`**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_btnmatrix_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **`LV_BTNMATRIX_DRAW_PART_BTN`**

The rectangle and label of buttons

Functions

`LV_EXPORT_CONST_INT`(LV_BTNMATRIX_BTN_NONE)

lv_obj_t ***`lv_btnmatrix_create`**(*lv_obj_t* *parent)

Create a button matrix object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new button matrix

Returns pointer to the created button matrix void **`lv_btnmatrix_set_map`**(*lv_obj_t* *obj, const char *map[])

Set a new map. Buttons will be created/deleted according to the map. The button matrix keeps a reference to the map and so the string array must not be deallocated during the life of the matrix.

Parameters

- **`obj`** -- pointer to a button matrix object
- **`map`** -- pointer a string array. The last string has to be: "". Use "\n" to make a line break.

void **`lv_btnmatrix_set_ctrl_map`**(*lv_obj_t* *obj, const *lv_btnmatrix_ctrl_t* ctrl_map[])

Set the button control map (hidden, disabled etc.) for a button matrix. The control map array will be copied and so may be deallocated after this function returns.

Parameters

- **`obj`** -- pointer to a button matrix object
- **`ctrl_map`** -- pointer to an array of `lv_btn_ctrl_t` control bytes. The length of the array and position of the elements must match the number and order of the individual buttons (i.e. excludes newline entries). An element of the map should look like e.g.: `ctrl_map[0] = width | LV_BTNMATRIX_CTRL_NO_REPEAT | LV_BTNMATRIX_CTRL_TGL_ENABLE`

void **`lv_btnmatrix_set_selected_btn`**(*lv_obj_t* *obj, uint16_t btn_id)

Set the selected buttons

Parameters

- **`obj`** -- pointer to button matrix object
- **`btn_id`** -- 0 based index of the button to modify. (Not counting new lines)

void **`lv_btnmatrix_set_btn_ctrl`**(*lv_obj_t* *obj, uint16_t btn_id, *lv_btnmatrix_ctrl_t* ctrl)

Set the attributes of a button of the button matrix

Parameters

- **`obj`** -- pointer to button matrix object
- **`btn_id`** -- 0 based index of the button to modify. (Not counting new lines)
- **`ctrl`** -- OR-ed attributs. E.g. `LV_BTNMATRIX_CTRL_NO_REPEAT | LV_BTNMATRIX_CTRL_CHECKABLE`

void **`lv_btnmatrix_clear_btn_ctrl`**(*lv_obj_t* *obj, uint16_t btn_id, *lv_btnmatrix_ctrl_t* ctrl)

Clear the attributes of a button of the button matrix

Parameters

- **`obj`** -- pointer to button matrix object
- **`btn_id`** -- 0 based index of the button to modify. (Not counting new lines)
- **`ctrl`** -- OR-ed attributs. E.g. `LV_BTNMATRIX_CTRL_NO_REPEAT | LV_BTNMATRIX_CTRL_CHECKABLE`

void **`lv_btnmatrix_set_btn_ctrl_all`**(*lv_obj_t* *obj, *lv_btnmatrix_ctrl_t* ctrl)

Set attributes of all buttons of a button matrix

Parameters

- **`obj`** -- pointer to a button matrix object
- **`ctrl`** -- attribute(s) to set from `lv_btnmatrix_ctrl_t`. Values can be ORed.

void **`lv_btnmatrix_clear_btn_ctrl_all`**(*lv_obj_t* *obj, *lv_btnmatrix_ctrl_t* ctrl)

Clear the attributes of all buttons of a button matrix

Parameters

- **`obj`** -- pointer to a button matrix object
- **`ctrl`** -- attribute(s) to set from `lv_btnmatrix_ctrl_t`. Values can be ORed.
- **`en`** -- true: set the attributes; false: clear the attributes

void **`lv_btnmatrix_set_btn_width`**(*lv_obj_t* *obj, uint16_t btn_id, uint8_t width)

Set a single button's relative width. This method will cause the matrix be regenerated and is a relatively expensive operation. It is recommended that initial width be specified using `lv_btnmatrix_set_ctrl_map` and this method only be used for dynamic changes.

Parameters

- **`obj`** -- pointer to button matrix object
- **`btn_id`** -- 0 based index of the button to modify.
- **`width`** -- relative width compared to the buttons in the same row. [1..7]

void **`lv_btnmatrix_set_one_checked`**(*lv_obj_t* *obj, bool en)

Make the button matrix like a selector widget (only one button may be checked at a time). `LV_BTNMATRIX_CTRL_CHECKABLE` must be enabled on the buttons to be selected using `lv_btnmatrix_set_ctrl()` or *`lv_btnmatrix_set_btn_ctrl_all()`*.

Parameters

- **`obj`** -- pointer to a button matrix object
- **`en`** -- whether "one check" mode is enabled

const char ****`lv_btnmatrix_get_map`**(const *lv_obj_t* *obj)

Get the current map of a button matrix

Parameters **`obj`** -- pointer to a button matrix object

Returns the current map

uint16_t **`lv_btnmatrix_get_selected_btn`**(const *lv_obj_t* *obj)

Get the index of the lastly "activated" button by the user (pressed, released, focused etc) Useful in the `event_cb` to get the text of the button, check if hidden etc.

Parameters **`obj`** -- pointer to button matrix object

Returns index of the last released button (LV_BTNMATRIX_BTN_NONE: if unset)

const char ***`lv_btnmatrix_get_btn_text`**(const *lv_obj_t* *obj, uint16_t btn_id)

Get the button's text

Parameters

- **`obj`** -- pointer to button matrix object
- **`btn_id`** -- the index a button not counting new line characters.

Returns text of btn_index` button

bool **`lv_btnmatrix_has_btn_ctrl`**(*lv_obj_t* *obj, uint16_t btn_id, *lv_btnmatrix_ctrl_t* ctrl)

Get the whether a control value is enabled or disabled for button of a button matrix

Parameters

- **`obj`** -- pointer to a button matrix object
- **`btn_id`** -- the index of a button not counting new line characters.
- **`ctrl`** -- control values to check (ORed value can be used)

Returns true: the control attribute is enabled false: disabled

bool **`lv_btnmatrix_get_one_checked`**(const *lv_obj_t* *obj)

Tell whether "one check" mode is enabled or not.

Parameters **`obj`** -- Button matrix object

Returns true: "one check" mode is enabled; false: disabled

Variables

const lv_obj_class_t **`lv_btnmatrix_class`**

struct **`lv_btnmatrix_t`**

Public Members

lv_obj_t **`obj`**

const char ****`map_p`**

lv_area_t ***`button_areas`**

lv_btnmatrix_ctrl_t ***`ctrl_bits`**

uint16_t **`btn_cnt`**

uint16_t **`row_cnt`**

uint16_t **`btn_id_sel`**

uint8_t **`one_check`**

6.7 Calendar (lv_calendar)

6.7.1 Overview

The Calendar object is a classic calendar which can:

- show the days of any month in a 7x7 matrix
- Show the name of the days
- highlight the current day (today)
- highlight any user-defined dates

The Calendar is added to the default group (if it is set). Calendar is an editable object which allow selecting and clicking the dates with encoder navigation too.

To make the Calendar flexible, by default it doesn't show the current year or month. Instead, there are optional "headers" that can be attached to the calendar.

6.7.2 Parts and Styles

The calendar object uses the *Button matrix* object under the hood to arrange the days into a matrix.

- `LV_PART_MAIN` The background of the calendar. Uses all the background related style properties.
- `LV_PART_ITEMS` Refers to the dates and day names. Button matrix control flags are set to differentiate the buttons and a custom drawer event is added modify the properties of the buttons as follows:
  - day names have no border, no background and drawn with a gray color
  - days of the previous and next month have `LV_BTNMATRIX_CTRL_DISABLED` flag
  - today has a thicker border with the theme's primary color
  - highlighted days have some opacity with the theme's primary color.

6.7.3 Usage

Some functions use the `lv_calendar_date_t` type which is a structure with `year`, `month` and `day` fields.

Current date

To set the current date (today), use the `lv_calendar_set_today_date(calendar, year, month, day)` function. `month` needs to be in 1..12 range and `day` in 1..31 range.

Shown date

To set the shown date, use `lv_calendar_set_shown_date(calendar, year, month);`

Highlighted days

The list of highlighted dates should be stored in a `lv_calendar_date_t` array loaded by `lv_calendar_set_highlighted_dates(calendar, highlighted_dates, date_num)`. Only the array's pointer will be saved so the array should be a static or global variable.

Name of the days

The name of the days can be adjusted with `lv_calendar_set_day_names(calendar, day_names)` where `day_names` looks like `const char * day_names[7] = {"Su", "Mo", ...};` Only the pointer of the day names is saved so the elements should be static, global or constant variables.

6.7.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent if a date is clicked. `lv_calendar_get_pressed_date(calendar, &date)` set `date` to the date currently being pressed. Returns `LV_RES_OK` if there is a valid pressed date, else `LV_RES_INV`.

Learn more about *Events*.

6.7.5 Keys

- `LV_KEY_RIGHT/UP/LEFT/RIGHT` To navigate among the buttons to dates
- `LV_KEY_ENTER` To press/release the selected date

Learn more about *Keys*.

6.7.6 Headers

From v8.1 the header is added directly into the Calendar widget and the API of the headers has been changed.

Arrow buttons

`lv_calendar_header_arrow_create(calendar)` creates a header that contains a left and right arrow on the sides and a text with the current year and month between them.

Drop-down

`lv_calendar_header_dropdown_create(calendar)` creates a header that contains 2 drop-drown lists: one for the year and another for the month.

6.7.7 Example

Calendar with header

```
#include "../../lv_examples.h"
#if LV_USE_CALENDAR && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_current_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        lv_calendar_date_t date;
        if(lv_calendar_get_pressed_date(obj, &date)) {
            LV_LOG_USER("Clicked date: %02d.%02d.%d", date.day, date.month, date.
↪year);
        }
    }
}

void lv_example_calendar_1(void)
{
    lv_obj_t  * calendar = lv_calendar_create(lv_scr_act());
    lv_obj_set_size(calendar, 185, 185);
    lv_obj_align(calendar, LV_ALIGN_CENTER, 0, 27);
    lv_obj_add_event(calendar, event_handler, LV_EVENT_ALL, NULL);

    lv_calendar_set_today_date(calendar, 2021, 02, 23);
    lv_calendar_set_showed_date(calendar, 2021, 02);

    /*Highlight a few days*/
    static lv_calendar_date_t highlighted_days[3];       /*Only its pointer will be␣
↪saved so should be static*/
    highlighted_days[0].year = 2021;
    highlighted_days[0].month = 02;
    highlighted_days[0].day = 6;

    highlighted_days[1].year = 2021;
    highlighted_days[1].month = 02;
    highlighted_days[1].day = 11;

    highlighted_days[2].year = 2022;
    highlighted_days[2].month = 02;
    highlighted_days[2].day = 22;

    lv_calendar_set_highlighted_dates(calendar, highlighted_days, 3);

#if LV_USE_CALENDAR_HEADER_DROPDOWN
    lv_calendar_header_dropdown_create(calendar);
#elif LV_USE_CALENDAR_HEADER_ARROW
```

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```
    lv_calendar_header_arrow_create(calendar);
#endif
    lv_calendar_set_showed_date(calendar, 2021, 10);
}

#endif
```

```

def event_handler(e):
    code = e.get_code()

    if code == lv.EVENT.VALUE_CHANGED:
        source = e.get_current_target_obj()
        date = lv.calendar_date_t()
        if source.get_pressed_date(date) == lv.RES.OK:
            calendar.set_today_date(date.year, date.month, date.day)
            print("Clicked date: %02d.%02d.%02d"%(date.day, date.month, date.year))


calendar = lv.calendar(lv.scr_act())
calendar.set_size(200, 200)
calendar.align(lv.ALIGN.CENTER, 0, 20)
calendar.add_event(event_handler, lv.EVENT.ALL, None)

calendar.set_today_date(2021, 02, 23)
calendar.set_showed_date(2021, 02)

# Highlight a few days
highlighted_days=[
    lv.calendar_date_t({'year':2021, 'month':2, 'day':6}),
    lv.calendar_date_t({'year':2021, 'month':2, 'day':11}),
    lv.calendar_date_t({'year':2021, 'month':2, 'day':22})
]

calendar.set_highlighted_dates(highlighted_days, len(highlighted_days))

lv.calendar_header_dropdown(calendar)
```

6.7.8 API

Functions

lv_obj_t ***lv_calendar_create**(*lv_obj_t* *parent)

void **lv_calendar_set_today_date**(*lv_obj_t* *obj, uint32_t year, uint32_t month, uint32_t day)

Set the today's date

Parameters

- **obj** -- pointer to a calendar object
- **year** -- today's year
- **month** -- today's month [1..12]
- **day** -- today's day [1..31]

void **`lv_calendar_set_showed_date`**(*lv_obj_t* *obj, uint32_t year, uint32_t month)

Set the currently showed

Parameters

- **`obj`** -- pointer to a calendar object
- **`year`** -- today's year
- **`month`** -- today's month [1..12]

void **`lv_calendar_set_highlighted_dates`**(*lv_obj_t* *obj, *lv_calendar_date_t* highlighted[], uint16_t date_num)

Set the highlighted dates

Parameters

- **`obj`** -- pointer to a calendar object
- **`highlighted`** -- pointer to an `lv_calendar_date_t` array containing the dates. Only the pointer will be saved so this variable can't be local which will be destroyed later.
- **`date_num`** -- number of dates in the array

void **`lv_calendar_set_day_names`**(*lv_obj_t* *obj, const char **day_names)

Set the name of the days

Parameters

- **`obj`** -- pointer to a calendar object
- **`day_names`** -- pointer to an array with the names. E.g. `const char * days[7] = {"Sun", "Mon", ...}` Only the pointer will be saved so this variable can't be local which will be destroyed later.

lv_obj_t ***`lv_calendar_get_btnmatrix`**(const *lv_obj_t* *obj)

Get the button matrix object of the calendar. It shows the dates and day names.

Parameters **`obj`** -- pointer to a calendar object

Returns pointer to a the button matrix

const *lv_calendar_date_t* ***`lv_calendar_get_today_date`**(const *lv_obj_t* *calendar)

Get the today's date

Parameters **`calendar`** -- pointer to a calendar object

Returns return pointer to an `lv_calendar_date_t` variable containing the date of today.

const *lv_calendar_date_t* ***`lv_calendar_get_showed_date`**(const *lv_obj_t* *calendar)

Get the currently showed

Parameters **`calendar`** -- pointer to a calendar object

Returns pointer to an `lv_calendar_date_t` variable containing the date is being shown.

lv_calendar_date_t ***`lv_calendar_get_highlighted_dates`**(const *lv_obj_t* *calendar)

Get the highlighted dates

Parameters **`calendar`** -- pointer to a calendar object

Returns pointer to an `lv_calendar_date_t` array containing the dates.

uint16_t **`lv_calendar_get_highlighted_dates_num`**(const *lv_obj_t* *calendar)

Get the number of the highlighted dates

Parameters **`calendar`** -- pointer to a calendar object

Returns number of highlighted days

lv_res_t **`lv_calendar_get_pressed_date`**(const *lv_obj_t* *calendar, *lv_calendar_date_t* *date)

Get the currently pressed day

Parameters

- **`calendar`** -- pointer to a calendar object
- **`date`** -- store the pressed date here

Returns LV_RES_OK: there is a valid pressed date; LV_RES_INV: there is no pressed data

Variables

const lv_obj_class_t **`lv_calendar_class`**

struct **`lv_calendar_date_t`**

#include <lv_calendar.h> Represents a date on the calendar object (platform-agnostic).

Public Members

uint16_t **`year`**

int8_t **`month`**

int8_t **`day`**

1..12

struct **`lv_calendar_t`**

Public Members

lv_obj_t **`obj`**

lv_obj_t ***`btnm`**

lv_calendar_date_t **`today`**

lv_calendar_date_t **`showed_date`**

lv_calendar_date_t ***`highlighted_dates`** uint16_t **`highlighted_dates_num`**

const char ***`map`**[8 * 7]

char **`nums`**[7 * 6][4]

6.8 Chart (lv_chart)

6.8.1 Overview

Charts are a basic object to visualize data points. Currently *Line* charts (connect points with lines and/or draw points on them) and *Bar* charts are supported.

Charts can have:

- division lines
- 2 y axis
- axis ticks and texts on ticks
- cursors
- scrolling and zooming

6.8.2 Parts and Styles

- `LV_PART_MAIN` The background of the chart. Uses all the typical background and *line* (for the division lines) related style properties. *Padding* makes the series area smaller. For column charts `pad_column` sets the space between the columns of the adjacent indices.
- `LV_PART_SCROLLBAR` The scrollbar used if the chart is zoomed. See the *Base object*'s documentation for details.
- `LV_PART_ITEMS` Refers to the line or bar series.
  - Line chart: The *line* properties are used by the lines. `width`, `height`, `bg_color` and `radius` is used to set the appearance of points.
  - Bar chart: The typical background properties are used to style the bars. `pad_column` sets the space between the columns on the same index.
- `LV_PART_INDICATOR` Refers to the points on line and scatter chart (small circles or squares).
- `LV_PART_CURSOR` *Line* properties are used to style the cursors. `width`, `height`, `bg_color` and `radius` are used to set the appearance of points.
- `LV_PART_TICKS` *Line* and *Text* style properties are used to style the ticks

6.8.3 Usage

Chart type

The following data display types exist:

- `LV_CHART_TYPE_NONE` Do not display any data. Can be used to hide the series.
- `LV_CHART_TYPE_LINE` Draw lines between the data points and/or points (rectangles or circles) on the data points.
- `LV_CHART_TYPE_BAR` - Draw bars.
- `LV_CHART_TYPE_SCATTER` - X/Y chart drawing point's and lines between the points. .

You can specify the display type with `lv_chart_set_type(chart, LV_CHART_TYPE_...)`.

Data series

You can add any number of series to the charts by `lv_chart_add_series(chart, color, axis)`. This allocates an `lv_chart_series_t` structure which contains the chosen `color` and an array for the data points. `axis` can have the following values:

- `LV_CHART_AXIS_PRIMARY_Y` Left axis
- `LV_CHART_AXIS_SECONDARY_Y` Right axis
- `LV_CHART_AXIS_PRIMARY_X` Bottom axis
- `LV_CHART_AXIS_SECONDARY_X` Top axis

`axis` tells which axis's range should be used te scale the values.

`lv_chart_set_ext_y_array(chart, ser, value_array)` makes the chart use an external array for the given series. `value_array` should look like this: `lv_coord_t * value_array[num_points]`. The array size needs to be large enough to hold all the points of that series. The array's pointer will be saved in the chart so it needs to be global, static or dynamically allocated. Note: you should call `lv_chart_refresh(chart)` after the external data source has been updated to update the chart.

The value array of a series can be obtained with `lv_chart_get_y_array(chart, ser)`, which can be used with `ext_array` or *normal arrays*.

For `LV_CHART_TYPE_SCATTER` type `lv_chart_set_ext_x_array(chart, ser, value_array)` and `lv_chart_get_x_array(chart, ser)` can be used as well.

Modify the data

You have several options to set the data of series:

1. Set the values manually in the array like `ser1->points[3] = 7` and refresh the chart with `lv_chart_refresh(chart)`.
2. Use `lv_chart_set_value_by_id(chart, ser, id, value)` where `id` is the index of the point you wish to update.
3. Use the `lv_chart_set_next_value(chart, ser, value)`.
4. Initialize all points to a given value with: `lv_chart_set_all_value(chart, ser, value)`.

Use `LV_CHART_POINT_NONE` as value to make the library skip drawing that point, column, or line segment.

For `LV_CHART_TYPE_SCATTER` type `lv_chart_set_value_by_id2(chart, ser, id, value)` and `lv_chart_set_next_value2(chart, ser, x_valuem y_value)` can be used as well.

Update modes

`lv_chart_set_next_value` can behave in two ways depending on *update mode*:

- `LV_CHART_UPDATE_MODE_SHIFT` Shift old data to the left and add the new one to the right.
- `LV_CHART_UPDATE_MODE_CIRCULAR` - Add the new data in circular fashion, like an ECG diagram.

The update mode can be changed with `lv_chart_set_update_mode(chart, LV_CHART_UPDATE_MODE_...)`.

Number of points

The number of points in the series can be modified by `lv_chart_set_point_count(chart, point_num)`. The default value is 10. Note: this also affects the number of points processed when an external buffer is assigned to a series, so you need to be sure the external array is large enough.

Handling large number of points

On line charts, if the number of points is greater than the pixels horizontally, the Chart will draw only vertical lines to make the drawing of large amount of data effective. If there are, let's say, 10 points to a pixel, LVGL searches the smallest and the largest value and draws a vertical lines between them to ensure no peaks are missed.

Vertical range

You can specify the minimum and maximum values in y-direction with `lv_chart_set_range(chart, axis, min, max)`. `axis` can be `LV_CHART_AXIS_PRIMARY` (left axis) or `LV_CHART_AXIS_SECONDARY` (right axis).

The value of the points will be scaled proportionally. The default range is: 0..100.

Division lines

The number of horizontal and vertical division lines can be modified by `lv_chart_set_div_line_count(chart, hdiv_num, vdiv_num)`. The default settings are 3 horizontal and 5 vertical division lines. If there is a visible border on a side and no padding on that side, the division line would be drawn on top of the border and therefore it won't be drawn.

Override default start point for series

If you want a plot to start from a point other than the default which is `point[0]` of the series, you can set an alternative index with the function `lv_chart_set_x_start_point(chart, ser, id)` where `id` is the new index position to start plotting from.

Note that `LV_CHART_UPDATE_MODE_SHIFT` also changes the `start_point`.

Tick marks and labels

Ticks and labels can be added to the axis with `lv_chart_set_axis_tick(chart, axis, major_len, minor_len, major_cnt, minor_cnt, label_en, draw_size)`.

- `axis` can be `LV_CHART_AXIS_X/PRIMARY_Y/SECONDARY_Y`
- `major_len` is the length of major ticks
- `minor_len` is the length of minor ticks
- `major_cnt` is the number of major ticks on the axis
- `minor_cnt` in the number of minor ticks between two major ticks
- `label_en` `true`: enable label drawing on major ticks
- `draw_size` extra size required to draw the tick and labels (start with 20 px and increase if the ticks/labels are clipped)

Zoom

The chart can be zoomed independently in x and y directions with `lv_chart_set_zoom_x(chart, factor)` and `lv_chart_set_zoom_y(chart, factor)`. If `factor` is 256 there is no zoom. 512 means double zoom, etc. Fractional values are also possible but < 256 value is not allowed.

Cursor

A cursor can be added with `lv_chart_cursor_t * c1 = lv_chart_add_cursor(chart, color, dir);`. The possible values of `dir` `LV_DIR_NONE/RIGHT/UP/LEFT/DOWN/HOR/VER/ALL` or their OR-ed values to tell in which direction(s) should the cursor be drawn.

`lv_chart_set_cursor_pos(chart, cursor, &point)` sets the position of the cursor. `pos` is a pointer to an `lv_point_t` variable. E.g. `lv_point_t point = {10, 20};`. If the chart is scrolled the cursor will remain in the same place.

`lv_chart_get_point_pos_by_id(chart, series, id, &point_out)` gets the coordinate of a given point. It's useful to place the cursor at a given point.

`lv_chart_set_cursor_point(chart, cursor, series, point_id)` sticks the cursor at a point. If the point's position changes (new value or scrolling) the cursor will move with the point.

6.8.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when a new point is clicked pressed. `lv_chart_get_pressed_point(chart)` returns the zero-based index of the pressed point.
- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` are sent with the following types:
  - `LV_CHART_DRAW_PART_DIV_LINE_INIT` Used before/after drawn the div lines to add masks to any extra drawings. The following fields are set:
    - `part`: `LV_PART_MAIN`
    - `line_dsc`
  - `LV_CHART_DRAW_PART_DIV_LINE_HOR`, `LV_CHART_DRAW_PART_DIV_LINE_VER` Used for each horizontal and vertical division lines.
    - `part`: `LV_PART_MAIN`
    - `id`: index of the line
    - `p1`, `p2`: points of the line
    - `line_dsc`
  - `LV_CHART_DRAW_PART_LINE_AND_POINT` Used on line and scatter charts for lines and points.
    - `part`: `LV_PART_ITEMS`
    - `id`: index of the point
    - `value`: value of `id`th point
    - `p1`, `p2`: points of the line
    - `draw_area`: area of the point
    - `line_dsc`
    - `rect_dsc`
    - `sub_part_ptr`: pointer to the series
  - `LV_CHART_DRAW_PART_BAR` Used on bar charts for the rectangles.
    - `part`: `LV_PART_ITEMS`
    - `id`: index of the point
    - `value`: value of `id`th point
    - `draw_area`: area of the point
    - `rect_dsc`:
    - `sub_part_ptr`: pointer to the series
  - `LV_CHART_DRAW_PART_CURSOR` Used on cursor lines and points.
    - `part`: `LV_PART_CURSOR`
    - `p1`, `p2`: points of the line
    - `line_dsc`
    - `rect_dsc`
    - `draw_area`: area of the points
  - `LV_CHART_DRAW_PART_TICK_LABEL` Used on tick lines and labels.

  * `part`: `LV_PART_TICKS`
  * `id`: axis
  * `value`: value of the tick
  * `text`: `value` converted to decimal or `NULL` for minor ticks
  * `line_dsc`,
  * `label_dsc`,

See the events of the *Base object* too.

Learn more about *Events*.

6.8.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.8.6 Example

Line Chart

```c
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES

void lv_example_chart_1(void)
{
    /*Create a chart*/
    lv_obj_t * chart;
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_center(chart);
    lv_chart_set_type(chart, LV_CHART_TYPE_LINE);   /*Show lines and points too*/

    /*Add two data series*/
    lv_chart_series_t * ser1 = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪RED), LV_CHART_AXIS_PRIMARY_Y);
    lv_chart_series_t * ser2 = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪GREEN), LV_CHART_AXIS_SECONDARY_Y);

    /*Set the next points on 'ser1'*/
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 30);
    lv_chart_set_next_value(chart, ser1, 70);
    lv_chart_set_next_value(chart, ser1, 90);

    /*Directly set points on 'ser2'*/
```

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```
    ser2->y_points[0] = 90;
    ser2->y_points[1] = 70;
    ser2->y_points[2] = 65;
    ser2->y_points[3] = 65;
    ser2->y_points[4] = 65;
    ser2->y_points[5] = 65;
    ser2->y_points[6] = 65;
    ser2->y_points[7] = 65;
    ser2->y_points[8] = 65;
    ser2->y_points[9] = 65;

    lv_chart_refresh(chart); /*Required after direct set*/
}

#endif
```

```
# Create a chart
chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.center()
chart.set_type(lv.chart.TYPE.LINE)   # Show lines and points too

# Add two data series
ser1 = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)
ser2 = chart.add_series(lv.palette_main(lv.PALETTE.GREEN), lv.chart.AXIS.SECONDARY_Y)
print(ser2)
# Set next points on ser1
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,10)
chart.set_next_value(ser1,30)
chart.set_next_value(ser1,70)
chart.set_next_value(ser1,90)

# Directly set points on 'ser2'
ser2.y_points = [90, 70, 65, 65, 65, 65, 65, 65, 65, 65]
chart.refresh()      #  Required after direct set
```

Faded area line chart with custom division lines

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_USE_DRAW_MASKS && LV_BUILD_EXAMPLES

static lv_obj_t * chart1;
static lv_chart_series_t * ser1;
static lv_chart_series_t * ser2;

static void draw_event_cb(lv_event_t * e)
{
```

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```
    lv_obj_t * obj = lv_event_get_target(e);

    /*Add the faded area before the lines are drawn*/
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->part == LV_PART_ITEMS) {
        if(!dsc->p1 || !dsc->p2) return;

        /*Add a line mask that keeps the area below the line*/
        lv_draw_mask_line_param_t line_mask_param;
        lv_draw_mask_line_points_init(&line_mask_param, dsc->p1->x, dsc->p1->y, dsc->
↪p2->x, dsc->p2->y,
                                      LV_DRAW_MASK_LINE_SIDE_BOTTOM);
        int16_t line_mask_id = lv_draw_mask_add(&line_mask_param, NULL);

        /*Add a fade effect: transparent bottom covering top*/
        lv_coord_t h = lv_obj_get_height(obj);
        lv_draw_mask_fade_param_t fade_mask_param;
        lv_draw_mask_fade_init(&fade_mask_param, &obj->coords, LV_OPA_COVER, obj->
↪coords.y1 + h / 8, LV_OPA_TRANSP,
                               obj->coords.y2);
        int16_t fade_mask_id = lv_draw_mask_add(&fade_mask_param, NULL);

        /*Draw a rectangle that will be affected by the mask*/
        lv_draw_rect_dsc_t draw_rect_dsc;
        lv_draw_rect_dsc_init(&draw_rect_dsc);
        draw_rect_dsc.bg_opa = LV_OPA_20;
        draw_rect_dsc.bg_color = dsc->line_dsc->color;

        lv_area_t a;
        a.x1 = dsc->p1->x;
        a.x2 = dsc->p2->x - 1;
        a.y1 = LV_MIN(dsc->p1->y, dsc->p2->y);
        a.y2 = obj->coords.y2;
        lv_draw_rect(dsc->draw_ctx, &draw_rect_dsc, &a);

        /*Remove the masks*/
        lv_draw_mask_free_param(&line_mask_param);
        lv_draw_mask_free_param(&fade_mask_param);
        lv_draw_mask_remove_id(line_mask_id);
        lv_draw_mask_remove_id(fade_mask_id);
    }
    /*Hook the division lines too*/
    else if(dsc->part == LV_PART_MAIN) {
        if(dsc->line_dsc == NULL || dsc->p1 == NULL || dsc->p2 == NULL) return;

        /*Vertical line*/
        if(dsc->p1->x == dsc->p2->x) {
            dsc->line_dsc->color  = lv_palette_lighten(LV_PALETTE_GREY, 1);
            if(dsc->id == 3) {
                dsc->line_dsc->width  = 2;
                dsc->line_dsc->dash_gap  = 0;
                dsc->line_dsc->dash_width  = 0;
            }
            else {
                dsc->line_dsc->width = 1;
                dsc->line_dsc->dash_gap  = 6;
                dsc->line_dsc->dash_width  = 6;
```

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```
            }
        }
        /*Horizontal line*/
        else {
            if(dsc->id == 2) {
                dsc->line_dsc->width  = 2;
                dsc->line_dsc->dash_gap  = 0;
                dsc->line_dsc->dash_width  = 0;
            }
            else {
                dsc->line_dsc->width = 2;
                dsc->line_dsc->dash_gap  = 6;
                dsc->line_dsc->dash_width  = 6;
            }

            if(dsc->id == 1  || dsc->id == 3) {
                dsc->line_dsc->color  = lv_palette_main(LV_PALETTE_GREEN);
            }
            else {
                dsc->line_dsc->color  = lv_palette_lighten(LV_PALETTE_GREY, 1);
            }
        }
    }
}

static void add_data(lv_timer_t * timer)
{
    LV_UNUSED(timer);
    static uint32_t cnt = 0;
    lv_chart_set_next_value(chart1, ser1, lv_rand(20, 90));

    if(cnt % 4 == 0) lv_chart_set_next_value(chart1, ser2, lv_rand(40, 60));

    cnt++;
}

/**
 * Add a faded area effect to the line chart and make some division lines ticker
 */
void lv_example_chart_2(void)
{
    /*Create a chart1*/
    chart1 = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart1, 200, 150);
    lv_obj_center(chart1);
    lv_chart_set_type(chart1, LV_CHART_TYPE_LINE);   /*Show lines and points too*/

    lv_chart_set_div_line_count(chart1, 5, 7);

    lv_obj_add_event(chart1, draw_event_cb, LV_EVENT_DRAW_PART_BEGIN, NULL);
    lv_chart_set_update_mode(chart1, LV_CHART_UPDATE_MODE_CIRCULAR);

    /*Add two data series*/
    ser1 = lv_chart_add_series(chart1, lv_palette_main(LV_PALETTE_RED), LV_CHART_AXIS_
↪PRIMARY_Y);
    ser2 = lv_chart_add_series(chart1, lv_palette_main(LV_PALETTE_BLUE), LV_CHART_
↪AXIS_SECONDARY_Y);
```

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```
    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_chart_set_next_value(chart1, ser1, lv_rand(20, 90));
        lv_chart_set_next_value(chart1, ser2, lv_rand(30, 70));
    }

    lv_timer_create(add_data, 200, NULL);
}

#endif
```

```
def draw_event_cb(e):

    obj = e.get_target_obj()

    # Add the faded area before the lines are drawn
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    if dsc.part != lv.PART.ITEMS:
        return
    if not dsc.p1 or not dsc.p2:
        return

    # Add a line mask that keeps the area below the line
    line_mask_param = lv.draw_mask_line_param_t()
    line_mask_param.points_init(dsc.p1.x, dsc.p1.y, dsc.p2.x, dsc.p2.y, lv.DRAW_MASK_
↪LINE_SIDE.BOTTOM)
    # line_mask_id = line_mask_param.draw_mask_add(None)
    line_mask_id = lv.draw_mask_add(line_mask_param, None)
    # Add a fade effect: transparent bottom covering top
    h = obj.get_height()
    fade_mask_param = lv.draw_mask_fade_param_t()
    coords = lv.area_t()
    obj.get_coords(coords)
    fade_mask_param.init(coords, lv.OPA.COVER, coords.y1 + h // 8, lv.OPA.TRANSP,
↪coords.y2)
    fade_mask_id = lv.draw_mask_add(fade_mask_param,None)

    # Draw a rectangle that will be affected by the mask
    draw_rect_dsc = lv.draw_rect_dsc_t()
    draw_rect_dsc.init()
    draw_rect_dsc.bg_opa = lv.OPA._20
    draw_rect_dsc.bg_color = dsc.line_dsc.color

    a = lv.area_t()
    a.x1 = dsc.p1.x
    a.x2 = dsc.p2.x - 1
    a.y1 = min(dsc.p1.y, dsc.p2.y)
    coords = lv.area_t()
    obj.get_coords(coords)
    a.y2 = coords.y2
    dsc.draw_ctx.rect(draw_rect_dsc, a)

    # Remove the masks
    lv.draw_mask_remove_id(line_mask_id)
    lv.draw_mask_remove_id(fade_mask_id)
```

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```
def add_data(timer):
    # LV_UNUSED(timer);
    cnt = 0
    chart1.set_next_value(ser1, lv.rand(20, 90))

    if cnt % 4 == 0:
        chart1.set_next_value(ser2, lv.rand(40, 60))

    cnt +=1

#
# Add a faded area effect to the line chart
#

# Create a chart1
chart1 = lv.chart(lv.scr_act())
chart1.set_size(200, 150)
chart1.center()
chart1.set_type(lv.chart.TYPE.LINE)    # Show lines and points too

chart1.add_event(draw_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)
chart1.set_update_mode(lv.chart.UPDATE_MODE.CIRCULAR)

# Add two data series
ser1 = chart1.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)
ser2 = chart1.add_series(lv.palette_main(lv.PALETTE.BLUE), lv.chart.AXIS.SECONDARY_Y)

for i in range(10):
    chart1.set_next_value(ser1, lv.rand(20, 90))
    chart1.set_next_value(ser2, lv.rand(30, 70))

timer = lv.timer_create(add_data, 200, None)
```

Axis ticks and labels with scrolling

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES

static void draw_event_cb(lv_event_t * e)
{
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(!lv_obj_draw_part_check_type(dsc, &lv_chart_class, LV_CHART_DRAW_PART_TICK_
↪LABEL)) return;

    if(dsc->id == LV_CHART_AXIS_PRIMARY_X && dsc->text) {
        const char * month[] = {"Jan", "Febr", "March", "Apr", "May", "Jun", "July",
↪"Aug", "Sept", "Oct", "Nov", "Dec"};
        lv_snprintf(dsc->text, dsc->text_length, "%s", month[dsc->value]);
    }
}

/**
 * Add ticks and labels to the axis and demonstrate scrolling
```

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```
 */
void lv_example_chart_3(void)
{
    /*Create a chart*/
    lv_obj_t * chart;
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_center(chart);
    lv_chart_set_type(chart, LV_CHART_TYPE_BAR);
    lv_chart_set_range(chart, LV_CHART_AXIS_PRIMARY_Y, 0, 100);
    lv_chart_set_range(chart, LV_CHART_AXIS_SECONDARY_Y, 0, 400);
    lv_chart_set_point_count(chart, 12);
    lv_obj_add_event(chart, draw_event_cb, LV_EVENT_DRAW_PART_BEGIN, NULL);

    /*Add ticks and label to every axis*/
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_X, 10, 5, 12, 3, true, 40);
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_Y, 10, 5, 6, 2, true, 50);
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_SECONDARY_Y, 10, 5, 3, 4, true, 50);

    /*Zoom in a little in X*/
    lv_chart_set_zoom_x(chart, 800);

    /*Add two data series*/
    lv_chart_series_t * ser1 = lv_chart_add_series(chart, lv_palette_lighten(LV_
↪PALETTE_GREEN, 2), LV_CHART_AXIS_PRIMARY_Y);
    lv_chart_series_t * ser2 = lv_chart_add_series(chart, lv_palette_darken(LV_
↪PALETTE_GREEN, 2),
                                                   LV_CHART_AXIS_SECONDARY_Y);

    /*Set the next points on 'ser1'*/
    lv_chart_set_next_value(chart, ser1, 31);
    lv_chart_set_next_value(chart, ser1, 66);
    lv_chart_set_next_value(chart, ser1, 10);
    lv_chart_set_next_value(chart, ser1, 89);
    lv_chart_set_next_value(chart, ser1, 63);
    lv_chart_set_next_value(chart, ser1, 56);
    lv_chart_set_next_value(chart, ser1, 32);
    lv_chart_set_next_value(chart, ser1, 35);
    lv_chart_set_next_value(chart, ser1, 57);
    lv_chart_set_next_value(chart, ser1, 85);
    lv_chart_set_next_value(chart, ser1, 22);
    lv_chart_set_next_value(chart, ser1, 58);

    lv_coord_t * ser2_array = lv_chart_get_y_array(chart, ser2);
    /*Directly set points on 'ser2'*/
    ser2_array[0] = 92;
    ser2_array[1] = 71;
    ser2_array[2] = 61;
    ser2_array[3] = 15;
    ser2_array[4] = 21;
    ser2_array[5] = 35;
    ser2_array[6] = 35;
    ser2_array[7] = 58;
    ser2_array[8] = 31;
    ser2_array[9] = 53;
    ser2_array[10] = 33;
    ser2_array[11] = 73;
```

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```
    lv_chart_refresh(chart); /*Required after direct set*/
}

#endif
```

```
def draw_event_cb(e):

    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    if dsc.part == lv.PART.TICKS and dsc.id == lv.chart.AXIS.PRIMARY_X:
        month = ["Jan", "Febr", "March", "Apr", "May", "Jun", "July", "Aug", "Sept",
↪"Oct", "Nov", "Dec"]
        # dsc.text is defined char text[16], I must therefore convert the Python␣
↪string to a byte_array
        dsc.text = bytes(month[dsc.value],"ascii")
#
# Add ticks and labels to the axis and demonstrate scrolling
#

# Create a chart
chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.center()
chart.set_type(lv.chart.TYPE.BAR)
chart.set_range(lv.chart.AXIS.PRIMARY_Y, 0, 100)
chart.set_range(lv.chart.AXIS.SECONDARY_Y, 0, 400)
chart.set_point_count(12)
chart.add_event(draw_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)

# Add ticks and label to every axis
chart.set_axis_tick(lv.chart.AXIS.PRIMARY_X, 10, 5, 12, 3, True, 40)
chart.set_axis_tick(lv.chart.AXIS.PRIMARY_Y, 10, 5, 6, 2, True, 50)
chart.set_axis_tick(lv.chart.AXIS.SECONDARY_Y, 10, 5, 3, 4,True, 50)

# Zoom in a little in X
chart.set_zoom_x(800)

# Add two data series
ser1 = lv.chart.add_series(chart, lv.palette_lighten(lv.PALETTE.GREEN, 2), lv.chart.
↪AXIS.PRIMARY_Y)
ser2 = lv.chart.add_series(chart, lv.palette_darken(lv.PALETTE.GREEN, 2), lv.chart.
↪AXIS.SECONDARY_Y)

# Set the next points on 'ser1'
chart.set_next_value(ser1, 31)
chart.set_next_value(ser1, 66)
chart.set_next_value(ser1, 10)
chart.set_next_value(ser1, 89)
chart.set_next_value(ser1, 63)
chart.set_next_value(ser1, 56)
chart.set_next_value(ser1, 32)
chart.set_next_value(ser1, 35)
chart.set_next_value(ser1, 57)
chart.set_next_value(ser1, 85)
chart.set_next_value(ser1, 22)
chart.set_next_value(ser1, 58)
```

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```
# Directly set points on 'ser2'
ser2.y_points = [92,71,61,15,21,35,35,58,31,53,33,73]

chart.refresh()  # Required after direct set
```

Show the value of the pressed points

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES


static void event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * chart = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        lv_obj_invalidate(chart);
    }
    if(code == LV_EVENT_REFR_EXT_DRAW_SIZE) {
        lv_coord_t * s = lv_event_get_param(e);
        *s = LV_MAX(*s, 20);
    }
    else if(code == LV_EVENT_DRAW_POST_END) {
        int32_t id = lv_chart_get_pressed_point(chart);
        if(id == LV_CHART_POINT_NONE) return;

        LV_LOG_USER("Selected point %d", (int)id);

        lv_chart_series_t * ser = lv_chart_get_series_next(chart, NULL);
        while(ser) {
            lv_point_t p;
            lv_chart_get_point_pos_by_id(chart, ser, id, &p);

            lv_coord_t * y_array = lv_chart_get_y_array(chart, ser);
            lv_coord_t value = y_array[id];

            char buf[16];
            lv_snprintf(buf, sizeof(buf), LV_SYMBOL_DUMMY"$%d", value);

            lv_draw_rect_dsc_t draw_rect_dsc;
            lv_draw_rect_dsc_init(&draw_rect_dsc);
            draw_rect_dsc.bg_color = lv_color_black();
            draw_rect_dsc.bg_opa = LV_OPA_50;
            draw_rect_dsc.radius = 3;
            draw_rect_dsc.bg_img_src = buf;
            draw_rect_dsc.bg_img_recolor = lv_color_white();

            lv_area_t a;
            a.x1 = chart->coords.x1 + p.x - 20;
            a.x2 = chart->coords.x1 + p.x + 20;
            a.y1 = chart->coords.y1 + p.y - 30;
            a.y2 = chart->coords.y1 + p.y - 10;
```

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```
            lv_draw_ctx_t * draw_ctx = lv_event_get_draw_ctx(e);
            lv_draw_rect(draw_ctx, &draw_rect_dsc, &a);

            ser = lv_chart_get_series_next(chart, ser);
        }
    }
    else if(code == LV_EVENT_RELEASED) {
        lv_obj_invalidate(chart);
    }
}

/**
 * Show the value of the pressed points
 */
void lv_example_chart_4(void)
{
    /*Create a chart*/
    lv_obj_t * chart;
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_center(chart);

    lv_obj_add_event(chart, event_cb, LV_EVENT_ALL, NULL);
    lv_obj_refresh_ext_draw_size(chart);

    /*Zoom in a little in X*/
    lv_chart_set_zoom_x(chart, 800);

    /*Add two data series*/
    lv_chart_series_t * ser1 = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪RED), LV_CHART_AXIS_PRIMARY_Y);
    lv_chart_series_t * ser2 = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪GREEN), LV_CHART_AXIS_PRIMARY_Y);
    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_chart_set_next_value(chart, ser1, lv_rand(60, 90));
        lv_chart_set_next_value(chart, ser2, lv_rand(10, 40));
    }
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv

def event_cb(e):

    code = e.get_code()
    chart = e.get_target_obj()

    if code == lv.EVENT.VALUE_CHANGED:
        chart.invalidate()

    if code == lv.EVENT.REFR_EXT_DRAW_SIZE:
        # s = lv.coord_t.__cast__(e.get_param())
```

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```
        # print("s: {:d}".format(s))
        e.set_ext_draw_size(20)

    elif code == lv.EVENT.DRAW_POST_END:
        id = chart.get_pressed_point()
        if id == lv.CHART_POINT_NONE :
            return

        # print("Selected point {:d}".format(id))

        ser = chart.get_series_next(None)

        while(ser) :
            p = lv.point_t()
            chart.get_point_pos_by_id(ser, id, p)
            # print("point coords: x: {:d}, y: {:d}".format(p.x,p.y))
            y_array = chart.get_y_array(ser)
            value = y_array[id]

            buf = lv.SYMBOL.DUMMY + "{:2d}".format(value)

            draw_rect_dsc = lv.draw_rect_dsc_t()
            draw_rect_dsc.init()
            draw_rect_dsc.bg_color = lv.color_black()
            draw_rect_dsc.bg_opa = lv.OPA._50
            draw_rect_dsc.radius = 3
            draw_rect_dsc.bg_img_src = buf
            draw_rect_dsc.bg_img_recolor = lv.color_white()

            coords = lv.area_t()
            chart.get_coords(coords)
            # print("coords: x1: {:d}, y1: {:d}".format(coords.x1, coords.y1))
            a = lv.area_t()
            a.x1 = coords.x1 + p.x - 20
            a.x2 = coords.x1 + p.x + 20
            a.y1 = coords.y1 + p.y - 30
            a.y2 = coords.y1 + p.y - 10
            # print("a: x1: {:d}, x2: {:d}, y1: {:d}, y2: {:d}".format(a.x1,a.x2,a.y1,
↪a.y2))
            draw_ctx = e.get_draw_ctx()
            draw_ctx.rect(draw_rect_dsc, a)

            ser = chart.get_series_next(ser)

    elif code == lv.EVENT.RELEASED:
        chart.invalidate()


#
#  Show the value of the pressed points
#

# Create a chart
chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.center()
```

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```
chart.add_event(event_cb, lv.EVENT.ALL, None)

chart.refresh_ext_draw_size()

# Zoom in a little in X
chart.set_zoom_x(800)

# Add two data series
ser1 = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)
ser2 = chart.add_series(lv.palette_main(lv.PALETTE.GREEN), lv.chart.AXIS.PRIMARY_Y)
for i in range(10):
    chart.set_next_value(ser1, lv.rand(60, 90))
    chart.set_next_value(ser2, lv.rand(10, 40))
```

Display 1000 data points with zooming and scrolling

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_USE_SLIDER && LV_BUILD_EXAMPLES

static lv_obj_t * chart;
/* Source: https://github.com/ankur219/ECG-Arrhythmia-classification/blob/
↪642230149583adfae1e4bd26c6f0e1fd8af2be0e/sample.csv*/
static const lv_coord_t ecg_sample[] = {
    -2, 2, 0, -15, -39, -63, -71, -68, -67, -69, -84, -95, -104, -107, -108, -107, -
↪107, -107, -107, -114, -118, -117,
        -112, -100, -89, -83, -71, -64, -58, -58, -62, -62, -58, -51, -46, -39, -27, -
↪10, 4, 7, 1, -3, 0, 14, 24, 30, 25, 19,
        13, 7, 12, 15, 18, 21, 13, 6, 9, 8, 17, 19, 13, 11, 11, 11, 23, 30, 37, 34,␣
↪25, 14, 15, 19, 28, 31, 26, 23, 25, 31,
        39, 37, 37, 34, 30, 32, 22, 29, 31, 33, 37, 23, 13, 7, 2, 4, -2, 2, 11, 22,␣
↪33, 19, -1, -27, -55, -67, -72, -71, -63,
        -49, -18, 35, 113, 230, 369, 525, 651, 722, 730, 667, 563, 454, 357, 305, 288,
↪ 274, 255, 212, 173, 143, 117, 82, 39,
        -13, -53, -78, -91, -101, -113, -124, -131, -131, -131, -129, -128, -129, -
↪125, -123, -123, -129, -139, -148, -153,
        -159, -166, -183, -205, -227, -243, -248, -246, -254, -280, -327, -381, -429,␣
↪-473, -517, -556, -592, -612, -620,
        -620, -614, -604, -591, -574, -540, -497, -441, -389, -358, -336, -313, -284,␣
↪-222, -167, -114, -70, -47, -28, -4, 12,
        38, 52, 58, 56, 56, 57, 68, 77, 86, 86, 80, 69, 67, 70, 82, 85, 89, 90, 89,␣
↪89, 88, 91, 96, 97, 91, 83, 78, 82, 88, 95,
        96, 105, 106, 110, 102, 100, 96, 98, 97, 101, 98, 99, 100, 107, 113, 119, 115,
↪ 110, 96, 85, 73, 64, 69, 76, 79,
        78, 75, 85, 100, 114, 113, 105, 96, 84, 74, 66, 60, 75, 85, 89, 83, 67, 61,␣
↪67, 73, 79, 74, 63, 57, 56, 58, 61, 55,
        48, 45, 46, 55, 62, 55, 49, 43, 50, 59, 63, 57, 40, 31, 23, 25, 27, 31, 35,␣
↪34, 30, 36, 34, 42, 38, 36, 40, 46, 50,
        47, 32, 30, 32, 52, 67, 73, 71, 63, 54, 53, 45, 41, 28, 13, 3, 1, 4, 4, -8, -
↪23, -32, -31, -19, -5, 3, 9, 13, 19,
        24, 27, 29, 25, 22, 26, 32, 42, 51, 56, 60, 57, 55, 53, 53, 54, 59, 54, 49,␣
↪26, -3, -11, -20, -47, -100, -194, -236,
        -212, -123, 8, 103, 142, 147, 120, 105, 98, 93, 81, 61, 40, 26, 28, 30, 30,␣
↪27, 19, 17, 21, 20, 19, 19, 22, 36, 40,
        35, 20, 7, 1, 10, 18, 27, 22, 6, -4, -2, 3, 6, -2, -13, -14, -10, -2, 3, 2, -
↪1, -5, -10, -19, -32, -42, -55, -60,
```

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```
        -68, -77, -86, -101, -110, -117, -115, -104, -92, -84, -85, -84, -73, -65, -
↪52, -50, -45, -35, -20, -3, 12, 20, 25,
        26, 28, 28, 30, 28, 25, 28, 33, 42, 42, 36, 23, 9, 0, 1, -4, 1, -4, -4, 1, 5,␣
↪9, 9, -3, -1, -18, -50, -108, -190,
        -272, -340, -408, -446, -537, -643, -777, -894, -920, -853, -697, -461, -251,␣
↪-60, 58, 103, 129, 139, 155, 170, 173,
        178, 185, 190, 193, 200, 208, 215, 225, 224, 232, 234, 240, 240, 236, 229,␣
↪226, 224, 232, 233, 232, 224, 219, 219,
        223, 231, 226, 223, 219, 218, 223, 223, 223, 233, 245, 268, 286, 296, 295,␣
↪283, 271, 263, 252, 243, 226, 210, 197,
        186, 171, 152, 133, 117, 114, 110, 107, 96, 80, 63, 48, 40, 38, 34, 28, 15, 2,
↪ -7, -11, -14, -18, -29, -37, -44, -50,
        -58, -63, -61, -52, -50, -48, -61, -59, -58, -54, -47, -52, -62, -61, -64, -
↪54, -52, -59, -69, -76, -76, -69, -67,
        -74, -78, -81, -80, -73, -65, -57, -53, -51, -47, -35, -27, -22, -22, -24, -
↪21, -17, -13, -10, -11, -13, -20, -20,
        -12, -2, 7, -1, -12, -16, -13, -2, 2, -4, -5, -2, 9, 19, 19, 14, 11, 13, 19,␣
↪21, 20, 18, 19, 19, 19, 16, 15, 13, 14,
        9, 3, -5, -9, -5, -3, -2, -3, -3, 2, 8, 9, 9, 5, 6, 8, 8, 7, 4, 3, 4, 5, 3, 5,
↪ 5, 13, 13, 12, 10, 10, 15, 22, 17,
        14, 7, 10, 15, 16, 11, 12, 10, 13, 9, -2, -4, -2, 7, 16, 16, 17, 16, 7, -1, -
↪16, -18, -16, -9, -4, -5, -10, -9, -8,
        -3, -4, -10, -19, -20, -16, -9, -9, -23, -40, -48, -43, -33, -19, -21, -26, -
↪31, -33, -19, 0, 17, 24, 9, -17, -47,
        -63, -67, -59, -52, -51, -50, -49, -42, -26, -21, -15, -20, -23, -22, -19, -
↪12, -8, 5, 18, 27, 32, 26, 25, 26, 22,
        23, 17, 14, 17, 21, 25, 2, -45, -121, -196, -226, -200, -118, -9, 73, 126,␣
↪131, 114, 87, 60, 42, 29, 26, 34, 35, 34,
        25, 12, 9, 7, 3, 2, -8, -11, 2, 23, 38, 41, 23, 9, 10, 13, 16, 8, -8, -17, -
↪23, -26, -25, -21, -15, -10, -13, -13,
        -19, -22, -29, -40, -48, -48, -54, -55, -66, -82, -85, -90, -92, -98, -114, -
↪119, -124, -129, -132, -146, -146, -138,
        -124, -99, -85, -72, -65, -65, -65, -66, -63, -64, -64, -58, -46, -26, -9, 2,␣
↪2, 4, 0, 1, 4, 3, 10, 11, 10, 2, -4,
        0, 10, 18, 20, 6, 2, -9, -7, -3, -3, -2, -7, -12, -5, 5, 24, 36, 31, 25, 6, 3,
↪ 7, 12, 17, 11, 0, -6, -9, -8, -7, -5,
        -6, -2, -2, -6, -2, 2, 14, 24, 22, 15, 8, 4, 6, 7, 12, 16, 25, 20, 7, -16, -
↪41, -60, -67, -65, -54, -35, -11, 30,
        84, 175, 302, 455, 603, 707, 743, 714, 625, 519, 414, 337, 300, 281, 263, 239,
↪ 197, 163, 136, 109, 77, 34, -18, -50,
        -66, -74, -79, -92, -107, -117, -127, -129, -135, -139, -141, -155, -159, -
↪167, -171, -169, -174, -175, -178, -191,
        -202, -223, -235, -243, -237, -240, -256, -298, -345, -393, -432, -475, -518,␣
↪-565, -596, -619, -623, -623, -614,
        -599, -583, -559, -524, -477, -425, -383, -357, -331, -301, -252, -198, -143,␣
↪-96, -57, -29, -8, 10, 31, 45, 60, 65,
        70, 74, 76, 79, 82, 79, 75, 62,
    };

static void slider_x_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    int32_t v = lv_slider_get_value(obj);
    lv_chart_set_zoom_x(chart, v);
}

static void slider_y_event_cb(lv_event_t * e)
```

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```
{
    lv_obj_t * obj = lv_event_get_target(e);
    int32_t v = lv_slider_get_value(obj);
    lv_chart_set_zoom_y(chart, v);
}

/**
 * Display 1000 data points with zooming and scrolling.
 * See how the chart changes drawing mode (draw only vertical lines) when
 * the points get too crowded.
 */
void lv_example_chart_5(void)
{
    /*Create a chart*/
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_align(chart, LV_ALIGN_CENTER, -30, -30);
    lv_chart_set_range(chart, LV_CHART_AXIS_PRIMARY_Y, -1000, 1000);

    /*Do not display points on the data*/
    lv_obj_set_style_size(chart, 0, 0, LV_PART_INDICATOR);

    lv_chart_series_t * ser = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪RED), LV_CHART_AXIS_PRIMARY_Y);

    uint32_t pcnt = sizeof(ecg_sample) / sizeof(ecg_sample[0]);
    lv_chart_set_point_count(chart, pcnt);
    lv_chart_set_ext_y_array(chart, ser, (lv_coord_t *)ecg_sample);

    lv_obj_t * slider;
    slider = lv_slider_create(lv_scr_act());
    lv_slider_set_range(slider, LV_ZOOM_NONE, LV_ZOOM_NONE * 10);
    lv_obj_add_event(slider, slider_x_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_obj_set_size(slider, 200, 10);
    lv_obj_align_to(slider, chart, LV_ALIGN_OUT_BOTTOM_MID, 0, 20);

    slider = lv_slider_create(lv_scr_act());
    lv_slider_set_range(slider, LV_ZOOM_NONE, LV_ZOOM_NONE * 10);
    lv_obj_add_event(slider, slider_y_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_obj_set_size(slider, 10, 150);
    lv_obj_align_to(slider, chart, LV_ALIGN_OUT_RIGHT_MID, 20, 0);
}

#endif
```

```
# Source: https://github.com/ankur219/ECG-Arrhythmia-classification/blob/
↪642230149583adfae1e4bd26c6f0e1fd8af2be0e/sample.csv
ecg_sample = [
    -2, 2, 0, -15, -39, -63, -71, -68, -67, -69, -84, -95, -104, -107, -108, -107, -
↪107, -107, -107, -114, -118, -117,
    -112, -100, -89, -83, -71, -64, -58, -58, -62, -62, -58, -51, -46, -39, -27, -10,␣
↪4, 7, 1, -3, 0, 14, 24, 30, 25, 19,
    13, 7, 12, 15, 18, 21, 13, 6, 9, 8, 17, 19, 13, 11, 11, 11, 23, 30, 37, 34, 25,␣
↪14, 15, 19, 28, 31, 26, 23, 25, 31,
    39, 37, 37, 34, 30, 32, 22, 29, 31, 33, 37, 23, 13, 7, 2, 4, -2, 2, 11, 22, 33,␣
↪19, -1, -27, -55, -67, -72, -71, -63,
```

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```
    -49, -18, 35, 113, 230, 369, 525, 651, 722, 730, 667, 563, 454, 357, 305, 288,␣
↪274, 255, 212, 173, 143, 117, 82, 39,
    -13, -53, -78, -91, -101, -113, -124, -131, -131, -131, -129, -128, -129, -125, -
↪123, -123, -129, -139, -148, -153,
    -159, -166, -183, -205, -227, -243, -248, -246, -254, -280, -327, -381, -429, -
↪473, -517, -556, -592, -612, -620,
    -620, -614, -604, -591, -574, -540, -497, -441, -389, -358, -336, -313, -284, -
↪222, -167, -114, -70, -47, -28, -4, 12,
    38, 52, 58, 56, 56, 57, 68, 77, 86, 86, 80, 69, 67, 70, 82, 85, 89, 90, 89, 89,␣
↪88, 91, 96, 97, 91, 83, 78, 82, 88, 95,
    96, 105, 106, 110, 102, 100, 96, 98, 97, 101, 98, 99, 100, 107, 113, 119, 115,␣
↪110, 96, 85, 73, 64, 69, 76, 79,
    78, 75, 85, 100, 114, 113, 105, 96, 84, 74, 66, 60, 75, 85, 89, 83, 67, 61, 67,␣
↪73, 79, 74, 63, 57, 56, 58, 61, 55,
    48, 45, 46, 55, 62, 55, 49, 43, 50, 59, 63, 57, 40, 31, 23, 25, 27, 31, 35, 34,␣
↪30, 36, 34, 42, 38, 36, 40, 46, 50,
    47, 32, 30, 32, 52, 67, 73, 71, 63, 54, 53, 45, 41, 28, 13, 3, 1, 4, 4, -8, -23, -
↪32, -31, -19, -5, 3, 9, 13, 19,
    24, 27, 29, 25, 22, 26, 32, 42, 51, 56, 60, 57, 55, 53, 53, 54, 59, 54, 49, 26, -
↪3, -11, -20, -47, -100, -194, -236,
    -212, -123, 8, 103, 142, 147, 120, 105, 98, 93, 81, 61, 40, 26, 28, 30, 30, 27,␣
↪19, 17, 21, 20, 19, 19, 22, 36, 40,
    35, 20, 7, 1, 10, 18, 27, 22, 6, -4, -2, 3, 6, -2, -13, -14, -10, -2, 3, 2, -1, -
↪5, -10, -19, -32, -42, -55, -60,
    -68, -77, -86, -101, -110, -117, -115, -104, -92, -84, -85, -84, -73, -65, -52, -
↪50, -45, -35, -20, -3, 12, 20, 25,
    26, 28, 28, 30, 28, 25, 28, 33, 42, 42, 36, 23, 9, 0, 1, -4, 1, -4, -4, 1, 5, 9,␣
↪9, -3, -1, -18, -50, -108, -190,
    -272, -340, -408, -446, -537, -643, -777, -894, -920, -853, -697, -461, -251, -60,
↪ 58, 103, 129, 139, 155, 170, 173,
    178, 185, 190, 193, 200, 208, 215, 225, 224, 232, 234, 240, 240, 236, 229, 226,␣
↪224, 232, 233, 232, 224, 219, 219,
    223, 231, 226, 223, 219, 218, 223, 223, 223, 233, 245, 268, 286, 296, 295, 283,␣
↪271, 263, 252, 243, 226, 210, 197,
    186, 171, 152, 133, 117, 114, 110, 107, 96, 80, 63, 48, 40, 38, 34, 28, 15, 2, -7,
↪ -11, -14, -18, -29, -37, -44, -50,
    -58, -63, -61, -52, -50, -48, -61, -59, -58, -54, -47, -52, -62, -61, -64, -54, -
↪52, -59, -69, -76, -76, -69, -67,
    -74, -78, -81, -80, -73, -65, -57, -53, -51, -47, -35, -27, -22, -22, -24, -21, -
↪17, -13, -10, -11, -13, -20, -20,
    -12, -2, 7, -1, -12, -16, -13, -2, 2, -4, -5, -2, 9, 19, 19, 14, 11, 13, 19, 21,␣
↪20, 18, 19, 19, 19, 16, 15, 13, 14,
    9, 3, -5, -9, -5, -3, -2, -3, -3, 2, 8, 9, 9, 5, 6, 8, 8, 7, 4, 3, 4, 5, 3, 5, 5,␣
↪13, 13, 12, 10, 10, 15, 22, 17,
    14, 7, 10, 15, 16, 11, 12, 10, 13, 9, -2, -4, -2, 7, 16, 16, 17, 16, 7, -1, -16, -
↪18, -16, -9, -4, -5, -10, -9, -8,
    -3, -4, -10, -19, -20, -16, -9, -9, -23, -40, -48, -43, -33, -19, -21, -26, -31, -
↪33, -19, 0, 17, 24, 9, -17, -47,
    -63, -67, -59, -52, -51, -50, -49, -42, -26, -21, -15, -20, -23, -22, -19, -12, -
↪8, 5, 18, 27, 32, 26, 25, 26, 22,
    23, 17, 14, 17, 21, 25, 2, -45, -121, -196, -226, -200, -118, -9, 73, 126, 131,␣
↪114, 87, 60, 42, 29, 26, 34, 35, 34,
    25, 12, 9, 7, 3, 2, -8, -11, 2, 23, 38, 41, 23, 9, 10, 13, 16, 8, -8, -17, -23, -
↪26, -25, -21, -15, -10, -13, -13,
    -19, -22, -29, -40, -48, -48, -54, -55, -66, -82, -85, -90, -92, -98, -114, -119,␣
↪-124, -129, -132, -146, -146, -138,
    -124, -99, -85, -72, -65, -65, -65, -66, -63, -64, -64, -58, -46, -26, -9, 2, 2,␣
↪4, 0, 1, 4, 3, 10, 11, 10, 2, -4,
```

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```
    0, 10, 18, 20, 6, 2, -9, -7, -3, -3, -2, -7, -12, -5, 5, 24, 36, 31, 25, 6, 3, 7,␣
↪12, 17, 11, 0, -6, -9, -8, -7, -5,
    -6, -2, -2, -6, -2, 2, 14, 24, 22, 15, 8, 4, 6, 7, 12, 16, 25, 20, 7, -16, -41, -
↪60, -67, -65, -54, -35, -11, 30,
    84, 175, 302, 455, 603, 707, 743, 714, 625, 519, 414, 337, 300, 281, 263, 239,␣
↪197, 163, 136, 109, 77, 34, -18, -50,
    -66, -74, -79, -92, -107, -117, -127, -129, -135, -139, -141, -155, -159, -167, -
↪171, -169, -174, -175, -178, -191,
    -202, -223, -235, -243, -237, -240, -256, -298, -345, -393, -432, -475, -518, -
↪565, -596, -619, -623, -623, -614,
    -599, -583, -559, -524, -477, -425, -383, -357, -331, -301, -252, -198, -143, -96,
↪ -57, -29, -8, 10, 31, 45, 60, 65,
    70, 74, 76, 79, 82, 79, 75, 62,
]

def slider_x_event_cb(e):

    slider = e.get_target_obj()
    v = slider.get_value()
    chart.set_zoom_x(v)

def slider_y_event_cb(e):

    slider = e.get_target_obj()
    v = slider.get_value()
    chart.set_zoom_y(v)


#
# Display 1000 data points with zooming and scrolling.
# See how the chart changes drawing mode (draw only vertical lines) when
# the points get too crowded.

# Create a chart
chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.align(lv.ALIGN.CENTER, -30, -30)
chart.set_range(lv.chart.AXIS.PRIMARY_Y, -1000, 1000)

# Do not display points on the data
chart.set_style_size(0, 0, lv.PART.INDICATOR)

ser = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)

pcnt = len(ecg_sample)
chart.set_point_count(pcnt)
chart.set_ext_y_array(ser, ecg_sample)

slider = lv.slider(lv.scr_act())
slider.set_range(lv.ZOOM_NONE, lv.ZOOM_NONE * 10)
slider.add_event(slider_x_event_cb, lv.EVENT.VALUE_CHANGED, None)
slider.set_size(200,10)
slider.align_to(chart, lv.ALIGN.OUT_BOTTOM_MID, 0, 20)

slider = lv.slider(lv.scr_act())
slider.set_range(lv.ZOOM_NONE, lv.ZOOM_NONE * 10)
slider.add_event(slider_y_event_cb, lv.EVENT.VALUE_CHANGED, None)
```

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```
slider.set_size(10, 150)
slider.align_to(chart, lv.ALIGN.OUT_RIGHT_MID, 20, 0)
```

Show cursor on the clicked point

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES

static lv_obj_t * chart;
static lv_chart_series_t * ser;
static lv_chart_cursor_t * cursor;

static void event_cb(lv_event_t * e)
{
    static int32_t last_id = -1;
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        last_id = lv_chart_get_pressed_point(obj);
        if(last_id != LV_CHART_POINT_NONE) {
            lv_chart_set_cursor_point(obj, cursor, NULL, last_id);
        }
    }
    else if(code == LV_EVENT_DRAW_PART_END) {
        lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
        if(!lv_obj_draw_part_check_type(dsc, &lv_chart_class, LV_CHART_DRAW_PART_
↪CURSOR)) return;
        if(dsc->p1 == NULL || dsc->p2 == NULL || dsc->p1->y != dsc->p2->y || last_id
↪< 0) return;

        lv_coord_t * data_array = lv_chart_get_y_array(chart, ser);
        lv_coord_t v = data_array[last_id];
        char buf[16];
        lv_snprintf(buf, sizeof(buf), "%d", v);

        lv_point_t size;
        lv_txt_get_size(&size, buf, LV_FONT_DEFAULT, 0, 0, LV_COORD_MAX, LV_TEXT_FLAG_
↪NONE);

        lv_area_t a;
        a.y2 = dsc->p1->y - 5;
        a.y1 = a.y2 - size.y - 10;
        a.x1 = dsc->p1->x + 10;
        a.x2 = a.x1 + size.x + 10;

        lv_draw_rect_dsc_t draw_rect_dsc;
        lv_draw_rect_dsc_init(&draw_rect_dsc);
        draw_rect_dsc.bg_color = lv_palette_main(LV_PALETTE_BLUE);
        draw_rect_dsc.radius = 3;

        lv_draw_rect(dsc->draw_ctx, &draw_rect_dsc, &a);

        lv_draw_label_dsc_t draw_label_dsc;
```

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```
        lv_draw_label_dsc_init(&draw_label_dsc);
        draw_label_dsc.color = lv_color_white();
        a.x1 += 5;
        a.x2 -= 5;
        a.y1 += 5;
        a.y2 -= 5;
        lv_draw_label(dsc->draw_ctx, &draw_label_dsc, &a, buf, NULL);
    }
}

/**
 * Show cursor on the clicked point
 */
void lv_example_chart_6(void)
{
    chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_align(chart, LV_ALIGN_CENTER, 0, -10);

    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_Y, 10, 5, 6, 5, true, 40);
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_X, 10, 5, 10, 1, true, 30);

    lv_obj_add_event(chart, event_cb, LV_EVENT_ALL, NULL);
    lv_obj_refresh_ext_draw_size(chart);

    cursor = lv_chart_add_cursor(chart, lv_palette_main(LV_PALETTE_BLUE), LV_DIR_LEFT␣
↪| LV_DIR_BOTTOM);

    ser = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_RED), LV_CHART_AXIS_
↪PRIMARY_Y);
    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_chart_set_next_value(chart, ser, lv_rand(10, 90));
    }

    lv_chart_set_zoom_x(chart, 500);

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Click on a point");
    lv_obj_align_to(label, chart, LV_ALIGN_OUT_TOP_MID, 0, -5);
}

#endif
```

```
class ExampleChart_6():

    def __init__(self):
        self.last_id = -1
        #
        # Show cursor on the clicked point
        #

        chart = lv.chart(lv.scr_act())
        chart.set_size(200, 150)
        chart.align(lv.ALIGN.CENTER, 0, -10)
```

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```
        chart.set_axis_tick(lv.chart.AXIS.PRIMARY_Y, 10, 5, 6, 5, True, 40)
        chart.set_axis_tick(lv.chart.AXIS.PRIMARY_X, 10, 5, 10, 1, True, 30)

        chart.add_event(self.event_cb, lv.EVENT.ALL, None)
        chart.refresh_ext_draw_size()

        self.cursor = chart.add_cursor(lv.palette_main(lv.PALETTE.BLUE), lv.DIR.LEFT␣
↪| lv.DIR.BOTTOM)

        self.ser = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.
↪PRIMARY_Y)

        self.ser_p = []
        for i in range(10):
            self.ser_p.append(lv.rand(10,90))
        self.ser.y_points = self.ser_p

        newser = chart.get_series_next(None)
        # print("length of data points: ",len(newser.points))
        chart.set_zoom_x(500)

        label = lv.label(lv.scr_act())
        label.set_text("Click on a point")
        label.align_to(chart, lv.ALIGN.OUT_TOP_MID, 0, -5)


    def event_cb(self,e):

        code = e.get_code()
        chart = e.get_target_obj()

        if code == lv.EVENT.VALUE_CHANGED:
            # print("last_id: ",self.last_id)
            self.last_id = chart.get_pressed_point()
            if self.last_id != lv.CHART_POINT_NONE:
                p = lv.point_t()
                chart.get_point_pos_by_id(self.ser, self.last_id, p)
                chart.set_cursor_point(self.cursor, None, self.last_id)

        elif code == lv.EVENT.DRAW_PART_END:
            # print("EVENT.DRAW_PART_END")
            dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
            # if dsc.p1 and dsc.p2:
                # print("p1, p2", dsc.p1,dsc.p2)
                # print("p1.y, p2.y", dsc.p1.y, dsc.p2.y)
                # print("last_id: ",self.last_id)
            if dsc.part == lv.PART.CURSOR and dsc.p1 and dsc.p2 and dsc.p1.y == dsc.
↪p2.y and self.last_id >= 0:

                v = self.ser_p[self.last_id]

                # print("value: ",v)
                value_txt = str(v)
                size = lv.point_t()
                lv.txt_get_size(size, value_txt, lv.font_default(), 0, 0, lv.COORD.
↪MAX, lv.TEXT_FLAG.NONE)
```

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```
                a = lv.area_t()
                a.y2 = dsc.p1.y - 5
                a.y1 = a.y2 - size.y - 10
                a.x1 = dsc.p1.x + 10
                a.x2 = a.x1 + size.x + 10

                draw_rect_dsc = lv.draw_rect_dsc_t()
                draw_rect_dsc.init()
                draw_rect_dsc.bg_color = lv.palette_main(lv.PALETTE.BLUE)
                draw_rect_dsc.radius = 3

                lv.draw_rect(a, dsc.clip_area, draw_rect_dsc)

                draw_label_dsc = lv.draw_label_dsc_t()
                draw_label_dsc.init()
                draw_label_dsc.color = lv.color_white()
                a.x1 += 5
                a.x2 -= 5
                a.y1 += 5
                a.y2 -= 5
                lv.draw_label(a, dsc.clip_area, draw_label_dsc, value_txt, None)

example_chart_6 = ExampleChart_6()
```

Scatter chart

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_BUILD_EXAMPLES

static void draw_event_cb(lv_event_t * e)
{
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->part == LV_PART_ITEMS) {
        lv_obj_t * obj = lv_event_get_target(e);
        lv_chart_series_t * ser = lv_chart_get_series_next(obj, NULL);
        uint32_t cnt = lv_chart_get_point_count(obj);
        /*Make older value more transparent*/
        dsc->rect_dsc->bg_opa = (LV_OPA_COVER *  dsc->id) / (cnt - 1);

        /*Make smaller values blue, higher values red*/
        lv_coord_t * x_array = lv_chart_get_x_array(obj, ser);
        lv_coord_t * y_array = lv_chart_get_y_array(obj, ser);
        /*dsc->id is the tells drawing order, but we need the ID of the point being␣
↪drawn.*/
        uint32_t start_point = lv_chart_get_x_start_point(obj, ser);
        uint32_t p_act = (start_point + dsc->id) % cnt; /*Consider start point to get␣
↪the index of the array*/
        lv_opa_t x_opa = (x_array[p_act] * LV_OPA_50) / 200;
        lv_opa_t y_opa = (y_array[p_act] * LV_OPA_50) / 1000;

        dsc->rect_dsc->bg_color = lv_color_mix(lv_palette_main(LV_PALETTE_RED),
                                               lv_palette_main(LV_PALETTE_BLUE),
                                               x_opa + y_opa);
    }
}
```

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```c
static void add_data(lv_timer_t * timer)
{
    LV_UNUSED(timer);
    lv_obj_t * chart = timer->user_data;
    lv_chart_set_next_value2(chart, lv_chart_get_series_next(chart, NULL), lv_rand(0,␣
↪200), lv_rand(0, 1000));
}

/**
 * A scatter chart
 */
void lv_example_chart_7(void)
{
    lv_obj_t * chart = lv_chart_create(lv_scr_act());
    lv_obj_set_size(chart, 200, 150);
    lv_obj_align(chart, LV_ALIGN_CENTER, 0, 0);
    lv_obj_add_event(chart, draw_event_cb, LV_EVENT_DRAW_PART_BEGIN, NULL);
    lv_obj_set_style_line_width(chart, 0, LV_PART_ITEMS);   /*Remove the lines*/

    lv_chart_set_type(chart, LV_CHART_TYPE_SCATTER);

    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_X, 5, 5, 5, 1, true, 30);
    lv_chart_set_axis_tick(chart, LV_CHART_AXIS_PRIMARY_Y, 10, 5, 6, 5, true, 50);

    lv_chart_set_range(chart, LV_CHART_AXIS_PRIMARY_X, 0, 200);
    lv_chart_set_range(chart, LV_CHART_AXIS_PRIMARY_Y, 0, 1000);

    lv_chart_set_point_count(chart, 50);

    lv_chart_series_t * ser = lv_chart_add_series(chart, lv_palette_main(LV_PALETTE_
↪RED), LV_CHART_AXIS_PRIMARY_Y);
    uint32_t i;
    for(i = 0; i < 50; i++) {
        lv_chart_set_next_value2(chart, ser, lv_rand(0, 200), lv_rand(0, 1000));
    }

    lv_timer_create(add_data, 100, chart);
}

#endif
```

```python
#!/opt/bin/lv_micropython -i
import utime as time
import lvgl as lv

def draw_event_cb(e):
    dsc = e.get_draw_part_dsc()
    if dsc.part == lv.PART.ITEMS:
        obj = e.get_target_obj()
        ser = obj.get_series_next(None)
        cnt = obj.get_point_count()
        # print("cnt: ",cnt)
        # Make older value more transparent
        dsc.rect_dsc.bg_opa = (lv.OPA.COVER *  dsc.id) // (cnt - 1)
```

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```
        # Make smaller values blue, higher values red
        # x_array = chart.get_x_array(ser)
        # y_array = chart.get_y_array(ser)
        # dsc->id is the tells drawing order, but we need the ID of the point being␣
↪drawn.
        start_point = chart.get_x_start_point(ser)
        # print("start point: ",start_point)
        p_act = (start_point + dsc.id) % cnt # Consider start point to get the index␣
↪of the array
        # print("p_act", p_act)
        x_opa = (x_array[p_act] * lv.OPA._50) // 200
        y_opa = (y_array[p_act] * lv.OPA._50) // 1000

        dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.RED).color_mix(
                                            lv.palette_main(lv.PALETTE.BLUE),
                                            x_opa + y_opa)

def add_data(timer,chart):
    # print("add_data")
    x = lv.rand(0,200)
    y = lv.rand(0,1000)
    chart.set_next_value2(ser, x, y)
    # chart.set_next_value2(chart.gx, y)
    x_array.pop(0)
    x_array.append(x)
    y_array.pop(0)
    y_array.append(y)

#
# A scatter chart
#

chart = lv.chart(lv.scr_act())
chart.set_size(200, 150)
chart.align(lv.ALIGN.CENTER, 0, 0)
chart.add_event(draw_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)
chart.set_style_line_width(0, lv.PART.ITEMS)   # Remove the lines

chart.set_type(lv.chart.TYPE.SCATTER)

chart.set_axis_tick(lv.chart.AXIS.PRIMARY_X, 5, 5, 5, 1, True, 30)
chart.set_axis_tick(lv.chart.AXIS.PRIMARY_Y, 10, 5, 6, 5, True, 50)

chart.set_range(lv.chart.AXIS.PRIMARY_X, 0, 200)
chart.set_range(lv.chart.AXIS.PRIMARY_Y, 0, 1000)

chart.set_point_count(50)

ser = chart.add_series(lv.palette_main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)

x_array = []
y_array = []
for i in range(50):
    x_array.append(lv.rand(0, 200))
    y_array.append(lv.rand(0, 1000))

ser.x_points = x_array
```

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```
ser.y_points = y_array

# Create an `lv_timer` to update the chart.

timer = lv.timer_create_basic()
timer.set_period(100)
timer.set_cb(lambda src: add_data(timer,chart))
```

Stacked area chart

```
#include "../../lv_examples.h"
#if LV_USE_CHART && LV_USE_DRAW_MASKS && LV_BUILD_EXAMPLES

/*  A struct is used to keep track of the series list because later we need to draw␣
↪to the series in the reverse order to which they were initialised. */
typedef struct {
    lv_obj_t * obj;
    lv_chart_series_t * series_list[3];
} stacked_area_chart_t;

static stacked_area_chart_t stacked_area_chart;

/**
 * Callback which draws the blocks of colour under the lines
 **/
static void draw_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);

    /*Add the faded area before the lines are drawn*/
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    if(dsc->part == LV_PART_ITEMS) {
        if(!dsc->p1 || !dsc->p2)
            return;

        /*Add a line mask that keeps the area below the line*/
        lv_draw_mask_line_param_t line_mask_param;
        lv_draw_mask_line_points_init(&line_mask_param, dsc->p1->x, dsc->p1->y, dsc->
↪p2->x, dsc->p2->y,
                                      LV_DRAW_MASK_LINE_SIDE_BOTTOM);
        int16_t line_mask_id = lv_draw_mask_add(&line_mask_param, NULL);

        /*Draw a rectangle that will be affected by the mask*/
        lv_draw_rect_dsc_t draw_rect_dsc;
        lv_draw_rect_dsc_init(&draw_rect_dsc);
        draw_rect_dsc.bg_opa = LV_OPA_COVER;
        draw_rect_dsc.bg_color = dsc->line_dsc->color;

        lv_area_t a;
        a.x1 = dsc->p1->x;
        a.x2 = dsc->p2->x;
        a.y1 = LV_MIN(dsc->p1->y, dsc->p2->y);
        a.y2 = obj->coords.y2 -
               13; /* -13 cuts off where the rectangle draws over the chart margin.␣
↪Without this an area of 0 doesn't look like 0 */
```

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```
        lv_draw_rect(dsc->draw_ctx, &draw_rect_dsc, &a);

        /*Remove the mask*/
        lv_draw_mask_free_param(&line_mask_param);
        lv_draw_mask_remove_id(line_mask_id);
    }
}

/**
 * Helper function to round a fixed point number
 **/
static int32_t round_fixed_point(int32_t n, int8_t shift)
{
    /* Create a bitmask to isolates the decimal part of the fixed point number */
    int32_t mask = 1;
    for(int32_t bit_pos = 0; bit_pos < shift; bit_pos++) {
        mask = (mask << 1) + 1;
    }

    int32_t decimal_part = n & mask;

    /* Get 0.5 as fixed point */
    int32_t rounding_boundary = 1 << (shift - 1);

    /* Return either the integer part of n or the integer part + 1 */
    return (decimal_part < rounding_boundary) ? (n & ~mask) : ((n >> shift) + 1) <<␣
↪shift;
}

/**
 * Stacked area chart
 */
void lv_example_chart_8(void)
{
    /*Create a stacked_area_chart.obj*/
    stacked_area_chart.obj = lv_chart_create(lv_scr_act());
    lv_obj_set_size(stacked_area_chart.obj, 200, 150);
    lv_obj_center(stacked_area_chart.obj);
    lv_chart_set_type(stacked_area_chart.obj, LV_CHART_TYPE_LINE);
    lv_chart_set_div_line_count(stacked_area_chart.obj, 5, 7);
    lv_obj_add_event(stacked_area_chart.obj, draw_event_cb, LV_EVENT_DRAW_PART_BEGIN,␣
↪NULL);

    /* Set range to 0 to 100 for percentages. Draw ticks */
    lv_chart_set_range(stacked_area_chart.obj, LV_CHART_AXIS_PRIMARY_Y, 0, 100);
    lv_chart_set_axis_tick(stacked_area_chart.obj, LV_CHART_AXIS_PRIMARY_Y, 3, 0, 5,␣
↪1, true, 30);

    /*Set point size to 0 so the lines are smooth */
    lv_obj_set_style_size(stacked_area_chart.obj, 0, 0, LV_PART_INDICATOR);

    /*Add some data series*/
    stacked_area_chart.series_list[0] = lv_chart_add_series(stacked_area_chart.obj,␣
↪lv_palette_main(LV_PALETTE_RED),
                                                            LV_CHART_AXIS_PRIMARY_Y);
    stacked_area_chart.series_list[1] = lv_chart_add_series(stacked_area_chart.obj,␣
↪lv_palette_main(LV_PALETTE_BLUE),
```

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```
                                                          LV_CHART_AXIS_PRIMARY_Y);
    stacked_area_chart.series_list[2] = lv_chart_add_series(stacked_area_chart.obj,␣
↪lv_palette_main(LV_PALETTE_GREEN),
                                                          LV_CHART_AXIS_PRIMARY_Y);

    for(int point = 0; point < 10; point++) {
        /* Make some random data */
        uint32_t vals[3] = {lv_rand(10, 20), lv_rand(20, 30), lv_rand(20, 30)};

        int8_t fixed_point_shift = 5;
        uint32_t total = vals[0] + vals[1] + vals[2];
        uint32_t draw_heights[3];
        uint32_t int_sum = 0;
        uint32_t decimal_sum = 0;

        /* Fixed point cascade rounding ensures percentages add to 100 */
        for(int32_t series_index = 0; series_index < 3; series_index++) {
            decimal_sum += (((vals[series_index] * 100) << fixed_point_shift) /␣
↪total);
            int_sum += (vals[series_index] * 100) / total;

            int32_t modifier = (round_fixed_point(decimal_sum, fixed_point_shift) >>␣
↪fixed_point_shift) - int_sum;

            /*  The draw heights are equal to the percentage of the total each value␣
↪is + the cumulative sum of the previous percentages.
                The accumulation is how the values get "stacked" */
            draw_heights[series_index] = int_sum + modifier;

            /*  Draw to the series in the reverse order to which they were␣
↪initialised.
                Without this the higher values will draw on top of the lower ones.
                This is because the Z-height of a series matches the order it was␣
↪initialised */
            lv_chart_set_next_value(stacked_area_chart.obj, stacked_area_chart.series_
↪list[3 - series_index - 1],
                                    draw_heights[series_index]);
        }
    }

    lv_chart_refresh(stacked_area_chart.obj);
}

#endif
```

```
import lvgl as lv

# A class is used to keep track of the series list because later we
#  need to draw to the series in the reverse order to which they were initialised.
class StackedAreaChart:
    def __init__(self):
        self.obj = None
        self.series_list = [None, None, None]

stacked_area_chart = StackedAreaChart()
```

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```
#
# Callback which draws the blocks of colour under the lines
#
def draw_event_cb(e):

    obj = e.get_target_obj()
    cont_a = lv.area_t()
    obj.get_coords(cont_a)

    #Add the faded area before the lines are drawn
    dsc = e.get_draw_part_dsc()
    if dsc.part == lv.PART.ITEMS:
        if not dsc.p1 or not dsc.p2:
            return

        # Add a line mask that keeps the area below the line
        line_mask_param = lv.draw_mask_line_param_t()
        line_mask_param.points_init(dsc.p1.x, dsc.p1.y, dsc.p2.x, dsc.p2.y, lv.DRAW_
↪MASK_LINE_SIDE.BOTTOM)
        line_mask_id = lv.draw_mask_add(line_mask_param, None)

        #Draw a rectangle that will be affected by the mask
        draw_rect_dsc = lv.draw_rect_dsc_t()
        draw_rect_dsc.init()
        draw_rect_dsc.bg_opa = lv.OPA.COVER
        draw_rect_dsc.bg_color = dsc.line_dsc.color

        a = lv.area_t()
        a.x1 = dsc.p1.x
        a.x2 = dsc.p2.x
        a.y1 = min(dsc.p1.y, dsc.p2.y)
        a.y2 = cont_a.y2 - 13 # -13 cuts off where the rectangle draws over the chart␣
↪margin. Without this an area of 0 doesn't look like 0
        dsc.draw_ctx.rect(draw_rect_dsc, a)

        # Remove the mask
        lv.draw_mask_free_param(line_mask_param)
        lv.draw_mask_remove_id(line_mask_id)


#
# Helper function to round a fixed point number
#
def round_fixed_point(n, shift):
    # Create a bitmask to isolates the decimal part of the fixed point number
    mask = 1
    for bit_pos in range(shift):
        mask = (mask << 1) + 1

    decimal_part = n & mask

    # Get 0.5 as fixed point
    rounding_boundary = 1 << (shift - 1)

    # Return either the integer part of n or the integer part + 1
    if decimal_part < rounding_boundary:
        return (n & ~mask)
```

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```
    return ((n >> shift) + 1) << shift


#
# Stacked area chart
#
def lv_example_chart_8():

    #Create a stacked_area_chart.obj
    stacked_area_chart.obj = lv.chart(lv.scr_act())
    stacked_area_chart.obj.set_size(200, 150)
    stacked_area_chart.obj.center()
    stacked_area_chart.obj.set_type( lv.chart.TYPE.LINE)
    stacked_area_chart.obj.set_div_line_count(5, 7)
    stacked_area_chart.obj.add_event( draw_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)

    # Set range to 0 to 100 for percentages. Draw ticks
    stacked_area_chart.obj.set_range(lv.chart.AXIS.PRIMARY_Y,0,100)
    stacked_area_chart.obj.set_axis_tick(lv.chart.AXIS.PRIMARY_Y, 3, 0, 5, 1, True,␣
↪30)

    #Set point size to 0 so the lines are smooth
    stacked_area_chart.obj.set_style_size(0, 0, lv.PART.INDICATOR)

    # Add some data series
    stacked_area_chart.series_list[0] = stacked_area_chart.obj.add_series(lv.palette_
↪main(lv.PALETTE.RED), lv.chart.AXIS.PRIMARY_Y)
    stacked_area_chart.series_list[1] = stacked_area_chart.obj.add_series(lv.palette_
↪main(lv.PALETTE.BLUE), lv.chart.AXIS.PRIMARY_Y)
    stacked_area_chart.series_list[2] = stacked_area_chart.obj.add_series(lv.palette_
↪main(lv.PALETTE.GREEN), lv.chart.AXIS.PRIMARY_Y)

    for point in range(10):
        # Make some random data
        vals = [lv.rand(10, 20), lv.rand(20, 30), lv.rand(20, 30)]

        fixed_point_shift = 5
        total = vals[0] + vals[1] + vals[2]
        draw_heights = [0, 0, 0]
        int_sum = 0
        decimal_sum = 0

        # Fixed point cascade rounding ensures percentages add to 100
        for series_index in range(3):
            decimal_sum += int(((vals[series_index] * 100) << fixed_point_shift) //␣
↪total)
            int_sum += int((vals[series_index] * 100) / total)

            modifier = (round_fixed_point(decimal_sum, fixed_point_shift) >> fixed_
↪point_shift) - int_sum

            #  The draw heights are equal to the percentage of the total each value␣
↪is + the cumulative sum of the previous percentages.
            #   The accumulation is how the values get "stacked"
            draw_heights[series_index] = int(int_sum + modifier)

            #  Draw to the series in the reverse order to which they were initialised.
```

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```
            #   Without this the higher values will draw on top of the lower ones.
            #   This is because the Z-height of a series matches the order it was␣
↪initialised
            stacked_area_chart.obj.set_next_value( stacked_area_chart.series_list[3 -␣
↪series_index - 1], draw_heights[series_index])

    stacked_area_chart.obj.refresh()

lv_example_chart_8()
```

6.8.7 API

Typedefs

typedef uint8_t **lv_chart_type_t**

typedef uint8_t **lv_chart_update_mode_t**

typedef uint8_t **lv_chart_axis_t**

Enums

enum **[anonymous]**

Chart types

Values:

enumerator **LV_CHART_TYPE_NONE**

Don't draw the series

enumerator **LV_CHART_TYPE_LINE**

Connect the points with lines

enumerator **LV_CHART_TYPE_BAR**

Draw columns

enumerator **LV_CHART_TYPE_SCATTER**

Draw points and lines in 2D (x,y coordinates)

enum **[anonymous]**

Chart update mode for `lv_chart_set_next`

Values:

enumerator **LV_CHART_UPDATE_MODE_SHIFT**

Shift old data to the left and add the new one the right enumerator **LV_CHART_UPDATE_MODE_CIRCULAR**

Add the new data in a circular way

enum **[anonymous]**

Enumeration of the axis'

Values:

enumerator **LV_CHART_AXIS_PRIMARY_Y**

enumerator **LV_CHART_AXIS_SECONDARY_Y**

enumerator **LV_CHART_AXIS_PRIMARY_X**

enumerator **LV_CHART_AXIS_SECONDARY_X**

enumerator **_LV_CHART_AXIS_LAST**

enum **lv_chart_draw_part_type_t**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_chart_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **LV_CHART_DRAW_PART_DIV_LINE_INIT**

Used before/after drawn the div lines

enumerator **LV_CHART_DRAW_PART_DIV_LINE_HOR**

Used for each horizontal division lines

enumerator **LV_CHART_DRAW_PART_DIV_LINE_VER**

Used for each vertical division lines

enumerator **LV_CHART_DRAW_PART_LINE_AND_POINT**

Used on line and scatter charts for lines and points

enumerator **LV_CHART_DRAW_PART_BAR**

Used on bar charts for the rectangles

enumerator **LV_CHART_DRAW_PART_CURSOR**

Used on cursor lines and points

enumerator **LV_CHART_DRAW_PART_TICK_LABEL**

Used on tick lines and labels

Functions

`LV_EXPORT_CONST_INT`(LV_CHART_POINT_NONE)

lv_obj_t ***`lv_chart_create`**(*lv_obj_t* *parent)

Create a chart object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new chart

Returns pointer to the created chart

void **`lv_chart_set_type`**(*lv_obj_t* *obj, *lv_chart_type_t* type)

Set a new type for a chart

Parameters

- **`obj`** -- pointer to a chart object
- **`type`** -- new type of the chart (from 'lv_chart_type_t' enum)

void **`lv_chart_set_point_count`**(*lv_obj_t* *obj, uint16_t cnt)

Set the number of points on a data line on a chart

Parameters

- **`obj`** -- pointer to a chart object
- **`cnt`** -- new number of points on the data lines

void **`lv_chart_set_range`**(*lv_obj_t* *obj, *lv_chart_axis_t* axis, lv_coord_t min, lv_coord_t max)

Set the minimal and maximal y values on an axis

Parameters

- **`obj`** -- pointer to a chart object
- **`axis`** -- `LV_CHART_AXIS_PRIMARY_Y` or `LV_CHART_AXIS_SECONDARY_Y`
- **`min`** -- minimum value of the y axis
- **`max`** -- maximum value of the y axis

void **`lv_chart_set_update_mode`**(*lv_obj_t* *obj, *lv_chart_update_mode_t* update_mode)

Set update mode of the chart object. Affects

Parameters

- **`obj`** -- pointer to a chart object
- **`mode`** -- the update mode

void **`lv_chart_set_div_line_count`**(*lv_obj_t* *obj, uint8_t hdiv, uint8_t vdiv)

Set the number of horizontal and vertical division lines

Parameters

- **`obj`** -- pointer to a chart object
- **`hdiv`** -- number of horizontal division lines
- **`vdiv`** -- number of vertical division lines

void **lv_chart_set_zoom_x**(*lv_obj_t* *obj, uint16_t zoom_x)

Zoom into the chart in X direction

Parameters

- **obj** -- pointer to a chart object
- **zoom_x** -- zoom in x direction. LV_ZOOM_NONE or 256 for no zoom, 512 double zoom

void **lv_chart_set_zoom_y**(*lv_obj_t* *obj, uint16_t zoom_y)

Zoom into the chart in Y direction

Parameters

- **obj** -- pointer to a chart object
- **zoom_y** -- zoom in y direction. LV_ZOOM_NONE or 256 for no zoom, 512 double zoom

uint16_t **lv_chart_get_zoom_x**(const *lv_obj_t* *obj)

Get X zoom of a chart

Parameters **obj** -- pointer to a chart object

Returns the X zoom value

uint16_t **lv_chart_get_zoom_y**(const *lv_obj_t* *obj)

Get Y zoom of a chart

Parameters **obj** -- pointer to a chart object

Returns the Y zoom value

void **lv_chart_set_axis_tick**(*lv_obj_t* *obj, *lv_chart_axis_t* axis, lv_coord_t major_len, lv_coord_t minor_len, lv_coord_t major_cnt, lv_coord_t minor_cnt, bool label_en, lv_coord_t draw_size)

Set the number of tick lines on an axis

Parameters

- **obj** -- pointer to a chart object
- **axis** -- an axis which ticks count should be set
- **major_len** -- length of major ticks
- **minor_len** -- length of minor ticks
- **major_cnt** -- number of major ticks on the axis
- **minor_cnt** -- number of minor ticks between two major ticks
- **label_en** -- true: enable label drawing on major ticks
- **draw_size** -- extra size required to draw the tick and labels (start with 20 px and increase if the ticks/labels are clipped)

lv_chart_type_t **lv_chart_get_type**(const *lv_obj_t* *obj)

Get the type of a chart

Parameters **obj** -- pointer to chart object

Returns type of the chart (from '*lv_chart_t*' enum) uint16_t **`lv_chart_get_point_count`**(const *lv_obj_t* *obj)

Get the data point number per data line on chart

Parameters **`chart`** -- pointer to chart object

Returns point number on each data line

uint16_t **`lv_chart_get_x_start_point`**(const *lv_obj_t* *obj, *lv_chart_series_t* *ser)

Get the current index of the x-axis start point in the data array

Parameters

- **`chart`** -- pointer to a chart object
- **`ser`** -- pointer to a data series on 'chart'

Returns the index of the current x start point in the data array

void **`lv_chart_get_point_pos_by_id`**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, uint16_t id, lv_point_t *p_out)

Get the position of a point to the chart.

Parameters

- **`chart`** -- pointer to a chart object
- **`ser`** -- pointer to series
- **`id`** -- the index.
- **`p_out`** -- store the result position here

void **`lv_chart_refresh`**(*lv_obj_t* *obj)

Refresh a chart if its data line has changed

Parameters **`chart`** -- pointer to chart object

lv_chart_series_t ***`lv_chart_add_series`**(*lv_obj_t* *obj, lv_color_t color, *lv_chart_axis_t* axis)

Allocate and add a data series to the chart

Parameters

- **`obj`** -- pointer to a chart object
- **`color`** -- color of the data series
- **`axis`** -- the y axis to which the series should be attached (::LV_CHART_AXIS_PRIMARY_Y or ::LV_CHART_AXIS_SECONDARY_Y)

Returns pointer to the allocated data series or NULL on failure

void **`lv_chart_remove_series`**(*lv_obj_t* *obj, *lv_chart_series_t* *series)

Deallocate and remove a data series from a chart

Parameters

- **`chart`** -- pointer to a chart object
- **`series`** -- pointer to a data series on 'chart'

void **`lv_chart_hide_series`**(*lv_obj_t* *chart, *lv_chart_series_t* *series, bool hide)

Hide/Unhide a single series of a chart.

Parameters

- **`obj`** -- pointer to a chart object.
- **`series`** -- pointer to a series object

- **hide** -- true: hide the series

void **lv_chart_set_series_color**(*lv_obj_t* *chart, *lv_chart_series_t* *series, lv_color_t color)

Change the color of a series

Parameters

- **obj** -- pointer to a chart object.
- **series** -- pointer to a series object
- **color** -- the new color of the series

void **lv_chart_set_x_start_point**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, uint16_t id)

Set the index of the x-axis start point in the data array. This point will be considers the first (left) point and the other points will be drawn after it.

Parameters

- **obj** -- pointer to a chart object
- **ser** -- pointer to a data series on 'chart'
- **id** -- the index of the x point in the data array

lv_chart_series_t ***lv_chart_get_series_next**(const *lv_obj_t* *chart, const *lv_chart_series_t* *ser)

Get the next series.

Parameters

- **chart** -- pointer to a chart
- **ser** -- the previous series or NULL to get the first

Returns the next series or NULL if there is no more.

lv_chart_cursor_t ***lv_chart_add_cursor**(*lv_obj_t* *obj, lv_color_t color, lv_dir_t dir)

Add a cursor with a given color

Parameters

- **obj** -- pointer to chart object
- **color** -- color of the cursor
- **dir** -- direction of the cursor. `LV_DIR_RIGHT/LEFT/TOP/DOWN/HOR/VER/ALL`. OR-ed values are possible

Returns pointer to the created cursor

void **lv_chart_set_cursor_pos**(*lv_obj_t* *chart, *lv_chart_cursor_t* *cursor, lv_point_t *pos)

Set the coordinate of the cursor with respect to the paddings

Parameters

- **obj** -- pointer to a chart object
- **cursor** -- pointer to the cursor
- **pos** -- the new coordinate of cursor relative to the chart

void **lv_chart_set_cursor_point**(*lv_obj_t* *chart, *lv_chart_cursor_t* *cursor, *lv_chart_series_t* *ser, uint16_t point_id)

Stick the cursor to a point

Parameters

- **obj** -- pointer to a chart object
- **cursor** -- pointer to the cursor
- **ser** -- pointer to a series
- **point_id** -- the point's index or `LV_CHART_POINT_NONE` to not assign to any points.

lv_point_t **lv_chart_get_cursor_point**(*lv_obj_t* *chart, *lv_chart_cursor_t* *cursor)

Get the coordinate of the cursor with respect to the paddings

Parameters

- **obj** -- pointer to a chart object
- **cursor** -- pointer to cursor

Returns coordinate of the cursor as lv_point_t

void **lv_chart_set_all_value**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, lv_coord_t value)

Initialize all data points of a series with a value

Parameters

- **obj** -- pointer to chart object
- **ser** -- pointer to a data series on 'chart'
- **value** -- the new value for all points. `LV_CHART_POINT_NONE` can be used to hide the points.

void **lv_chart_set_next_value**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, lv_coord_t value)

Set the next point's Y value according to the update mode policy.

Parameters

- **obj** -- pointer to chart object
- **ser** -- pointer to a data series on 'chart'
- **value** -- the new value of the next data

void **lv_chart_set_next_value2**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, lv_coord_t x_value, lv_coord_t y_value)

Set the next point's X and Y value according to the update mode policy.

Parameters

- **obj** -- pointer to chart object
- **ser** -- pointer to a data series on 'chart'
- **x_value** -- the new X value of the next data
- **y_value** -- the new Y value of the next data

void **lv_chart_set_value_by_id**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, uint16_t id, lv_coord_t value)

Set an individual point's y value of a chart's series directly based on its index

Parameters

- **obj** -- pointer to a chart object
- **ser** -- pointer to a data series on 'chart'
- **id** -- the index of the x point in the array
- **value** -- value to assign to array point

void **lv_chart_set_value_by_id2**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, uint16_t id, lv_coord_t x_value, lv_coord_t y_value)

Set an individual point's x and y value of a chart's series directly based on its index Can be used only with `LV_CHART_TYPE_SCATTER`.

Parameters

- **obj** -- pointer to chart object
- **ser** -- pointer to a data series on 'chart'
- **id** -- the index of the x point in the array
- **x_value** -- the new X value of the next data
- **y_value** -- the new Y value of the next data

void **lv_chart_set_ext_y_array**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, lv_coord_t array[])

Set an external array for the y data points to use for the chart NOTE: It is the users responsibility to make sure the `point_cnt` matches the external array size.

Parameters

- **obj** -- pointer to a chart object
- **ser** -- pointer to a data series on 'chart'
- **array** -- external array of points for chart

void **lv_chart_set_ext_x_array**(*lv_obj_t* *obj, *lv_chart_series_t* *ser, lv_coord_t array[])

Set an external array for the x data points to use for the chart NOTE: It is the users responsibility to make sure the `point_cnt` matches the external array size.

Parameters

- **obj** -- pointer to a chart object
- **ser** -- pointer to a data series on 'chart'
- **array** -- external array of points for chart

lv_coord_t ***lv_chart_get_y_array**(const *lv_obj_t* *obj, *lv_chart_series_t* *ser)

Get the array of y values of a series

Parameters

- **obj** -- pointer to a chart object
- **ser** -- pointer to a data series on 'chart'

Returns the array of values with 'point_count' elements

lv_coord_t ***lv_chart_get_x_array**(const *lv_obj_t* *obj, *lv_chart_series_t* *ser)

Get the array of x values of a series

Parameters

- **obj** -- pointer to a chart object
- **ser** -- pointer to a data series on 'chart'

Returns the array of values with 'point_count' elements uint32_t **lv_chart_get_pressed_point**(const *lv_obj_t* *obj)

Get the index of the currently pressed point. It's the same for every series.

Parameters **obj** -- pointer to a chart object

Returns the index of the point [0 .. point count] or LV_CHART_POINT_ID_NONE if no point is being pressed

Variables

const lv_obj_class_t **lv_chart_class**

struct **lv_chart_series_t**

#include <lv_chart.h> Descriptor a chart series

Public Members

lv_coord_t ***x_points**

lv_coord_t ***y_points**

lv_color_t **color**

uint16_t **start_point**

uint8_t **hidden**

uint8_t **x_ext_buf_assigned**

uint8_t **y_ext_buf_assigned**

uint8_t **x_axis_sec**

uint8_t **y_axis_sec**

struct **lv_chart_cursor_t**

Public Members

lv_point_t **pos**

lv_coord_t **point_id**

lv_color_t **color**

lv_chart_series_t ***ser**

lv_dir_t **dir**

uint8_t **pos_set**

struct **lv_chart_tick_dsc_t**

Public Members

lv_coord_t **major_len**

lv_coord_t **minor_len**

lv_coord_t **draw_size**

uint32_t **minor_cnt**

uint32_t **major_cnt**

uint32_t **label_en**

struct **lv_chart_t**

Public Members

lv_obj_t **obj**

lv_ll_t **series_ll**

Linked list for the series (stores *lv_chart_series_t*)

lv_ll_t **cursor_ll**

Linked list for the cursors (stores *lv_chart_cursor_t*) *lv_chart_tick_dsc_t* **tick**[4]

lv_coord_t **ymin**[2]

lv_coord_t **ymax**[2]

lv_coord_t **xmin**[2]

lv_coord_t **xmax**[2]

lv_coord_t **pressed_point_id**

uint16_t **hdiv_cnt**

Number of horizontal division lines

uint16_t **vdiv_cnt**

Number of vertical division lines

uint16_t **point_cnt**

Point number in a data line

uint16_t **zoom_x**

uint16_t **zoom_y**

lv_chart_type_t **type**

Line or column chart

lv_chart_update_mode_t **update_mode**

6.9 Color wheel (lv_colorwheel)

6.9.1 Overview

As its name implies *Color wheel* allows the user to select a color. The Hue, Saturation and Value of the color can be selected separately.

Long pressing the object, the color wheel will change to the next parameter of the color (hue, saturation or value). A double click will reset the current parameter.

6.9.2 Parts and Styles

- `LV_PART_MAIN` Only `arc_width` is used to set the width of the color wheel
- `LV_PART_KNOB` A rectangle (or circle) drawn on the current value. It uses all the rectangle like style properties and padding to make it larger than the width of the arc.

6.9.3 Usage

Create a color wheel

`lv_colorwheel_create(parent, knob_recolor)` creates a new color wheel. With `knob_recolor=true` the knob's background color will be set to the current color.

Set color

The color can be set manually with `lv_colorwheel_set_hue/saturation/value(colorwheel, x)` or all at once with `lv_colorwheel_set_hsv(colorwheel, hsv)` or `lv_colorwheel_set_color(colorwheel, rgb)`

Color mode

The current color mode can be manually selected with `lv_colorwheel_set_mode(colorwheel, LV_COLORWHEEL_MODE_HUE/SATURATION/VALUE)`.

The color mode can be fixed (so as to not change with long press) using `lv_colorwheel_set_mode_fixed(colorwheel, true)`

6.9.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent if a new color is selected.

Learn more about *Events*.

6.9.5 Keys

- `LV_KEY_UP`, `LV_KEY_RIGHT` Increment the current parameter's value by 1
- `LV_KEY_DOWN`, `LV_KEY_LEFT` Decrement the current parameter's value by 1
- `LV_KEY_ENTER` A long press will show the next mode. Double click to reset the current parameter.

Learn more about *Keys*.

6.9.6 Example

Simple Colorwheel

```c
#include "../../lv_examples.h"
#if LV_USE_COLORWHEEL && LV_BUILD_EXAMPLES

void lv_example_colorwheel_1(void)
{
    lv_obj_t * cw;

    cw = lv_colorwheel_create(lv_scr_act(), true);
    lv_obj_set_size(cw, 200, 200);
    lv_obj_center(cw);
}

#endif
```

```python
cw = lv.colorwheel(lv.scr_act(), True)
cw.set_size(200, 200)
cw.center()
```

6.9.7 API

Typedefs

typedef uint8_t **lv_colorwheel_mode_t**

Enums

enum **[anonymous]**

Values:

enumerator **LV_COLORWHEEL_MODE_HUE**

enumerator **LV_COLORWHEEL_MODE_SATURATION**

enumerator **LV_COLORWHEEL_MODE_VALUE**

Functions

lv_obj_t ***lv_colorwheel_create**(*lv_obj_t* *parent, bool knob_recolor)

Create a color picker object with disc shape

Parameters

- **parent** -- pointer to an object, it will be the parent of the new color picker
- **knob_recolor** -- true: set the knob's color to the current color

Returns pointer to the created color picker

bool **lv_colorwheel_set_hsv**(*lv_obj_t* *obj, *lv_color_hsv_t* hsv)

Set the current hsv of a color wheel.

Parameters

- **colorwheel** -- pointer to color wheel object
- **color** -- current selected hsv

Returns true if changed, otherwise false

bool **lv_colorwheel_set_rgb**(*lv_obj_t* *obj, lv_color_t color)

Set the current color of a color wheel.

Parameters

- **colorwheel** -- pointer to color wheel object
- **color** -- current selected color

Returns true if changed, otherwise false

void **lv_colorwheel_set_mode**(*lv_obj_t* *obj, *lv_colorwheel_mode_t* mode)

Set the current color mode.

Parameters

- **colorwheel** -- pointer to color wheel object
- **mode** -- color mode (hue/sat/val)

void **lv_colorwheel_set_mode_fixed**(*lv_obj_t* *obj, bool fixed)

Set if the color mode is changed on long press on center

Parameters

- **colorwheel** -- pointer to color wheel object
- **fixed** -- color mode cannot be changed on long press

lv_color_hsv_t **lv_colorwheel_get_hsv**(*lv_obj_t* *obj)

Get the current selected hsv of a color wheel.

Parameters **colorwheel** -- pointer to color wheel object

Returns current selected hsv

lv_color_t **lv_colorwheel_get_rgb**(*lv_obj_t* *obj)

Get the current selected color of a color wheel.

Parameters **colorwheel** -- pointer to color wheel object

Returns color current selected color *lv_colorwheel_mode_t* **`lv_colorwheel_get_color_mode`**(*lv_obj_t* *obj)

Get the current color mode.

Parameters **`colorwheel`** -- pointer to color wheel object

Returns color mode (hue/sat/val)

bool **`lv_colorwheel_get_color_mode_fixed`**(*lv_obj_t* *obj)

Get if the color mode is changed on long press on center

Parameters **`colorwheel`** -- pointer to color wheel object

Returns mode cannot be changed on long press

Variables

const lv_obj_class_t **`lv_colorwheel_class`**

struct **`lv_colorwheel_t`**

Public Members

lv_obj_t **`obj`**

lv_color_hsv_t **`hsv`**

lv_point_t **`pos`**

uint8_t **`recolor`**

struct *lv_colorwheel_t*::[anonymous] **`knob`**

uint32_t **`last_click_time`**

uint32_t **`last_change_time`**

lv_point_t **`last_press_point`**

lv_colorwheel_mode_t **`mode`**

uint8_t **`mode_fixed`**

6.10 Canvas (lv_canvas)

6.10.1 Overview

A Canvas inherits from *Image* where the user can draw anything. Rectangles, texts, images, lines, arcs can be drawn here using lvgl's drawing engine. Additionally "effects" can be applied, such as rotation, zoom and blur.

6.10.2 Parts and Styles

`LV_PART_MAIN` Uses the typical rectangle style properties and image style properties.

6.10.3 Usage

Buffer

The Canvas needs a buffer in which stores the drawn image. To assign a buffer to a Canvas, use `lv_canvas_set_buffer(canvas, buffer, width, height, LV_IMG_CF_...)`. Where `buffer` is a static buffer (not just a local variable) to hold the image of the canvas. For example, `static uint8_t buffer[LV_CANVAS_BUF_SIZE_TRUE_COLOR(width, height)]`. `LV_CANVAS_BUF_SIZE_...` macros help to determine the size of the buffer with different color formats.

The canvas supports all the built-in color formats like `LV_IMG_CF_TRUE_COLOR` or `LV_IMG_CF_INDEXED_2BIT`. See the full list in the Color formats section.

Indexed colors

For `LV_IMG_CF_INDEXED_1/2/4/8` color formats a palette needs to be initialized with `lv_canvas_set_palette(canvas, 3, LV_COLOR_RED)`. It sets pixels with *index=3* to red.

Drawing

To set a pixel's color on the canvas, use `lv_canvas_set_px_color(canvas, x, y, LV_COLOR_RED)`. With `LV_IMG_CF_INDEXED_...` the index of the color needs to be passed as color. E.g. `lv_color_t c; c.full = 3;`

To set a pixel's opacity with `LV_IMG_CF_TRUE_COLOR_ALPHA` or `LV_IMG_CF_ALPHA_...` format on the canvas, use `lv_canvas_set_px_opa(canvas, x, y, opa)`.

`lv_canvas_fill_bg(canvas, LV_COLOR_BLUE, LV_OPA_50)` fills the whole canvas to blue with 50% opacity. Note that if the current color format doesn't support colors (e.g. `LV_IMG_CF_ALPHA_2BIT`) the color will be ignored. Similarly, if opacity is not supported (e.g. `LV_IMG_CF_TRUE_COLOR`) it will be ignored.

An array of pixels can be copied to the canvas with `lv_canvas_copy_buf(canvas, buffer_to_copy, x, y, width, height)`. The color format of the buffer and the canvas need to match.

To draw something to the canvas use

- `lv_canvas_draw_rect(canvas, x, y, width, heigth, &draw_dsc)`
- `lv_canvas_draw_text(canvas, x, y, max_width, &draw_dsc, txt)`
- `lv_canvas_draw_img(canvas, x, y, &img_src, &draw_dsc)`
- `lv_canvas_draw_line(canvas, point_array, point_cnt, &draw_dsc)`

- `lv_canvas_draw_polygon(canvas, points_array, point_cnt, &draw_dsc)`
- `lv_canvas_draw_arc(canvas, x, y, radius, start_angle, end_angle, &draw_dsc)`

`draw_dsc` is a `lv_draw_rect/label/img/line/arc_dsc_t` variable which should be first initialized with one of `lv_draw_rect/label/img/line/arc_dsc_init()` and then modified with the desired colors and other values.

The draw function can draw to any color format. For example, it's possible to draw a text to an `LV_IMG_VF_ALPHA_8BIT` canvas and use the result image as a *draw mask* later.

Transformations

`lv_canvas_transform()` can be used to rotate and/or scale the image of an image and store the result on the canvas. The function needs the following parameters:

- `canvas` pointer to a canvas object to store the result of the transformation.
- `img pointer` to an image descriptor to transform. Can be the image descriptor of another canvas too (`lv_canvas_get_img()`).
- `angle` the angle of rotation (0..3600), 0.1 deg resolution
- `zoom` zoom factor (256: no zoom, 512: double size, 128: half size);
- `offset_x` offset X to tell where to put the result data on destination canvas
- `offset_y` offset X to tell where to put the result data on destination canvas
- `pivot_x` pivot X of rotation. Relative to the source canvas. Set to `source width / 2` to rotate around the center
- `pivot_y` pivot Y of rotation. Relative to the source canvas. Set to `source height / 2` to rotate around the center
- `antialias` true: apply anti-aliasing during the transformation. Looks better but slower.

Note that a canvas can't be rotated on itself. You need a source and destination canvas or image.

Blur

A given area of the canvas can be blurred horizontally with `lv_canvas_blur_hor(canvas, &area, r)` or vertically with `lv_canvas_blur_ver(canvas, &area, r)`. `r` is the radius of the blur (greater value means more intensive burring). `area` is the area where the blur should be applied (interpreted relative to the canvas).

6.10.4 Events

No special events are sent by canvas objects. The same events are sent as for the

See the events of the *Images* too.

Learn more about *Events*.

6.10.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.10.6 Example

Drawing on the Canvas and rotate

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES


#define CANVAS_WIDTH  200
#define CANVAS_HEIGHT  150

void lv_example_canvas_1(void)
{
    lv_draw_rect_dsc_t rect_dsc;
    lv_draw_rect_dsc_init(&rect_dsc);
    rect_dsc.radius = 10;
    rect_dsc.bg_opa = LV_OPA_COVER;
    rect_dsc.bg_grad.dir = LV_GRAD_DIR_HOR;
    rect_dsc.bg_grad.stops[0].color = lv_palette_main(LV_PALETTE_RED);
    rect_dsc.bg_grad.stops[1].color = lv_palette_main(LV_PALETTE_BLUE);
    rect_dsc.border_width = 2;
    rect_dsc.border_opa = LV_OPA_90;
    rect_dsc.border_color = lv_color_white();
    rect_dsc.shadow_width = 5;
    rect_dsc.shadow_ofs_x = 5;
    rect_dsc.shadow_ofs_y = 5;

    lv_draw_label_dsc_t label_dsc;
    lv_draw_label_dsc_init(&label_dsc);
    label_dsc.color = lv_palette_main(LV_PALETTE_ORANGE);

    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_obj_center(canvas);
    lv_canvas_fill_bg(canvas, lv_palette_lighten(LV_PALETTE_GREY, 3), LV_OPA_COVER);

    lv_canvas_draw_rect(canvas, 70, 60, 100, 70, &rect_dsc);

    lv_canvas_draw_text(canvas, 40, 20, 100, &label_dsc, "Some text on text canvas");

    /*Test the rotation. It requires another buffer where the original image is␣
↪stored.
     *So copy the current image to buffer and rotate it to the canvas*/
    static uint8_t cbuf_tmp[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_
↪HEIGHT)];
    memcpy(cbuf_tmp, cbuf, sizeof(cbuf_tmp));
    lv_img_dsc_t img;
```

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```
    img.data = (void *)cbuf_tmp;
    img.header.cf = LV_COLOR_FORMAT_NATIVE;
    img.header.w = CANVAS_WIDTH;
    img.header.h = CANVAS_HEIGHT;

    lv_canvas_fill_bg(canvas, lv_palette_lighten(LV_PALETTE_GREY, 3), LV_OPA_COVER);
    lv_canvas_transform(canvas, &img, 120, LV_ZOOM_NONE, 0, 0, CANVAS_WIDTH / 2,␣
↪CANVAS_HEIGHT / 2, true);
}

#endif
```

```
_CANVAS_WIDTH = 200
_CANVAS_HEIGHT = 150
LV_ZOOM_NONE = 256

rect_dsc = lv.draw_rect_dsc_t()
rect_dsc.init()
rect_dsc.radius = 10
rect_dsc.bg_opa = lv.OPA.COVER
rect_dsc.bg_grad.dir = lv.GRAD_DIR.HOR
rect_dsc.bg_grad.stops[0].color = lv.palette_main(lv.PALETTE.RED)
rect_dsc.bg_grad.stops[1].color = lv.palette_main(lv.PALETTE.BLUE)
rect_dsc.border_width = 2
rect_dsc.border_opa = lv.OPA._90
rect_dsc.border_color = lv.color_white()
rect_dsc.shadow_width = 5
rect_dsc.shadow_ofs_x = 5
rect_dsc.shadow_ofs_y = 5

label_dsc = lv.draw_label_dsc_t()
label_dsc.init()
label_dsc.color = lv.palette_main(lv.PALETTE.YELLOW)

cbuf = bytearray(_CANVAS_WIDTH * _CANVAS_HEIGHT * 4)

canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, _CANVAS_WIDTH, _CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.center()
canvas.fill_bg(lv.palette_lighten(lv.PALETTE.GREY, 3), lv.OPA.COVER)

canvas.draw_rect(70, 60, 100, 70, rect_dsc)
canvas.draw_text(40, 20, 100, label_dsc, "Some text on text canvas")

# Test the rotation. It requires another buffer where the original image is stored.
# So copy the current image to buffer and rotate it to the canvas

img = lv.img_dsc_t()
img.data = cbuf[:]
img.header.cf = lv.COLOR_FORMAT.NATIVE
img.header.w = _CANVAS_WIDTH
img.header.h = _CANVAS_HEIGHT

canvas.fill_bg(lv.palette_lighten(lv.PALETTE.GREY, 3), lv.OPA.COVER)
canvas.transform(img, 30, LV_ZOOM_NONE, 0, 0, _CANVAS_WIDTH // 2, _CANVAS_HEIGHT // 2,
↪ True)
```

Transparent Canvas with chroma keying

```c
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Create a transparent canvas with Chroma keying and indexed color format (palette).
 */
void lv_example_canvas_2(void)
{
    /*Create a button to better see the transparency*/
    lv_btn_create(lv_scr_act());

    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_INDEXED_1BIT(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪I1);
    lv_canvas_set_palette(canvas, 0, lv_color_to32(LV_COLOR_CHROMA_KEY));
    lv_canvas_set_palette(canvas, 1, lv_color_to32(lv_palette_main(LV_PALETTE_RED)));

    /*Create colors with the indices of the palette*/
    lv_color_t c0;
    lv_color_t c1;

    lv_color_set_int(&c0, 0);
    lv_color_set_int(&c1, 1);

    /*Red background (There is no dedicated alpha channel in indexed images so LV_OPA_
↪COVER is ignored)*/
    lv_canvas_fill_bg(canvas, c1, LV_OPA_COVER);

    /*Create hole on the canvas*/
    uint32_t x;
    uint32_t y;
    for(y = 10; y < 30; y++) {
        for(x = 5; x < 20; x++) {
            lv_canvas_set_px(canvas, x, y, c0, LV_OPA_COVER);
        }
    }
}
#endif
```

```python
import math

CANVAS_WIDTH   = 50
CANVAS_HEIGHT  = 50
LV_COLOR_CHROMA_KEY = lv.color_hex(0x00ff00)

def LV_IMG_BUF_SIZE_ALPHA_1BIT(w, h):
    return int(math.floor((w + 7) / 8 ) * h)
```

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```
def LV_IMG_BUF_SIZE_INDEXED_1BIT(w, h):
    return LV_IMG_BUF_SIZE_ALPHA_1BIT(w, h) + 4 * 2

def LV_CANVAS_BUF_SIZE_INDEXED_1BIT(w, h):
    return LV_IMG_BUF_SIZE_INDEXED_1BIT(w, h)

#
# Create a transparent canvas with Chroma keying and indexed color format (palette).
#

# Create a button to better see the transparency
btn=lv.btn(lv.scr_act())

# Create a buffer for the canvas
cbuf= bytearray(LV_CANVAS_BUF_SIZE_INDEXED_1BIT(CANVAS_WIDTH, CANVAS_HEIGHT))

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.I1)
canvas.set_palette(0, LV_COLOR_CHROMA_KEY)
canvas.set_palette(1, lv.palette_main(lv.PALETTE.RED))

# Create colors with the indices of the palette
c0 = lv.color_t()
c1 = lv.color_t()

c0.set_int(0)
c1.set_int(1)

# Red background (There is no dedicated alpha channel in indexed images so LV_OPA_
↪COVER is ignored)
canvas.fill_bg(c1, lv.OPA.COVER)

# Create hole on the canvas
for y in range(10,30):
    for x in range(5,20):
        canvas.set_px(x, y, c0, lv.OPA.COVER)
```

Draw a rectangle to the canvas

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw a rectangle to the canvas
 */
void lv_example_canvas_3(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
```

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```
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_rect_dsc_t dsc;
    lv_draw_rect_dsc_init(&dsc);
    dsc.bg_color = lv_palette_main(LV_PALETTE_RED);
    dsc.border_color = lv_palette_main(LV_PALETTE_BLUE);
    dsc.border_width = 3;
    dsc.outline_color = lv_palette_main(LV_PALETTE_GREEN);
    dsc.outline_width = 2;
    dsc.outline_pad = 2;
    dsc.outline_opa = LV_OPA_50;
    dsc.radius = 5;
    dsc.border_width = 3;
    lv_canvas_draw_rect(canvas, 10, 10, 30, 20, &dsc);


}
#endif
```

```
CANVAS_WIDTH  = 50
CANVAS_HEIGHT =  50

LV_COLOR_SIZE = 32
#
# Draw a rectangle to the canvas
#
# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette*/
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)

canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_rect_dsc_t()
dsc.init()

dsc.bg_color = lv.palette_main(lv.PALETTE.RED)
dsc.border_color = lv.palette_main(lv.PALETTE.BLUE)
dsc.border_width = 3
dsc.outline_color = lv.palette_main(lv.PALETTE.GREEN)
dsc.outline_width = 2
dsc.outline_pad = 2
dsc.outline_opa = lv.OPA._50
dsc.radius = 5
dsc.border_width = 3
canvas.draw_rect(10, 10, 30, 20, dsc)
```

Draw a label to the canvas

```c
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_FONT_MONTSERRAT_18 && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw a text to the canvas
 */
void lv_example_canvas_4(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_label_dsc_t dsc;
    lv_draw_label_dsc_init(&dsc);
    dsc.color = lv_palette_main(LV_PALETTE_RED);
    dsc.font = &lv_font_montserrat_18;
    dsc.decor = LV_TEXT_DECOR_UNDERLINE;

    lv_canvas_draw_text(canvas, 10, 10, 30, &dsc, "Hello");
}
#endif
```

```python
import fs_driver

CANVAS_WIDTH  = 50
CANVAS_HEIGHT = 50

LV_COLOR_SIZE = 32

#
# Draw a text to the canvas
#

# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_label_dsc_t()
dsc.init()

dsc.color = lv.palette_main(lv.PALETTE.RED)
```

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```
try:
    dsc.font = lv_font_montserrat_18
except:
    # needed for dynamic font loading
    fs_drv = lv.fs_drv_t()
    fs_driver.fs_register(fs_drv, 'S')

    print("Loading font montserrat_18")
    font_montserrat_18 = lv.font_load("S:../../assets/font/montserrat-18.fnt")
    if not font_montserrat_18:
        print("Font loading failed")
    else:
        dsc.font = font_montserrat_18

dsc.decor = lv.TEXT_DECOR.UNDERLINE
print('Printing "Hello"')
canvas.draw_text(10, 10, 30, dsc, "Hello")
```

Draw an arc to the canvas

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw an arc to the canvas
 */
void lv_example_canvas_5(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_arc_dsc_t dsc;
    lv_draw_arc_dsc_init(&dsc);
    dsc.color = lv_palette_main(LV_PALETTE_RED);
    dsc.width = 5;

    lv_canvas_draw_arc(canvas, 25, 25, 15, 0, 220, &dsc);
}
#endif
```

```
CANVAS_WIDTH  = 50
```

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```
CANVAS_HEIGHT = 50

LV_COLOR_SIZE = 32

#
# Draw an arc to the canvas
#

# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_arc_dsc_t()
dsc.init()
dsc.color = lv.palette_main(lv.PALETTE.RED)
dsc.width = 5

canvas.draw_arc(25, 25, 15, 0, 220, dsc)
```

Draw an image to the canvas

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS && LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw an image to the canvas
 */
void lv_example_canvas_6(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_img_dsc_t dsc;
    lv_draw_img_dsc_init(&dsc);

    LV_IMG_DECLARE(img_star);
    lv_canvas_draw_img(canvas, 5, 5, &img_star, &dsc);
}
#endif
```

```
CANVAS_WIDTH  = 50
CANVAS_HEIGHT = 50

LV_COLOR_SIZE = 32

# Create an image from the png file
try:
    with open('../../assets/img_star.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find star.png")
    sys.exit()

img_star_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

#
# Draw an image to the canvas
#

# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_img_dsc_t()
dsc.init()

canvas.draw_img(5, 5, img_star_argb, dsc)
```

Draw a line to the canvas

```
#include "../../lv_examples.h"
#if LV_USE_CANVAS&& LV_BUILD_EXAMPLES

#define CANVAS_WIDTH  50
#define CANVAS_HEIGHT  50

/**
 * Draw a line to the canvas
 */
void lv_example_canvas_7(void)
{
    /*Create a buffer for the canvas*/
    static uint8_t cbuf[LV_CANVAS_BUF_SIZE_TRUE_COLOR(CANVAS_WIDTH, CANVAS_HEIGHT)];

    /*Create a canvas and initialize its palette*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
```

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```
    lv_canvas_set_buffer(canvas, cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, LV_COLOR_FORMAT_
↪NATIVE);
    lv_canvas_fill_bg(canvas, lv_color_hex3(0xccc), LV_OPA_COVER);
    lv_obj_center(canvas);

    lv_draw_line_dsc_t dsc;
    lv_draw_line_dsc_init(&dsc);
    dsc.color = lv_palette_main(LV_PALETTE_RED);
    dsc.width = 4;
    dsc.round_end = 1;
    dsc.round_start = 1;

    lv_point_t p[] = {{15, 15}, {35, 10}, {10, 40}};
    lv_canvas_draw_line(canvas, p, 3, &dsc);
}
#endif
```

```
CANVAS_WIDTH  = 50
CANVAS_HEIGHT = 50

LV_COLOR_SIZE = 32

#
# Draw a line to the canvas
#

# Create a buffer for the canvas
cbuf = bytearray((LV_COLOR_SIZE // 8) * CANVAS_WIDTH * CANVAS_HEIGHT)

# Create a canvas and initialize its palette
canvas = lv.canvas(lv.scr_act())
canvas.set_buffer(cbuf, CANVAS_WIDTH, CANVAS_HEIGHT, lv.COLOR_FORMAT.NATIVE)
canvas.fill_bg(lv.color_hex3(0xccc), lv.OPA.COVER)
canvas.center()

dsc = lv.draw_line_dsc_t()
dsc.init()

dsc.color = lv.palette_main(lv.PALETTE.RED)
dsc.width = 4
dsc.round_end = 1
dsc.round_start = 1

p = [ {"x":15,"y":15},
      {"x":35,"y":10},
      {"x":10,"y":40} ]

canvas.draw_line(p, 3, dsc)
```

6.10.7 API

Functions

lv_obj_t ***lv_canvas_create**(*lv_obj_t* *parent)

Create a canvas object

Parameters **parent** -- pointer to an object, it will be the parent of the new canvas

Returns pointer to the created canvas

void **lv_canvas_set_buffer**(*lv_obj_t* *canvas, void *buf, lv_coord_t w, lv_coord_t h, *lv_color_format_t* cf)

Set a buffer for the canvas.

Parameters

- **buf** -- a buffer where the content of the canvas will be. The required size is (lv_img_color_format_get_px_size(cf) * w) / 8 * h) It can be allocated with `lv_malloc()` or it can be statically allocated array (e.g. static lv_color_t buf[100*50]) or it can be an address in RAM or external SRAM
- **canvas** -- pointer to a canvas object
- **w** -- width of the canvas
- **h** -- height of the canvas
- **cf** -- color format. `LV_IMG_CF_...`

void **lv_canvas_set_px**(*lv_obj_t* *obj, lv_coord_t x, lv_coord_t y, lv_color_t color, lv_opa_t opa)

void **lv_canvas_set_palette**(*lv_obj_t* *canvas, uint8_t id, *lv_color32_t* c)

Set the palette color of a canvas with index format. Valid only for `LV_IMG_CF_INDEXED1/2/4/8`

Parameters

- **canvas** -- pointer to canvas object
- **id** -- the palette color to set:
  - for `LV_IMG_CF_INDEXED1`: 0..1
  - for `LV_IMG_CF_INDEXED2`: 0..3
  - for `LV_IMG_CF_INDEXED4`: 0..15
  - for `LV_IMG_CF_INDEXED8`: 0..255
- **c** -- the color to set

void **lv_canvas_get_px**(*lv_obj_t* *obj, lv_coord_t x, lv_coord_t y, lv_color_t *color, lv_opa_t *opa)

lv_img_dsc_t ***lv_canvas_get_img**(*lv_obj_t* *canvas)

Get the image of the canvas as a pointer to an *`lv_img_dsc_t`* variable.

Parameters **canvas** -- pointer to a canvas object

Returns pointer to the image descriptor.

void **lv_canvas_copy_buf**(*lv_obj_t* *canvas, const void *to_copy, lv_coord_t x, lv_coord_t y, lv_coord_t w, lv_coord_t h)

Copy a buffer to the canvas

Parameters

- **`canvas`** -- pointer to a canvas object
- **`to_copy`** -- buffer to copy. The color format has to match with the canvas's buffer color format
- **`x`** -- left side of the destination position
- **`y`** -- top side of the destination position
- **`w`** -- width of the buffer to copy
- **`h`** -- height of the buffer to copy

void **`lv_canvas_transform`**(*lv_obj_t* *canvas, *lv_img_dsc_t* *img, int16_t angle, uint16_t zoom, lv_coord_t offset_x, lv_coord_t offset_y, int32_t pivot_x, int32_t pivot_y, bool antialias)

Transform and image and store the result on a canvas.

Parameters

- **`canvas`** -- pointer to a canvas object to store the result of the transformation.
- **`img`** -- pointer to an image descriptor to transform. Can be the image descriptor of an other canvas too (`lv_canvas_get_img()`).
- **`angle`** -- the angle of rotation (0..3600), 0.1 deg resolution
- **`zoom`** -- zoom factor (256 no zoom);
- **`offset_x`** -- offset X to tell where to put the result data on destination canvas
- **`offset_y`** -- offset X to tell where to put the result data on destination canvas
- **`pivot_x`** -- pivot X of rotation. Relative to the source canvas Set to `source width / 2` to rotate around the center
- **`pivot_y`** -- pivot Y of rotation. Relative to the source canvas Set to `source height / 2` to rotate around the center
- **`antialias`** -- apply anti-aliasing during the transformation. Looks better but slower.

void **`lv_canvas_blur_hor`**(*lv_obj_t* *canvas, const lv_area_t *area, uint16_t r)

Apply horizontal blur on the canvas

Parameters

- **`canvas`** -- pointer to a canvas object
- **`area`** -- the area to blur. If `NULL` the whole canvas will be blurred.
- **`r`** -- radius of the blur

void **`lv_canvas_blur_ver`**(*lv_obj_t* *canvas, const lv_area_t *area, uint16_t r)

Apply vertical blur on the canvas

Parameters

- **`canvas`** -- pointer to a canvas object
- **`area`** -- the area to blur. If `NULL` the whole canvas will be blurred.
- **`r`** -- radius of the blur

void **`lv_canvas_fill_bg`**(*lv_obj_t* *canvas, lv_color_t color, lv_opa_t opa)

Fill the canvas with color

Parameters

- **canvas** -- pointer to a canvas
- **color** -- the background color
- **opa** -- the desired opacity

void **lv_canvas_draw_rect**(*lv_obj_t* *canvas, lv_coord_t x, lv_coord_t y, lv_coord_t w, lv_coord_t h, const lv_draw_rect_dsc_t *draw_dsc)

Draw a rectangle on the canvas

Parameters

- **canvas** -- pointer to a canvas object
- **x** -- left coordinate of the rectangle
- **y** -- top coordinate of the rectangle
- **w** -- width of the rectangle
- **h** -- height of the rectangle
- **draw_dsc** -- descriptor of the rectangle

void **lv_canvas_draw_text**(*lv_obj_t* *canvas, lv_coord_t x, lv_coord_t y, lv_coord_t max_w, lv_draw_label_dsc_t *draw_dsc, const char *txt)

Draw a text on the canvas.

Parameters

- **canvas** -- pointer to a canvas object
- **x** -- left coordinate of the text
- **y** -- top coordinate of the text
- **max_w** -- max width of the text. The text will be wrapped to fit into this size
- **draw_dsc** -- pointer to a valid label descriptor `lv_draw_label_dsc_t`
- **txt** -- text to display

void **lv_canvas_draw_img**(*lv_obj_t* *canvas, lv_coord_t x, lv_coord_t y, const void *src, const lv_draw_img_dsc_t *draw_dsc)

Draw an image on the canvas

Parameters

- **canvas** -- pointer to a canvas object
- **x** -- left coordinate of the image
- **y** -- top coordinate of the image
- **src** -- image source. Can be a pointer an `lv_img_dsc_t` variable or a path an image.
- **draw_dsc** -- pointer to a valid label descriptor `lv_draw_img_dsc_t`

void **lv_canvas_draw_line**(*lv_obj_t* *canvas, const lv_point_t points[], uint32_t point_cnt, const lv_draw_line_dsc_t *draw_dsc)

Draw a line on the canvas

Parameters

- **canvas** -- pointer to a canvas object
- **points** -- point of the line

- **`point_cnt`** -- number of points
- **`draw_dsc`** -- pointer to an initialized `lv_draw_line_dsc_t` variable

void **`lv_canvas_draw_polygon`**(*lv_obj_t* *canvas, const lv_point_t points[], uint32_t point_cnt, const lv_draw_rect_dsc_t *draw_dsc)

Draw a polygon on the canvas

Parameters

- **`canvas`** -- pointer to a canvas object
- **`points`** -- point of the polygon
- **`point_cnt`** -- number of points
- **`draw_dsc`** -- pointer to an initialized `lv_draw_rect_dsc_t` variable

void **`lv_canvas_draw_arc`**(*lv_obj_t* *canvas, lv_coord_t x, lv_coord_t y, lv_coord_t r, int32_t start_angle, int32_t end_angle, const lv_draw_arc_dsc_t *draw_dsc)

Draw an arc on the canvas

Parameters

- **`canvas`** -- pointer to a canvas object
- **`x`** -- origo x of the arc
- **`y`** -- origo y of the arc
- **`r`** -- radius of the arc
- **`start_angle`** -- start angle in degrees
- **`end_angle`** -- end angle in degrees
- **`draw_dsc`** -- pointer to an initialized `lv_draw_line_dsc_t` variable

Variables

const lv_obj_class_t **`lv_canvas_class`**

struct **`lv_canvas_t`**

Public Members

lv_img_t **`img`**

lv_img_dsc_t **`dsc`**

6.11 Checkbox (lv_checkbox)

6.11.1 Overview

The Checkbox object is created from a "tick box" and a label. When the Checkbox is clicked the tick box is toggled.

6.11.2 Parts and Styles

- `LV_PART_MAIN` The is the background of the Checkbox and it uses the text and all the typical background style properties. `pad_column` adjusts the spacing between the tickbox and the label
- `LV_PART_INDICATOR` The "tick box" is a square that uses all the typical background style properties. By default, its size is equal to the height of the main part's font. Padding properties make the tick box larger in the respective directions.

The Checkbox is added to the default group (if it is set).

6.11.3 Usage

Text

The text can be modified with the `lv_checkbox_set_text(cb, "New text")` function and will be dynamically allocated.

To set a static text, use `lv_checkbox_set_static_text(cb, txt)`. This way, only a pointer to `txt` will be stored. The text then shouldn't be deallocated while the checkbox exists.

Check, uncheck, disable

You can manually check, un-check, and disable the Checkbox by using the common state add/clear function:

```
lv_obj_add_state(cb, LV_STATE_CHECKED);   /*Make the chekbox checked*/
lv_obj_clear_state(cb, LV_STATE_CHECKED); /*MAke the checkbox unchecked*/
lv_obj_add_state(cb, LV_STATE_CHECKED | LV_STATE_DISABLED); /*Make the checkbox␣
↪checked and disabled*/
```

To get whether the checkbox is checked or not use: `lv_obj_has_state(cb, LV_STATE_CHECKED)`.

6.11.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when the checkbox is toggled.
- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` are sent for the following types:
  - `LV_CHECKBOX_DRAW_PART_BOX` The tickbox of the checkbox
    - `part`: `LV_PART_INDICATOR`
    - `draw_area`: the area of the tickbox
    - `rect_dsc`

See the events of the *Base object* too.

Learn more about *Events*.

6.11.5 Keys

The following *Keys* are processed by the 'Buttons':

- LV_KEY_RIGHT/UP Go to toggled state if toggling is enabled
- LV_KEY_LEFT/DOWN Go to non-toggled state if toggling is enabled
- LV_KEY_ENTER Clicks the checkbox and toggles it

Note that, as usual, the state of LV_KEY_ENTER is translated to LV_EVENT_PRESSED/PRESSING/RELEASED etc.

Learn more about *Keys*.

6.11.6 Example

Simple Checkboxes

```
#include "../../lv_examples.h"
#if LV_USE_CHECKBOX && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        LV_UNUSED(obj);
        const char * txt = lv_checkbox_get_text(obj);
        const char * state = lv_obj_get_state(obj) & LV_STATE_CHECKED ? "Checked" :
↪"Unchecked";
        LV_UNUSED(txt);
        LV_UNUSED(state);
        LV_LOG_USER("%s: %s", txt, state);
    }
}

void lv_example_checkbox_1(void)
{
    lv_obj_set_flex_flow(lv_scr_act(), LV_FLEX_FLOW_COLUMN);
    lv_obj_set_flex_align(lv_scr_act(), LV_FLEX_ALIGN_CENTER, LV_FLEX_ALIGN_START, LV_
↪FLEX_ALIGN_CENTER);

    lv_obj_t * cb;
    cb = lv_checkbox_create(lv_scr_act());
    lv_checkbox_set_text(cb, "Apple");
    lv_obj_add_event(cb, event_handler, LV_EVENT_ALL, NULL);

    cb = lv_checkbox_create(lv_scr_act());
    lv_checkbox_set_text(cb, "Banana");
    lv_obj_add_state(cb, LV_STATE_CHECKED);
    lv_obj_add_event(cb, event_handler, LV_EVENT_ALL, NULL);

    cb = lv_checkbox_create(lv_scr_act());
    lv_checkbox_set_text(cb, "Lemon");
    lv_obj_add_state(cb, LV_STATE_DISABLED);
    lv_obj_add_event(cb, event_handler, LV_EVENT_ALL, NULL);
```

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```
    cb = lv_checkbox_create(lv_scr_act());
    lv_obj_add_state(cb, LV_STATE_CHECKED | LV_STATE_DISABLED);
    lv_checkbox_set_text(cb, "Melon\nand a new line");
    lv_obj_add_event(cb, event_handler, LV_EVENT_ALL, NULL);

    lv_obj_update_layout(cb);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        txt = obj.get_text()
        if obj.get_state() & lv.STATE.CHECKED:
            state = "Checked"
        else:
            state = "Unchecked"
        print(txt + ":" + state)


lv.scr_act().set_flex_flow(lv.FLEX_FLOW.COLUMN)
lv.scr_act().set_flex_align(lv.FLEX_ALIGN.CENTER, lv.FLEX_ALIGN.START, lv.FLEX_ALIGN.
↪CENTER)

cb = lv.checkbox(lv.scr_act())
cb.set_text("Apple")
cb.add_event(event_handler, lv.EVENT.ALL, None)

cb = lv.checkbox(lv.scr_act())
cb.set_text("Banana")
cb.add_state(lv.STATE.CHECKED)
cb.add_event(event_handler, lv.EVENT.ALL, None)

cb = lv.checkbox(lv.scr_act())
cb.set_text("Lemon")
cb.add_state(lv.STATE.DISABLED)
cb.add_event(event_handler, lv.EVENT.ALL, None)

cb = lv.checkbox(lv.scr_act())
cb.add_state(lv.STATE.CHECKED | lv.STATE.DISABLED)
cb.set_text("Melon")
cb.add_event(event_handler, lv.EVENT.ALL, None)

cb.update_layout()
```

Checkboxes as radio buttons

```c
#include "../../lv_examples.h"
#if LV_USE_CHECKBOX && LV_BUILD_EXAMPLES

static lv_style_t style_radio;
static lv_style_t style_radio_chk;
static uint32_t active_index_1 = 0;
static uint32_t active_index_2 = 0;

static void radio_event_handler(lv_event_t * e)
{
    uint32_t * active_id = lv_event_get_user_data(e);
    lv_obj_t * cont = lv_event_get_current_target(e);
    lv_obj_t * act_cb = lv_event_get_target(e);
    lv_obj_t * old_cb = lv_obj_get_child(cont, *active_id);

    /*Do nothing if the container was clicked*/
    if(act_cb == cont) return;

    lv_obj_clear_state(old_cb, LV_STATE_CHECKED);   /*Uncheck the previous radio␣
↪button*/
    lv_obj_add_state(act_cb, LV_STATE_CHECKED);     /*Uncheck the current radio␣
↪button*/

    *active_id = lv_obj_get_index(act_cb);

    LV_LOG_USER("Selected radio buttons: %d, %d", (int)active_index_1, (int)active_
↪index_2);
}


static void radiobutton_create(lv_obj_t * parent, const char * txt)
{
    lv_obj_t * obj = lv_checkbox_create(parent);
    lv_checkbox_set_text(obj, txt);
    lv_obj_add_flag(obj, LV_OBJ_FLAG_EVENT_BUBBLE);
    lv_obj_add_style(obj, &style_radio, LV_PART_INDICATOR);
    lv_obj_add_style(obj, &style_radio_chk, LV_PART_INDICATOR | LV_STATE_CHECKED);
}

/**
 * Checkboxes as radio buttons
 */
void lv_example_checkbox_2(void)
{
    /* The idea is to enable `LV_OBJ_FLAG_EVENT_BUBBLE` on checkboxes and process the
     * `LV_EVENT_CLICKED` on the container.
     * A variable is passed as event user data where the index of the active
     * radiobutton is saved */


    lv_style_init(&style_radio);
    lv_style_set_radius(&style_radio, LV_RADIUS_CIRCLE);

    lv_style_init(&style_radio_chk);
    lv_style_set_bg_img_src(&style_radio_chk, NULL);
```

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```
    uint32_t i;
    char buf[32];

    lv_obj_t * cont1 = lv_obj_create(lv_scr_act());
    lv_obj_set_flex_flow(cont1, LV_FLEX_FLOW_COLUMN);
    lv_obj_set_size(cont1, lv_pct(40), lv_pct(80));
    lv_obj_add_event(cont1, radio_event_handler, LV_EVENT_CLICKED, &active_index_1);

    for(i = 0; i < 5; i++) {
        lv_snprintf(buf, sizeof(buf), "A %d", (int)i + 1);
        radiobutton_create(cont1, buf);

    }
    /*Make the first checkbox checked*/
    lv_obj_add_state(lv_obj_get_child(cont1, 0), LV_STATE_CHECKED);

    lv_obj_t * cont2 = lv_obj_create(lv_scr_act());
    lv_obj_set_flex_flow(cont2, LV_FLEX_FLOW_COLUMN);
    lv_obj_set_size(cont2, lv_pct(40), lv_pct(80));
    lv_obj_set_x(cont2, lv_pct(50));
    lv_obj_add_event(cont2, radio_event_handler, LV_EVENT_CLICKED, &active_index_2);

    for(i = 0; i < 3; i++) {
        lv_snprintf(buf, sizeof(buf), "B %d", (int)i + 1);
        radiobutton_create(cont2, buf);
    }

    /*Make the first checkbox checked*/
    lv_obj_add_state(lv_obj_get_child(cont2, 0), LV_STATE_CHECKED);
}


#endif
```

```
import time

class LV_Example_Checkbox_2:
    def __init__(self):
        #
        # Checkboxes as radio buttons
        #
        # The idea is to enable `LV_OBJ_FLAG_EVENT_BUBBLE` on checkboxes and process␣
↪the
        #`LV.EVENT.CLICKED` on the container.
        # Since user_data cannot be used to pass parameters in MicroPython I use an␣
↪instance variable to
        # keep the index of the active button

        self.active_index_1 = 0
        self.active_index_2 = 0
        self.style_radio = lv.style_t()
        self.style_radio.init()
        self.style_radio.set_radius(lv.RADIUS_CIRCLE)

        self.style_radio_chk = lv.style_t()
```

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```
        self.style_radio_chk.init()
        self.style_radio_chk.init()
        self.style_radio_chk.set_bg_img_src(None)

        self.cont1 = lv.obj(lv.scr_act())
        self.cont1.set_flex_flow(lv.FLEX_FLOW.COLUMN)
        self.cont1.set_size(lv.pct(40), lv.pct(80))
        self.cont1.add_event(self.radio_event_handler, lv.EVENT.CLICKED, None)

        for i in range(5):
            txt = "A {:d}".format(i+1)
            self.radiobutton_create(self.cont1,txt)

        # Make the first checkbox checked
        #lv_obj_add_state(lv_obj_get_child(self.cont1, 0), LV_STATE_CHECKED);
        self.cont1.get_child(0).add_state(lv.STATE.CHECKED)

        self.cont2 = lv.obj(lv.scr_act())
        self.cont2.set_flex_flow(lv.FLEX_FLOW.COLUMN)
        self.cont2.set_size(lv.pct(40), lv.pct(80))
        self.cont2.set_x(lv.pct(50))
        self.cont2.add_event(self.radio_event_handler, lv.EVENT.CLICKED, None)

        for i in range(3):
            txt = "B {:d}".format(i+1)
            self.radiobutton_create(self.cont2,txt)

        # Make the first checkbox checked*/
        self.cont2.get_child(0).add_state(lv.STATE.CHECKED)


    def radio_event_handler(self,e):
        cont = e.get_current_target_obj()
        act_cb = e.get_target_obj()
        if cont == self.cont1:
            active_id = self.active_index_1
        else:
            active_id = self.active_index_2
        old_cb = cont.get_child(active_id)

        # Do nothing if the container was clicked
        if act_cb == cont:
            return

        old_cb.clear_state(lv.STATE.CHECKED)          # Uncheck the previous radio␣
↪button
        act_cb.add_state(lv.STATE.CHECKED)            # Uncheck the current radio␣
↪button

        if cont == self.cont1:
            self.active_index_1 = act_cb.get_index()
            # print("active index 1: ", self.active_index_1)
        else:
            self.active_index_2 = act_cb.get_index()
            # print("active index 2: ", self.active_index_2)

        print("Selected radio buttons: {:d}, {:d}".format(self.active_index_1, self.
↪active_index_2))
```

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```
    def radiobutton_create(self,parent, txt):
        obj = lv.checkbox(parent)
        obj.set_text(txt)
        obj.add_flag(lv.obj.FLAG.EVENT_BUBBLE)
        obj.add_style(self.style_radio, lv.PART.INDICATOR)
        obj.add_style(self.style_radio_chk, lv.PART.INDICATOR | lv.STATE.CHECKED)

lv_example_checkbox_2 = LV_Example_Checkbox_2()
```

6.11.7 API

Enums

enum **`lv_checkbox_draw_part_type_t`**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_checkbox_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **`LV_CHECKBOX_DRAW_PART_BOX`**

The tick box

Functions

lv_obj_t ***`lv_checkbox_create`**(*lv_obj_t* *parent)

Create a check box object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new button

Returns pointer to the created check box

void **`lv_checkbox_set_text`**(*lv_obj_t* *obj, const char *txt)

Set the text of a check box. `txt` will be copied and may be deallocated after this function returns.

Parameters

- **`cb`** -- pointer to a check box
- **`txt`** -- the text of the check box. NULL to refresh with the current text.

void **`lv_checkbox_set_text_static`**(*lv_obj_t* *obj, const char *txt)

Set the text of a check box. `txt` must not be deallocated during the life of this checkbox.

Parameters

- **`cb`** -- pointer to a check box
- **`txt`** -- the text of the check box.

const char ***`lv_checkbox_get_text`**(const *lv_obj_t* *obj)

Get the text of a check box

Parameters **`cb`** -- pointer to check box object

Returns pointer to the text of the check box

Variables

const lv_obj_class_t **`lv_checkbox_class`**

struct **`lv_checkbox_t`**

Public Members

lv_obj_t **`obj`**

char ***`txt`**

uint32_t **`static_txt`**

6.12 Drop-down list (lv_dropdown)

6.12.1 Overview

The drop-down list allows the user to select one value from a list.

The drop-down list is closed by default and displays a single value or a predefined text. When activated (by click on the drop-down list), a list is created from which the user may select one option. When the user selects a new value, the list is deleted again.

The Drop-down list is added to the default group (if it is set). Besides the Drop-down list is an editable object to allow selecting an option with encoder navigation too.

6.12.2 Parts and Styles

The Dropdown widget is built from the elements: "button" and "list" (both not related to the button and list widgets)

Button

- `LV_PART_MAIN` The background of the button. Uses the typical background properties and text properties for the text on it.
- `LV_PART_INDICATOR` Typically an arrow symbol that can be an image or a text (`LV_SYMBOL`).

The button goes to `LV_STATE_CHECKED` when it's opened.

List

- `LV_PART_MAIN` The list itself. Uses the typical background properties. `max_height` can be used to limit the height of the list.
- `LV_PART_SCROLLBAR` The scrollbar background, border, shadow properties and width (for its own width) and right padding for the spacing on the right.
- `LV_PART_SELECTED` Refers to the currently pressed, checked or pressed+checked option. Also uses the typical background properties.

The list is hidden/shown on open/close. To add styles to it use `lv_dropdown_get_list(dropdown)` to get the list object. For example:

```
lv_obj_t * list = lv_dropdown_get_list(dropdown) /*Get the list*/
lv_obj_add_style(list, &my_style, ...)           /*Add the styles to the list*/}`
```

Alternatively the theme can be extended with the new styles.

6.12.3 Usage

6.12.4 Overview

Set options

Options are passed to the drop-down list as a string with `lv_dropdown_set_options(dropdown, options)`. Options should be separated by `\n`. For example: `"First\nSecond\nThird"`. This string will be saved in the drop-down list, so it can in a local variable.

The `lv_dropdown_add_option(dropdown, "New option", pos)` function inserts a new option to `pos` index.

To save memory the options can set from a static(constant) string too with `lv_dropdown_set_static_options(dropdown, options)`. In this case the options string should be alive while the drop-down list exists and `lv_dropdown_add_option` can't be used

You can select an option manually with `lv_dropdown_set_selected(dropdown, id)`, where `id` is the index of an option.

Get selected option

The get the *index* of the selected option, use `lv_dropdown_get_selected(dropdown)`.

`lv_dropdown_get_selected_str(dropdown, buf, buf_size)` copies the *name* of the selected option to `buf`.

Direction

The list can be created on any side. The default `LV_DIR_BOTTOM` can be modified by `lv_dropdown_set_dir(dropdown, LV_DIR_LEFT/RIGHT/UP/BOTTOM)` function.

If the list would be vertically out of the screen, it will be aligned to the edge.

Symbol

A symbol (typically an arrow) can be added to the dropdown list with `lv_dropdown_set_symbol(dropdown, LV_SYMBOL_...)`

If the direction of the drop-down list is `LV_DIR_LEFT` the symbol will be shown on the left, otherwise on the right.

Show selected

The main part can either show the selected option or a static text. If a static is set with `lv_dropdown_set_text(dropdown, "Some text")` it will be shown regardless to th selected option. If the text is `NULL` the selected option is displayed on the button.

Manually open/close

To manually open or close the drop-down list the `lv_dropdown_open/close(dropdown)` function can be used.

6.12.5 Events

Apart from the Generic events, the following Special events are sent by the drop-down list:

- `LV_EVENT_VALUE_CHANGED` Sent when the new option is selected or the list is opened/closed.
- `LV_EVENT_CANCEL` Sent when the list is closed
- `LV_EVENT_READY` Sent when the list is opened

See the events of the *Base object* too.

Learn more about *Events*.

6.12.6 Keys

- `LV_KEY_RIGHT/DOWN` Select the next option.
- `LV_KEY_LEFT/UP` Select the previous option.
- `LY_KEY_ENTER` Apply the selected option (Sends `LV_EVENT_VALUE_CHANGED` event and closes the drop-down list).

Learn more about *Keys*.

6.12.7 Example

Simple Drop down list

```c
#include "../../lv_examples.h"
#if LV_USE_DROPDOWN && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        char buf[32];
        lv_dropdown_get_selected_str(obj, buf, sizeof(buf));
        LV_LOG_USER("Option: %s", buf);
    }
}

void lv_example_dropdown_1(void)
{

    /*Create a normal drop down list*/
    lv_obj_t * dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options(dd, "Apple\n"
                            "Banana\n"
                            "Orange\n"
                            "Cherry\n"
                            "Grape\n"
                            "Raspberry\n"
                            "Melon\n"
                            "Orange\n"
                            "Lemon\n"
                            "Nuts");

    lv_obj_align(dd, LV_ALIGN_TOP_MID, 0, 20);
    lv_obj_add_event(dd, event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```python
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        option = " "*10 # should be large enough to store the option
        obj.get_selected_str(option, len(option))
        # .strip() removes trailing spaces
        print("Option: \"%s\"" % option.strip())

# Create a normal drop down list
dd = lv.dropdown(lv.scr_act())
dd.set_options("\n".join([
    "Apple",
    "Banana",
    "Orange",
    "Cherry",
    "Grape",
```

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```
    "Raspberry",
    "Melon",
    "Orange",
    "Lemon",
    "Nuts"]))

dd.align(lv.ALIGN.TOP_MID, 0, 20)
dd.add_event(event_handler, lv.EVENT.ALL, None)
```

Drop down in four directions

```
#include "../../lv_examples.h"
#if LV_USE_DROPDOWN && LV_BUILD_EXAMPLES


/**
 * Create a drop down, up, left and right menus
 */
void lv_example_dropdown_2(void)
{
    static const char * opts = "Apple\n"
                               "Banana\n"
                               "Orange\n"
                               "Melon";

    lv_obj_t * dd;
    dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options_static(dd, opts);
    lv_obj_align(dd, LV_ALIGN_TOP_MID, 0, 10);

    dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options_static(dd, opts);
    lv_dropdown_set_dir(dd, LV_DIR_BOTTOM);
    lv_dropdown_set_symbol(dd, LV_SYMBOL_UP);
    lv_obj_align(dd, LV_ALIGN_BOTTOM_MID, 0, -10);

    dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options_static(dd, opts);
    lv_dropdown_set_dir(dd, LV_DIR_RIGHT);
    lv_dropdown_set_symbol(dd, LV_SYMBOL_RIGHT);
    lv_obj_align(dd, LV_ALIGN_LEFT_MID, 10, 0);

    dd = lv_dropdown_create(lv_scr_act());
    lv_dropdown_set_options_static(dd, opts);
    lv_dropdown_set_dir(dd, LV_DIR_LEFT);
    lv_dropdown_set_symbol(dd, LV_SYMBOL_LEFT);
    lv_obj_align(dd, LV_ALIGN_RIGHT_MID, -10, 0);
}

#endif
```

```
#
# Create a drop down, up, left and right menus
```

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```
#

opts = "\n".join([
    "Apple",
    "Banana",
    "Orange",
    "Melon",
    "Grape",
    "Raspberry"])

dd = lv.dropdown(lv.scr_act())
dd.set_options_static(opts)
dd.align(lv.ALIGN.TOP_MID, 0, 10)
dd = lv.dropdown(lv.scr_act())
dd.set_options_static(opts)
dd.set_dir(lv.DIR.BOTTOM)
dd.set_symbol(lv.SYMBOL.UP)
dd.align(lv.ALIGN.BOTTOM_MID, 0, -10)

dd = lv.dropdown(lv.scr_act())
dd.set_options_static(opts)
dd.set_dir(lv.DIR.RIGHT)
dd.set_symbol(lv.SYMBOL.RIGHT)
dd.align(lv.ALIGN.LEFT_MID, 10, 0)

dd = lv.dropdown(lv.scr_act())
dd.set_options_static(opts)
dd.set_dir(lv.DIR.LEFT)
dd.set_symbol(lv.SYMBOL.LEFT)
dd.align(lv.ALIGN.RIGHT_MID, -10, 0)
```

Menu

```
#include "../../lv_examples.h"
#if LV_USE_DROPDOWN && LV_BUILD_EXAMPLES

static void event_cb(lv_event_t * e)
{
    lv_obj_t * dropdown = lv_event_get_target(e);
    char buf[64];
    lv_dropdown_get_selected_str(dropdown, buf, sizeof(buf));
    LV_LOG_USER("'%s' is selected", buf);
}

/**
 * Create a menu from a drop-down list and show some drop-down list features and␣
↪styling
 */
void lv_example_dropdown_3(void)
{
    /*Create a drop down list*/
    lv_obj_t * dropdown = lv_dropdown_create(lv_scr_act());
    lv_obj_align(dropdown, LV_ALIGN_TOP_LEFT, 10, 10);
```

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```
    lv_dropdown_set_options(dropdown, "New project\n"
                            "New file\n"
                            "Save\n"
                            "Save as ...\n"
                            "Open project\n"
                            "Recent projects\n"
                            "Preferences\n"
                            "Exit");

    /*Set a fixed text to display on the button of the drop-down list*/
    lv_dropdown_set_text(dropdown, "Menu");

    /*Use a custom image as down icon and flip it when the list is opened*/
    LV_IMG_DECLARE(img_caret_down)
    lv_dropdown_set_symbol(dropdown, &img_caret_down);
    lv_obj_set_style_transform_angle(dropdown, 1800, LV_PART_INDICATOR | LV_STATE_
↪CHECKED);

    /*In a menu we don't need to show the last clicked item*/
    lv_dropdown_set_selected_highlight(dropdown, false);

    lv_obj_add_event(dropdown, event_cb, LV_EVENT_VALUE_CHANGED, NULL);
}

#endif
```

```
# Create an image from the png file
try:
    with open('../../assets/img_caret_down.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_caret_down.png")
    sys.exit()

img_caret_down_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def event_cb(e):
    dropdown = e.get_target_obj()
    option = " "*64 # should be large enough to store the option
    dropdown.get_selected_str(option, len(option))
    print(option.strip() +" is selected")
#
# Create a menu from a drop-down list and show some drop-down list features and␣
↪styling
#

# Create a drop down list
dropdown = lv.dropdown(lv.scr_act())
dropdown.align(lv.ALIGN.TOP_LEFT, 10, 10)
dropdown.set_options("\n".join([
    "New project",
    "New file",
    "Open project",
```

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```
    "Recent projects",
    "Preferences",
    "Exit"]))

# Set a fixed text to display on the button of the drop-down list
dropdown.set_text("Menu")

# Use a custom image as down icon and flip it when the list is opened
# LV_IMG_DECLARE(img_caret_down)
dropdown.set_symbol(img_caret_down_argb)
dropdown.set_style_transform_angle(1800, lv.PART.INDICATOR | lv.STATE.CHECKED)

# In a menu we don't need to show the last clicked item
dropdown.set_selected_highlight(False)

dropdown.add_event(event_cb, lv.EVENT.VALUE_CHANGED, None)
```

6.12.8 API

Functions

`LV_EXPORT_CONST_INT`(LV_DROPDOWN_POS_LAST)

lv_obj_t ***`lv_dropdown_create`**(*lv_obj_t* *parent)

Create a drop-down list object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new drop-down list

Returns pointer to the created drop-down list

void **`lv_dropdown_set_text`**(*lv_obj_t* *obj, const char *txt)

Set text of the drop-down list's button. If set to `NULL` the selected option's text will be displayed on the button. If set to a specific text then that text will be shown regardless of the selected option.

Parameters

- **`obj`** -- pointer to a drop-down list object
- **`txt`** -- the text as a string (Only its pointer is saved)

void **`lv_dropdown_set_options`**(*lv_obj_t* *obj, const char *options)

Set the options in a drop-down list from a string. The options will be copied and saved in the object so the `options` can be destroyed after calling this function

Parameters

- **`obj`** -- pointer to drop-down list object
- **`options`** -- a string with '

  ' separated options. E.g. "One\nTwo\nThree"

void **`lv_dropdown_set_options_static`**(*lv_obj_t* *obj, const char *options)

Set the options in a drop-down list from a static string (global, static or dynamically allocated). Only the pointer of the option string will be saved.

Parameters

- **obj** -- pointer to drop-down list object
- **options** -- a static string with '

  ' separated options. E.g. "One\nTwo\nThree"

void **lv_dropdown_add_option**(*lv_obj_t* *obj, const char *option, uint32_t pos)

Add an options to a drop-down list from a string. Only works for non-static options.

Parameters

- **obj** -- pointer to drop-down list object
- **option** -- a string without '

  '. E.g. "Four"
- **pos** -- the insert position, indexed from 0, LV_DROPDOWN_POS_LAST = end of string

void **lv_dropdown_clear_options**(*lv_obj_t* *obj)

Clear all options in a drop-down list. Works with both static and dynamic options.

Parameters **obj** -- pointer to drop-down list object

void **lv_dropdown_set_selected**(*lv_obj_t* *obj, uint16_t sel_opt)

Set the selected option

Parameters

- **obj** -- pointer to drop-down list object
- **sel_opt** -- id of the selected option (0 ... number of option - 1);

void **lv_dropdown_set_dir**(*lv_obj_t* *obj, lv_dir_t dir)

Set the direction of the a drop-down list

Parameters

- **obj** -- pointer to a drop-down list object
- **dir** -- LV_DIR_LEFT/RIGHT/TOP/BOTTOM

void **lv_dropdown_set_symbol**(*lv_obj_t* *obj, const void *symbol)

Set an arrow or other symbol to display when on drop-down list's button. Typically a down caret or arrow.

Note: angle and zoom transformation can be applied if the symbol is an image. E.g. when drop down is checked (opened) rotate the symbol by 180 degree

Parameters

- **obj** -- pointer to drop-down list object
- **symbol** -- a text like `LV_SYMBOL_DOWN`, an image (pointer or path) or NULL to not draw symbol icon

void **lv_dropdown_set_selected_highlight**(*lv_obj_t* *obj, bool en)

Set whether the selected option in the list should be highlighted or not

Parameters

- **obj** -- pointer to drop-down list object
- **en** -- true: highlight enabled; false: disabled

lv_obj_t ***lv_dropdown_get_list**(*lv_obj_t* *obj)

Get the list of a drop-down to allow styling or other modifications

Parameters **obj** -- pointer to a drop-down list object

Returns pointer to the list of the drop-down

const char ***lv_dropdown_get_text**(*lv_obj_t* *obj)

Get text of the drop-down list's button.

Parameters **obj** -- pointer to a drop-down list object

Returns the text as string, `NULL` if no text

const char ***lv_dropdown_get_options**(const *lv_obj_t* *obj)

Get the options of a drop-down list

Parameters **obj** -- pointer to drop-down list object

Returns

the options separated by '

'-s (E.g. "Option1\nOption2\nOption3")

uint16_t **lv_dropdown_get_selected**(const *lv_obj_t* *obj)

Get the index of the selected option

Parameters **obj** -- pointer to drop-down list object

Returns index of the selected option (0 ... number of option - 1);

uint16_t **lv_dropdown_get_option_cnt**(const *lv_obj_t* *obj)

Get the total number of options

Parameters **obj** -- pointer to drop-down list object

Returns the total number of options in the list

void **lv_dropdown_get_selected_str**(const *lv_obj_t* *obj, char *buf, uint32_t buf_size)

Get the current selected option as a string

Parameters

- **obj** -- pointer to drop-down object
- **buf** -- pointer to an array to store the string
- **buf_size** -- size of `buf` in bytes. 0: to ignore it.

int32_t **lv_dropdown_get_option_index**(*lv_obj_t* *obj, const char *option)

Get the index of an option.

Parameters

- **obj** -- pointer to drop-down object
- **option** -- an option as string

Returns index of `option` in the list of all options. -1 if not found.

const char ***lv_dropdown_get_symbol**(*lv_obj_t* *obj)

Get the symbol on the drop-down list. Typically a down caret or arrow.

Parameters **obj** -- pointer to drop-down list object

Returns the symbol or NULL if not enabled bool **`lv_dropdown_get_selected_highlight`**(*lv_obj_t* *obj)

Get whether the selected option in the list should be highlighted or not

Parameters **`obj`** -- pointer to drop-down list object

Returns true: highlight enabled; false: disabled

lv_dir_t **`lv_dropdown_get_dir`**(const *lv_obj_t* *obj)

Get the direction of the drop-down list

Parameters **`obj`** -- pointer to a drop-down list object

Returns LV_DIR_LEF/RIGHT/TOP/BOTTOM

void **`lv_dropdown_open`**(*lv_obj_t* *dropdown_obj)

Open the drop.down list

Parameters **`obj`** -- pointer to drop-down list object

void **`lv_dropdown_close`**(*lv_obj_t* *obj)

Close (Collapse) the drop-down list

Parameters **`obj`** -- pointer to drop-down list object

bool **`lv_dropdown_is_open`**(*lv_obj_t* *obj)

Tells whether the list is opened or not

Parameters **`obj`** -- pointer to a drop-down list object

Returns true if the list os opened

Variables

const lv_obj_class_t **`lv_dropdown_class`**

const lv_obj_class_t **`lv_dropdownlist_class`**

struct **`lv_dropdown_t`**

Public Members

lv_obj_t **`obj`**

lv_obj_t ***`list`**

The dropped down list

const char ***`text`**

Text to display on the dropdown's button

const void ***`symbol`**

Arrow or other icon when the drop-down list is closed char ***options**

Options in a '

' separated list

uint16_t **option_cnt**

Number of options

uint16_t **sel_opt_id**

Index of the currently selected option

uint16_t **sel_opt_id_orig**

Store the original index on focus

uint16_t **pr_opt_id**

Index of the currently pressed option

lv_dir_t **dir**

Direction in which the list should open

uint8_t **static_txt**

1: Only a pointer is saved in `options`

uint8_t **selected_highlight**

1: Make the selected option highlighted in the list

struct **lv_dropdown_list_t**

Public Members

lv_obj_t **obj**

lv_obj_t ***dropdown**

6.13 Image (lv_img)

6.13.1 Overview

Images are the basic object to display images from flash (as arrays) or from files. Images can display symbols (`LV_SYMBOL_...`) too.

Using the Image decoder interface custom image formats can be supported as well.

6.13.2 Parts and Styles

- `LV_PART_MAIN` A background rectangle that uses the typical background style properties and the image itself using the image style properties.

6.13.3 Usage

Image source

To provide maximum flexibility, the source of the image can be:

- a variable in code (a C array with the pixels).
- a file stored externally (e.g. on an SD card).
- a text with *Symbols*.

To set the source of an image, use `lv_img_set_src(img, src)`.

To generate a pixel array from a PNG, JPG or BMP image, use the Online image converter tool and set the converted image with its pointer: `lv_img_set_src(img1, &converted_img_var);` To make the variable visible in the C file, you need to declare it with `LV_IMG_DECLARE(converted_img_var)`.

To use external files, you also need to convert the image files using the online converter tool but now you should select the binary output format. You also need to use LVGL's file system module and register a driver with some functions for the basic file operation. Go to the *File system* to learn more. To set an image sourced from a file, use `lv_img_set_src(img, "S:folder1/my_img.bin")`.

You can also set a symbol similarly to *Labels*. In this case, the image will be rendered as text according to the *font* specified in the style. It enables to use of light-weight monochrome "letters" instead of real images. You can set symbol like `lv_img_set_src(img1, LV_SYMBOL_OK)`.

Label as an image

Images and labels are sometimes used to convey the same thing. For example, to describe what a button does. Therefore, images and labels are somewhat interchangeable, that is the images can display texts by using `LV_SYMBOL_DUMMY` as the prefix of the text. For example, `lv_img_set_src(img, LV_SYMBOL_DUMMY "Some text")`.

Transparency

The internal (variable) and external images support 2 transparency handling methods:

- **Chroma-keying** - Pixels with `LV_COLOR_CHROMA_KEY` (*lv_conf.h*) color will be transparent.
- **Alpha byte** - An alpha byte is added to every pixel that contains the pixel's opacity

Palette and Alpha index

Besides the *True color* (RGB) color format, the following formats are supported:

- **Indexed** - Image has a palette.
- **Alpha indexed** - Only alpha values are stored.

These options can be selected in the image converter. To learn more about the color formats, read the *Images* section.

Recolor

A color can be mixed with every pixel of an image with a given intensity. This can be useful to show different states (checked, inactive, pressed, etc.) of an image without storing more versions of the same image. This feature can be enabled in the style by setting `img_recolor_opa` between `LV_OPA_TRANSP` (no recolor, value: 0) and `LV_OPA_COVER` (full recolor, value: 255). The default value is `LV_OPA_TRANSP` so this feature is disabled.

The color to mix is set by `img_recolor`.

Auto-size

If the width or height of the image object is set to `LV_SIZE_CONTENT` the object's size will be set according to the size of the image source in the respective direction.

Mosaic

If the object's size is greater than the image size in any directions, then the image will be repeated like a mosaic. This allows creation a large image from only a very narrow source. For example, you can have a *300 x 5* image with a special gradient and set it as a wallpaper using the mosaic feature.

Offset

With `lv_img_set_offset_x(img, x_ofs)` and `lv_img_set_offset_y(img, y_ofs)`, you can add some offset to the displayed image. Useful if the object size is smaller than the image source size. Using the offset parameter a Texture atlas or a "running image" effect can be created by *Animating* the x or y offset.

6.13.4 Transformations

Using the `lv_img_set_zoom(img, factor)` the images will be zoomed. Set `factor` to `256` or `LV_ZOOM_NONE` to disable zooming. A larger value enlarges the images (e.g. `512` double size), a smaller value shrinks it (e.g. `128` half size). Fractional scale works as well. E.g. `281` for 10% enlargement.

To rotate the image use `lv_img_set_angle(img, angle)`. Angle has 0.1 degree precision, so for 45.8° set 458.

The `transform_zoom` and `transform_angle` style properties are also used to determine the final zoom and angle.

By default, the pivot point of the rotation is the center of the image. It can be changed with `lv_img_set_pivot(img, pivot_x, pivot_y)`. `0;0` is the top left corner.

The quality of the transformation can be adjusted with `lv_img_set_antialias(img, true/false)`. With enabled anti-aliasing the transformations are higher quality but slower.

The transformations require the whole image to be available. Therefore indexed images (`LV_IMG_CF_INDEXED_...`), alpha only images (`LV_IMG_CF_ALPHA_...`) or images from files can not be transformed. In other words transformations work only on true color images stored as C array, or if a custom Image decoder returns the whole image.

Note that the real coordinates of image objects won't change during transformation. That is `lv_obj_get_width/height/x/y()` will return the original, non-zoomed coordinates.

IMPORTANT The transformation of the image is independent of the transformation properties coming from styles. (See here). The main differences are that pure image widget transformation

- doesn't transform the children of the image widget
- image is transformed directly without creating an intermediate layer (buffer) to snapshot the widget

Size mode

By default, when the image is zoomed or rotated the real coordinates of the image object are not changed. The larger content simply overflows the object's boundaries. It also means the layouts are not affected the by the transformations.

If you need the object size to be updated to the transformed size set `lv_img_set_size_mode(img, LV_IMG_SIZE_MODE_REAL)`. (The previous mode is the default and called `LV_IMG_SIZE_MODE_VIRTUAL`). In this case if the width/height of the object is set to `LV_SIZE_CONTENT` the object's size will be set to the zoomed and rotated size. If an explicit size is set then the overflowing content will be cropped.

Rounded image

You can use `lv_obj_set_style_radius` to set radius to an image, and enable `lv_obj_set_style_clip_corner` to clip the content to rounded rectangle or circular shape. Please note this will have some negative performance impact to CPU based renderers.

6.13.5 Events

No special events are sent by image objects.

See the events of the *Base object* too.

Learn more about *Events*.

6.13.6 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.13.7 Example

Image from variable and symbol

```c
#include "../../lv_examples.h"
#if LV_USE_IMG && LV_BUILD_EXAMPLES


void lv_example_img_1(void)
```

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```
{
    LV_IMG_DECLARE(img_cogwheel_chroma_keyed);
    lv_obj_t * img1 = lv_img_create(lv_scr_act());
    lv_img_set_src(img1, &img_cogwheel_chroma_keyed);
    lv_obj_align(img1, LV_ALIGN_CENTER, 0, -20);
    lv_obj_set_size(img1, 200, 200);

    lv_obj_t * img2 = lv_img_create(lv_scr_act());
    lv_img_set_src(img2, LV_SYMBOL_OK "Accept");
    lv_obj_align_to(img2, img1, LV_ALIGN_OUT_BOTTOM_MID, 0, 20);
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import usys as sys
import lvgl as lv
import display_driver

# Create an image from the png file
try:
    with open('../../assets/img_cogwheel_argb.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_cogwheel_argb.png")
    sys.exit()

img_cogwheel_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

img1 = lv.img(lv.scr_act())
img1.set_src(img_cogwheel_argb)
img1.align(lv.ALIGN.CENTER, 0, -20)
img1.set_size(200, 200)

img2 = lv.img(lv.scr_act())
img2.set_src(lv.SYMBOL.OK + "Accept")
img2.align_to(img1, lv.ALIGN.OUT_BOTTOM_MID, 0, 20)
```

Image recoloring

```
#include "../../lv_examples.h"
#if LV_USE_IMG && LV_USE_SLIDER && LV_BUILD_EXAMPLES

static lv_obj_t * create_slider(lv_color_t color);
static void slider_event_cb(lv_event_t * e);

static lv_obj_t * red_slider, * green_slider, * blue_slider, * intense_slider;
static lv_obj_t * img1;


/**
```

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```
 * Demonstrate runtime image re-coloring
 */
void lv_example_img_2(void)
{
    /*Create 4 sliders to adjust RGB color and re-color intensity*/
    red_slider = create_slider(lv_palette_main(LV_PALETTE_RED));
    green_slider = create_slider(lv_palette_main(LV_PALETTE_GREEN));
    blue_slider = create_slider(lv_palette_main(LV_PALETTE_BLUE));
    intense_slider = create_slider(lv_palette_main(LV_PALETTE_GREY));

    lv_slider_set_value(red_slider, LV_OPA_20, LV_ANIM_OFF);
    lv_slider_set_value(green_slider, LV_OPA_90, LV_ANIM_OFF);
    lv_slider_set_value(blue_slider, LV_OPA_60, LV_ANIM_OFF);
    lv_slider_set_value(intense_slider, LV_OPA_50, LV_ANIM_OFF);

    lv_obj_align(red_slider, LV_ALIGN_LEFT_MID, 25, 0);
    lv_obj_align_to(green_slider, red_slider, LV_ALIGN_OUT_RIGHT_MID, 25, 0);
    lv_obj_align_to(blue_slider, green_slider, LV_ALIGN_OUT_RIGHT_MID, 25, 0);
    lv_obj_align_to(intense_slider, blue_slider, LV_ALIGN_OUT_RIGHT_MID, 25, 0);

    /*Now create the actual image*/
    LV_IMG_DECLARE(img_cogwheel_argb)
    img1 = lv_img_create(lv_scr_act());
    lv_img_set_src(img1, &img_cogwheel_argb);
    lv_obj_align(img1, LV_ALIGN_RIGHT_MID, -20, 0);

    lv_obj_send_event(intense_slider, LV_EVENT_VALUE_CHANGED, NULL);
}

static void slider_event_cb(lv_event_t * e)
{
    LV_UNUSED(e);

    /*Recolor the image based on the sliders' values*/
    lv_color_t color  = lv_color_make(lv_slider_get_value(red_slider), lv_slider_get_
↪value(green_slider),
                                       lv_slider_get_value(blue_slider));
    lv_opa_t intense = lv_slider_get_value(intense_slider);
    lv_obj_set_style_img_recolor_opa(img1, intense, 0);
    lv_obj_set_style_img_recolor(img1, color, 0);
}

static lv_obj_t * create_slider(lv_color_t color)
{
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_slider_set_range(slider, 0, 255);
    lv_obj_set_size(slider, 10, 200);
    lv_obj_set_style_bg_color(slider, color, LV_PART_KNOB);
    lv_obj_set_style_bg_color(slider, lv_color_darken(color, LV_OPA_40), LV_PART_
↪INDICATOR);
    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    return slider;
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import usys as sys
import lvgl as lv
import display_driver

# Create an image from the png file
try:
    with open('../../assets/img_cogwheel_argb.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_cogwheel_argb.png")
    sys.exit()

img_cogwheel_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def create_slider(color):
    slider = lv.slider(lv.scr_act())
    slider.set_range(0, 255)
    slider.set_size(10, 200)
    slider.set_style_bg_color(color, lv.PART.KNOB)
    slider.set_style_bg_color(color.color_darken(lv.OPA._40), lv.PART.INDICATOR)
    slider.add_event(slider_event_cb, lv.EVENT.VALUE_CHANGED, None)
    return slider

def slider_event_cb(e):
    # Recolor the image based on the sliders' values
    color  = lv.color_make(red_slider.get_value(), green_slider.get_value(), blue_
↪slider.get_value())
    intense = intense_slider.get_value()
    img1.set_style_img_recolor_opa(intense, 0)
    img1.set_style_img_recolor(color, 0)

#
# Demonstrate runtime image re-coloring
#
# Create 4 sliders to adjust RGB color and re-color intensity
red_slider = create_slider(lv.palette_main(lv.PALETTE.RED))
green_slider = create_slider(lv.palette_main(lv.PALETTE.GREEN))
blue_slider = create_slider(lv.palette_main(lv.PALETTE.BLUE))
intense_slider = create_slider(lv.palette_main(lv.PALETTE.GREY))

red_slider.set_value(lv.OPA._20, lv.ANIM.OFF)
green_slider.set_value(lv.OPA._90, lv.ANIM.OFF)
blue_slider.set_value(lv.OPA._60, lv.ANIM.OFF)
intense_slider.set_value(lv.OPA._50, lv.ANIM.OFF)

red_slider.align(lv.ALIGN.LEFT_MID, 25, 0)
green_slider.align_to(red_slider, lv.ALIGN.OUT_RIGHT_MID, 25, 0)
blue_slider.align_to(green_slider, lv.ALIGN.OUT_RIGHT_MID, 25, 0)
intense_slider.align_to(blue_slider, lv.ALIGN.OUT_RIGHT_MID, 25, 0)

# Now create the actual image
img1 = lv.img(lv.scr_act())
img1.set_src(img_cogwheel_argb)
```

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```
img1.align(lv.ALIGN.RIGHT_MID, -20, 0)

intense_slider.send_event(lv.EVENT.VALUE_CHANGED, None)
```

Rotate and zoom

```
#include "../../lv_examples.h"
#if LV_USE_IMG && LV_BUILD_EXAMPLES

static void set_angle(void * img, int32_t v)
{
    lv_img_set_angle(img, v);
}

static void set_zoom(void * img, int32_t v)
{
    lv_img_set_zoom(img, v);
}


/**
 * Show transformations (zoom and rotation) using a pivot point.
 */
void lv_example_img_3(void)
{
    LV_IMG_DECLARE(img_cogwheel_argb);

    /*Now create the actual image*/
    lv_obj_t * img = lv_img_create(lv_scr_act());
    lv_img_set_src(img, &img_cogwheel_argb);
    lv_obj_align(img, LV_ALIGN_CENTER, 50, 50);
    lv_img_set_pivot(img, 0, 0);    /*Rotate around the top left corner*/

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, img);
    lv_anim_set_exec_cb(&a, set_angle);
    lv_anim_set_values(&a, 0, 3600);
    lv_anim_set_time(&a, 5000);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);

    lv_anim_set_exec_cb(&a, set_zoom);
    lv_anim_set_values(&a, 128, 256);
    lv_anim_set_playback_time(&a, 3000);
    lv_anim_start(&a);
}

#endif
```

```python
#!/opt/bin/lv_micropython -i
import usys as sys
import lvgl as lv
import display_driver

# Create an image from the png file
try:
    with open('../../assets/img_cogwheel_argb.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_cogwheel_argb.png")
    sys.exit()

img_cogwheel_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def set_angle(img, v):
    img.set_angle(v)

def set_zoom(img, v):
    img.set_zoom(v)


#
# Show transformations (zoom and rotation) using a pivot point.
#

# Now create the actual image
img = lv.img(lv.scr_act())
img.set_src(img_cogwheel_argb)
img.align(lv.ALIGN.CENTER, 50, 50)
img.set_pivot(0, 0)               # Rotate around the top left corner

a1 = lv.anim_t()
a1.init()
a1.set_var(img)
a1.set_custom_exec_cb(lambda a,val: set_angle(img,val))
a1.set_values(0, 3600)
a1.set_time(5000)
a1.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
lv.anim_t.start(a1)

a2 = lv.anim_t()
a2.init()
a2.set_var(img)
a2.set_custom_exec_cb(lambda a,val: set_zoom(img,val))
a2.set_values(128, 256)
a2.set_time(5000)
a2.set_playback_time(3000)
a2.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
lv.anim_t.start(a2)
```

Image offset and styling

```c
#include "../../lv_examples.h"
#if LV_USE_IMG && LV_BUILD_EXAMPLES

static void ofs_y_anim(void * img, int32_t v)
{
    lv_img_set_offset_y(img, v);
}

/**
 * Image styling and offset
 */
void lv_example_img_4(void)
{
    LV_IMG_DECLARE(img_skew_strip);

    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_bg_color(&style, lv_palette_main(LV_PALETTE_YELLOW));
    lv_style_set_bg_opa(&style, LV_OPA_COVER);
    lv_style_set_img_recolor_opa(&style, LV_OPA_COVER);
    lv_style_set_img_recolor(&style, lv_color_black());

    lv_obj_t * img = lv_img_create(lv_scr_act());
    lv_obj_add_style(img, &style, 0);
    lv_img_set_src(img, &img_skew_strip);
    lv_obj_set_size(img, 150, 100);
    lv_obj_center(img);

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, img);
    lv_anim_set_exec_cb(&a, ofs_y_anim);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_set_time(&a, 3000);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);

}

#endif
```

```python

def ofs_y_anim(img, v):
    img.set_offset_y(v)
    # print(img,v)

# Create an image from the png file
try:
    with open('../../assets/img_skew_strip.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find img_skew_strip.png")
    sys.exit()
```

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```
img_skew_strip = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

#
# Image styling and offset
#

style = lv.style_t()
style.init()
style.set_bg_color(lv.palette_main(lv.PALETTE.YELLOW))
style.set_bg_opa(lv.OPA.COVER)
style.set_img_recolor_opa(lv.OPA.COVER)
style.set_img_recolor(lv.color_black())

img = lv.img(lv.scr_act())
img.add_style(style, 0)
img.set_src(img_skew_strip)
img.set_size(150, 100)
img.center()

a = lv.anim_t()
a.init()
a.set_var(img)
a.set_values(0, 100)
a.set_time(3000)
a.set_playback_time(500)
a.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a.set_custom_exec_cb(lambda a,val: ofs_y_anim(img,val))
lv.anim_t.start(a)
```

6.13.8 API

Typedefs

typedef uint8_t **lv_img_size_mode_t**

Enums

enum **[anonymous]**

Image size mode, when image size and object size is different

Values:

enumerator **LV_IMG_SIZE_MODE_VIRTUAL**

Zoom doesn't affect the coordinates of the object, however if zoomed in the image is drawn out of the its coordinates. The layout's won't change on zoom enumerator **LV_IMG_SIZE_MODE_REAL**

If the object size is set to SIZE_CONTENT, then object size equals zoomed image size. It causes layout recalculation. If the object size is set explicitly, the image will be cropped when zoomed in.

Functions

lv_obj_t ***lv_img_create**(*lv_obj_t* *parent)

Create an image object

Parameters **parent** -- pointer to an object, it will be the parent of the new image

Returns pointer to the created image

void **lv_img_set_src**(*lv_obj_t* *obj, const void *src)

Set the image data to display on the object

Parameters

- **obj** -- pointer to an image object
- **src_img** -- 1) pointer to an *lv_img_dsc_t* descriptor (converted by LVGL's image converter) (e.g. &my_img) or 2) path to an image file (e.g. "S:/dir/img.bin")or 3) a SYMBOL (e.g. LV_SYMBOL_OK)

void **lv_img_set_offset_x**(*lv_obj_t* *obj, lv_coord_t x)

Set an offset for the source of an image so the image will be displayed from the new origin.

Parameters

- **obj** -- pointer to an image
- **x** -- the new offset along x axis.

void **lv_img_set_offset_y**(*lv_obj_t* *obj, lv_coord_t y)

Set an offset for the source of an image. so the image will be displayed from the new origin.

Parameters

- **obj** -- pointer to an image
- **y** -- the new offset along y axis.

void **lv_img_set_angle**(*lv_obj_t* *obj, int16_t angle)

Set the rotation angle of the image. The image will be rotated around the set pivot set by `lv_img_set_pivot()` Note that indexed and alpha only images can't be transformed.

Parameters

- **obj** -- pointer to an image object
- **angle** -- rotation angle in degree with 0.1 degree resolution (0..3600: clock wise)

void **lv_img_set_pivot**(*lv_obj_t* *obj, lv_coord_t x, lv_coord_t y)

Set the rotation center of the image. The image will be rotated around this point.

Parameters

- **obj** -- pointer to an image object
- **x** -- rotation center x of the image
- **y** -- rotation center y of the image

void **lv_img_set_zoom**(*lv_obj_t* *obj, uint16_t zoom)

void **lv_img_set_antialias**(*lv_obj_t* *obj, bool antialias)

Enable/disable anti-aliasing for the transformations (rotate, zoom) or not. The quality is better with anti-aliasing looks better but slower.

Parameters

- **obj** -- pointer to an image object
- **antialias** -- true: anti-aliased; false: not anti-aliased

void **lv_img_set_size_mode**(*lv_obj_t* *obj, *lv_img_size_mode_t* mode)

Set the image object size mode.

Parameters

- **obj** -- pointer to an image object
- **mode** -- the new size mode.

const void ***lv_img_get_src**(*lv_obj_t* *obj)

Get the source of the image

Parameters **obj** -- pointer to an image object

Returns the image source (symbol, file name or ::lv-img_dsc_t for C arrays)

lv_coord_t **lv_img_get_offset_x**(*lv_obj_t* *obj)

Get the offset's x attribute of the image object.

Parameters **img** -- pointer to an image

Returns offset X value.

lv_coord_t **lv_img_get_offset_y**(*lv_obj_t* *obj)

Get the offset's y attribute of the image object.

Parameters **obj** -- pointer to an image

Returns offset Y value.

uint16_t **lv_img_get_angle**(*lv_obj_t* *obj)

Get the rotation angle of the image.

Parameters **obj** -- pointer to an image object

Returns rotation angle in 0.1 degrees (0..3600)

void **lv_img_get_pivot**(*lv_obj_t* *obj, lv_point_t *pivot)

Get the pivot (rotation center) of the image.

Parameters

- **img** -- pointer to an image object
- **pivot** -- store the rotation center here

uint16_t **lv_img_get_zoom**(*lv_obj_t* *obj)

Get the zoom factor of the image.

Parameters **obj** -- pointer to an image object

Returns zoom factor (256: no zoom)

bool **`lv_img_get_antialias`**(*lv_obj_t* *obj)

Get whether the transformations (rotate, zoom) are anti-aliased or not

Parameters **`obj`** -- pointer to an image object

Returns true: anti-aliased; false: not anti-aliased

lv_img_size_mode_t **`lv_img_get_size_mode`**(*lv_obj_t* *obj)

Get the size mode of the image

Parameters **`obj`** -- pointer to an image object

Returns element of lv_img_size_mode_t

Variables

const lv_obj_class_t **`lv_img_class`**

struct **`lv_img_t`**

#include <lv_img.h> Data of image

Public Members

lv_obj_t **`obj`**

const void ***`src`**

lv_point_t **`offset`**

lv_coord_t **`w`**

lv_coord_t **`h`**

uint16_t **`angle`**

lv_point_t **`pivot`**

uint16_t **`zoom`**

uint8_t **`src_type`**

uint8_t **`cf`**

uint8_t **`antialias`**

uint8_t **`obj_size_mode`**

6.14 Image button (lv_imgbtn)

6.14.1 Overview

The Image button is very similar to the simple 'Button' object. The only difference is that it displays user-defined images in each state instead of drawing a rectangle.

You can set a left, right and center image, and the center image will be repeated to match the width of the object.

6.14.2 Parts and Styles

- `LV_PART_MAIN` Refers to the image(s). If background style properties are used, a rectangle will be drawn behind the image button.

6.14.3 Usage

Image sources

To set the image in a state, use the `lv_imgbtn_set_src(imgbtn, LV_IMGBTN_STATE_..., src_left, src_center, src_right)`.

The image sources work the same as described in the *Image object* except that "Symbols" are not supported by the Image button. Any of the sources can `NULL`.

The possible states are:

- `LV_IMGBTN_STATE_RELEASED`
- `LV_IMGBTN_STATE_PRESSED`
- `LV_IMGBTN_STATE_DISABLED`
- `LV_IMGBTN_STATE_CHECKED_RELEASED`
- `LV_IMGBTN_STATE_CHECKED_PRESSED`
- `LV_IMGBTN_STATE_CHECKED_DISABLED`

If you set sources only in `LV_IMGBTN_STATE_RELEASED`, these sources will be used in other states too. If you set e.g. `LV_IMGBTN_STATE_PRESSED` they will be used in pressed state instead of the released images.

States

Instead of the regular `lv_obj_add/clear_state()` functions the `lv_imgbtn_set_state(imgbtn, LV_IMGBTN_STATE_...)` functions should be used to manually set a state.

6.14.4 Events

- LV_EVENT_VALUE_CHANGED Sent when the button is toggled.

Learn more about *Events*.

6.14.5 Keys

- LV_KEY_RIGHT/UP Go to toggled state if LV_OBJ_FLAG_CHECKABLE is enabled.
- LV_KEY_LEFT/DOWN Go to non-toggled state if LV_OBJ_FLAG_CHECKABLE is enabled.
- LV_KEY_ENTER Clicks the button

Learn more about *Keys*.

6.14.6 Example

Simple Image button

```
#include "../../lv_examples.h"
#if LV_USE_IMGBTN && LV_BUILD_EXAMPLES

void lv_example_imgbtn_1(void)
{
    LV_IMG_DECLARE(imgbtn_left);
    LV_IMG_DECLARE(imgbtn_right);
    LV_IMG_DECLARE(imgbtn_mid);

    /*Create a transition animation on width transformation and recolor.*/
    static lv_style_prop_t tr_prop[] = {LV_STYLE_TRANSFORM_WIDTH, LV_STYLE_IMG_
↪RECOLOR_OPA, 0};
    static lv_style_transition_dsc_t tr;
    lv_style_transition_dsc_init(&tr, tr_prop, lv_anim_path_linear, 200, 0, NULL);

    static lv_style_t style_def;
    lv_style_init(&style_def);
    lv_style_set_text_color(&style_def, lv_color_white());
    lv_style_set_transition(&style_def, &tr);

    /*Darken the button when pressed and make it wider*/
    static lv_style_t style_pr;
    lv_style_init(&style_pr);
    lv_style_set_img_recolor_opa(&style_pr, LV_OPA_30);
    lv_style_set_img_recolor(&style_pr, lv_color_black());
    lv_style_set_transform_width(&style_pr, 20);

    /*Create an image button*/
    lv_obj_t * imgbtn1 = lv_imgbtn_create(lv_scr_act());
    lv_imgbtn_set_src(imgbtn1, LV_IMGBTN_STATE_RELEASED, &imgbtn_left, &imgbtn_mid, &
↪imgbtn_right);
    lv_obj_add_style(imgbtn1, &style_def, 0);
    lv_obj_add_style(imgbtn1, &style_pr, LV_STATE_PRESSED);

    lv_obj_align(imgbtn1, LV_ALIGN_CENTER, 0, 0);
```

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```
    /*Create a label on the image button*/
    lv_obj_t * label = lv_label_create(imgbtn1);
    lv_label_set_text(label, "Button");
    lv_obj_align(label, LV_ALIGN_CENTER, 0, -4);
}

#endif
```

```
# Create an image from the png file
try:
    with open('../../assets/imgbtn_left.png','rb') as f:
        imgbtn_left_data = f.read()
except:
    print("Could not find imgbtn_left.png")
    sys.exit()

imgbtn_left_dsc = lv.img_dsc_t({
  'data_size': len(imgbtn_left_data),
  'data': imgbtn_left_data
})

try:
    with open('../../assets/imgbtn_mid.png','rb') as f:
        imgbtn_mid_data = f.read()
except:
    print("Could not find imgbtn_mid.png")
    sys.exit()

imgbtn_mid_dsc = lv.img_dsc_t({
  'data_size': len(imgbtn_mid_data),
  'data': imgbtn_mid_data
})

try:
    with open('../../assets/imgbtn_right.png','rb') as f:
        imgbtn_right_data = f.read()
except:
    print("Could not find imgbtn_right.png")
    sys.exit()

imgbtn_right_dsc = lv.img_dsc_t({
  'data_size': len(imgbtn_right_data),
  'data': imgbtn_right_data
})

# Create a transition animation on width transformation and recolor.
tr_prop = [lv.STYLE.TRANSFORM_WIDTH, lv.STYLE.IMG_RECOLOR_OPA, 0]
tr = lv.style_transition_dsc_t()
tr.init(tr_prop, lv.anim_t.path_linear, 200, 0, None)

style_def = lv.style_t()
style_def.init()
style_def.set_text_color(lv.color_white())
style_def.set_transition(tr)

# Darken the button when pressed and make it wider
```

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```
style_pr = lv.style_t()
style_pr.init()
style_pr.set_img_recolor_opa(lv.OPA._30)
style_pr.set_img_recolor(lv.color_black())
style_pr.set_transform_width(20)

# Create an image button
imgbtn1 = lv.imgbtn(lv.scr_act())
imgbtn1.set_src(lv.imgbtn.STATE.RELEASED, imgbtn_left_dsc, imgbtn_mid_dsc, imgbtn_
↪right_dsc)
imgbtn1.add_style(style_def, 0)
imgbtn1.add_style(style_pr, lv.STATE.PRESSED)

imgbtn1.align(lv.ALIGN.CENTER, 0, 0)

# Create a label on the image button
label = lv.label(imgbtn1)
label.set_text("Button")
label.align(lv.ALIGN.CENTER, 0, -4)
```

6.14.7 API

Enums

enum **lv_imgbtn_state_t**

Values:

enumerator **LV_IMGBTN_STATE_RELEASED**

enumerator **LV_IMGBTN_STATE_PRESSED**

enumerator **LV_IMGBTN_STATE_DISABLED**

enumerator **LV_IMGBTN_STATE_CHECKED_RELEASED**

enumerator **LV_IMGBTN_STATE_CHECKED_PRESSED**

enumerator **LV_IMGBTN_STATE_CHECKED_DISABLED**

enumerator **_LV_IMGBTN_STATE_NUM**

Functions

lv_obj_t ***lv_imgbtn_create**(*lv_obj_t* *parent)

Create an image button object

Parameters **parent** -- pointer to an object, it will be the parent of the new image button

Returns pointer to the created image button

void **lv_imgbtn_set_src**(*lv_obj_t* *imgbtn, *lv_imgbtn_state_t* state, const void *src_left, const void *src_mid, const void *src_right)

Set images for a state of the image button

Parameters

- **imgbtn** -- pointer to an image button object
- **state** -- for which state set the new image
- **src_left** -- pointer to an image source for the left side of the button (a C array or path to a file)
- **src_mid** -- pointer to an image source for the middle of the button (ideally 1px wide) (a C array or path to a file)
- **src_right** -- pointer to an image source for the right side of the button (a C array or path to a file)

void **lv_imgbtn_set_state**(*lv_obj_t* *imgbtn, *lv_imgbtn_state_t* state)

Use this function instead of `lv_obj_add/clear_state` to set a state manually

Parameters

- **imgbtn** -- pointer to an image button object
- **state** -- the new state

const void ***lv_imgbtn_get_src_left**(*lv_obj_t* *imgbtn, *lv_imgbtn_state_t* state)

Get the left image in a given state

Parameters

- **imgbtn** -- pointer to an image button object
- **state** -- the state where to get the image (from `lv_btn_state_t`)`

Returns pointer to the left image source (a C array or path to a file)

const void ***lv_imgbtn_get_src_middle**(*lv_obj_t* *imgbtn, *lv_imgbtn_state_t* state)

Get the middle image in a given state

Parameters

- **imgbtn** -- pointer to an image button object
- **state** -- the state where to get the image (from `lv_btn_state_t`)`

Returns pointer to the middle image source (a C array or path to a file)

const void ***lv_imgbtn_get_src_right**(*lv_obj_t* *imgbtn, *lv_imgbtn_state_t* state)

Get the right image in a given state

Parameters

- **imgbtn** -- pointer to an image button object

- `state` -- the state where to get the image (from `lv_btn_state_t`)`

Returns pointer to the left image source (a C array or path to a file)

Variables

const lv_obj_class_t **`lv_imgbtn_class`**

struct **`lv_imgbtn_src_info_t`**

Public Members

const void ***`img_src`**

lv_img_header_t **`header`**

struct **`lv_imgbtn_t`**

Public Members

lv_obj_t **`obj`**

lv_imgbtn_src_info_t **`src_mid`**[*_LV_IMGBTN_STATE_NUM*]

lv_imgbtn_src_info_t **`src_left`**[*_LV_IMGBTN_STATE_NUM*]

lv_imgbtn_src_info_t **`src_right`**[*_LV_IMGBTN_STATE_NUM*]

6.15 Keyboard (lv_keyboard)

6.15.1 Overview

The Keyboard object is a special *Button matrix* with predefined keymaps and other features to realize a virtual keyboard to write texts into a *Text area*.

6.15.2 Parts and Styles

Similarly to Button matrices Keyboards consist of 2 part:

- `LV_PART_MAIN` The main part. Uses all the typical background properties
- `LV_PART_ITEMS` The buttons. Also uses all typical background properties as well as the *text* properties.

6.15.3 Usage

Modes

The Keyboards have the following modes:

- `LV_KEYBOARD_MODE_TEXT_LOWER` Display lower case letters
- `LV_KEYBOARD_MODE_TEXT_UPPER` Display upper case letters
- `LV_KEYBOARD_MODE_TEXT_SPECIAL` Display special characters
- `LV_KEYBOARD_MODE_NUMBER` Display numbers, +/- sign, and decimal dot
- `LV_KEYBOARD_MODE_USER_1` through `LV_KEYBOARD_MODE_USER_4` User-defined modes.

The `TEXT` modes' layout contains buttons to change mode.

To set the mode manually, use `lv_keyboard_set_mode(kb, mode)`. The default mode is `LV_KEYBOARD_MODE_TEXT_UPPER`.

Assign Text area

You can assign a *Text area* to the Keyboard to automatically put the clicked characters there. To assign the text area, use `lv_keyboard_set_textarea(kb, ta)`.

Key Popovers

To enable key popovers on press, like on common Android and iOS keyboards, use `lv_keyboard_set_popovers(kb, true)`. The default control maps are preconfigured to only show the popovers on keys that produce a symbol and not on e.g. space. If you use a custom keymap, set the `LV_BTNMATRIX_CTRL_POPOVER` flag for all keys that you want to show a popover.

Note that popovers for keys in the top row will draw outside the widget boundaries. To account for this, reserve extra free space on top of the keyboard or ensure that the keyboard is added *after* any widgets adjacent to its top boundary so that the popovers can draw over those.

The popovers currently are merely a visual effect and don't allow selecting additional characters such as accents yet.

New Keymap

You can specify a new map (layout) for the keyboard with `lv_keyboard_set_map(kb, LV_KEYBOARD_MODE_..., kb_map, kb_ctrl);`. See the *Button matrix* for more information about creating new maps a ctrls.

Keep in mind that using following keywords will have the same effect as with the original map:

- `LV_SYMBOL_OK` Send `LV_EVENT_RADY` to the assigend Text area.
- `LV_SYMBOL_CLOSE` or `LV_SYMBOL_KEYBOARD` Send `LV_EVENT_CANCEL` to the assigend Text area.
- `LV_SYMBOL_BACKSPACE` Delete on the left.
- `LV_SYMBOL_LEFT` Move the cursor left.
- `LV_SYMBOL_RIGHT` Move the cursor right.
- `LV_SYMBOL_NEW_LINE` New line.
- *"ABC"* Load the uppercase map.
- *"abc"* Load the lower case map.
- *"1#"* Load the lower case map.

6.15.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when the button is pressed/released or repeated after long press. The event data is set to the ID of the pressed/released button.
- `LV_EVENT_READY` - The *Ok* button is clicked.
- `LV_EVENT_CANCEL` - The *Close* button is clicked.

The keyboard has a **default event handler** callback called `lv_keyboard_def_event_cb`, which handles the button pressing, map changing, the assigned text area, etc. You can remove it and replace it with a custom event handler if you wish.

Note: In 8.0 and newer, adding an event handler to the keyboard does not remove the default event handler. This behavior differs from v7, where adding an event handler would always replace the previous one.

Learn more about *Events*.

6.15.5 Keys

- `LV_KEY_RIGHT/UP/LEFT/RIGHT` To navigate among the buttons and select one.
- `LV_KEY_ENTER` To press/release the selected button.

Learn more about *Keys*.

6.15.6 Examples

Keyboard with text area

```
#include "../../lv_examples.h"
#if LV_USE_KEYBOARD && LV_BUILD_EXAMPLES

static void ta_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * ta = lv_event_get_target(e);
    lv_obj_t * kb = lv_event_get_user_data(e);
    if(code == LV_EVENT_FOCUSED) {
        lv_keyboard_set_textarea(kb, ta);
        lv_obj_clear_flag(kb, LV_OBJ_FLAG_HIDDEN);
    }

    if(code == LV_EVENT_DEFOCUSED) {
        lv_keyboard_set_textarea(kb, NULL);
        lv_obj_add_flag(kb, LV_OBJ_FLAG_HIDDEN);
    }
}

void lv_example_keyboard_1(void)
{
    /*Create a keyboard to use it with an of the text areas*/
    lv_obj_t * kb = lv_keyboard_create(lv_scr_act());

    /*Create a text area. The keyboard will write here*/
    lv_obj_t * ta;
    ta = lv_textarea_create(lv_scr_act());
    lv_obj_align(ta, LV_ALIGN_TOP_LEFT, 10, 10);
    lv_obj_add_event(ta, ta_event_cb, LV_EVENT_ALL, kb);
    lv_textarea_set_placeholder_text(ta, "Hello");
    lv_obj_set_size(ta, 140, 80);

    ta = lv_textarea_create(lv_scr_act());
    lv_obj_align(ta, LV_ALIGN_TOP_RIGHT, -10, 10);
    lv_obj_add_event(ta, ta_event_cb, LV_EVENT_ALL, kb);
    lv_obj_set_size(ta, 140, 80);

    lv_keyboard_set_textarea(kb, ta);
}
#endif
```

```
def ta_event_cb(e,kb):
    code = e.get_code()
    ta = e.get_target_obj()
    if code == lv.EVENT.FOCUSED:
        kb.set_textarea(ta)
        kb.clear_flag(lv.obj.FLAG.HIDDEN)

    if code == lv.EVENT.DEFOCUSED:
        kb.set_textarea(None)
        kb.add_flag(lv.obj.FLAG.HIDDEN)

# Create a keyboard to use it with one of the text areas
```

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```
kb = lv.keyboard(lv.scr_act())

# Create a text area. The keyboard will write here
ta = lv.textarea(lv.scr_act())
ta.set_width(200)
ta.align(lv.ALIGN.TOP_LEFT, 10, 10)
ta.add_event(lambda e: ta_event_cb(e,kb), lv.EVENT.ALL, None)
ta.set_placeholder_text("Hello")

ta = lv.textarea(lv.scr_act())
ta.set_width(200)
ta.align(lv.ALIGN.TOP_RIGHT, -10, 10)
ta.add_event(lambda e: ta_event_cb(e,kb), lv.EVENT.ALL, None)

kb.set_textarea(ta)
```

Keyboard with custom map

```
#include "../../lv_examples.h"
#if LV_USE_KEYBOARD && LV_BUILD_EXAMPLES

void lv_example_keyboard_2(void)
{
    /*Create an AZERTY keyboard map*/
    static const char * kb_map[] = {"A", "Z", "E", "R", "T", "Y", "U", "I", "O", "P",␣
↪LV_SYMBOL_BACKSPACE, "\n",
                                    "Q", "S", "D", "F", "G", "J", "K", "L", "M",  LV_
↪SYMBOL_NEW_LINE, "\n",
                                    "W", "X", "C", "V", "B", "N", ",", ".", ":", "!",
↪"?", "\n",
                                    LV_SYMBOL_CLOSE, " ",  " ", " ", LV_SYMBOL_OK,␣
↪NULL
                                   };

    /*Set the relative width of the buttons and other controls*/
    static const lv_btnmatrix_ctrl_t kb_ctrl[] = {4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 6,
                                                  4, 4, 4, 4, 4, 4, 4, 4, 4, 6,
                                                  4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
                                                  2, LV_BTNMATRIX_CTRL_HIDDEN | 2, 6,␣
↪LV_BTNMATRIX_CTRL_HIDDEN | 2, 2
                                                 };

    /*Create a keyboard and add the new map as USER_1 mode*/
    lv_obj_t * kb = lv_keyboard_create(lv_scr_act());

    lv_keyboard_set_map(kb, LV_KEYBOARD_MODE_USER_1, kb_map, kb_ctrl);
    lv_keyboard_set_mode(kb, LV_KEYBOARD_MODE_USER_1);

    /*Create a text area. The keyboard will write here*/
    lv_obj_t * ta;
    ta = lv_textarea_create(lv_scr_act());
    lv_obj_align(ta, LV_ALIGN_TOP_MID, 0, 10);
    lv_obj_set_size(ta, lv_pct(90), 80);
    lv_obj_add_state(ta, LV_STATE_FOCUSED);
```

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```
    lv_keyboard_set_textarea(kb, ta);
}
#endif
```

```
# Create an AZERTY keyboard map
kb_map = ["A", "Z", "E", "R", "T", "Y", "U", "I", "O", "P", lv.SYMBOL.BACKSPACE, "\n",
          "Q", "S", "D", "F", "G", "J", "K", "L", "M",  lv.SYMBOL.NEW_LINE, "\n",
          "W", "X", "C", "V", "B", "N", ",", ".", ":", "!", "?", "\n",
          lv.SYMBOL.CLOSE, " ",  " ", " ", lv.SYMBOL.OK, None]

# Set the relative width of the buttons and other controls
kb_ctrl = [4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 6,
           4, 4, 4, 4, 4, 4, 4, 4, 4, 6,
           4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
           2, lv.btnmatrix.CTRL.HIDDEN | 2, 6, lv.btnmatrix.CTRL.HIDDEN | 2, 2]

# Create a keyboard and add the new map as USER_1 mode
kb = lv.keyboard(lv.scr_act())

kb.set_map(lv.keyboard.MODE.USER_1, kb_map, kb_ctrl)
kb.set_mode(lv.keyboard.MODE.USER_1)

# Create a text area. The keyboard will write here
ta = lv.textarea(lv.scr_act())
ta.align(lv.ALIGN.TOP_MID, 0, 10)
ta.set_size(lv.pct(90), 80)
ta.add_state(lv.STATE.FOCUSED)

kb.set_textarea(ta)
```

6.15.7 API

Typedefs

typedef uint8_t **lv_keyboard_mode_t**

Enums

enum **[anonymous]**

Current keyboard mode.

Values:

enumerator **LV_KEYBOARD_MODE_TEXT_LOWER**

enumerator **LV_KEYBOARD_MODE_TEXT_UPPER** enumerator **`LV_KEYBOARD_MODE_SPECIAL`**

enumerator **`LV_KEYBOARD_MODE_NUMBER`**

enumerator **`LV_KEYBOARD_MODE_USER_1`**

enumerator **`LV_KEYBOARD_MODE_USER_2`**

enumerator **`LV_KEYBOARD_MODE_USER_3`**

enumerator **`LV_KEYBOARD_MODE_USER_4`**

enumerator **`LV_KEYBOARD_MODE_TEXT_ARABIC`**

Functions

lv_obj_t ***`lv_keyboard_create`**(*lv_obj_t* *parent)

Create a Keyboard object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new keyboard

Returns pointer to the created keyboard

void **`lv_keyboard_set_textarea`**(*lv_obj_t* *kb, *lv_obj_t* *ta)

Assign a Text Area to the Keyboard. The pressed characters will be put there.

Parameters

- **`kb`** -- pointer to a Keyboard object
- **`ta`** -- pointer to a Text Area object to write there

void **`lv_keyboard_set_mode`**(*lv_obj_t* *kb, *lv_keyboard_mode_t* mode)

Set a new a mode (text or number map)

Parameters

- **`kb`** -- pointer to a Keyboard object
- **`mode`** -- the mode from 'lv_keyboard_mode_t'

void **`lv_keyboard_set_popovers`**(*lv_obj_t* *kb, bool en)

Show the button title in a popover when pressed.

Parameters

- **`kb`** -- pointer to a Keyboard object
- **`en`** -- whether "popovers" mode is enabled

void **`lv_keyboard_set_map`**(*lv_obj_t* *kb, *lv_keyboard_mode_t* mode, const char *map[], const *lv_btnmatrix_ctrl_t* ctrl_map[])

Set a new map for the keyboard

Parameters

- **kb** -- pointer to a Keyboard object
- **mode** -- keyboard map to alter 'lv_keyboard_mode_t'
- **map** -- pointer to a string array to describe the map. See '*lv_btnmatrix_set_map()*' for more info.

lv_obj_t ***lv_keyboard_get_textarea**(const *lv_obj_t* *kb)

Assign a Text Area to the Keyboard. The pressed characters will be put there.

Parameters **kb** -- pointer to a Keyboard object

Returns pointer to the assigned Text Area object

lv_keyboard_mode_t **lv_keyboard_get_mode**(const *lv_obj_t* *kb)

Set a new a mode (text or number map)

Parameters **kb** -- pointer to a Keyboard object

Returns the current mode from 'lv_keyboard_mode_t'

bool **lv_btnmatrix_get_popovers**(const *lv_obj_t* *obj)

Tell whether "popovers" mode is enabled or not.

Parameters **kb** -- pointer to a Keyboard object

Returns true: "popovers" mode is enabled; false: disabled

static inline const char ****lv_keyboard_get_map_array**(const *lv_obj_t* *kb)

Get the current map of a keyboard

Parameters **kb** -- pointer to a keyboard object

Returns the current map

static inline uint16_t **lv_keyboard_get_selected_btn**(const *lv_obj_t* *obj)

Get the index of the lastly "activated" button by the user (pressed, released, focused etc) Useful in the `event_cb` to get the text of the button, check if hidden etc.

Parameters **obj** -- pointer to button matrix object

Returns index of the last released button (LV_BTNMATRIX_BTN_NONE: if unset)

static inline const char ***lv_keyboard_get_btn_text**(const *lv_obj_t* *obj, uint16_t btn_id)

Get the button's text

Parameters

- **obj** -- pointer to button matrix object
- **btn_id** -- the index a button not counting new line characters.

Returns text of btn_index` button

void **lv_keyboard_def_event_cb**(*lv_event_t* *e)

Default keyboard event to add characters to the Text area and change the map. If a custom `event_cb` is added to the keyboard this function can be called from it to handle the button clicks

Parameters

- **kb** -- pointer to a keyboard
- **event** -- the triggering event

Variables

const lv_obj_class_t **`lv_keyboard_class`**

struct **`lv_keyboard_t`**

Public Members

lv_btnmatrix_t **`btnm`**

lv_obj_t ***`ta`**

lv_keyboard_mode_t **`mode`**

uint8_t **`popovers`**

6.16 Label (lv_label)

6.16.1 Overview

A label is the basic object type that is used to display text.

6.16.2 Parts and Styles

- `LV_PART_MAIN` Uses all the typical background properties and the text properties. The padding values can be used to add space between the text and the background.
- `LV_PART_SCROLLBAR` The scrollbar that is shown when the text is larger than the widget's size.
- `LV_PART_SELECTED` Tells the style of the *selected text*. Only `text_color` and `bg_color` style properties can be used.

6.16.3 Usage

Set text

You can set the text on a label at runtime with `lv_label_set_text(label, "New text")`. This will allocate a buffer dynamically, and the provided string will be copied into that buffer. Therefore, you don't need to keep the text you pass to `lv_label_set_text` in scope after that function returns.

With `lv_label_set_text_fmt(label, "Value: %d", 15)` printf formatting can be used to set the text.

Labels are able to show text from a static character buffer. To do so, use `lv_label_set_text_static(label, "Text")`. In this case, the text is not stored in the dynamic memory and the given buffer is used directly instead. This means that the array can't be a local variable which goes out of scope when the function exits. Constant strings are safe to use with `lv_label_set_text_static` (except when used with `LV_LABEL_LONG_DOT`, as it modifies the buffer in-place), as they are stored in ROM memory, which is always accessible.

Newline

Newline characters are handled automatically by the label object. You can use `\n` to make a line break. For example: `"line1\nline2\n\nline4"`

Long modes

By default, the width and height of the label is set to `LV_SIZE_CONTENT`. Therefore, the size of the label is automatically expanded to the text size. Otherwise, if the width or height are explicitly set (using e.g.`lv_obj_set_width` or a layout), the lines wider than the label's width can be manipulated according to several long mode policies. Similarly, the policies can be applied if the height of the text is greater than the height of the label.

- `LV_LABEL_LONG_WRAP` Wrap too long lines. If the height is `LV_SIZE_CONTENT` the label's height will be expanded, otherwise the text will be clipped. (Default)
- `LV_LABEL_LONG_DOT` Replaces the last 3 characters from bottom right corner of the label with dots (`.`)
- `LV_LABEL_LONG_SCROLL` If the text is wider than the label scroll it horizontally back and forth. If it's higher, scroll vertically. Only one direction is scrolled and horizontal scrolling has higher precedence.
- `LV_LABEL_LONG_SCROLL_CIRCULAR` If the text is wider than the label scroll it horizontally continuously. If it's higher, scroll vertically. Only one direction is scrolled and horizontal scrolling has higher precedence.
- `LV_LABEL_LONG_CLIP` Simply clip the parts of the text outside the label.

You can specify the long mode with `lv_label_set_long_mode(label, LV_LABEL_LONG_...)`

Note that `LV_LABEL_LONG_DOT` manipulates the text buffer in-place in order to add/remove the dots. When `lv_label_set_text` or `lv_label_set_array_text` are used, a separate buffer is allocated and this implementation detail is unnoticed. This is not the case with `lv_label_set_text_static`. The buffer you pass to `lv_label_set_text_static` must be writable if you plan to use `LV_LABEL_LONG_DOT`.

Text recolor

In the text, you can use commands to recolor parts of the text. For example: `"Write a #ff0000 red# word"`. This feature can be enabled individually for each label by `lv_label_set_recolor()` function.

Text selection

If enabled by `LV_LABEL_TEXT_SELECTION` part of the text can be selected. It's similar to when you use your mouse on a PC to select a text. The whole mechanism (click and select the text as you drag your finger/mouse) is implemented in *Text area* and the Label widget only allows manual text selection with `lv_label_get_text_selection_start(label, start_char_index)` and `lv_label_get_text_selection_start(label, end_char_index)`.

Very long texts

LVGL can efficiently handle very long (e.g. > 40k characters) labels by saving some extra data (~12 bytes) to speed up drawing. To enable this feature, set `LV_LABEL_LONG_TXT_HINT 1` in `lv_conf.h`.

Custom scrolling animations

Some aspects of the scrolling animations in long modes `LV_LABEL_LONG_SCROLL` and `LV_LABEL_LONG_SCROLL_CIRCULAR` can be customized by setting the animation property of a style, using `lv_style_set_anim()`. Currently, only the start and repeat delay of the circular scrolling animation can be customized. If you need to customize another aspect of the scrolling animation, feel free to open an issue on Github to request the feature.

Symbols

The labels can display symbols alongside letters (or on their own). Read the *Font* section to learn more about the symbols.

6.16.4 Events

No special events are sent by the Label.

See the events of the *Base object* too.

Learn more about *Events*.

6.16.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.16.6 Example

Line wrap, recoloring and scrolling

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_BUILD_EXAMPLES

/**
 * Show line wrap, re-color, line align and text scrolling.
 */
void lv_example_label_1(void)
{
    lv_obj_t * label1 = lv_label_create(lv_scr_act());
    lv_label_set_long_mode(label1, LV_LABEL_LONG_WRAP);     /*Break the long lines*/
    lv_label_set_recolor(label1, true);                      /*Enable re-coloring by␣
↪commands in the text*/
    lv_label_set_text(label1, "#0000ff Re-color# #ff00ff words# #ff0000 of a# label,␣
↪align the lines to the center "
                      "and wrap long text automatically.");
    lv_obj_set_width(label1, 150);  /*Set smaller width to make the lines wrap*/
```

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```
    lv_obj_set_style_text_align(label1, LV_TEXT_ALIGN_CENTER, 0);
    lv_obj_align(label1, LV_ALIGN_CENTER, 0, -40);

    lv_obj_t * label2 = lv_label_create(lv_scr_act());
    lv_label_set_long_mode(label2, LV_LABEL_LONG_SCROLL_CIRCULAR);     /*Circular␣
↪scroll*/
    lv_obj_set_width(label2, 150);
    lv_label_set_text(label2, "It is a circularly scrolling text. ");
    lv_obj_align(label2, LV_ALIGN_CENTER, 0, 40);
}

#endif
```

```
#
# Show line wrap, re-color, line align and text scrolling.
#
label1 = lv.label(lv.scr_act())
label1.set_long_mode(lv.label.LONG.WRAP)      # Break the long lines*/
label1.set_recolor(True)                      # Enable re-coloring by commands in the␣
↪text
label1.set_text("#0000ff Re-color# #ff00ff words# #ff0000 of a# label, align the␣
↪lines to the center"
                              "and  wrap long text automatically.")
label1.set_width(150)                         # Set smaller width to make the lines␣
↪wrap
label1.set_style_text_align(lv.ALIGN.CENTER, 0)
label1.align(lv.ALIGN.CENTER, 0, -40)


label2 = lv.label(lv.scr_act())
label2.set_long_mode(lv.label.LONG.SCROLL_CIRCULAR) # Circular scroll
label2.set_width(150)
label2.set_text("It is a circularly scrolling text. ")
label2.align(lv.ALIGN.CENTER, 0, 40)
```

Text shadow

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_BUILD_EXAMPLES

/**
 * Create a fake text shadow
 */
void lv_example_label_2(void)
{
    /*Create a style for the shadow*/
    static lv_style_t style_shadow;
    lv_style_init(&style_shadow);
    lv_style_set_text_opa(&style_shadow, LV_OPA_30);
    lv_style_set_text_color(&style_shadow, lv_color_black());

    /*Create a label for the shadow first (it's in the background)*/
    lv_obj_t * shadow_label = lv_label_create(lv_scr_act());
```

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```
    lv_obj_add_style(shadow_label, &style_shadow, 0);

    /*Create the main label*/
    lv_obj_t * main_label = lv_label_create(lv_scr_act());
    lv_label_set_text(main_label, "A simple method to create\n"
                      "shadows on a text.\n"
                      "It even works with\n\n"
                      "newlines     and spaces.");

    /*Set the same text for the shadow label*/
    lv_label_set_text(shadow_label, lv_label_get_text(main_label));

    /*Position the main label*/
    lv_obj_align(main_label, LV_ALIGN_CENTER, 0, 0);

    /*Shift the second label down and to the right by 2 pixel*/
    lv_obj_align_to(shadow_label, main_label, LV_ALIGN_TOP_LEFT, 2, 2);
}

#endif
```

```
#
# Create a fake text shadow
#

# Create a style for the shadow
style_shadow = lv.style_t()
style_shadow.init()
style_shadow.set_text_opa(lv.OPA._30)
style_shadow.set_text_color(lv.color_black())

# Create a label for the shadow first (it's in the background)
shadow_label = lv.label(lv.scr_act())
shadow_label.add_style(style_shadow, 0)

# Create the main label
main_label = lv.label(lv.scr_act())
main_label.set_text("A simple method to create\n"
                   "shadows on a text.\n"
                   "It even works with\n\n"
                   "newlines     and spaces.")

# Set the same text for the shadow label
shadow_label.set_text(lv.label.get_text(main_label))

# Position the main label
main_label.align(lv.ALIGN.CENTER, 0, 0)

# Shift the second label down and to the right by 2 pixel
shadow_label.align_to(main_label, lv.ALIGN.TOP_LEFT, 2, 2)
```

Show LTR, RTL and Chinese texts

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_BUILD_EXAMPLES && LV_FONT_DEJAVU_16_PERSIAN_HEBREW && LV_FONT_
↪SIMSUN_16_CJK && LV_USE_BIDI

/**
 * Show mixed LTR, RTL and Chinese label
 */
void lv_example_label_3(void)
{
    lv_obj_t * ltr_label = lv_label_create(lv_scr_act());
    lv_label_set_text(ltr_label, "In modern terminology, a microcontroller is similar␣
↪to a system on a chip (SoC).");
    lv_obj_set_style_text_font(ltr_label, &lv_font_montserrat_16, 0);
    lv_obj_set_width(ltr_label, 310);
    lv_obj_align(ltr_label, LV_ALIGN_TOP_LEFT, 5, 5);

    lv_obj_t * rtl_label = lv_label_create(lv_scr_act());
    lv_label_set_text(rtl_label,
                      ",□□□□□ □□ □□□□□ □□□□□ □□□□□□ □□□□□□ □□□□□□□ :□□□□□□□□) CPU - Central␣
↪Processing Unit).");
    lv_obj_set_style_base_dir(rtl_label, LV_BASE_DIR_RTL, 0);
    lv_obj_set_style_text_font(rtl_label, &lv_font_dejavu_16_persian_hebrew, 0);
    lv_obj_set_width(rtl_label, 310);
    lv_obj_align(rtl_label, LV_ALIGN_LEFT_MID, 5, 0);

    lv_obj_t * cz_label = lv_label_create(lv_scr_act());
    lv_label_set_text(cz_label,
                      "□□□□□□Embedded System□□\n□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□");
    lv_obj_set_style_text_font(cz_label, &lv_font_simsun_16_cjk, 0);
    lv_obj_set_width(cz_label, 310);
    lv_obj_align(cz_label, LV_ALIGN_BOTTOM_LEFT, 5, -5);
}

#endif
```

```
import fs_driver
#
# Show mixed LTR, RTL and Chinese label
#

ltr_label = lv.label(lv.scr_act())
ltr_label.set_text("In modern terminology, a microcontroller is similar to a system␣
↪on a chip (SoC).")
# ltr_label.set_style_text_font(ltr_label, &lv_font_montserrat_16, 0);

fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'S')

try:
    ltr_label.set_style_text_font(ltr_label, lv.font_montserrat_16, 0)
except:
    font_montserrat_16 = lv.font_load("S:../../assets/font/montserrat-16.fnt")
    ltr_label.set_style_text_font(font_montserrat_16, 0)

ltr_label.set_width(310)
```

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```
ltr_label.align(lv.ALIGN.TOP_LEFT, 5, 5)

rtl_label = lv.label(lv.scr_act())
rtl_label.set_text(",□□□□ □□ □□□□ □□□□ □□□□□ □□□□□ □□□□□□ :□□□□□□□) CPU - Central␣
↪Processing Unit).")
rtl_label.set_style_base_dir(lv.BASE_DIR.RTL, 0)
rtl_label.set_style_text_font(lv.font_dejavu_16_persian_hebrew, 0)
rtl_label.set_width(310)
rtl_label.align(lv.ALIGN.LEFT_MID, 5, 0)

font_simsun_16_cjk = lv.font_load("S:../../assets/font/lv_font_simsun_16_cjk.fnt")

cz_label = lv.label(lv.scr_act())
cz_label.set_style_text_font(font_simsun_16_cjk, 0)
cz_label.set_text("□□□□□□Embedded System□□\n□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□")
cz_label.set_width(310)
cz_label.align(lv.ALIGN.BOTTOM_LEFT, 5, -5)
```

Draw label with gradient color

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_USE_CANVAS && LV_BUILD_EXAMPLES && LV_USE_DRAW_MASKS

#define MASK_WIDTH 100
#define MASK_HEIGHT 45

static void add_mask_event_cb(lv_event_t * e)
{
    static lv_draw_mask_map_param_t m;
    static int16_t mask_id;

    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    lv_opa_t * mask_map = lv_event_get_user_data(e);
    if(code == LV_EVENT_COVER_CHECK) {
        lv_event_set_cover_res(e, LV_COVER_RES_MASKED);
    }
    else if(code == LV_EVENT_DRAW_MAIN_BEGIN) {
        lv_draw_mask_map_init(&m, &obj->coords, mask_map);
        mask_id = lv_draw_mask_add(&m, NULL);

    }
    else if(code == LV_EVENT_DRAW_MAIN_END) {
        lv_draw_mask_free_param(&m);
        lv_draw_mask_remove_id(mask_id);
    }
}

/**
 * Draw label with gradient color
 */
void lv_example_label_4(void)
{
    /* Create the mask of a text by drawing it to a canvas*/
```

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```
    static lv_opa_t mask_map[MASK_WIDTH * MASK_HEIGHT];

    /*Create a "8 bit alpha" canvas and clear it*/
    lv_obj_t * canvas = lv_canvas_create(lv_scr_act());
    lv_canvas_set_buffer(canvas, mask_map, MASK_WIDTH, MASK_HEIGHT, LV_COLOR_FORMAT_
↪L8);
    lv_canvas_fill_bg(canvas, lv_color_black(), LV_OPA_TRANSP);

    /*Draw a label to the canvas. The result "image" will be used as mask*/
    lv_draw_label_dsc_t label_dsc;
    lv_draw_label_dsc_init(&label_dsc);
    label_dsc.color = lv_color_white();
    label_dsc.align = LV_TEXT_ALIGN_CENTER;
    lv_canvas_draw_text(canvas, 5, 5, MASK_WIDTH, &label_dsc, "Text with gradient");

    /*The mask is reads the canvas is not required anymore*/
    lv_obj_del(canvas);

    /* Create an object from where the text will be masked out.
     * Now it's a rectangle with a gradient but it could be an image too*/
    lv_obj_t * grad = lv_obj_create(lv_scr_act());
    lv_obj_set_size(grad, MASK_WIDTH, MASK_HEIGHT);
    lv_obj_center(grad);
    lv_obj_set_style_bg_color(grad, lv_color_hex(0xff0000), 0);
    lv_obj_set_style_bg_grad_color(grad, lv_color_hex(0x0000ff), 0);
    lv_obj_set_style_bg_grad_dir(grad, LV_GRAD_DIR_HOR, 0);
    lv_obj_add_event(grad, add_mask_event_cb, LV_EVENT_ALL, mask_map);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/widgets/
↪label/lv_example_label_4.py
```

Customize circular scrolling animation

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_BUILD_EXAMPLES

/**
 * Show customizing the circular scrolling animation of a label with `LV_LABEL_LONG_
↪SCROLL_CIRCULAR`
 * long mode.
 */
void lv_example_label_5(void)
{
    static lv_anim_t animation_template;
    static lv_style_t label_style;

    lv_anim_init(&animation_template);
    lv_anim_set_delay(&animation_template, 1000);           /*Wait 1 second to start␣
↪the first scroll*/
    lv_anim_set_repeat_delay(&animation_template,
                             3000);    /*Repeat the scroll 3 seconds after the label␣
↪scrolls back to the initial position*/
```

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```
    /*Initialize the label style with the animation template*/
    lv_style_init(&label_style);
    lv_style_set_anim(&label_style, &animation_template);

    lv_obj_t * label1 = lv_label_create(lv_scr_act());
    lv_label_set_long_mode(label1, LV_LABEL_LONG_SCROLL_CIRCULAR);      /*Circular␣
↪scroll*/
    lv_obj_set_width(label1, 150);
    lv_label_set_text(label1, "It is a circularly scrolling text. ");
    lv_obj_align(label1, LV_ALIGN_CENTER, 0, 40);
    lv_obj_add_style(label1, &label_style, LV_STATE_DEFAULT);           /*Add the␣
↪style to the label*/
}

#endif
```

```
#
# Show customizing the circular scrolling animation of a label with `LV_LABEL_LONG_
↪SCROLL_CIRCULAR` long mode.
#

label1 = lv.label(lv.scr_act())
label1.set_long_mode(lv.label.LONG.SCROLL_CIRCULAR)         # Circular scroll
label1.set_width(150)
label1.set_text("It is a circularly scrolling text. ")
label1.align(lv.ALIGN.CENTER, 0, 40)
```

6.16.7 API

Typedefs

typedef uint8_t **lv_label_long_mode_t**

Enums

enum **[anonymous]**

Long mode behaviors. Used in 'lv_label_ext_t'

Values:

enumerator **LV_LABEL_LONG_WRAP**

Keep the object width, wrap lines longer than object width and expand the object height

enumerator **LV_LABEL_LONG_DOT**

Keep the size and write dots at the end if the text is too long enumerator **`LV_LABEL_LONG_SCROLL`**

Keep the size and roll the text back and forth

enumerator **`LV_LABEL_LONG_SCROLL_CIRCULAR`**

Keep the size and roll the text circularly

enumerator **`LV_LABEL_LONG_CLIP`**

Keep the size and clip the text out of it

Functions

`LV_EXPORT_CONST_INT`(LV_LABEL_DOT_NUM)

`LV_EXPORT_CONST_INT`(LV_LABEL_POS_LAST)

`LV_EXPORT_CONST_INT`(LV_LABEL_TEXT_SELECTION_OFF)

lv_obj_t ***`lv_label_create`**(*lv_obj_t* *parent)

Create a label object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new label.

Returns pointer to the created button

void **`lv_label_set_text`**(*lv_obj_t* *obj, const char *text)

Set a new text for a label. Memory will be allocated to store the text by the label.

Parameters

- **`obj`** -- pointer to a label object
- **`text`** -- '\0' terminated character string. NULL to refresh with the current text.

`void lv_label_set_text_fmt (lv_obj_t *obj, const char *fmt,...`
`) LV_FORMAT_ATTRIBUTE(2`

`void void lv_label_set_text_static (lv_obj_t *obj, const char *text)`

Set a static text. It will not be saved by the label so the 'text' variable has to be 'alive' while the label exists.

Parameters

- **`obj`** -- pointer to a label object
- **`text`** -- pointer to a text. NULL to refresh with the current text.

void **`lv_label_set_long_mode`**(*lv_obj_t* *obj, *lv_label_long_mode_t* long_mode)

Set the behavior of the label with text longer than the object size

Parameters

- **`obj`** -- pointer to a label object
- **`long_mode`** -- the new mode from 'lv_label_long_mode' enum. In LV_LONG_WRAP/DOT/SCROLL/SCROLL_CIRC the size of the label should be set AFTER this function

void **`lv_label_set_recolor`**(*lv_obj_t* *obj, bool en)

void **`lv_label_set_text_selection_start`**(*lv_obj_t* *obj, uint32_t index)

Set where text selection should start

Parameters

- **`obj`** -- pointer to a label object
- **`index`** -- character index from where selection should start. `LV_LABEL_TEXT_SELECTION_OFF` for no selection

void **`lv_label_set_text_selection_end`**(*lv_obj_t* *obj, uint32_t index)

Set where text selection should end

Parameters

- **`obj`** -- pointer to a label object
- **`index`** -- character index where selection should end. `LV_LABEL_TEXT_SELECTION_OFF` for no selection

char ***`lv_label_get_text`**(const *lv_obj_t* *obj)

Get the text of a label

Parameters **`obj`** -- pointer to a label object

Returns the text of the label

lv_label_long_mode_t **`lv_label_get_long_mode`**(const *lv_obj_t* *obj)

Get the long mode of a label

Parameters **`obj`** -- pointer to a label object

Returns the current long mode

bool **`lv_label_get_recolor`**(const *lv_obj_t* *obj)

Get the recoloring attribute

Parameters **`obj`** -- pointer to a label object

Returns true: recoloring is enabled, false: disable

void **`lv_label_get_letter_pos`**(const *lv_obj_t* *obj, uint32_t char_id, lv_point_t *pos)

Get the relative x and y coordinates of a letter

Parameters

- **`obj`** -- pointer to a label object
- **`index`** -- index of the character [0 ... text length - 1]. Expressed in character index, not byte index (different in UTF-8)
- **`pos`** -- store the result here (E.g. index = 0 gives 0;0 coordinates if the text if aligned to the left)

uint32_t **`lv_label_get_letter_on`**(const *lv_obj_t* *obj, lv_point_t *pos_in)

Get the index of letter on a relative point of a label.

Parameters

- **`obj`** -- pointer to label object
- **`pos`** -- pointer to point with coordinates on a the label

Returns The index of the letter on the 'pos_p' point (E.g. on 0;0 is the 0. letter if aligned to the left) Expressed in character index and not byte index (different in UTF-8)

bool **`lv_label_is_char_under_pos`**(const *lv_obj_t* *obj, lv_point_t *pos)

Check if a character is drawn under a point.

Parameters

- **`obj`** -- pointer to a label object
- **`pos`** -- Point to check for character under

Returns whether a character is drawn under the point

uint32_t **`lv_label_get_text_selection_start`**(const *lv_obj_t* *obj)

Get the selection start index.

Parameters **`obj`** -- pointer to a label object.

Returns selection start index. `LV_LABEL_TEXT_SELECTION_OFF` if nothing is selected.

uint32_t **`lv_label_get_text_selection_end`**(const *lv_obj_t* *obj)

Get the selection end index.

Parameters **`obj`** -- pointer to a label object.

Returns selection end index. `LV_LABEL_TXT_SEL_OFF` if nothing is selected.

void **`lv_label_ins_text`**(*lv_obj_t* *obj, uint32_t pos, const char *txt)

Insert a text to a label. The label text can not be static.

Parameters

- **`obj`** -- pointer to a label object
- **`pos`** -- character index to insert. Expressed in character index and not byte index. 0: before first char. LV_LABEL_POS_LAST: after last char.
- **`txt`** -- pointer to the text to insert

void **`lv_label_cut_text`**(*lv_obj_t* *obj, uint32_t pos, uint32_t cnt)

Delete characters from a label. The label text can not be static.

Parameters

- **`obj`** -- pointer to a label object
- **`pos`** -- character index from where to cut. Expressed in character index and not byte index. 0: start in from of the first character
- **`cnt`** -- number of characters to cut

Variables

const lv_obj_class_t **`lv_label_class`**

struct **`lv_label_t`**

Public Members

lv_obj_t **obj**

char ***text**

char ***tmp_ptr**

char **tmp**[LV_LABEL_DOT_NUM + 1]

union *lv_label_t*::[anonymous] **dot**

uint32_t **dot_end**

lv_draw_label_hint_t **hint**

uint32_t **sel_start**

uint32_t **sel_end**

lv_point_t **size_cache**

lv_point_t **offset**

lv_label_long_mode_t **long_mode**

uint8_t **static_txt**

uint8_t **recolor**

uint8_t **expand**

uint8_t **dot_tmp_alloc**

uint8_t **invalid_size_cache**

6.17 LED (lv_led)

6.17.1 Overview

The LEDs are rectangle-like (or circle) object whose brightness can be adjusted. With lower brightness the colors of the LED become darker.

6.17.2 Parts and Styles

The LEDs have only one main part, called `LV_LED_PART_MAIN` and it uses all the typical background style properties.

6.17.3 Usage

Color

You can set the color of the LED with `lv_led_set_color(led, lv_color_hex(0xff0080))`. This will be used as background color, border color, and shadow color.

Brightness

You can set their brightness with `lv_led_set_bright(led, bright)`. The brightness should be between 0 (darkest) and 255 (lightest).

Toggle

Use `lv_led_on(led)` and `lv_led_off(led)` to set the brightness to a predefined ON or OFF value. The `lv_led_toggle(led)` toggles between the ON and OFF state.

6.17.4 Events

- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` is sent for the following types:
  - `LV_LED_DRAW_PART_RECTANGLE` The main rectangle. `LV_OBJ_DRAW_PART_RECTANGLE` is not sent by the base object.
    - `part`: `LV_PART_MAIN`
    - `rect_dsc`
    - `draw_area`: the area of the rectangle

See the events of the *Base object* too.

Learn more about *Events*.

6.17.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.17.6 Example

LED with custom style

```c
#include "../../lv_examples.h"
#if LV_USE_LED && LV_BUILD_EXAMPLES

/**
 * Create LED's with different brightness and color
 */
void lv_example_led_1(void)
{
    /*Create a LED and switch it OFF*/
    lv_obj_t * led1  = lv_led_create(lv_scr_act());
    lv_obj_align(led1, LV_ALIGN_CENTER, -80, 0);
    lv_led_off(led1);

    /*Copy the previous LED and set a brightness*/
    lv_obj_t * led2  = lv_led_create(lv_scr_act());
    lv_obj_align(led2, LV_ALIGN_CENTER, 0, 0);
    lv_led_set_brightness(led2, 150);
    lv_led_set_color(led2, lv_palette_main(LV_PALETTE_RED));

    /*Copy the previous LED and switch it ON*/
    lv_obj_t * led3  = lv_led_create(lv_scr_act());
    lv_obj_align(led3, LV_ALIGN_CENTER, 80, 0);
    lv_led_on(led3);
}

#endif
```

```python
#
# Create LED's with different brightness and color
#

# Create a LED and switch it OFF
led1  = lv.led(lv.scr_act())
led1.align(lv.ALIGN.CENTER, -80, 0)
led1.off()

# Copy the previous LED and set a brightness
led2  = lv.led(lv.scr_act())
led2.align(lv.ALIGN.CENTER, 0, 0)
led2.set_brightness(150)
led2.set_color(lv.palette_main(lv.PALETTE.RED))

# Copy the previous LED and switch it ON
led3  = lv.led(lv.scr_act())
led3.align(lv.ALIGN.CENTER, 80, 0)
```

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```
led3.on()
```

6.17.7 API

Enums

enum **`lv_led_draw_part_type_t`**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_led_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **`LV_LED_DRAW_PART_RECTANGLE`**

The main rectangle

Functions

lv_obj_t ***`lv_led_create`**(*lv_obj_t* *parent)

Create a led object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new led

Returns pointer to the created led

void **`lv_led_set_color`**(*lv_obj_t* *led, lv_color_t color)

Set the color of the LED

Parameters

- **`led`** -- pointer to a LED object
- **`color`** -- the color of the LED

void **`lv_led_set_brightness`**(*lv_obj_t* *led, uint8_t bright)

Set the brightness of a LED object

Parameters

- **`led`** -- pointer to a LED object
- **`bright`** -- LV_LED_BRIGHT_MIN (max. dark) ... LV_LED_BRIGHT_MAX (max. light)

void **`lv_led_on`**(*lv_obj_t* *led)

Light on a LED

Parameters **`led`** -- pointer to a LED object

void **`lv_led_off`**(*lv_obj_t* *led)

Light off a LED

Parameters **`led`** -- pointer to a LED object void **`lv_led_toggle`**(*lv_obj_t* *led)

Toggle the state of a LED

Parameters **`led`** -- pointer to a LED object

uint8_t **`lv_led_get_brightness`**(const *lv_obj_t* *obj)

Get the brightness of a LEd object

Parameters **`led`** -- pointer to LED object

Returns bright 0 (max. dark) ... 255 (max. light)

Variables

const lv_obj_class_t **`lv_led_class`**

struct **`lv_led_t`**

Public Members

lv_obj_t **`obj`**

lv_color_t **`color`**

uint8_t **`bright`**

Current brightness of the LED (0..255)

6.18 Line (lv_line)

6.18.1 Overview

The Line object is capable of drawing straight lines between a set of points.

6.18.2 Parts and Styles

- `LV_PART_MAIN` uses all the typical background properties and line style properties.

6.18.3 Usage

Set points

The points have to be stored in an `lv_point_t` array and passed to the object by the `lv_line_set_points(lines, point_array, point_cnt)` function.

Their coordinates can either be specified as raw pixel coordinates (e.g. `{5, 10}`), or as a percentage of the line's bounding box using `LV_PCT(x)`. In the latter case, the line's width/height may need to be set explicitly using `lv_obj_set_width/height`, as percentage values do not automatically expand the bounding box.

Auto-size

By default, the Line's width and height are set to `LV_SIZE_CONTENT`. This means it will automatically set its size to fit all the points. If the size is set explicitly, parts on the line may not be visible.

Invert y

By default, the *y == 0* point is in the top of the object. It might be counter-intuitive in some cases so the y coordinates can be inverted with `lv_line_set_y_invert(line, true)`. In this case, *y == 0* will be the bottom of the object. *y invert* is disabled by default.

6.18.4 Events

Only the Generic events are sent by the object type.

See the events of the *Base object* too.

Learn more about *Events*.

6.18.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.18.6 Example

Simple Line

```
#include "../../lv_examples.h"
#if LV_USE_LINE && LV_BUILD_EXAMPLES

void lv_example_line_1(void)
{
    /*Create an array for the points of the line*/
    static lv_point_t line_points[] = { {5, 5}, {70, 70}, {120, 10}, {180, 60}, {240,␣
↪10} };

    /*Create style*/
    static lv_style_t style_line;
    lv_style_init(&style_line);
    lv_style_set_line_width(&style_line, 8);
    lv_style_set_line_color(&style_line, lv_palette_main(LV_PALETTE_BLUE));
    lv_style_set_line_rounded(&style_line, true);

    /*Create a line and apply the new style*/
    lv_obj_t * line1;
    line1 = lv_line_create(lv_scr_act());
    lv_line_set_points(line1, line_points, 5);     /*Set the points*/
    lv_obj_add_style(line1, &style_line, 0);
    lv_obj_center(line1);
}
```

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```
#endif
```

```
# Create an array for the points of the line
line_points = [ {"x":5, "y":5},
                {"x":70, "y":70},
                {"x":120, "y":10},
                {"x":180, "y":60},
                {"x":240, "y":10}]

# Create style
style_line = lv.style_t()
style_line.init()
style_line.set_line_width(8)
style_line.set_line_color(lv.palette_main(lv.PALETTE.BLUE))
style_line.set_line_rounded(True)

# Create a line and apply the new style
line1 = lv.line(lv.scr_act())
line1.set_points(line_points, 5)     # Set the points
line1.add_style(style_line, 0)
line1.center()
```

6.18.7 API

Functions

lv_obj_t ***lv_line_create**(*lv_obj_t* *parent)

Create a line object

Parameters **parent** -- pointer to an object, it will be the parent of the new line

Returns pointer to the created line

void **lv_line_set_points**(*lv_obj_t* *obj, const lv_point_t points[], uint16_t point_num)

Set an array of points. The line object will connect these points.

Parameters

- **obj** -- pointer to a line object
- **points** -- an array of points. Only the address is saved, so the array needs to be alive while the line exists
- **point_num** -- number of points in 'point_a'

void **lv_line_set_y_invert**(*lv_obj_t* *obj, bool en)

Enable (or disable) the y coordinate inversion. If enabled then y will be subtracted from the height of the object, therefore the y = 0 coordinate will be on the bottom.

Parameters

- **obj** -- pointer to a line object
- **en** -- true: enable the y inversion, false:disable the y inversion

bool **lv_line_get_y_invert**(const *lv_obj_t* *obj)

Get the y inversion attribute

Parameters **obj** -- pointer to a line object

Returns true: y inversion is enabled, false: disabled

Variables

const lv_obj_class_t **lv_line_class**

struct **lv_line_t**

Public Members

lv_obj_t **obj**

const lv_point_t ***point_array**

Pointer to an array with the points of the line

uint16_t **point_num**

Number of points in 'point_array'

uint8_t **y_inv**

1: y == 0 will be on the bottom

6.19 List (lv_list)

6.19.1 Overview

The List is basically a rectangle with vertical layout to which Buttons and Texts can be added

6.19.2 Parts and Styles

Background

- `LV_PART_MAIN` The main part of the list that uses all the typical background properties
- `LV_PART_SCROLLBAR` The scrollbar. See the *Base objects* documentation for details.

Buttons and Texts See the *Button*'s and *Label*'s documentation.

6.19.3 Usage

Buttons

`lv_list_add_btn(list, icon, text)` adds a full-width button with an icon - that can be an image or symbol - and a text.

The text starts to scroll horizontally if it's too long.

Texts

`lv_list_add_text(list, text)` adds a text.

6.19.4 Events

No special events are sent by the List, but sent by the Button as usual.

Learn more about *Events*.

6.19.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.19.6 Example

Simple List

```
#include "../../lv_examples.h"
#if LV_USE_LIST && LV_BUILD_EXAMPLES
static lv_obj_t * list1;

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_CLICKED) {
        LV_UNUSED(obj);
        LV_LOG_USER("Clicked: %s", lv_list_get_btn_text(list1, obj));
    }
}
void lv_example_list_1(void)
{
    /*Create a list*/
    list1 = lv_list_create(lv_scr_act());
    lv_obj_set_size(list1, 180, 220);
    lv_obj_center(list1);

    /*Add buttons to the list*/
    lv_obj_t * btn;
```

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```
    lv_list_add_text(list1, "File");
    btn = lv_list_add_btn(list1, LV_SYMBOL_FILE, "New");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_DIRECTORY, "Open");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_SAVE, "Save");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_CLOSE, "Delete");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_EDIT, "Edit");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    lv_list_add_text(list1, "Connectivity");
    btn = lv_list_add_btn(list1, LV_SYMBOL_BLUETOOTH, "Bluetooth");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_GPS, "Navigation");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_USB, "USB");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_BATTERY_FULL, "Battery");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    lv_list_add_text(list1, "Exit");
    btn = lv_list_add_btn(list1, LV_SYMBOL_OK, "Apply");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
    btn = lv_list_add_btn(list1, LV_SYMBOL_CLOSE, "Close");
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
            print("Clicked: list1." + list1.get_btn_text(obj))

# Create a list
list1 = lv.list(lv.scr_act())
list1.set_size(180, 220)
list1.center()

# Add buttons to the list
list1.add_text("File")
btn_new = list1.add_btn(lv.SYMBOL.FILE, "New")
btn_new.add_event(event_handler,lv.EVENT.ALL, None)
btn_open = list1.add_btn(lv.SYMBOL.DIRECTORY, "Open")
btn_open.add_event(event_handler,lv.EVENT.ALL, None)
btn_save = list1.add_btn(lv.SYMBOL.SAVE, "Save")
btn_save.add_event(event_handler,lv.EVENT.ALL, None)
btn_delete = list1.add_btn(lv.SYMBOL.CLOSE, "Delete")
btn_delete.add_event(event_handler,lv.EVENT.ALL, None)
btn_edit = list1.add_btn(lv.SYMBOL.EDIT, "Edit")
btn_edit.add_event(event_handler,lv.EVENT.ALL, None)

list1.add_text("Connectivity")
```

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```
btn_bluetooth = list1.add_btn(lv.SYMBOL.BLUETOOTH, "Bluetooth")
btn_bluetooth.add_event(event_handler,lv.EVENT.ALL, None)
btn_navig = list1.add_btn(lv.SYMBOL.GPS, "Navigation")
btn_navig.add_event(event_handler,lv.EVENT.ALL, None)
btn_USB = list1.add_btn(lv.SYMBOL.USB, "USB")
btn_USB.add_event(event_handler,lv.EVENT.ALL, None)
btn_battery = list1.add_btn(lv.SYMBOL.BATTERY_FULL, "Battery")
btn_battery.add_event(event_handler,lv.EVENT.ALL, None)

list1.add_text("Exit")
btn_apply = list1.add_btn(lv.SYMBOL.OK, "Apply")
btn_apply.add_event(event_handler,lv.EVENT.ALL, None)
btn_close = list1.add_btn(lv.SYMBOL.CLOSE, "Close")
btn_close.add_event(event_handler,lv.EVENT.ALL, None)
```

Sorting a List using up and down buttons

```
#include <stdlib.h>


#include "../../lv_examples.h"
#if LV_USE_LIST && LV_BUILD_EXAMPLES

static lv_obj_t * list1;
static lv_obj_t * list2;

static lv_obj_t * currentButton = NULL;

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_CLICKED) {
        LV_LOG_USER("Clicked: %s", lv_list_get_btn_text(list1, obj));

        if(currentButton == obj) {
            currentButton = NULL;
        }
        else {
            currentButton = obj;
        }
        lv_obj_t * parent = lv_obj_get_parent(obj);
        uint32_t i;
        for(i = 0; i < lv_obj_get_child_cnt(parent); i++) {
            lv_obj_t * child = lv_obj_get_child(parent, i);
            if(child == currentButton) {
                lv_obj_add_state(child, LV_STATE_CHECKED);
            }
            else {
                lv_obj_clear_state(child, LV_STATE_CHECKED);
            }
        }
    }
}
```

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```
static void event_handler_top(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_CLICKED) {
        if(currentButton == NULL) return;
        lv_obj_move_background(currentButton);
        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_up(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if((code == LV_EVENT_CLICKED) || (code == LV_EVENT_LONG_PRESSED_REPEAT)) {
        if(currentButton == NULL) return;
        uint32_t index = lv_obj_get_index(currentButton);
        if(index <= 0) return;
        lv_obj_move_to_index(currentButton, index - 1);
        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_center(lv_event_t * e)
{
    const lv_event_code_t code = lv_event_get_code(e);
    if((code == LV_EVENT_CLICKED) || (code == LV_EVENT_LONG_PRESSED_REPEAT)) {
        if(currentButton == NULL) return;

        lv_obj_t * parent = lv_obj_get_parent(currentButton);
        const uint32_t pos = lv_obj_get_child_cnt(parent) / 2;

        lv_obj_move_to_index(currentButton, pos);

        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_dn(lv_event_t * e)
{
    const lv_event_code_t code = lv_event_get_code(e);
    if((code == LV_EVENT_CLICKED) || (code == LV_EVENT_LONG_PRESSED_REPEAT)) {
        if(currentButton == NULL) return;
        const uint32_t index = lv_obj_get_index(currentButton);

        lv_obj_move_to_index(currentButton, index + 1);
        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
    }
}

static void event_handler_bottom(lv_event_t * e)
{
    const lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_CLICKED) {
        if(currentButton == NULL) return;
        lv_obj_move_foreground(currentButton);
        lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
```

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```
    }
}

static void event_handler_swap(lv_event_t * e)
{
    const lv_event_code_t code = lv_event_get_code(e);
    // lv_obj_t* obj = lv_event_get_target(e);
    if((code == LV_EVENT_CLICKED) || (code == LV_EVENT_LONG_PRESSED_REPEAT)) {
        uint32_t cnt = lv_obj_get_child_cnt(list1);
        for(int i = 0; i < 100; i++)
            if(cnt > 1) {
                lv_obj_t * obj = lv_obj_get_child(list1, rand() % cnt);
                lv_obj_move_to_index(obj, rand() % cnt);
                if(currentButton != NULL) {
                    lv_obj_scroll_to_view(currentButton, LV_ANIM_ON);
                }
            }
    }
}

void lv_example_list_2(void)
{
    /*Create a list*/
    list1 = lv_list_create(lv_scr_act());
    lv_obj_set_size(list1, lv_pct(60), lv_pct(100));
    lv_obj_set_style_pad_row(list1, 5, 0);

    /*Add buttons to the list*/
    lv_obj_t * btn;
    int i;
    for(i = 0; i < 15; i++) {
        btn = lv_btn_create(list1);
        lv_obj_set_width(btn, lv_pct(50));
        lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

        lv_obj_t * lab = lv_label_create(btn);
        lv_label_set_text_fmt(lab, "Item %d", i);
    }

    /*Select the first button by default*/
    currentButton = lv_obj_get_child(list1, 0);
    lv_obj_add_state(currentButton, LV_STATE_CHECKED);

    /*Create a second list with up and down buttons*/
    list2 = lv_list_create(lv_scr_act());
    lv_obj_set_size(list2, lv_pct(40), lv_pct(100));
    lv_obj_align(list2, LV_ALIGN_TOP_RIGHT, 0, 0);
    lv_obj_set_flex_flow(list2, LV_FLEX_FLOW_COLUMN);

    btn = lv_list_add_btn(list2, NULL, "Top");
    lv_obj_add_event(btn, event_handler_top, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, LV_SYMBOL_UP, "Up");
    lv_obj_add_event(btn, event_handler_up, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);
```

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```
    btn = lv_list_add_btn(list2, LV_SYMBOL_LEFT, "Center");
    lv_obj_add_event(btn, event_handler_center, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, LV_SYMBOL_DOWN, "Down");
    lv_obj_add_event(btn, event_handler_dn, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, NULL, "Bottom");
    lv_obj_add_event(btn, event_handler_bottom, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);

    btn = lv_list_add_btn(list2, LV_SYMBOL_SHUFFLE, "Shuffle");
    lv_obj_add_event(btn, event_handler_swap, LV_EVENT_ALL, NULL);
    lv_group_remove_obj(btn);
}

#endif
```

```
import urandom

currentButton = None
list1 = None

def event_handler(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
        if currentButton == obj:
            currentButton = None
        else:
            currentButton = obj
        parent = obj.get_parent()
        for i in range( parent.get_child_cnt()):
            child = parent.get_child(i)
            if child == currentButton:
                child.add_state(lv.STATE.CHECKED)
            else:
                child.clear_state(lv.STATE.CHECKED)

def event_handler_top(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
        if currentButton == None:
            return
        currentButton.move_background()
        currentButton.scroll_to_view( lv.ANIM.ON)

def event_handler_up(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
```

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```
        if currentButton == None:
            return
        index = currentButton.get_index()
        if index <= 0:
            return
        currentButton.move_to_index(index - 1)
        currentButton.scroll_to_view(lv.ANIM.ON)

def event_handler_center(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        if currentButton == None:
            return
        parent = currentButton.get_parent()
        pos = parent.get_child_cnt() // 2
        currentButton.move_to_index(pos)
        currentButton.scroll_to_view(lv.ANIM.ON)

def event_handler_dn(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        if currentButton == None:
            return
        index = currentButton.get_index()
        currentButton.move_to_index(index + 1)
        currentButton.scroll_to_view(lv.ANIM.ON)

def event_handler_bottom(e):
    global currentButton
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        if currentButton == None:
            return
        currentButton.move_foreground()
        currentButton.scroll_to_view(lv.ANIM.ON)

def event_handler_swap(e):
    global currentButton
    global list1
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
        cnt = list1.get_child_cnt()
        for i in range(100):
            if cnt > 1:
                obj = list1.get_child(urandom.getrandbits(32) % cnt )
                obj.move_to_index(urandom.getrandbits(32) % cnt)
        if currentButton != None:
            currentButton.scroll_to_view(lv.ANIM.ON)

#Create a list with buttons that can be sorted
list1 = lv.list(lv.scr_act())
```

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```
list1.set_size(lv.pct(60), lv.pct(100))
list1.set_style_pad_row( 5, 0)

for i in range(15):
    btn = lv.btn(list1)
    btn.set_width(lv.pct(100))
    btn.add_event( event_handler, lv.EVENT.CLICKED, None)
    lab = lv.label(btn)
    lab.set_text("Item " + str(i))

#Select the first button by default
currentButton = list1.get_child(0)
currentButton.add_state(lv.STATE.CHECKED)

#Create a second list with up and down buttons
list2 = lv.list(lv.scr_act())
list2.set_size(lv.pct(40), lv.pct(100))
list2.align(lv.ALIGN.TOP_RIGHT, 0, 0)
list2.set_flex_flow(lv.FLEX_FLOW.COLUMN)

btn = list2.add_btn(None, "Top")
btn.add_event(event_handler_top, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(lv.SYMBOL.UP, "Up")
btn.add_event(event_handler_up, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(lv.SYMBOL.LEFT, "Center")
btn.add_event(event_handler_center, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(lv.SYMBOL.DOWN, "Down")
btn.add_event(event_handler_dn, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(None, "Bottom")
btn.add_event(event_handler_bottom, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)

btn = list2.add_btn(lv.SYMBOL.SHUFFLE, "Shuffle")
btn.add_event(event_handler_swap, lv.EVENT.ALL, None)
lv.group_remove_obj(btn)
```

6.19.7 API

Functions

lv_obj_t ***lv_list_create**(*lv_obj_t* *parent)

lv_obj_t ***lv_list_add_text**(*lv_obj_t* *list, const char *txt)

lv_obj_t ***lv_list_add_btn**(*lv_obj_t* *list, const void *icon, const char *txt)

const char ***lv_list_get_btn_text**(*lv_obj_t* *list, *lv_obj_t* *btn)

Variables

const lv_obj_class_t **`lv_list_class`**

const lv_obj_class_t **`lv_list_text_class`**

const lv_obj_class_t **`lv_list_btn_class`**

6.20 Menu (lv_menu)

6.20.1 Overview

The menu widget can be used to easily create multi-level menus. It handles the traversal between pages automatically.

6.20.2 Parts and Styles

The menu widget is built from the following objects:

- Main container: lv_menu_main_cont
  - Main header: lv_menu_main_header_cont
    - Back btn: *lv_btn*
      - Back btn icon: *lv_img*
  - Main page: lv_menu_page
- Sidebar container: lv_menu_sidebar_cont
  - Sidebar header: lv_menu_sidebar_header_cont
    - Back btn: *lv_btn*
      - Back btn icon: *lv_img*
  - Sidebar page: lv_menu_page

6.20.3 Usage

Create a menu

`lv_menu_create(parent)` creates a new empty menu.

Header mode

The following header modes exist:

- `LV_MENU_HEADER_TOP_FIXED` Header is positioned at the top.
- `LV_MENU_HEADER_TOP_UNFIXED` Header is positioned at the top and can be scrolled out of view.
- `LV_MENU_HEADER_BOTTOM_FIXED` Header is positioned at the bottom.

You can set header modes with `lv_menu_set_mode_header(menu, LV_MENU_HEADER...)`.

Root back button mode

The following root back button modes exist:

- `LV_MENU_ROOT_BACK_BTN_DISABLED`
- `LV_MENU_ROOT_BACK_BTN_ENABLED`

You can set root back button modes with `lv_menu_set_mode_root_back_btn(menu, LV_MENU_ROOT_BACK_BTN...)`.

Create a menu page

`lv_menu_page_create(menu, title)` creates a new empty menu page. You can add any widgets to the page.

Set a menu page in the main area

Once a menu page has been created, you can set it to the main area with `lv_menu_set_page(menu, page)`. NULL to clear main and clear menu history.

Set a menu page in the sidebar

Once a menu page has been created, you can set it to the sidebar with `lv_menu_set_sidebar_page(menu, page)`. NULL to clear sidebar.

Linking between menu pages

For instance, you have created a btn obj in the main page. When you click the btn obj, you want it to open up a new page, use `lv_menu_set_load_page_event(menu, obj, new page)`.

Create a menu container, section, separator

The following objects can be created so that it is easier to style the menu:

`lv_menu_cont_create(parent page)` creates a new empty container.

`lv_menu_section_create(parent page)` creates a new empty section.

`lv_menu_separator_create(parent page)` creates a separator.

6.20.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when a page is shown.
  - `lv_menu_get_cur_main_page(menu)` returns a pointer to menu page that is currently displayed in main.
  - `lv_menu_get_cur_sidebar_page(menu)` returns a pointer to menu page that is currently displayed in sidebar.
- `LV_EVENT_CLICKED` Sent when a back btn in a header from either main or sidebar is clicked. `LV_OBJ_FLAG_EVENT_BUBBLE` is enabled on the buttons so you can add events to the menu itself.
  - `lv_menu_back_btn_is_root(menu, btn)` to check if btn is root back btn

See the events of the *Base object* too.

Learn more about *Events*.

6.20.5 Keys

No keys are handled by the menu widget.

Learn more about *Keys*.

6.20.6 Example

Simple Menu

```c
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_BUILD_EXAMPLES

void lv_example_menu_1(void)
{
    /*Create a menu object*/
    lv_obj_t * menu = lv_menu_create(lv_scr_act());
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    lv_obj_t * cont;
    lv_obj_t * label;

    /*Create a sub page*/
    lv_obj_t * sub_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(sub_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    /*Create a main page*/
    lv_obj_t * main_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 1");
```

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```
    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 2");

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 3 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_page);

    lv_menu_set_page(menu, main_page);
}

#endif
```

```
# Create a menu object
menu = lv.menu(lv.scr_act())
menu.set_size(320, 240)
menu.center()

# Create a sub page
sub_page = lv.menu_page(menu, None)
cont = lv.menu_cont(sub_page)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")

# Create a main page
main_page = lv.menu_page(menu, None)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 1")

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 2")

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 3 (Click me!)")
menu.set_load_page_event(cont, sub_page)

menu.set_page(main_page)
```

Simple Menu with root btn

```
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_USE_MSGBOX && LV_BUILD_EXAMPLES

static void back_event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_t * menu = lv_event_get_user_data(e);

    if(lv_menu_back_btn_is_root(menu, obj)) {
```

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```c
        lv_obj_t * mbox1 = lv_msgbox_create(NULL, "Hello", "Root back btn click.",␣
↪NULL, true);
        lv_obj_center(mbox1);
    }
}

void lv_example_menu_2(void)
{
    lv_obj_t * menu = lv_menu_create(lv_scr_act());
    lv_menu_set_mode_root_back_btn(menu, LV_MENU_ROOT_BACK_BTN_ENABLED);
    lv_obj_add_event(menu, back_event_handler, LV_EVENT_CLICKED, menu);
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    lv_obj_t * cont;
    lv_obj_t * label;

    /*Create a sub page*/
    lv_obj_t * sub_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(sub_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    /*Create a main page*/
    lv_obj_t * main_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 1");

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 2");

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 3 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_page);

    lv_menu_set_page(menu, main_page);
}

#endif
```

```python
def back_event_handler(e):
    obj = e.get_target_obj()
    if menu.back_btn_is_root(obj):
        mbox1 = lv.msgbox(lv.scr_act(), "Hello", "Root back btn click.", None, True)
        mbox1.center()

# Create a menu object
menu = lv.menu(lv.scr_act())
menu.set_mode_root_back_btn(lv.menu.ROOT_BACK_BTN.ENABLED)
menu.add_event(back_event_handler, lv.EVENT.CLICKED, None)
menu.set_size(320, 240)
```

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```
menu.center()

# Create a sub page
sub_page = lv.menu_page(menu, None)
cont = lv.menu_cont(sub_page)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")

# Create a main page
main_page = lv.menu_page(menu, None)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 1")

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 2")

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 3 (Click me!)")
menu.set_load_page_event(cont, sub_page)

menu.set_page(main_page)
```

Simple Menu with custom header

```
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_USE_USER_DATA && LV_BUILD_EXAMPLES

void lv_example_menu_3(void)
{
    /*Create a menu object*/
    lv_obj_t * menu = lv_menu_create(lv_scr_act());
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    /*Modify the header*/
    lv_obj_t * back_btn = lv_menu_get_main_header_back_btn(menu);
    lv_obj_t * back_btn_label = lv_label_create(back_btn);
    lv_label_set_text(back_btn_label, "Back");

    lv_obj_t * cont;
    lv_obj_t * label;

    /*Create sub pages*/
    lv_obj_t * sub_1_page = lv_menu_page_create(menu, "Page 1");

    cont = lv_menu_cont_create(sub_1_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    lv_obj_t * sub_2_page = lv_menu_page_create(menu, "Page 2");
```

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```
    cont = lv_menu_cont_create(sub_2_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    lv_obj_t * sub_3_page = lv_menu_page_create(menu, "Page 3");

    cont = lv_menu_cont_create(sub_3_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding here");

    /*Create a main page*/
    lv_obj_t * main_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 1 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_1_page);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 2 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_2_page);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 3 (Click me!)");
    lv_menu_set_load_page_event(menu, cont, sub_3_page);

    lv_menu_set_page(menu, main_page);
}

#endif
```

```
# Create a menu object
menu = lv.menu(lv.scr_act())
menu.set_size(320, 240)
menu.center()

# Create sub pages
sub_page_1 = lv.menu_page(menu, "Page 1")

cont = lv.menu_cont(sub_page_1)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")

sub_page_2 = lv.menu_page(menu, "Page 2")

cont = lv.menu_cont(sub_page_2)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")

sub_page_3 = lv.menu_page(menu, "Page 3")

cont = lv.menu_cont(sub_page_3)
label = lv.label(cont)
label.set_text("Hello, I am hiding here")
```

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```
# Create a main page
main_page = lv.menu_page(menu, None)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 1 (Click me!)")
menu.set_load_page_event(cont, sub_page_1)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 2 (Click me!)")
menu.set_load_page_event(cont, sub_page_2)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 3 (Click me!)")
menu.set_load_page_event(cont, sub_page_3)

menu.set_page(main_page)
```

Simple Menu with floating btn to add new menu page

```
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_BUILD_EXAMPLES

static uint32_t btn_cnt = 1;
static lv_obj_t * main_page;
static lv_obj_t * menu;

static void float_btn_event_cb(lv_event_t * e)
{
    LV_UNUSED(e);

    btn_cnt++;

    lv_obj_t * cont;
    lv_obj_t * label;

    lv_obj_t * sub_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(sub_page);
    label = lv_label_create(cont);
    lv_label_set_text_fmt(label, "Hello, I am hiding inside %"LV_PRIu32"", btn_cnt);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text_fmt(label, "Item %"LV_PRIu32"", btn_cnt);
    lv_menu_set_load_page_event(menu, cont, sub_page);

    lv_obj_scroll_to_view_recursive(cont, LV_ANIM_ON);
}

void lv_example_menu_4(void)
{
```

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```
    /*Create a menu object*/
    menu = lv_menu_create(lv_scr_act());
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    lv_obj_t * cont;
    lv_obj_t * label;

    /*Create a sub page*/
    lv_obj_t * sub_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(sub_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Hello, I am hiding inside the first item");

    /*Create a main page*/
    main_page = lv_menu_page_create(menu, NULL);

    cont = lv_menu_cont_create(main_page);
    label = lv_label_create(cont);
    lv_label_set_text(label, "Item 1");
    lv_menu_set_load_page_event(menu, cont, sub_page);

    lv_menu_set_page(menu, main_page);

    /*Create floating btn*/
    lv_obj_t * float_btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(float_btn, 50, 50);
    lv_obj_add_flag(float_btn, LV_OBJ_FLAG_FLOATING);
    lv_obj_align(float_btn, LV_ALIGN_BOTTOM_RIGHT, -10, -10);
    lv_obj_add_event(float_btn, float_btn_event_cb, LV_EVENT_CLICKED, menu);
    lv_obj_set_style_radius(float_btn, LV_RADIUS_CIRCLE, 0);
    lv_obj_set_style_bg_img_src(float_btn, LV_SYMBOL_PLUS, 0);
    lv_obj_set_style_text_font(float_btn, lv_theme_get_font_large(float_btn), 0);
}

#endif
```

```
btn_cnt = 1

def float_btn_event_cb(e):
    global btn_cnt
    btn_cnt += 1

    sub_page = lv.menu_page(menu, None)

    cont = lv.menu_cont(sub_page)
    label = lv.label(cont)
    label.set_text("Hello, I am hiding inside {:d}".format(btn_cnt))

    cont = lv.menu_cont(main_page)
    label = lv.label(cont)
    label.set_text("Item {:d}".format(btn_cnt))
    menu.set_load_page_event(cont, sub_page)
```

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```
# Create a menu object
menu = lv.menu(lv.scr_act())
menu.set_size(320, 240)
menu.center()

# Create a sub page
sub_page = lv.menu_page(menu, None)

cont = lv.menu_cont(sub_page)
label = lv.label(cont)
label.set_text("Hello, I am hiding inside the first item")

# Create a main page
main_page = lv.menu_page(menu, None)

cont = lv.menu_cont(main_page)
label = lv.label(cont)
label.set_text("Item 1")
menu.set_load_page_event(cont, sub_page)

menu.set_page(main_page)

float_btn = lv.btn(lv.scr_act())
float_btn.set_size(50, 50)
float_btn.add_flag(lv.obj.FLAG.FLOATING)
float_btn.align(lv.ALIGN.BOTTOM_RIGHT, -10, -10)
float_btn.add_event(float_btn_event_cb, lv.EVENT.CLICKED, None)
float_btn.set_style_radius(lv.RADIUS_CIRCLE, 0)
float_btn.set_style_bg_img_src(lv.SYMBOL.PLUS, 0)
float_btn.set_style_text_font(lv.theme_get_font_large(float_btn), 0)
```

Complex Menu

```
#include "../../lv_examples.h"
#if LV_USE_MENU && LV_USE_MSGBOX && LV_BUILD_EXAMPLES

enum {
    LV_MENU_ITEM_BUILDER_VARIANT_1,
    LV_MENU_ITEM_BUILDER_VARIANT_2
};
typedef uint8_t lv_menu_builder_variant_t;

static void back_event_handler(lv_event_t * e);
static void switch_handler(lv_event_t * e);
lv_obj_t * root_page;
static lv_obj_t * create_text(lv_obj_t * parent, const char * icon, const char * txt,
                              lv_menu_builder_variant_t builder_variant);
static lv_obj_t * create_slider(lv_obj_t * parent,
                                const char * icon, const char * txt, int32_t min,␣
↪int32_t max, int32_t val);
static lv_obj_t * create_switch(lv_obj_t * parent,
                                const char * icon, const char * txt, bool chk);

void lv_example_menu_5(void)
{
```

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```
    lv_obj_t * menu = lv_menu_create(lv_scr_act());

    lv_color_t bg_color = lv_obj_get_style_bg_color(menu, 0);
    if(lv_color_brightness(bg_color) > 127) {
        lv_obj_set_style_bg_color(menu, lv_color_darken(lv_obj_get_style_bg_
↪color(menu, 0), 10), 0);
    }
    else {
        lv_obj_set_style_bg_color(menu, lv_color_darken(lv_obj_get_style_bg_
↪color(menu, 0), 50), 0);
    }
    lv_menu_set_mode_root_back_btn(menu, LV_MENU_ROOT_BACK_BTN_ENABLED);
    lv_obj_add_event(menu, back_event_handler, LV_EVENT_CLICKED, menu);
    lv_obj_set_size(menu, lv_disp_get_hor_res(NULL), lv_disp_get_ver_res(NULL));
    lv_obj_center(menu);

    lv_obj_t * cont;
    lv_obj_t * section;

    /*Create sub pages*/
    lv_obj_t * sub_mechanics_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_mechanics_page, lv_obj_get_style_pad_left(lv_menu_
↪get_main_header(menu), 0), 0);
    lv_menu_separator_create(sub_mechanics_page);
    section = lv_menu_section_create(sub_mechanics_page);
    create_slider(section, LV_SYMBOL_SETTINGS, "Velocity", 0, 150, 120);
    create_slider(section, LV_SYMBOL_SETTINGS, "Acceleration", 0, 150, 50);
    create_slider(section, LV_SYMBOL_SETTINGS, "Weight limit", 0, 150, 80);

    lv_obj_t * sub_sound_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_sound_page, lv_obj_get_style_pad_left(lv_menu_get_
↪main_header(menu), 0), 0);
    lv_menu_separator_create(sub_sound_page);
    section = lv_menu_section_create(sub_sound_page);
    create_switch(section, LV_SYMBOL_AUDIO, "Sound", false);

    lv_obj_t * sub_display_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_display_page, lv_obj_get_style_pad_left(lv_menu_get_
↪main_header(menu), 0), 0);
    lv_menu_separator_create(sub_display_page);
    section = lv_menu_section_create(sub_display_page);
    create_slider(section, LV_SYMBOL_SETTINGS, "Brightness", 0, 150, 100);

    lv_obj_t * sub_software_info_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_software_info_page, lv_obj_get_style_pad_left(lv_
↪menu_get_main_header(menu), 0), 0);
    section = lv_menu_section_create(sub_software_info_page);
    create_text(section, NULL, "Version 1.0", LV_MENU_ITEM_BUILDER_VARIANT_1);

    lv_obj_t * sub_legal_info_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_legal_info_page, lv_obj_get_style_pad_left(lv_menu_
↪get_main_header(menu), 0), 0);
    section = lv_menu_section_create(sub_legal_info_page);
    for(uint32_t i = 0; i < 15; i++) {
        create_text(section, NULL,
                    "This is a long long long long long long long long long text, if␣
↪it is long enough it may scroll.",
```

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```
                    LV_MENU_ITEM_BUILDER_VARIANT_1);
    }

    lv_obj_t * sub_about_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_about_page, lv_obj_get_style_pad_left(lv_menu_get_
↪main_header(menu), 0), 0);
    lv_menu_separator_create(sub_about_page);
    section = lv_menu_section_create(sub_about_page);
    cont = create_text(section, NULL, "Software information", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_software_info_page);
    cont = create_text(section, NULL, "Legal information", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_legal_info_page);

    lv_obj_t * sub_menu_mode_page = lv_menu_page_create(menu, NULL);
    lv_obj_set_style_pad_hor(sub_menu_mode_page, lv_obj_get_style_pad_left(lv_menu_
↪get_main_header(menu), 0), 0);
    lv_menu_separator_create(sub_menu_mode_page);
    section = lv_menu_section_create(sub_menu_mode_page);
    cont = create_switch(section, LV_SYMBOL_AUDIO, "Sidebar enable", true);
    lv_obj_add_event(lv_obj_get_child(cont, 2), switch_handler, LV_EVENT_VALUE_
↪CHANGED, menu);

    /*Create a root page*/
    root_page = lv_menu_page_create(menu, "Settings");
    lv_obj_set_style_pad_hor(root_page, lv_obj_get_style_pad_left(lv_menu_get_main_
↪header(menu), 0), 0);
    section = lv_menu_section_create(root_page);
    cont = create_text(section, LV_SYMBOL_SETTINGS, "Mechanics", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_mechanics_page);
    cont = create_text(section, LV_SYMBOL_AUDIO, "Sound", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_sound_page);
    cont = create_text(section, LV_SYMBOL_SETTINGS, "Display", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_display_page);

    create_text(root_page, NULL, "Others", LV_MENU_ITEM_BUILDER_VARIANT_1);
    section = lv_menu_section_create(root_page);
    cont = create_text(section, NULL, "About", LV_MENU_ITEM_BUILDER_VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_about_page);
    cont = create_text(section, LV_SYMBOL_SETTINGS, "Menu mode", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
    lv_menu_set_load_page_event(menu, cont, sub_menu_mode_page);

    lv_menu_set_sidebar_page(menu, root_page);

    lv_obj_send_event(lv_obj_get_child(lv_obj_get_child(lv_menu_get_cur_sidebar_
↪page(menu), 0), 0), LV_EVENT_CLICKED,
                      NULL);
}

static void back_event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
```

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```
    lv_obj_t * menu = lv_event_get_user_data(e);

    if(lv_menu_back_btn_is_root(menu, obj)) {
        lv_obj_t * mbox1 = lv_msgbox_create(NULL, "Hello", "Root back btn click.",␣
↪NULL, true);
        lv_obj_center(mbox1);
    }
}

static void switch_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * menu = lv_event_get_user_data(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        if(lv_obj_has_state(obj, LV_STATE_CHECKED)) {
            lv_menu_set_page(menu, NULL);
            lv_menu_set_sidebar_page(menu, root_page);
            lv_obj_send_event(lv_obj_get_child(lv_obj_get_child(lv_menu_get_cur_
↪sidebar_page(menu), 0), 0), LV_EVENT_CLICKED,
                                  NULL);
        }
        else {
            lv_menu_set_sidebar_page(menu, NULL);
            lv_menu_clear_history(menu); /* Clear history because we will be showing␣
↪the root page later */
            lv_menu_set_page(menu, root_page);
        }
    }
}

static lv_obj_t * create_text(lv_obj_t * parent, const char * icon, const char * txt,
                              lv_menu_builder_variant_t builder_variant)
{
    lv_obj_t * obj = lv_menu_cont_create(parent);

    lv_obj_t * img = NULL;
    lv_obj_t * label = NULL;

    if(icon) {
        img = lv_img_create(obj);
        lv_img_set_src(img, icon);
    }

    if(txt) {
        label = lv_label_create(obj);
        lv_label_set_text(label, txt);
        lv_label_set_long_mode(label, LV_LABEL_LONG_SCROLL_CIRCULAR);
        lv_obj_set_flex_grow(label, 1);
    }

    if(builder_variant == LV_MENU_ITEM_BUILDER_VARIANT_2 && icon && txt) {
        lv_obj_add_flag(img, LV_OBJ_FLAG_FLEX_IN_NEW_TRACK);
        lv_obj_swap(img, label);
    }

    return obj;
```

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```
}

static lv_obj_t * create_slider(lv_obj_t * parent, const char * icon, const char *␣
↪txt, int32_t min, int32_t max,
                                int32_t val)
{
    lv_obj_t * obj = create_text(parent, icon, txt, LV_MENU_ITEM_BUILDER_VARIANT_2);

    lv_obj_t * slider = lv_slider_create(obj);
    lv_obj_set_flex_grow(slider, 1);
    lv_slider_set_range(slider, min, max);
    lv_slider_set_value(slider, val, LV_ANIM_OFF);

    if(icon == NULL) {
        lv_obj_add_flag(slider, LV_OBJ_FLAG_FLEX_IN_NEW_TRACK);
    }

    return obj;
}

static lv_obj_t * create_switch(lv_obj_t * parent, const char * icon, const char *␣
↪txt, bool chk)
{
    lv_obj_t * obj = create_text(parent, icon, txt, LV_MENU_ITEM_BUILDER_VARIANT_1);

    lv_obj_t * sw = lv_switch_create(obj);
    lv_obj_add_state(sw, chk ? LV_STATE_CHECKED : 0);

    return obj;
}

#endif
```

```
from micropython import const

def create_text(parent, icon, txt, builder_variant):

    obj = lv.menu_cont(parent)

    img = None
    label = None

    if icon  :
        img = lv.img(obj)
        img.set_src(icon)

    if txt :
        label = lv.label(obj)
        label.set_text(txt)
        label.set_long_mode(lv.label.LONG.SCROLL_CIRCULAR)
        label.set_flex_grow(1)

    if builder_variant == LV_MENU_ITEM_BUILDER_VARIANT_2 and icon and txt :
        img.add_flag(lv.OBJ_FLAG_FLEX_IN_NEW_TRACK)
        img.swap(label)
```

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```
    return obj


def create_slider(parent, icon, txt, min, max, val) :

    obj = create_text(parent, icon, txt, LV_MENU_ITEM_BUILDER_VARIANT_2)

    slider = lv.slider(obj)
    slider.set_flex_grow(1)
    slider.set_range(min, max)
    slider.set_value(val, lv.ANIM.OFF)

    if icon == None :
        slider.add_flag(lv.obj.FLAG_FLEX.IN_NEW_TRACK)

    return obj

def create_switch(parent, icon, txt, chk) :

    obj = create_text(parent, icon, txt, LV_MENU_ITEM_BUILDER_VARIANT_1)

    sw = lv.switch(obj)
    if chk == lv.STATE.CHECKED:
        sw.add_state(chk )
    else:
        sw.add_state(0)

    return obj


def back_event_handler(e,menu):

    obj = e.get_target_obj()
    # menu = lv_event_get_user_data(e);

    if menu.back_btn_is_root(obj) :
        mbox1 = lv.msgbox(None, "Hello", "Root back btn click.", None, True)
        mbox1.center()

def switch_handler(e,menu):

    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED :
        if obj.has_state(lv.STATE.CHECKED) :
            menu.set_page(None)
            menu.set_sidebar_page(root_page)
            menu.get_cur_sidebar_page().get_child(0).get_child(0).send_event(lv.EVENT.
↪CLICKED,None)
        else :
            menu.set_sidebar_page(None)
            menu.clear_history()      #  Clear history because we will be showing the␣
↪root page later
            menu.set_page(root_page)

LV_MENU_ITEM_BUILDER_VARIANT_1 = const(0)
```

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```
LV_MENU_ITEM_BUILDER_VARIANT_2 = const(1)

menu = lv.menu(lv.scr_act())

bg_color = menu.get_style_bg_color(0)
if bg_color.color_brightness() > 127 :
    menu.set_style_bg_color(menu.get_style_bg_color(0).color_darken(10),0)
else :
    menu.set_style_bg_color(menu.get_style_bg_color(0).color_darken(50),0)


menu.set_mode_root_back_btn(lv.menu.ROOT_BACK_BTN.ENABLED)
menu.add_event(lambda evt: back_event_handler(evt,menu), lv.EVENT.CLICKED, None)
menu.set_size(lv.pct(100), lv.pct(100))
menu.center()

# Create sub pages
sub_mechanics_page = lv.menu_page(menu, None)
sub_mechanics_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
lv.menu_separator(sub_mechanics_page)
section = lv.menu_section(sub_mechanics_page);
create_slider(section,lv.SYMBOL.SETTINGS, "Velocity", 0, 150, 120)
create_slider(section,lv.SYMBOL.SETTINGS, "Acceleration", 0, 150, 50)
create_slider(section,lv.SYMBOL.SETTINGS, "Weight limit", 0, 150, 80)

sub_sound_page = lv.menu_page(menu, None)
sub_sound_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
lv.menu_separator(sub_sound_page)
section = lv.menu_section(sub_sound_page)
create_switch(section,lv.SYMBOL.AUDIO, "Sound", False)

sub_display_page = lv.menu_page(menu, None)
sub_display_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
lv.menu_separator(sub_display_page)
section = lv.menu_section(sub_display_page)
create_slider(section,lv.SYMBOL.SETTINGS, "Brightness", 0, 150, 100)

sub_software_info_page = lv.menu_page(menu, None)
sub_software_info_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),
↪0)
section = lv.menu_section(sub_software_info_page)
create_text(section,None, "Version 1.0", LV_MENU_ITEM_BUILDER_VARIANT_1)

sub_legal_info_page = lv.menu_page(menu, None)
sub_legal_info_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)

section = lv.menu_section(sub_legal_info_page)

for i in range(15):
    create_text(section, None,
                "This is a long long long long long long long long long text, if it␣
↪is long enough it may scroll.",
                LV_MENU_ITEM_BUILDER_VARIANT_1)

sub_about_page = lv.menu_page(menu, None)
sub_about_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
```

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```
lv.menu_separator(sub_about_page)
section = lv.menu_section(sub_about_page)
cont = create_text(section, None, "Software information", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
menu.set_load_page_event(cont, sub_software_info_page);
cont = create_text(section, None, "Legal information", LV_MENU_ITEM_BUILDER_VARIANT_
↪1);
menu.set_load_page_event(cont, sub_legal_info_page)

sub_menu_mode_page = lv.menu_page(menu, None)
sub_menu_mode_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
lv.menu_separator(sub_menu_mode_page)
section = lv.menu_section(sub_menu_mode_page)
cont = create_switch(section, lv.SYMBOL.AUDIO, "Sidebar enable",True)
cont.get_child(2).add_event(lambda evt: switch_handler(evt,menu), lv.EVENT.VALUE_
↪CHANGED, None)

# Create a root page
root_page = lv.menu_page(menu, "Settings")
root_page.set_style_pad_hor(menu.get_main_header().get_style_pad_left(0),0)
section = lv.menu_section(root_page)
cont = create_text(section, lv.SYMBOL.SETTINGS, "Mechanics", LV_MENU_ITEM_BUILDER_
↪VARIANT_1)
menu.set_load_page_event(cont, sub_mechanics_page);
cont = create_text(section, lv.SYMBOL.AUDIO, "Sound", LV_MENU_ITEM_BUILDER_VARIANT_1);
menu.set_load_page_event(cont, sub_sound_page)
cont = create_text(section, lv.SYMBOL.SETTINGS, "Display", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
menu.set_load_page_event(cont, sub_display_page)

create_text(root_page, None, "Others", LV_MENU_ITEM_BUILDER_VARIANT_1);
section = lv.menu_section(root_page)
cont = create_text(section, None, "About", LV_MENU_ITEM_BUILDER_VARIANT_1);
menu.set_load_page_event(cont, sub_about_page)
cont = create_text(section, lv.SYMBOL.SETTINGS, "Menu mode", LV_MENU_ITEM_BUILDER_
↪VARIANT_1);
menu.set_load_page_event(cont, sub_menu_mode_page)

menu.set_sidebar_page(root_page)


menu.get_cur_sidebar_page().get_child(0).get_child(0).send_event(lv.EVENT.CLICKED,
↪None)
```

6.20.7 API

Typedefs

typedef uint8_t **`lv_menu_mode_header_t`**

typedef uint8_t **`lv_menu_mode_root_back_btn_t`**

typedef struct *lv_menu_load_page_event_data_t* **`lv_menu_load_page_event_data_t`**

Enums

enum **`[anonymous]`**

Values:

enumerator **`LV_MENU_HEADER_TOP_FIXED`**

enumerator **`LV_MENU_HEADER_TOP_UNFIXED`**

enumerator **`LV_MENU_HEADER_BOTTOM_FIXED`**

enum **`[anonymous]`**

Values:

enumerator **`LV_MENU_ROOT_BACK_BTN_DISABLED`**

enumerator **`LV_MENU_ROOT_BACK_BTN_ENABLED`**

Functions

lv_obj_t ***`lv_menu_create`**(*lv_obj_t* *parent)

Create a menu object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new menu

Returns pointer to the created menu

lv_obj_t ***`lv_menu_page_create`**(*lv_obj_t* *parent, char const *const title)

Create a menu page object

Parameters

- **`parent`** -- pointer to menu object
- **`title`** -- pointer to text for title in header (NULL to not display title)

Returns pointer to the created menu page *lv_obj_t* ***lv_menu_cont_create**(*lv_obj_t* *parent)

Create a menu cont object

Parameters **parent** -- pointer to an object, it will be the parent of the new menu cont object

Returns pointer to the created menu cont

lv_obj_t ***lv_menu_section_create**(*lv_obj_t* *parent)

Create a menu section object

Parameters **parent** -- pointer to an object, it will be the parent of the new menu section object

Returns pointer to the created menu section

lv_obj_t ***lv_menu_separator_create**(*lv_obj_t* *parent)

Create a menu separator object

Parameters **parent** -- pointer to an object, it will be the parent of the new menu separator object

Returns pointer to the created menu separator

void **lv_menu_set_page**(*lv_obj_t* *obj, *lv_obj_t* *page)

Set menu page to display in main

Parameters

- **obj** -- pointer to the menu
- **page** -- pointer to the menu page to set (NULL to clear main and clear menu history)

void **lv_menu_set_page_title**(*lv_obj_t* *page, char const *const title)

Set menu page title

Parameters

- **page** -- pointer to the menu page
- **title** -- pointer to text for title in header (NULL to not display title)

void **lv_menu_set_page_title_static**(*lv_obj_t* *page, char const *const title)

Set menu page title with a static text. It will not be saved by the label so the 'text' variable has to be 'alive' while the page exists.

Parameters

- **page** -- pointer to the menu page
- **title** -- pointer to text for title in header (NULL to not display title)

void **lv_menu_set_sidebar_page**(*lv_obj_t* *obj, *lv_obj_t* *page)

Set menu page to display in sidebar

Parameters

- **obj** -- pointer to the menu
- **page** -- pointer to the menu page to set (NULL to clear sidebar)

void **lv_menu_set_mode_header**(*lv_obj_t* *obj, *lv_menu_mode_header_t* mode_header)

Set the how the header should behave and its position

Parameters

- **obj** -- pointer to a menu
- **mode_header** --

void **`lv_menu_set_mode_root_back_btn`**(*lv_obj_t* *obj, *lv_menu_mode_root_back_btn_t* mode_root_back_btn)

Set whether back button should appear at root

Parameters

- **`obj`** -- pointer to a menu
- **`mode_root_back_btn`** --

void **`lv_menu_set_load_page_event`**(*lv_obj_t* *menu, *lv_obj_t* *obj, *lv_obj_t* *page)

Add menu to the menu item

Parameters

- **`menu`** -- pointer to the menu
- **`obj`** -- pointer to the obj
- **`page`** -- pointer to the page to load when obj is clicked

lv_obj_t ***`lv_menu_get_cur_main_page`**(*lv_obj_t* *obj)

Get a pointer to menu page that is currently displayed in main

Parameters **`obj`** -- pointer to the menu

Returns pointer to current page

lv_obj_t ***`lv_menu_get_cur_sidebar_page`**(*lv_obj_t* *obj)

Get a pointer to menu page that is currently displayed in sidebar

Parameters **`obj`** -- pointer to the menu

Returns pointer to current page

lv_obj_t ***`lv_menu_get_main_header`**(*lv_obj_t* *obj)

Get a pointer to main header obj

Parameters **`obj`** -- pointer to the menu

Returns pointer to main header obj

lv_obj_t ***`lv_menu_get_main_header_back_btn`**(*lv_obj_t* *obj)

Get a pointer to main header back btn obj

Parameters **`obj`** -- pointer to the menu

Returns pointer to main header back btn obj

lv_obj_t ***`lv_menu_get_sidebar_header`**(*lv_obj_t* *obj)

Get a pointer to sidebar header obj

Parameters **`obj`** -- pointer to the menu

Returns pointer to sidebar header obj

lv_obj_t ***`lv_menu_get_sidebar_header_back_btn`**(*lv_obj_t* *obj)

Get a pointer to sidebar header obj

Parameters **`obj`** -- pointer to the menu

Returns pointer to sidebar header back btn obj bool **`lv_menu_back_btn_is_root`**(*lv_obj_t* *menu, *lv_obj_t* *obj)

Check if an obj is a root back btn

Parameters **`menu`** -- pointer to the menu

Returns true if it is a root back btn

void **`lv_menu_clear_history`**(*lv_obj_t* *obj)

Clear menu history

Parameters **`obj`** -- pointer to the menu

Variables

const lv_obj_class_t **`lv_menu_class`**

const lv_obj_class_t **`lv_menu_page_class`**

const lv_obj_class_t **`lv_menu_cont_class`**

const lv_obj_class_t **`lv_menu_section_class`**

const lv_obj_class_t **`lv_menu_separator_class`**

const lv_obj_class_t **`lv_menu_sidebar_cont_class`**

const lv_obj_class_t **`lv_menu_main_cont_class`**

const lv_obj_class_t **`lv_menu_sidebar_header_cont_class`**

const lv_obj_class_t **`lv_menu_main_header_cont_class`**

struct **`lv_menu_load_page_event_data_t`**

Public Members

lv_obj_t ***`menu`**

lv_obj_t ***`page`**

struct **`lv_menu_history_t`**

Public Members

lv_obj_t ***page**

struct **lv_menu_t**

Public Members

lv_obj_t **obj**

lv_obj_t ***storage**

lv_obj_t ***main**

lv_obj_t ***main_page**

lv_obj_t ***main_header**

lv_obj_t ***main_header_back_btn**

lv_obj_t ***main_header_title**

lv_obj_t ***sidebar**

lv_obj_t ***sidebar_page**

lv_obj_t ***sidebar_header**

lv_obj_t ***sidebar_header_back_btn**

lv_obj_t ***sidebar_header_title**

lv_obj_t ***selected_tab**

lv_ll_t **history_ll**

uint8_t **cur_depth**

uint8_t **prev_depth**

uint8_t **sidebar_generated**

lv_menu_mode_header_t **`mode_header`**

lv_menu_mode_root_back_btn_t **`mode_root_back_btn`**

struct **`lv_menu_page_t`**

Public Members

lv_obj_t **`obj`**

char ***`title`**

bool **`static_title`**

6.21 Meter (lv_meter)

6.21.1 Overview

The Meter widget can visualize data in very flexible ways. In can show arcs, needles, ticks lines and labels.

6.21.2 Parts and Styles

- `LV_PART_MAIN` The background of the Meter. Uses the typical background properties.
- `LV_PART_TICK` The tick lines a labels using the *line* and *text* style properties.
- `LV_PART_INDICATOR` The needle line or image using the *line* and *img* style properties, as well as the background properties to draw a square (or circle) on the pivot of the needles. Padding makes the square larger.
- `LV_PART_ITEMS` The arcs using the *arc* properties.

6.21.3 Usage

Scale

The Scale has minor and major ticks, and labels on the major ticks.

The minor tick lines can be configured with: `lv_meter_set_scale_ticks(meter, tick_count, line_width, tick_length, ctick_olor)`.

To show major tick lines use `lv_meter_set_scale_major_ticks(meter, nth_major, tick_width, tick_length, tick_color, label_gap)`. `nth_major` to specify how many minor ticks to skip to draw a major tick.

Labels are added automatically on major ticks with `label_gap` distance from the ticks with text proportionally to the values of the tick line.

`lv_meter_set_scale_range(meter, min, max, angle_range, rotation)` sets the value and angle range of the scale.

Add indicators

Indicators can be added to meter and their value is interpreted in the range of the scale.

All the indicator add functions return an `lv_meter_indicator_t *`.

Needle line

`indic = lv_meter_add_needle_line(meter, line_width, line_color, r_mod)` adds a needle line to a Scale. By default, the length of the line is the same as the scale's radius but `r_mod` changes the length.

`lv_meter_set_indicator_value(meter, indic, value)` sets the value of the indicator.

Needle image

`indic = lv_meter_add_needle_img(meter, img_src, pivot_x, pivot_y)` sets an image that will be used as a needle. `img_src` should be a needle pointing to the right like this `-O--->`. `pivot_x` and `pivot_y` sets the pivot point of the rotation relative to the top left corner of the image.

`lv_meter_set_indicator_value(meter, inidicator, value)` sets the value of the indicator.

Arc

`indic = lv_meter_add_arc(meter, arc_width, arc_color, r_mod)` adds and arc indicator. . By default, the radius of the arc is the same as the scale's radius but `r_mod` changes the radius.

`lv_meter_set_indicator_start_value(meter, indic, value)` and `lv_meter_set_indicator_end_value(meter, inidicator, value)` sets the value of the indicator.

Scale lines (ticks)

`indic = lv_meter_add_scale_lines(meter, color_start, color_end, local, width_mod)` adds an indicator that modifies the ticks lines. If `local` is `true` the ticks' color will be faded from `color_start` to `color_end` in the indicator's start and end value range. If `local` is `false` `color_start` and `color_end` will be mapped to the start and end value of the scale and only a "slice" of that color gradient will be visible in the indicator's start and end value range. `width_mod` modifies the width of the tick lines.

`lv_meter_set_indicator_start_value(meter, inidicator, value)` and `lv_meter_set_indicator_end_value(meter, inidicator, value)` sets the value of the indicator.

6.21.4 Events

- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` is sent for the following types:
  - `LV_METER_DRAW_PART_ARC` The arc indicator
    - `part`: `LV_PART_ITEMS`
    - `sub_part_ptr`: pointer to the indicator
    - `arc_dsc`
    - `radius`: radius of the arc
    - `p1` center of the arc
  - `LV_METER_DRAW_PART_NEEDLE_LINE` The needle lines
    - `part`: `LV_PART_ITEMS`
    - `p1`, `p2` points of the line
    - `line_dsc`
    - `sub_part_ptr`: pointer to the indicator
  - `LV_METER_DRAW_PART_NEEDLE_IMG` The needle images
    - `part`: `LV_PART_ITEMS`
    - `p1`, `p2` points of the line
    - `img_dsc`
    - `sub_part_ptr`: pointer to the indicator
  - `LV_METER_DRAW_PART_TICK` The tick lines and labels
    - `part`: `LV_PART_TICKS`
    - `value`: the value of the line
    - `text`: `value` converted to decimal or `NULL` on minor lines
    - `label_dsc`: label draw descriptor or `NULL` on minor lines
    - `line_dsc`:
    - `id`: the index of the line

See the events of the *Base object* too.

Learn more about *Events*.

6.21.5 Keys

No keys are handled by the Meter widget.

Learn more about *Keys*.

6.21.6 Example

Simple meter

```
#include "../../lv_examples.h"
#if LV_USE_METER && LV_BUILD_EXAMPLES

static lv_obj_t * meter;

static void set_value(void * indic, int32_t v)
{
    lv_meter_set_indicator_value(meter, indic, v);
}

/**
 * A simple meter
 */
void lv_example_meter_1(void)
{
    meter = lv_meter_create(lv_scr_act());
    lv_obj_center(meter);
    lv_obj_set_size(meter, 200, 200);

    /*Add a scale first*/
    lv_meter_set_scale_ticks(meter, 41, 2, 10, lv_palette_main(LV_PALETTE_GREY));
    lv_meter_set_scale_major_ticks(meter, 8, 4, 15, lv_color_black(), 10);

    lv_meter_indicator_t * indic;

    /*Add a blue arc to the start*/
    indic = lv_meter_add_arc(meter, 3, lv_palette_main(LV_PALETTE_BLUE), 0);
    lv_meter_set_indicator_start_value(meter, indic, 0);
    lv_meter_set_indicator_end_value(meter, indic, 20);

    /*Make the tick lines blue at the start of the scale*/
    indic = lv_meter_add_scale_lines(meter, lv_palette_main(LV_PALETTE_BLUE), lv_
↪palette_main(LV_PALETTE_BLUE),
                                     false, 0);
    lv_meter_set_indicator_start_value(meter, indic, 0);
    lv_meter_set_indicator_end_value(meter, indic, 20);

    /*Add a red arc to the end*/
    indic = lv_meter_add_arc(meter, 3, lv_palette_main(LV_PALETTE_RED), 0);
    lv_meter_set_indicator_start_value(meter, indic, 80);
    lv_meter_set_indicator_end_value(meter, indic, 100);

    /*Make the tick lines red at the end of the scale*/
    indic = lv_meter_add_scale_lines(meter, lv_palette_main(LV_PALETTE_RED), lv_
↪palette_main(LV_PALETTE_RED), false,
                                     0);
    lv_meter_set_indicator_start_value(meter, indic, 80);
    lv_meter_set_indicator_end_value(meter, indic, 100);

    /*Add a needle line indicator*/
    indic = lv_meter_add_needle_line(meter, 4, lv_palette_main(LV_PALETTE_GREY), -10);

    /*Create an animation to set the value*/
```

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```
    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_exec_cb(&a, set_value);
    lv_anim_set_var(&a, indic);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_set_time(&a, 2000);
    lv_anim_set_repeat_delay(&a, 100);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_set_playback_delay(&a, 100);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_start(&a);
}

#endif
```

```
#!//opt/bin/lv_micropython -i
import utime as time
import lvgl as lv
import display_driver

def set_value(indic, v):
    meter.set_indicator_value(indic, v)

#
# A simple meter
#
meter = lv.meter(lv.scr_act())
meter.center()
meter.set_size(200, 200)

indic = lv.meter_indicator_t()

# Add a blue arc to the start
indic = meter.add_arc(3, lv.palette_main(lv.PALETTE.BLUE), 0)
meter.set_indicator_start_value(indic, 0)
meter.set_indicator_end_value(indic, 20)

# Make the tick lines blue at the start of the scale
indic = meter.add_scale_lines(lv.palette_main(lv.PALETTE.BLUE), lv.palette_main(lv.
↪PALETTE.BLUE), False, 0)
meter.set_indicator_start_value(indic, 0)
meter.set_indicator_end_value(indic, 20)

# Add a red arc to the end
indic = meter.add_arc(3, lv.palette_main(lv.PALETTE.RED), 0)
meter.set_indicator_start_value(indic, 80)
meter.set_indicator_end_value(indic, 100)

# Make the tick lines red at the end of the scale
indic = meter.add_scale_lines(lv.palette_main(lv.PALETTE.RED), lv.palette_main(lv.
↪PALETTE.RED), False, 0)
meter.set_indicator_start_value(indic, 80)
meter.set_indicator_end_value(indic, 100)

# Add a needle line indicator
indic = meter.add_needle_line(4, lv.palette_main(lv.PALETTE.GREY), -10)
```

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```
# Create an animation to set the value
a = lv.anim_t()
a.init()
a.set_var(indic)
a.set_values(0, 100)
a.set_time(2000)
a.set_repeat_delay(100)
a.set_playback_time(500)
a.set_playback_delay(100)
a.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a.set_custom_exec_cb(lambda a,val: set_value(indic,val))
lv.anim_t.start(a)
```

A meter with multiple arcs

```
#include "../../lv_examples.h"
#if LV_USE_METER && LV_BUILD_EXAMPLES

static lv_obj_t * meter;

static void set_value(void * indic, int32_t v)
{
    lv_meter_set_indicator_end_value(meter, indic, v);
}


/**
 * A meter with multiple arcs
 */
void lv_example_meter_2(void)
{
    meter = lv_meter_create(lv_scr_act());
    lv_obj_center(meter);
    lv_obj_set_size(meter, 220, 220);

    /*Remove the circle from the middle*/
    lv_obj_remove_style(meter, NULL, LV_PART_INDICATOR);

    /*Add a scale first*/
    lv_meter_set_scale_ticks(meter, 11, 2, 10, lv_palette_main(LV_PALETTE_GREY));
    lv_meter_set_scale_major_ticks(meter, 1, 2, 30, lv_color_hex3(0xeee), 15);
    lv_meter_set_scale_range(meter, 0, 100, 270, 90);

    /*Add a three arc indicator*/
    lv_meter_indicator_t * indic1 = lv_meter_add_arc(meter, 10, lv_palette_main(LV_
↪PALETTE_RED), 0);
    lv_meter_indicator_t * indic2 = lv_meter_add_arc(meter, 10, lv_palette_main(LV_
↪PALETTE_GREEN), -10);
    lv_meter_indicator_t * indic3 = lv_meter_add_arc(meter, 10, lv_palette_main(LV_
↪PALETTE_BLUE), -20);

    /*Create an animation to set the value*/
    lv_anim_t a;
```

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```
    lv_anim_init(&a);
    lv_anim_set_exec_cb(&a, set_value);
    lv_anim_set_values(&a, 0, 100);
    lv_anim_set_repeat_delay(&a, 100);
    lv_anim_set_playback_delay(&a, 100);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);

    lv_anim_set_time(&a, 2000);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_set_var(&a, indic1);
    lv_anim_start(&a);

    lv_anim_set_time(&a, 1000);
    lv_anim_set_playback_time(&a, 1000);
    lv_anim_set_var(&a, indic2);
    lv_anim_start(&a);

    lv_anim_set_time(&a, 1000);
    lv_anim_set_playback_time(&a, 2000);
    lv_anim_set_var(&a, indic3);
    lv_anim_start(&a);
}

#endif
```

```
#!//opt/bin/lv_micropython -i
import utime as time
import lvgl as lv
import display_driver

def set_value(indic,v):
    meter.set_indicator_end_value(indic, v)

#
# A meter with multiple arcs
#

meter = lv.meter(lv.scr_act())
meter.center()
meter.set_size(200, 200)

# Remove the circle from the middle
meter.remove_style(None, lv.PART.INDICATOR)

# Scale settings
meter.set_scale_ticks(11, 2, 10, lv.palette_main(lv.PALETTE.GREY))
meter.set_scale_major_ticks(1, 2, 30, lv.color_hex3(0xeee), 10)
meter.set_scale_range(0, 100, 270, 90)

# Add a three arc indicator
indic1 = meter.add_arc(10, lv.palette_main(lv.PALETTE.RED), 0)
indic2 = meter.add_arc(10, lv.palette_main(lv.PALETTE.GREEN), -10)
indic3 = meter.add_arc(10, lv.palette_main(lv.PALETTE.BLUE), -20)

# Create an animation to set the value
a1 = lv.anim_t()
```

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```
a1.init()
a1.set_values(0, 100)
a1.set_time(2000)
a1.set_repeat_delay(100)
a1.set_playback_delay(100)
a1.set_playback_time(500)
a1.set_var(indic1)
a1.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a1.set_custom_exec_cb(lambda a,val: set_value(indic1,val))
lv.anim_t.start(a1)

a2 = lv.anim_t()
a2.init()
a2.set_values(0, 100)
a2.set_time(1000)
a2.set_repeat_delay(100)
a2.set_playback_delay(100)
a2.set_playback_time(1000)
a2.set_var(indic2)
a2.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a2.set_custom_exec_cb(lambda a,val: set_value(indic2,val))
lv.anim_t.start(a2)

a3 = lv.anim_t()
a3.init()
a3.set_values(0, 100)
a3.set_time(1000)
a3.set_repeat_delay(100)
a3.set_playback_delay(100)
a3.set_playback_time(2000)
a3.set_var(indic3)
a3.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a3.set_custom_exec_cb(lambda a,val: set_value(indic3,val))
lv.anim_t.start(a3)
```

A clock from a meter

```
#include "../../lv_examples.h"
#if LV_USE_METER && LV_BUILD_EXAMPLES

static lv_obj_t * meter;

static void set_value(void * indic, int32_t v)
{
    lv_meter_set_indicator_end_value(meter, indic, v);
}

static void tick_label_event(lv_event_t * e)
{
    lv_obj_draw_part_dsc_t * draw_part_dsc = lv_event_get_draw_part_dsc(e);

    /*Be sure it's drawing meter related parts*/
```

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```
    if(draw_part_dsc->class_p != &lv_meter_class) return;

    /*Be sure it's drawing the ticks*/
    if(draw_part_dsc->type != LV_METER_DRAW_PART_TICK) return;

    /*Be sure it's a major ticks*/
    if(draw_part_dsc->id % 5) return;

    /*The order of numbers on the clock is tricky: 12, 1, 2, 3...*/
    if(draw_part_dsc->id == 0) {
        lv_strncpy(draw_part_dsc->text, "12", 4);
    }
    else {
        lv_snprintf(draw_part_dsc->text, 4, "%d", draw_part_dsc->id / 5);
    }
}

/**
 * A clock from a meter
 */
void lv_example_meter_3(void)
{
    meter = lv_meter_create(lv_scr_act());
    lv_obj_set_size(meter, 220, 220);
    lv_obj_center(meter);

    /*Create a scale for the minutes*/
    /*61 ticks in a 360 degrees range (the last and the first line overlaps)*/
    lv_meter_set_scale_ticks(meter, 60, 1, 10, lv_palette_main(LV_PALETTE_GREY));
    lv_meter_set_scale_major_ticks(meter, 5, 2, 20, lv_color_black(), 10);
    lv_meter_set_scale_range(meter, 0, 59, 354, 270);

    LV_IMG_DECLARE(img_hand)

    /*Add a the hands from images*/
    lv_meter_indicator_t * indic_min = lv_meter_add_needle_img(meter, &img_hand, 5,␣
↪5);
    lv_meter_indicator_t * indic_hour = lv_meter_add_needle_img(meter, &img_hand, 5,␣
↪5);

    lv_obj_add_event(meter, tick_label_event, LV_EVENT_DRAW_PART_BEGIN, NULL);


    /*Create an animation to set the value*/
    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_exec_cb(&a, set_value);
    lv_anim_set_values(&a, 0, 59);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);
    lv_anim_set_time(&a, 5000);     /*2 sec for 1 turn of the minute hand (1 hour)*/
    lv_anim_set_var(&a, indic_min);
    lv_anim_start(&a);

    lv_anim_set_var(&a, indic_hour);
    lv_anim_set_time(&a, 240000);    /*24 sec for 1 turn of the hour hand*/
    lv_anim_set_values(&a, 0, 59);
    lv_anim_start(&a);
```

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```
}

#endif
```

```
#!//opt/bin/lv_micropython -i
import utime as time
import lvgl as lv
import display_driver

# Create an image from the png file
try:
    with open('../../assets/img_hand_min.png','rb') as f:
        img_hand_min_data = f.read()
except:
    print("Could not find img_hand_min.png")
    sys.exit()

img_hand_min_dsc = lv.img_dsc_t({
  'data_size': len(img_hand_min_data),
  'data': img_hand_min_data
})

# Create an image from the png file
try:
    with open('../../assets/img_hand_hour.png','rb') as f:
        img_hand_hour_data = f.read()
except:
    print("Could not find img_hand_hour.png")
    sys.exit()

img_hand_hour_dsc = lv.img_dsc_t({
  'data_size': len(img_hand_hour_data),
  'data': img_hand_hour_data
})

def set_value(indic, v):
    meter.set_indicator_value(indic, v)
#
# A clock from a meter
#

def tick_label_event(e):
    draw_part_dsc = e.get_draw_part_dsc();

    # Be sure it's drawing the ticks
    if draw_part_dsc.type != lv.meter.DRAW_PART.TICK: return

    # Be sure it's a major ticks
    if draw_part_dsc.id % 5:  return

    # The order of numbers on the clock is tricky: 12, 1, 2, 3...*/
    txt = ["12", "1", "2as", "3", "4", "5", "6", "7", "8", "9", "10", "11"]
    # dsc.text is defined char text[16], I must therefore convert the Python string␣
↪to a byte_array

    idx = int(draw_part_dsc.id / 5)
```

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```
    draw_part_dsc.text = bytes(txt[idx],"ascii")

meter = lv.meter(lv.scr_act())
meter.set_size(220, 220)
meter.center()

# Create a scale for the minutes
# 60 ticks in a 354 degrees range
meter.set_scale_ticks(60, 1, 10, lv.palette_main(lv.PALETTE.GREY))
meter.set_scale_major_ticks(5, 2, 20, lv.color_black(), 10)         # Every tick is␣
↪major
meter.set_scale_range(0, 59, 354, 270)

# Add the hands from images
indic_min = meter.add_needle_img(img_hand_min_dsc, 5, 5)
indic_hour = meter.add_needle_img(img_hand_hour_dsc, 5, 5)

#Add an event to set the numbers of hours
meter.add_event(tick_label_event, lv.EVENT.DRAW_PART_BEGIN, None)

# Create an animation to set the value
a1 = lv.anim_t()
a1.init()
a1.set_values(0, 60)
a1.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
a1.set_time(2000)        # 2 sec for 1 turn of the minute hand (1 hour)
a1.set_var(indic_min)
a1.set_custom_exec_cb(lambda a1,val: set_value(indic_min,val))
lv.anim_t.start(a1)

a2 = lv.anim_t()
a2.init()
a2.set_var(indic_hour)
a2.set_time(24000)       # 24 sec for 1 turn of the hour hand
a2.set_values(0, 60)
a2.set_custom_exec_cb(lambda a2,val: set_value(indic_hour,val))
lv.anim_t.start(a2)
```

Pie chart

```
#include "../../lv_examples.h"
#if LV_USE_METER && LV_BUILD_EXAMPLES

/**
 * Create a pie chart
 */
void lv_example_meter_4(void)
{
    lv_obj_t * meter = lv_meter_create(lv_scr_act());

    /*Remove the background and the circle from the middle*/
    lv_obj_remove_style(meter, NULL, LV_PART_MAIN);
    lv_obj_remove_style(meter, NULL, LV_PART_INDICATOR);
```

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```
    lv_obj_set_size(meter, 200, 200);
    lv_obj_center(meter);

    /*Add a scale first with no ticks.*/
    lv_meter_set_scale_ticks(meter, 0, 0, 0, lv_color_black());
    lv_meter_set_scale_range(meter, 0, 100, 360, 0);

    /*Add a three arc indicator*/
    lv_coord_t indic_w = 100;
    lv_meter_indicator_t * indic1 = lv_meter_add_arc(meter, indic_w, lv_palette_
↪main(LV_PALETTE_ORANGE), 0);
    lv_meter_set_indicator_start_value(meter, indic1, 0);
    lv_meter_set_indicator_end_value(meter, indic1, 40);

    lv_meter_indicator_t * indic2 = lv_meter_add_arc(meter, indic_w, lv_palette_
↪main(LV_PALETTE_YELLOW), 0);
    lv_meter_set_indicator_start_value(meter, indic2, 40);  /*Start from the␣
↪previous*/
    lv_meter_set_indicator_end_value(meter, indic2, 80);

    lv_meter_indicator_t * indic3 = lv_meter_add_arc(meter, indic_w, lv_palette_
↪main(LV_PALETTE_DEEP_ORANGE), 0);
    lv_meter_set_indicator_start_value(meter, indic3, 80);  /*Start from the␣
↪previous*/
    lv_meter_set_indicator_end_value(meter, indic3, 100);
}

#endif
```

```
#
# Create a pie chart
#

meter = lv.meter(lv.scr_act())

# Remove the background and the circle from the middle
meter.remove_style(None, lv.PART.MAIN)
meter.remove_style(None, lv.PART.INDICATOR)

meter.set_size(200, 200)
meter.center()

# Add a scale first with no ticks.
meter.set_scale_ticks( 0, 0, 0, lv.color_black())
meter.set_scale_range(0, 100, 360, 0)

# Add a three arc indicator*
indic_w = 100
indic1 = meter.add_arc(indic_w,lv.palette_main(lv.PALETTE.ORANGE), 0)
meter.set_indicator_start_value(indic1, 0)
meter.set_indicator_end_value(indic1, 40)

indic2 = meter.add_arc(indic_w, lv.palette_main(lv.PALETTE.YELLOW), 0)
meter.set_indicator_start_value(indic2, 40)  # Start from the previous
meter.set_indicator_end_value(indic2, 80)

```

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```
indic3 = meter.add_arc(indic_w, lv.palette_main(lv.PALETTE.DEEP_ORANGE), 0)
meter.set_indicator_start_value(indic3, 80)  # Start from the previous
meter.set_indicator_end_value(indic3, 100)
```

6.21.7 API

Typedefs

typedef uint8_t **lv_meter_indicator_type_t**

Enums

enum **[anonymous]**

Values:

enumerator **LV_METER_INDICATOR_TYPE_NEEDLE_IMG**

enumerator **LV_METER_INDICATOR_TYPE_NEEDLE_LINE**

enumerator **LV_METER_INDICATOR_TYPE_SCALE_LINES**

enumerator **LV_METER_INDICATOR_TYPE_ARC**

enum **lv_meter_draw_part_type_t**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_meter_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **LV_METER_DRAW_PART_ARC**

The arc indicator

enumerator **LV_METER_DRAW_PART_NEEDLE_LINE**

The needle lines

enumerator **LV_METER_DRAW_PART_NEEDLE_IMG**

The needle images

enumerator **LV_METER_DRAW_PART_TICK**

The tick lines and labels

Functions

lv_obj_t ***lv_meter_create**(*lv_obj_t* *parent)

Create a Meter object

Parameters **parent** -- pointer to an object, it will be the parent of the new bar.

Returns pointer to the created meter

void **lv_meter_set_scale_ticks**(*lv_obj_t* *obj, uint16_t cnt, uint16_t width, uint16_t len, lv_color_t color)

Set the properties of the ticks of a scale

Parameters

- **obj** -- pointer to a meter object
- **cnt** -- number of tick lines
- **width** -- width of tick lines
- **len** -- length of tick lines
- **color** -- color of tick lines

void **lv_meter_set_scale_major_ticks**(*lv_obj_t* *obj, uint16_t nth, uint16_t width, uint16_t len, lv_color_t color, int16_t label_gap)

Make some "normal" ticks major ticks and set their attributes. Texts with the current value are also added to the major ticks.

Parameters

- **obj** -- pointer to a meter object
- **nth** -- make every Nth normal tick major tick. (start from the first on the left)
- **width** -- width of the major ticks
- **len** -- length of the major ticks
- **color** -- color of the major ticks
- **label_gap** -- gap between the major ticks and the labels

void **lv_meter_set_scale_range**(*lv_obj_t* *obj, int32_t min, int32_t max, uint32_t angle_range, uint32_t rotation)

Set the value and angular range of a scale.

Parameters

- **obj** -- pointer to a meter object
- **min** -- the minimum value
- **max** -- the maximal value
- **angle_range** -- the angular range of the scale
- **rotation** -- the angular offset from the 3 o'clock position (clock-wise)

lv_meter_indicator_t ***lv_meter_add_needle_line**(*lv_obj_t* *obj, uint16_t width, lv_color_t color, int16_t r_mod)

Add a needle line indicator the scale

Parameters

- **obj** -- pointer to a meter object

- **width** -- width of the line
- **color** -- color of the line
- **r_mod** -- the radius modifier (added to the scale's radius) to get the lines length

Returns the new indicator

lv_meter_indicator_t ***lv_meter_add_needle_img**(*lv_obj_t* *obj, const void *src, lv_coord_t pivot_x, lv_coord_t pivot_y)

Add a needle image indicator the scale

Note: the needle image should point to the right, like -O-->

Parameters

- **obj** -- pointer to a meter object
- **src** -- the image source of the indicator. path or pointer to *lv_img_dsc_t*
- **pivot_x** -- the X pivot point of the needle
- **pivot_y** -- the Y pivot point of the needle

Returns the new indicator

lv_meter_indicator_t ***lv_meter_add_arc**(*lv_obj_t* *obj, uint16_t width, lv_color_t color, int16_t r_mod)

Add an arc indicator the scale

Parameters

- **obj** -- pointer to a meter object
- **width** -- width of the arc
- **color** -- color of the arc
- **r_mod** -- the radius modifier (added to the scale's radius) to get the outer radius of the arc

Returns the new indicator

lv_meter_indicator_t ***lv_meter_add_scale_lines**(*lv_obj_t* *obj, lv_color_t color_start, lv_color_t color_end, bool local, int16_t width_mod)

Add a scale line indicator the scale. It will modify the ticks.

Parameters

- **obj** -- pointer to a meter object
- **color_start** -- the start color
- **color_end** -- the end color
- **local** -- tell how to map start and end color. true: the indicator's start and end_value; false: the scale's min max value
- **width_mod** -- add this the affected tick's width

Returns the new indicator

void **lv_meter_set_indicator_value**(*lv_obj_t* *obj, *lv_meter_indicator_t* *indic, int32_t value)

Set the value of the indicator. It will set start and and value to the same value

Parameters

- **obj** -- pointer to a meter object
- **indic** -- pointer to an indicator
- **value** -- the new value

void **lv_meter_set_indicator_start_value**(*lv_obj_t* *obj, *lv_meter_indicator_t* *indic, int32_t value)

Set the start value of the indicator.

Parameters

- **obj** -- pointer to a meter object
- **indic** -- pointer to an indicator
- **value** -- the new value

void **lv_meter_set_indicator_end_value**(*lv_obj_t* *obj, *lv_meter_indicator_t* *indic, int32_t value)

Set the start value of the indicator.

Parameters

- **obj** -- pointer to a meter object
- **indic** -- pointer to an indicator
- **value** -- the new value

Variables

const lv_obj_class_t **lv_meter_class**

struct **lv_meter_indicator_t**

Public Members

lv_meter_indicator_type_t **type**

lv_opa_t **opa**

int32_t **start_value**

int32_t **end_value**

const void ***src**

lv_point_t **pivot**

struct *lv_meter_indicator_t*::[anonymous]::[anonymous] **`needle_img`**

uint16_t **`width`**

int16_t **`r_mod`**

lv_color_t **`color`**

struct *lv_meter_indicator_t*::[anonymous]::[anonymous] **`needle_line`**

struct *lv_meter_indicator_t*::[anonymous]::[anonymous] **`arc`**

int16_t **`width_mod`**

lv_color_t **`color_start`**

lv_color_t **`color_end`**

uint8_t **`local_grad`**

struct *lv_meter_indicator_t*::[anonymous]::[anonymous] **`scale_lines`**

union *lv_meter_indicator_t*::[anonymous] **`type_data`**

struct **`lv_meter_t`**

Public Members

lv_obj_t **`obj`**

lv_color_t **`tick_color`**

uint16_t **`tick_cnt`**

uint16_t **`tick_length`**

uint16_t **`tick_width`**

lv_color_t **`tick_major_color`**

uint16_t **`tick_major_nth`**

uint16_t **tick_major_length**

uint16_t **tick_major_width**

int16_t **label_gap**

int16_t **label_color**

int32_t **min**

int32_t **max**

int16_t **r_mod**

uint16_t **angle_range**

int16_t **rotation**

struct *lv_meter_t*::[anonymous] **scale**

lv_ll_t **indicator_ll**

6.22 Message box (lv_msgbox)

6.22.1 Overview

The Message boxes act as pop-ups. They are built from a background container, a title, an optional close button, a text and optional buttons.

The text will be broken into multiple lines automatically and the height will be set automatically to include the text and the buttons.

The message box can be modal (blocking clicks on the rest of the screen) or not modal.

6.22.2 Parts and Styles

The message box is built from other widgets, so you can check these widgets' documentation for details.

- Background: *lv_obj*
- Close button: *lv_btn*
- Title and text: *lv_label*
- Buttons: *lv_btnmatrix*

6.22.3 Usage

Create a message box

`lv_msgbox_create(parent, title, txt, btn_txts[], add_close_btn)` creates a message box.

If `parent` is `NULL` the message box will be modal. `title` and `txt` are strings for the title and the text. `btn_txts[]` is an array with the buttons' text. E.g. `const char * btn_txts[] = {"Ok", "Cancel", NULL}`. `add_close_btn` can be `true` or `false` to add/don't add a close button.

Get the parts

The building blocks of the message box can be obtained using the following functions:

```
lv_obj_t * lv_msgbox_get_title(lv_obj_t * mbox);
lv_obj_t * lv_msgbox_get_close_btn(lv_obj_t * mbox);
lv_obj_t * lv_msgbox_get_text(lv_obj_t * mbox);
lv_obj_t * lv_msgbox_get_btns(lv_obj_t * mbox);
```

Close the message box

`lv_msgbox_close(msgbox)` closes (deletes) the message box.

6.22.4 Events

- `LV_EVENT_VALUE_CHANGED` is sent by the buttons if one of them is clicked. `LV_OBJ_FLAG_EVENT_BUBBLE` is enabled on the buttons so you can add events to the message box itself. In the event handler, `lv_event_get_target(e)` will return the button matrix and `lv_event_get_current_target(e)` will return the message box. `lv_msgbox_get_active_btn(msgbox)` and `lv_msgbox_get_active_btn_text(msgbox)` can be used to get the index and text of the clicked button.

Learn more about *Events*.

6.22.5 Keys

Keys have effect on the close button and button matrix. You can add them manually to a group if required.

Learn more about *Keys*.

6.22.6 Example

Simple Message box

```
#include "../../lv_examples.h"
#if LV_USE_MSGBOX && LV_BUILD_EXAMPLES

static void event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_current_target(e);
```

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```
    LV_UNUSED(obj);
    LV_LOG_USER("Button %s clicked", lv_msgbox_get_active_btn_text(obj));
}

void lv_example_msgbox_1(void)
{
    static const char * btns[] = {"Apply", "Close", ""};

    lv_obj_t * mbox1 = lv_msgbox_create(NULL, "Hello", "This is a message box with␣
↪two buttons.", btns, true);
    lv_obj_add_event(mbox1, event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_obj_center(mbox1);
}

#endif
```

```
def event_cb(e):
    mbox = e.get_target_obj()
    print("Button %s clicked" % mbox.get_active_btn_text())

btns = ["Apply", "Close", ""]

mbox1 = lv.msgbox(lv.scr_act(), "Hello", "This is a message box with two buttons.",␣
↪btns, True)
mbox1.add_event(event_cb, lv.EVENT.VALUE_CHANGED, None)
mbox1.center()
```

6.22.7 API

Functions

lv_obj_t ***lv_msgbox_create**(*lv_obj_t* *parent, const char *title, const char *txt, const char *btn_txts[], bool add_close_btn)

Create a message box object

Parameters

- **parent** -- pointer to parent or NULL to create a full screen modal message box
- **title** -- the title of the message box
- **txt** -- the text of the message box
- **btn_txts** -- the buttons as an array of texts terminated by an "" element. E.g. {"btn1", "btn2", ""}
- **add_close_btn** -- true: add a close button

Returns pointer to the message box object

lv_obj_t ***lv_msgbox_get_title**(*lv_obj_t* *obj)

lv_obj_t ***lv_msgbox_get_close_btn**(*lv_obj_t* *obj)

lv_obj_t ***lv_msgbox_get_text**(*lv_obj_t* *obj) *lv_obj_t* ***lv_msgbox_get_content**(*lv_obj_t* *obj)

lv_obj_t ***lv_msgbox_get_btns**(*lv_obj_t* *obj)

uint16_t **lv_msgbox_get_active_btn**(*lv_obj_t* *mbox)

Get the index of the selected button

Parameters **mbox** -- message box object

Returns index of the button (LV_BTNMATRIX_BTN_NONE: if unset)

const char ***lv_msgbox_get_active_btn_text**(*lv_obj_t* *mbox)

void **lv_msgbox_close**(*lv_obj_t* *mbox)

void **lv_msgbox_close_async**(*lv_obj_t* *mbox)

Variables

const lv_obj_class_t **lv_msgbox_class**

const lv_obj_class_t **lv_msgbox_content_class**

const lv_obj_class_t **lv_msgbox_backdrop_class**

struct **lv_msgbox_t**

Public Members

lv_obj_t **obj**

lv_obj_t ***title**

lv_obj_t ***close_btn**

lv_obj_t ***content**

lv_obj_t ***text**

lv_obj_t ***btns**

6.23 Roller (lv_roller)

6.23.1 Overview

Roller allows you to simply select one option from a list by scrolling.

6.23.2 Parts and Styles

- `LV_PART_MAIN` The background of the roller uses all the typical background properties and text style properties. `style_text_line_space` adjusts the space between the options. When the Roller is scrolled and doesn't stop exactly on an option it will scroll to the nearest valid option automatically in `anim_time` milliseconds as specified in the style.
- `LV_PART_SELECTED` The selected option in the middle. Besides the typical background properties it uses the text style properties to change the appearance of the text in the selected area.

6.23.3 Usage

Set options

Options are passed to the Roller as a string with `lv_roller_set_options(roller, options, LV_ROLLER_MODE_NORMAL/INFINITE)`. The options should be separated by `\n`. For example: `"First\nSecond\nThird"`.

`LV_ROLLER_MODE_INFINITE` makes the roller circular.

You can select an option manually with `lv_roller_set_selected(roller, id, LV_ANIM_ON/OFF)`, where *id* is the index of an option.

Get selected option

To get the *index* of the currently selected option use `lv_roller_get_selected(roller)`.

`lv_roller_get_selected_str(roller, buf, buf_size)` will copy the name of the selected option to `buf`.

Visible rows

The number of visible rows can be adjusted with `lv_roller_set_visible_row_count(roller, num)`.

This function calculates the height with the current style. If the font, line space, border width, etc. of the roller changes this function needs to be called again.

6.23.4 Events

- LV_EVENT_VALUE_CHANGED Sent when a new option is selected.

See the events of the *Base object* too.

Learn more about *Events*.

6.23.5 Keys

- LV_KEY_RIGHT/DOWN Select the next option
- LV_KEY_LEFT/UP Select the previous option
- LY_KEY_ENTER Apply the selected option (Send LV_EVENT_VALUE_CHANGED event)

6.23.6 Example

Simple Roller

```c
#include "../../lv_examples.h"
#if LV_USE_ROLLER && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        char buf[32];
        lv_roller_get_selected_str(obj, buf, sizeof(buf));
        LV_LOG_USER("Selected month: %s\n", buf);
    }
}

/**
 * An infinite roller with the name of the months
 */
void lv_example_roller_1(void)
{
    lv_obj_t * roller1 = lv_roller_create(lv_scr_act());
    lv_roller_set_options(roller1,
                          "January\n"
                          "February\n"
                          "March\n"
                          "April\n"
                          "May\n"
                          "June\n"
                          "July\n"
                          "August\n"
                          "September\n"
                          "October\n"
                          "November\n"
                          "December",
                          LV_ROLLER_MODE_INFINITE);

    lv_roller_set_visible_row_count(roller1, 4);
```

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```
    lv_obj_center(roller1);
    lv_obj_add_event(roller1, event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        option = " "*10
        obj.get_selected_str(option, len(option))
        print("Selected month: " + option.strip())

#
# An infinite roller with the name of the months
#

roller1 = lv.roller(lv.scr_act())
roller1.set_options("\n".join([
    "January",
    "February",
    "March",
    "April",
    "May",
    "June",
    "July",
    "August",
    "September",
    "October",
    "November",
    "December"]),lv.roller.MODE.INFINITE)

roller1.set_visible_row_count(4)
roller1.center()
roller1.add_event(event_handler, lv.EVENT.ALL, None)
```

Styling the roller

```
#include "../../lv_examples.h"
#if LV_USE_ROLLER && LV_FONT_MONTSERRAT_22 && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        char buf[32];
        lv_roller_get_selected_str(obj, buf, sizeof(buf));
        LV_LOG_USER("Selected value: %s", buf);
    }
}
```

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```
/**
 * Roller with various alignments and larger text in the selected area
 */
void lv_example_roller_2(void)
{
    /*A style to make the selected option larger*/
    static lv_style_t style_sel;
    lv_style_init(&style_sel);
    lv_style_set_text_font(&style_sel, &lv_font_montserrat_22);
    lv_style_set_bg_color(&style_sel, lv_color_hex3(0xf88));
    lv_style_set_border_width(&style_sel, 2);
    lv_style_set_border_color(&style_sel, lv_color_hex3(0xf00));

    const char * opts = "1\n2\n3\n4\n5\n6\n7\n8\n9\n10";
    lv_obj_t * roller;

    /*A roller on the left with left aligned text, and custom width*/
    roller = lv_roller_create(lv_scr_act());
    lv_roller_set_options(roller, opts, LV_ROLLER_MODE_NORMAL);
    lv_roller_set_visible_row_count(roller, 2);
    lv_obj_set_width(roller, 100);
    lv_obj_add_style(roller, &style_sel, LV_PART_SELECTED);
    lv_obj_set_style_text_align(roller, LV_TEXT_ALIGN_LEFT, 0);
    lv_obj_set_style_bg_color(roller, lv_color_hex3(0x0f0), 0);
    lv_obj_set_style_bg_grad_color(roller, lv_color_hex3(0xafa), 0);
    lv_obj_set_style_bg_grad_dir(roller, LV_GRAD_DIR_VER, 0);
    lv_obj_align(roller, LV_ALIGN_LEFT_MID, 10, 0);
    lv_obj_add_event(roller, event_handler, LV_EVENT_ALL, NULL);
    lv_roller_set_selected(roller, 2, LV_ANIM_OFF);

    /*A roller on the middle with center aligned text, and auto (default) width*/
    roller = lv_roller_create(lv_scr_act());
    lv_roller_set_options(roller, opts, LV_ROLLER_MODE_NORMAL);
    lv_roller_set_visible_row_count(roller, 3);
    lv_obj_add_style(roller, &style_sel, LV_PART_SELECTED);
    lv_obj_align(roller, LV_ALIGN_CENTER, 0, 0);
    lv_obj_add_event(roller, event_handler, LV_EVENT_ALL, NULL);
    lv_roller_set_selected(roller, 5, LV_ANIM_OFF);

    /*A roller on the right with right aligned text, and custom width*/
    roller = lv_roller_create(lv_scr_act());
    lv_roller_set_options(roller, opts, LV_ROLLER_MODE_NORMAL);
    lv_roller_set_visible_row_count(roller, 4);
    lv_obj_set_width(roller, 80);
    lv_obj_add_style(roller, &style_sel, LV_PART_SELECTED);
    lv_obj_set_style_text_align(roller, LV_TEXT_ALIGN_RIGHT, 0);
    lv_obj_align(roller, LV_ALIGN_RIGHT_MID, -10, 0);
    lv_obj_add_event(roller, event_handler, LV_EVENT_ALL, NULL);
    lv_roller_set_selected(roller, 8, LV_ANIM_OFF);
}

#endif
```

```
import fs_driver
```

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```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        option = " "*10
        obj.get_selected_str(option, len(option))
        print("Selected value: %s\n" + option.strip())

#
# Roller with various alignments and larger text in the selected area
#

# A style to make the selected option larger
style_sel = lv.style_t()
style_sel.init()

try:
    style_sel.set_text_font(lv.font_montserrat_22)
except:
    fs_drv = lv.fs_drv_t()
    fs_driver.fs_register(fs_drv, 'S')
    print("montserrat-22 not enabled in lv_conf.h, dynamically loading the font")
    font_montserrat_22 = lv.font_load("S:" + "../../assets/font/montserrat-22.fnt")
    style_sel.set_text_font(font_montserrat_22)

opts = "\n".join(["1","2","3","4","5","6","7","8","9","10"])

# A roller on the left with left aligned text, and custom width
roller = lv.roller(lv.scr_act())
roller.set_options(opts, lv.roller.MODE.NORMAL)
roller.set_visible_row_count(2)
roller.set_width(100)
roller.add_style(style_sel, lv.PART.SELECTED)
roller.set_style_text_align(lv.TEXT_ALIGN.LEFT, 0)
roller.align(lv.ALIGN.LEFT_MID, 10, 0)
roller.add_event(event_handler, lv.EVENT.ALL, None)
roller.set_selected(2, lv.ANIM.OFF)

# A roller in the middle with center aligned text, and auto (default) width
roller = lv.roller(lv.scr_act())
roller.set_options(opts, lv.roller.MODE.NORMAL)
roller.set_visible_row_count(3)
roller.add_style(style_sel, lv.PART.SELECTED)
roller.align(lv.ALIGN.CENTER, 0, 0)
roller.add_event(event_handler, lv.EVENT.ALL, None)
roller.set_selected(5, lv.ANIM.OFF)

# A roller on the right with right aligned text, and custom width
roller = lv.roller(lv.scr_act())
roller.set_options(opts, lv.roller.MODE.NORMAL)
roller.set_visible_row_count(4)
roller.set_width(80)
roller.add_style(style_sel, lv.PART.SELECTED)
roller.set_style_text_align(lv.TEXT_ALIGN.RIGHT, 0)
roller.align(lv.ALIGN.RIGHT_MID, -10, 0)
roller.add_event(event_handler, lv.EVENT.ALL, None)
roller.set_selected(8, lv.ANIM.OFF)
```

add fade mask to roller

```
#include "../../lv_examples.h"
#if LV_USE_ROLLER && LV_USE_DRAW_MASKS && LV_BUILD_EXAMPLES

static void mask_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    static int16_t mask_top_id = -1;
    static int16_t mask_bottom_id = -1;

    if(code == LV_EVENT_COVER_CHECK) {
        lv_event_set_cover_res(e, LV_COVER_RES_MASKED);

    }
    else if(code == LV_EVENT_DRAW_MAIN_BEGIN) {
        /* add mask */
        const lv_font_t * font = lv_obj_get_style_text_font(obj, LV_PART_MAIN);
        lv_coord_t line_space = lv_obj_get_style_text_line_space(obj, LV_PART_MAIN);
        lv_coord_t font_h = lv_font_get_line_height(font);

        lv_area_t roller_coords;
        lv_obj_get_coords(obj, &roller_coords);

        lv_area_t rect_area;
        rect_area.x1 = roller_coords.x1;
        rect_area.x2 = roller_coords.x2;
        rect_area.y1 = roller_coords.y1;
        rect_area.y2 = roller_coords.y1 + (lv_obj_get_height(obj) - font_h - line_
→space) / 2;

        lv_draw_mask_fade_param_t * fade_mask_top = lv_malloc(sizeof(lv_draw_mask_
→fade_param_t));
        lv_draw_mask_fade_init(fade_mask_top, &rect_area, LV_OPA_TRANSP, rect_area.y1,
→ LV_OPA_COVER, rect_area.y2);
        mask_top_id = lv_draw_mask_add(fade_mask_top, NULL);

        rect_area.y1 = rect_area.y2 + font_h + line_space - 1;
        rect_area.y2 = roller_coords.y2;

        lv_draw_mask_fade_param_t * fade_mask_bottom = lv_malloc(sizeof(lv_draw_mask_
→fade_param_t));
        lv_draw_mask_fade_init(fade_mask_bottom, &rect_area, LV_OPA_COVER, rect_area.
→y1, LV_OPA_TRANSP, rect_area.y2);
        mask_bottom_id = lv_draw_mask_add(fade_mask_bottom, NULL);

    }
    else if(code == LV_EVENT_DRAW_POST_END) {
        lv_draw_mask_fade_param_t * fade_mask_top = lv_draw_mask_remove_id(mask_top_
→id);
        lv_draw_mask_fade_param_t * fade_mask_bottom = lv_draw_mask_remove_id(mask_
→bottom_id);
        lv_draw_mask_free_param(fade_mask_top);
        lv_draw_mask_free_param(fade_mask_bottom);
        lv_free(fade_mask_top);
```

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```
        lv_free(fade_mask_bottom);
        mask_top_id = -1;
        mask_bottom_id = -1;
    }
}

/**
 * Add a fade mask to roller.
 */
void lv_example_roller_3(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_bg_color(&style, lv_color_black());
    lv_style_set_text_color(&style, lv_color_white());
    lv_style_set_border_width(&style, 0);
    lv_style_set_pad_all(&style, 0);
    lv_obj_add_style(lv_scr_act(), &style, 0);

    lv_obj_t * roller1 = lv_roller_create(lv_scr_act());
    lv_obj_add_style(roller1, &style, 0);
    lv_obj_set_style_bg_opa(roller1, LV_OPA_TRANSP, LV_PART_SELECTED);

#if LV_FONT_MONTSERRAT_22
    lv_obj_set_style_text_font(roller1, &lv_font_montserrat_22, LV_PART_SELECTED);
#endif

    lv_roller_set_options(roller1,
                          "January\n"
                          "February\n"
                          "March\n"
                          "April\n"
                          "May\n"
                          "June\n"
                          "July\n"
                          "August\n"
                          "September\n"
                          "October\n"
                          "November\n"
                          "December",
                          LV_ROLLER_MODE_NORMAL);

    lv_obj_center(roller1);
    lv_roller_set_visible_row_count(roller1, 3);
    lv_obj_add_event(roller1, mask_event_cb, LV_EVENT_ALL, NULL);
}

#endif
```

```
import fs_driver
import sys

class Lv_Roller_3():

    def __init__(self):
        self.mask_top_id = -1
```

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```
        self.mask_bottom_id = -1

        #
        # Add a fade mask to roller.
        #
        style = lv.style_t()
        style.init()
        style.set_bg_color(lv.color_black())
        style.set_text_color(lv.color_white())

        lv.scr_act().add_style(style, 0)

        roller1 = lv.roller(lv.scr_act())
        roller1.add_style(style, 0)
        roller1.set_style_border_width(0, 0)
        roller1.set_style_pad_all(0, 0)
        roller1.set_style_bg_opa(lv.OPA.TRANSP, lv.PART.SELECTED)

        #if LV_FONT_MONTSERRAT_22
        #    lv_obj_set_style_text_font(roller1, &lv_font_montserrat_22, LV_PART_
↪SELECTED);
        #endif
        try:
            roller1.set_style_text_font(lv.font_montserrat_22,lv.PART.SELECTED)
        except:
            fs_drv = lv.fs_drv_t()
            fs_driver.fs_register(fs_drv, 'S')
            print("montserrat-22 not enabled in lv_conf.h, dynamically loading the␣
↪font")
            font_montserrat_22 = lv.font_load("S:" + "../../assets/font/montserrat-22.
↪fnt")
            roller1.set_style_text_font(font_montserrat_22,lv.PART.SELECTED)

        roller1.set_options("\n".join([
            "January",
            "February",
            "March",
            "April",
            "May",
            "June",
            "July",
            "August",
            "September",
            "October",
            "November",
            "December"]),lv.roller.MODE.NORMAL)

        roller1.center()
        roller1.set_visible_row_count(3)
        roller1.add_event(self.mask_event_cb, lv.EVENT.ALL, None)

    def mask_event_cb(self,e):

        code = e.get_code()
        obj = e.get_target_obj()

        if code == lv.EVENT.COVER_CHECK:
```

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```
            e.set_cover_res(lv.COVER_RES.MASKED)

        elif code == lv.EVENT.DRAW_MAIN_BEGIN:
            # add mask
            font = obj.get_style_text_font(lv.PART.MAIN)
            line_space = obj.get_style_text_line_space(lv.PART.MAIN)
            font_h = font.get_line_height()

            roller_coords = lv.area_t()
            obj.get_coords(roller_coords)

            rect_area = lv.area_t()
            rect_area.x1 = roller_coords.x1
            rect_area.x2 = roller_coords.x2
            rect_area.y1 = roller_coords.y1
            rect_area.y2 = roller_coords.y1 + (obj.get_height() - font_h - line_
↪space) // 2

            fade_mask_top = lv.draw_mask_fade_param_t()
            fade_mask_top.init(rect_area, lv.OPA.TRANSP, rect_area.y1, lv.OPA.COVER,␣
↪rect_area.y2)
            self.mask_top_id = lv.draw_mask_add(fade_mask_top,None)

            rect_area.y1 = rect_area.y2 + font_h + line_space - 1
            rect_area.y2 = roller_coords.y2

            fade_mask_bottom = lv.draw_mask_fade_param_t()
            fade_mask_bottom.init(rect_area, lv.OPA.COVER, rect_area.y1, lv.OPA.
↪TRANSP, rect_area.y2)
            self.mask_bottom_id = lv.draw_mask_add(fade_mask_bottom, None)

        elif code == lv.EVENT.DRAW_POST_END:
            fade_mask_top = lv.draw_mask_remove_id(self.mask_top_id)
            fade_mask_bottom = lv.draw_mask_remove_id(self.mask_bottom_id)
            # Remove the masks
            lv.draw_mask_remove_id(self.mask_top_id)
            lv.draw_mask_remove_id(self.mask_bottom_id)
            self.mask_top_id = -1
            self.mask_bottom_id = -1

roller3 = Lv_Roller_3()
```

6.23.7 API

Typedefs

typedef uint8_t **lv_roller_mode_t**

Enums

enum **`[anonymous]`**

Roller mode.

Values:

enumerator **`LV_ROLLER_MODE_NORMAL`**

Normal mode (roller ends at the end of the options).

enumerator **`LV_ROLLER_MODE_INFINITE`**

Infinite mode (roller can be scrolled forever).

Functions

lv_obj_t ***`lv_roller_create`**(*lv_obj_t* *parent)

Create a roller object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new roller.

Returns pointer to the created roller

void **`lv_roller_set_options`**(*lv_obj_t* *obj, const char *options, *lv_roller_mode_t* mode)

Set the options on a roller

Parameters

- **`obj`** -- pointer to roller object
- **`options`** -- a string with '

  ' separated options. E.g. "One\nTwo\nThree"
- **`mode`** -- `LV_ROLLER_MODE_NORMAL` or `LV_ROLLER_MODE_INFINITE`

void **`lv_roller_set_selected`**(*lv_obj_t* *obj, uint16_t sel_opt, *lv_anim_enable_t* anim)

Set the selected option

Parameters

- **`obj`** -- pointer to a roller object
- **`sel_opt`** -- index of the selected option (0 ... number of option - 1);
- **`anim_en`** -- LV_ANIM_ON: set with animation; LV_ANOM_OFF set immediately

void **`lv_roller_set_visible_row_count`**(*lv_obj_t* *obj, uint8_t row_cnt)

Set the height to show the given number of rows (options)

Parameters

- **`obj`** -- pointer to a roller object
- **`row_cnt`** -- number of desired visible rows

uint16_t **`lv_roller_get_selected`**(const *lv_obj_t* *obj)

Get the index of the selected option

Parameters **`obj`** -- pointer to a roller object

Returns index of the selected option (0 ... number of option - 1);

void **`lv_roller_get_selected_str`**(const *lv_obj_t* *obj, char *buf, uint32_t buf_size)

Get the current selected option as a string.

Parameters

- **`obj`** -- pointer to ddlist object
- **`buf`** -- pointer to an array to store the string
- **`buf_size`** -- size of `buf` in bytes. 0: to ignore it.

const char ***`lv_roller_get_options`**(const *lv_obj_t* *obj)

Get the options of a roller

Parameters **`obj`** -- pointer to roller object

Returns

the options separated by '

'-s (E.g. "Option1\nOption2\nOption3")

uint16_t **`lv_roller_get_option_cnt`**(const *lv_obj_t* *obj)

Get the total number of options

Parameters **`obj`** -- pointer to a roller object

Returns the total number of options

Variables

const lv_obj_class_t **`lv_roller_class`**

struct **`lv_roller_t`**

Public Members

lv_obj_t **`obj`**

uint16_t **`option_cnt`**

Number of options

uint16_t **`sel_opt_id`**

Index of the current option

uint16_t **`sel_opt_id_ori`**

Store the original index on focus

uint32_t **`inf_page_cnt`**

Number of extra pages added to make the roller look infinite *lv_roller_mode_t* **mode**

uint32_t **moved**

6.24 Slider (lv_slider)

6.24.1 Overview

The Slider object looks like a *Bar* supplemented with a knob. The knob can be dragged to set a value. Just like Bar, Slider can be vertical or horizontal.

6.24.2 Parts and Styles

- `LV_PART_MAIN` The background of the slider. Uses all the typical background style properties. `padding` makes the indicator smaller in the respective direction.
- `LV_PART_INDICATOR` The indicator that shows the current state of the slider. Also uses all the typical background style properties.
- `LV_PART_KNOB` A rectangle (or circle) drawn at the current value. Also uses all the typical background properties to describe the knob(s). By default, the knob is square (with an optional corner radius) with side length equal to the smaller side of the slider. The knob can be made larger with the `padding` values. Padding values can be asymmetric too.

6.24.3 Usage

Value and range

To set an initial value use `lv_slider_set_value(slider, new_value, LV_ANIM_ON/OFF)`. The animation time is set by the styles' `anim_time` property.

To specify the range (min, max values), `lv_slider_set_range(slider, min , max)` can be used.

Modes

The slider can be one of the following modes:

- `LV_SLIDER_MODE_NORMAL` A normal slider as described above
- `LV_SLIDER_SYMMETRICAL` Draw the indicator form the zero value to current value. Requires negative minimum range and positive maximum range.
- `LV_SLIDER_RANGE` Allows setting the start value too by `lv_bar_set_start_value(bar, new_value, LV_ANIM_ON/OFF)`. The start value has to be always smaller than the end value.

The mode can be changed with `lv_slider_set_mode(slider, LV_SLIDER_MODE_...)`

Knob-only mode

Normally, the slider can be adjusted either by dragging the knob, or by clicking on the slider bar. In the latter case the knob moves to the point clicked and slider value changes accordingly. In some cases it is desirable to set the slider to react on dragging the knob only. This feature is enabled by adding the `LV_OBJ_FLAG_ADV_HITTEST`: `lv_obj_add_flag(slider, LV_OBJ_FLAG_ADV_HITTEST)`.

The extended click area (set by `lv_obj_set_ext_click_area(slider, value)`) increases to knob's click area.

6.24.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent while the slider is being dragged or changed with keys. The event is sent continuously while the slider is being dragged.
- `LV_EVENT_RELEASED` Sent when the slider has just been released.
- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` are sent for the following parts.
  - `LV_SLIDER_DRAW_PART_KNOB` The main (right) knob of the slider
    - `part`: `LV_PART_KNOB`
    - `draw_area`: area of the indicator
    - `rect_dsc`
    - `id`: 0
  - `LV_SLIDER_DRAW_PART_KNOB` The left knob of the slider
    - `part`: `LV_PART_KNOB`
    - `draw_area`: area of the indicator
    - `rect_dsc`
    - `id`: 1

See the events of the *Bar* too.

Learn more about *Events*.

6.24.5 Keys

- `LV_KEY_UP/RIGHT` Increment the slider's value by 1
- `LV_KEY_DOWN/LEFT` Decrement the slider's value by 1

Learn more about *Keys*.

6.24.6 Example

Simple Slider

```c
#include "../../lv_examples.h"
#if LV_USE_SLIDER && LV_BUILD_EXAMPLES

static void slider_event_cb(lv_event_t * e);
static lv_obj_t * slider_label;

/**
 * A default slider with a label displaying the current value
 */
void lv_example_slider_1(void)
{
    /*Create a slider in the center of the display*/
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_obj_center(slider);
    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_VALUE_CHANGED, NULL);

    /*Create a label below the slider*/
    slider_label = lv_label_create(lv_scr_act());
    lv_label_set_text(slider_label, "0%");

    lv_obj_align_to(slider_label, slider, LV_ALIGN_OUT_BOTTOM_MID, 0, 10);
}

static void slider_event_cb(lv_event_t * e)
{
    lv_obj_t * slider = lv_event_get_target(e);
    char buf[8];
    lv_snprintf(buf, sizeof(buf), "%d%%", (int)lv_slider_get_value(slider));
    lv_label_set_text(slider_label, buf);
    lv_obj_align_to(slider_label, slider, LV_ALIGN_OUT_BOTTOM_MID, 0, 10);
}

#endif
```

```python
#
# A default slider with a label displaying the current value
#
def slider_event_cb(e):

    slider = e.get_target_obj()
    slider_label.set_text("{:d}%".format(slider.get_value()))
    slider_label.align_to(slider, lv.ALIGN.OUT_BOTTOM_MID, 0, 10)

# Create a slider in the center of the display
slider = lv.slider(lv.scr_act())
slider.center()
slider.add_event(slider_event_cb, lv.EVENT.VALUE_CHANGED, None)

# Create a label below the slider
slider_label = lv.label(lv.scr_act())
slider_label.set_text("0%")

slider_label.align_to(slider, lv.ALIGN.OUT_BOTTOM_MID, 0, 10)
```

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Slider with custom style

```
#include "../../lv_examples.h"
#if LV_USE_SLIDER && LV_BUILD_EXAMPLES



/**
 * Show how to style a slider.
 */
void lv_example_slider_2(void)
{
    /*Create a transition*/
    static const lv_style_prop_t props[] = {LV_STYLE_BG_COLOR, 0};
    static lv_style_transition_dsc_t transition_dsc;
    lv_style_transition_dsc_init(&transition_dsc, props, lv_anim_path_linear, 300, 0,␣
↪NULL);

    static lv_style_t style_main;
    static lv_style_t style_indicator;
    static lv_style_t style_knob;
    static lv_style_t style_pressed_color;
    lv_style_init(&style_main);
    lv_style_set_bg_opa(&style_main, LV_OPA_COVER);
    lv_style_set_bg_color(&style_main, lv_color_hex3(0xbbb));
    lv_style_set_radius(&style_main, LV_RADIUS_CIRCLE);
    lv_style_set_pad_ver(&style_main, -2); /*Makes the indicator larger*/

    lv_style_init(&style_indicator);
    lv_style_set_bg_opa(&style_indicator, LV_OPA_COVER);
    lv_style_set_bg_color(&style_indicator, lv_palette_main(LV_PALETTE_CYAN));
    lv_style_set_radius(&style_indicator, LV_RADIUS_CIRCLE);
    lv_style_set_transition(&style_indicator, &transition_dsc);

    lv_style_init(&style_knob);
    lv_style_set_bg_opa(&style_knob, LV_OPA_COVER);
    lv_style_set_bg_color(&style_knob, lv_palette_main(LV_PALETTE_CYAN));
    lv_style_set_border_color(&style_knob, lv_palette_darken(LV_PALETTE_CYAN, 3));
    lv_style_set_border_width(&style_knob, 2);
    lv_style_set_radius(&style_knob, LV_RADIUS_CIRCLE);
    lv_style_set_pad_all(&style_knob, 6); /*Makes the knob larger*/
    lv_style_set_transition(&style_knob, &transition_dsc);

    lv_style_init(&style_pressed_color);
    lv_style_set_bg_color(&style_pressed_color, lv_palette_darken(LV_PALETTE_CYAN,␣
↪2));

    /*Create a slider and add the style*/
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_obj_remove_style_all(slider);        /*Remove the styles coming from the␣
↪theme*/

    lv_obj_add_style(slider, &style_main, LV_PART_MAIN);
```

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```
    lv_obj_add_style(slider, &style_indicator, LV_PART_INDICATOR);
    lv_obj_add_style(slider, &style_pressed_color, LV_PART_INDICATOR | LV_STATE_
↪PRESSED);
    lv_obj_add_style(slider, &style_knob, LV_PART_KNOB);
    lv_obj_add_style(slider, &style_pressed_color, LV_PART_KNOB | LV_STATE_PRESSED);

    lv_obj_center(slider);
}

#endif
```

```
#
# Show how to style a slider.
#
# Create a transition
props = [lv.STYLE.BG_COLOR, 0]
transition_dsc = lv.style_transition_dsc_t()
transition_dsc.init(props, lv.anim_t.path_linear, 300, 0, None)

style_main = lv.style_t()
style_indicator = lv.style_t()
style_knob = lv.style_t()
style_pressed_color = lv.style_t()
style_main.init()
style_main.set_bg_opa(lv.OPA.COVER)
style_main.set_bg_color(lv.color_hex3(0xbbb))
style_main.set_radius(lv.RADIUS_CIRCLE)
style_main.set_pad_ver(-2)                  # Makes the indicator larger

style_indicator.init()
style_indicator.set_bg_opa(lv.OPA.COVER)
style_indicator.set_bg_color(lv.palette_main(lv.PALETTE.CYAN))
style_indicator.set_radius(lv.RADIUS_CIRCLE)
style_indicator.set_transition(transition_dsc)

style_knob.init()
style_knob.set_bg_opa(lv.OPA.COVER)
style_knob.set_bg_color(lv.palette_main(lv.PALETTE.CYAN))
style_knob.set_border_color(lv.palette_darken(lv.PALETTE.CYAN, 3))
style_knob.set_border_width(2)
style_knob.set_radius(lv.RADIUS_CIRCLE)
style_knob.set_pad_all(6)                    # Makes the knob larger
style_knob.set_transition(transition_dsc)

style_pressed_color.init()
style_pressed_color.set_bg_color(lv.palette_darken(lv.PALETTE.CYAN, 2))

# Create a slider and add the style
slider = lv.slider(lv.scr_act())
slider.remove_style_all()                    # Remove the styles coming from the theme

slider.add_style(style_main, lv.PART.MAIN)
slider.add_style(style_indicator, lv.PART.INDICATOR)
slider.add_style(style_pressed_color, lv.PART.INDICATOR | lv.STATE.PRESSED)
slider.add_style(style_knob, lv.PART.KNOB)
slider.add_style(style_pressed_color, lv.PART.KNOB | lv.STATE.PRESSED)
```

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```
slider.center()
```

Slider with extended drawer

```
#include "../../lv_examples.h"
#if LV_USE_SLIDER && LV_BUILD_EXAMPLES

static void slider_event_cb(lv_event_t * e);

/**
 * Show the current value when the slider is pressed by extending the drawer
 *
 */
void lv_example_slider_3(void)
{
    /*Create a slider in the center of the display*/
    lv_obj_t * slider;
    slider = lv_slider_create(lv_scr_act());
    lv_obj_center(slider);

    lv_slider_set_mode(slider, LV_SLIDER_MODE_RANGE);
    lv_slider_set_value(slider, 70, LV_ANIM_OFF);
    lv_slider_set_left_value(slider, 20, LV_ANIM_OFF);

    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_ALL, NULL);
    lv_obj_refresh_ext_draw_size(slider);
}

static void slider_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    /*Provide some extra space for the value*/
    if(code == LV_EVENT_REFR_EXT_DRAW_SIZE) {
        lv_event_set_ext_draw_size(e, 50);
    }
    else if(code == LV_EVENT_DRAW_PART_END) {
        lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
        if(dsc->part == LV_PART_INDICATOR) {
            char buf[16];
            lv_snprintf(buf, sizeof(buf), "%d - %d", (int)lv_slider_get_left_
↪value(obj), (int)lv_slider_get_value(obj));

            lv_point_t label_size;
            lv_txt_get_size(&label_size, buf, LV_FONT_DEFAULT, 0, 0, LV_COORD_MAX, 0);
            lv_area_t label_area;
            label_area.x1 = dsc->draw_area->x1 + lv_area_get_width(dsc->draw_area) /␣
↪2 - label_size.x / 2;
            label_area.x2 = label_area.x1 + label_size.x;
            label_area.y2 = dsc->draw_area->y1 - 10;
            label_area.y1 = label_area.y2 - label_size.y;
```

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```
            lv_draw_label_dsc_t label_draw_dsc;
            lv_draw_label_dsc_init(&label_draw_dsc);
            label_draw_dsc.color = lv_color_hex3(0x888);
            lv_draw_label(dsc->draw_ctx, &label_draw_dsc, &label_area, buf, NULL);
        }
    }
}

#endif
```

```
def slider_event_cb(e):
    code = e.get_code()
    obj = e.get_target_obj()

    # Provide some extra space for the value
    if code == lv.EVENT.REFR_EXT_DRAW_SIZE:
        e.set_ext_draw_size(50)

    elif code == lv.EVENT.DRAW_PART_END:
        # print("DRAW_PART_END")
        dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
        # print(dsc)
        if dsc.part == lv.PART.INDICATOR:
            label_text = "{:d} - {:d}".format(obj.get_left_value(),slider.get_value())
            label_size = lv.point_t()
            lv.txt_get_size(label_size, label_text, lv.font_default(), 0, 0, lv.COORD.
↪MAX, 0)
            # print(label_size.x,label_size.y)
            label_area = lv.area_t()
            label_area.x1 = dsc.draw_area.x1 + dsc.draw_area.get_width() // 2 - label_
↪size.x // 2
            label_area.x2 = label_area.x1 + label_size.x
            label_area.y2 = dsc.draw_area.y1 - 10
            label_area.y1 = label_area.y2 - label_size.y

            label_draw_dsc = lv.draw_label_dsc_t()
            label_draw_dsc.init()

            dsc.draw_ctx.label(label_draw_dsc, label_area, label_text, None)
#
# Show the current value when the slider if pressed by extending the drawer
#
#
#Create a slider in the center of the display

slider = lv.slider(lv.scr_act())
slider.center()

slider.set_mode(lv.slider.MODE.RANGE)
slider.set_value(70, lv.ANIM.OFF)
slider.set_left_value(20, lv.ANIM.OFF)

slider.add_event(slider_event_cb, lv.EVENT.ALL, None)
slider.refresh_ext_draw_size()
```

6.24.7 API

Typedefs

typedef uint8_t **`lv_slider_mode_t`**

Enums

enum **`[anonymous]`**

Values:

enumerator **`LV_SLIDER_MODE_NORMAL`**

enumerator **`LV_SLIDER_MODE_SYMMETRICAL`**

enumerator **`LV_SLIDER_MODE_RANGE`**

enum **`lv_slider_draw_part_type_t`**

`type` field in `lv_obj_draw_part_dsc_t` if `class_p = lv_slider_class` Used in `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END`

Values:

enumerator **`LV_SLIDER_DRAW_PART_KNOB`**

The main (right) knob's rectangle

enumerator **`LV_SLIDER_DRAW_PART_KNOB_LEFT`**

The left knob's rectangle

Functions

lv_obj_t ***`lv_slider_create`**(*lv_obj_t* *parent)

Create a slider object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new slider.

Returns pointer to the created slider

static inline void **`lv_slider_set_value`**(*lv_obj_t* *obj, int32_t value, *lv_anim_enable_t* anim)

Set a new value on the slider

Parameters

- **`obj`** -- pointer to a slider object
- **`value`** -- the new value
- **`anim`** -- LV_ANIM_ON: set the value with an animation; LV_ANIM_OFF: change the value immediately

static inline void **`lv_slider_set_left_value`**(*lv_obj_t* *obj, int32_t value, *lv_anim_enable_t* anim)

Set a new value for the left knob of a slider

Parameters

- **`obj`** -- pointer to a slider object
- **`value`** -- new value
- **`anim`** -- LV_ANIM_ON: set the value with an animation; LV_ANIM_OFF: change the value immediately

static inline void **`lv_slider_set_range`**(*lv_obj_t* *obj, int32_t min, int32_t max)

Set minimum and the maximum values of a bar

Parameters

- **`obj`** -- pointer to the slider object
- **`min`** -- minimum value
- **`max`** -- maximum value

static inline void **`lv_slider_set_mode`**(*lv_obj_t* *obj, *lv_slider_mode_t* mode)

Set the mode of slider.

Parameters

- **`obj`** -- pointer to a slider object
- **`mode`** -- the mode of the slider. See ::lv_slider_mode_t

static inline int32_t **`lv_slider_get_value`**(const *lv_obj_t* *obj)

Get the value of the main knob of a slider

Parameters **`obj`** -- pointer to a slider object

Returns the value of the main knob of the slider

static inline int32_t **`lv_slider_get_left_value`**(const *lv_obj_t* *obj)

Get the value of the left knob of a slider

Parameters **`obj`** -- pointer to a slider object

Returns the value of the left knob of the slider

static inline int32_t **`lv_slider_get_min_value`**(const *lv_obj_t* *obj)

Get the minimum value of a slider

Parameters **`obj`** -- pointer to a slider object

Returns the minimum value of the slider

static inline int32_t **`lv_slider_get_max_value`**(const *lv_obj_t* *obj)

Get the maximum value of a slider

Parameters **`obj`** -- pointer to a slider object

Returns the maximum value of the slider

bool **`lv_slider_is_dragged`**(const *lv_obj_t* *obj)

Give the slider is being dragged or not

Parameters **`obj`** -- pointer to a slider object

Returns true: drag in progress false: not dragged static inline *lv_slider_mode_t* **`lv_slider_get_mode`**(*lv_obj_t* *slider)

Get the mode of the slider.

Parameters **`obj`** -- pointer to a bar object

Returns see ::lv_slider_mode_t

Variables

const lv_obj_class_t **`lv_slider_class`**

struct **`lv_slider_t`**

Public Members

lv_bar_t **`bar`**

lv_area_t **`left_knob_area`**

lv_area_t **`right_knob_area`**

lv_point_t **`pressed_point`**

int32_t ***`value_to_set`**

uint8_t **`dragging`**

uint8_t **`left_knob_focus`**

6.25 Span (lv_span)

6.25.1 Overview

A spangroup is the object that is used to display rich text. Different from the label object, `spangroup` can render text styled with different fonts, colors, and sizes into the spangroup object.

6.25.2 Parts and Styles

- `LV_PART_MAIN` The spangroup has only one part.

6.25.3 Usage

Set text and style

The spangroup object uses span to describe text and text style. so, first we need to create `span` descriptor using `lv_span_t * span = lv_spangroup_new_span(spangroup)`. Then use `lv_span_set_text(span, "text")` to set text. The style of the span is configured as with a normal style object by using its `style` member, eg:`lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_RED))`.

If spangroup object `mode != LV_SPAN_MODE_FIXED` you must call `lv_spangroup_refr_mode()` after you have modified `span` style(eg:set text, changed the font size, del span).

Retrieving a span child

Spangroups store their children differently from normal objects, so normal functions for getting children won't work.

`lv_spangroup_get_child(spangroup, id)` will return a pointer to the child span at index `id`. In addition, `id` can be negative to index from the end of the spangroup where `-1` is the youngest child, `-2` is second youngest, etc.

e.g. `lv_span_t* span = lv_spangroup_get_child(spangroup, 0)` will return the first child of the spangroup. `lv_span_t* span = lv_spangroup_get_child(spangroup, -1)` will return the last (or most recent) child.

Child Count

Use the function `lv_spangroup_get_child_cnt(spangroup)` to get back the number of spans the group is maintaining.

e.g. `uint32_t size = lv_spangroup_get_child_cnt(spangroup)`

Text align

like label object, the spangroup can be set to one the following modes:

- `LV_TEXT_ALIGN_LEFT` Align text to left.
- `LV_TEXT_ALIGN_CENTER` Align text to center.
- `LV_TEXT_ALIGN_RIGHT` Align text to right.
- `LV_TEXT_ALIGN_AUTO` Align text auto.

use function `lv_spangroup_set_align(spangroup, LV_TEXT_ALIGN_CENTER)` to set text align.

Modes

The spangroup can be set to one the following modes:

- `LV_SPAN_MODE_FIXED` fixes the object size.
- `LV_SPAN_MODE_EXPAND` Expand the object size to the text size but stay on a single line.
- `LV_SPAN_MODE_BREAK` Keep width, break the too long lines and auto expand height.

Use `lv_spangroup_set_mode(spangroup, LV_SPAN_MODE_BREAK)` to set object mode.

Overflow

The spangroup can be set to one the following modes:

- `LV_SPAN_OVERFLOW_CLIP` truncates the text at the limit of the area.
- `LV_SPAN_OVERFLOW_ELLIPSIS` will display an ellipsis(`...`) when text overflows the area.

Use `lv_spangroup_set_overflow(spangroup, LV_SPAN_OVERFLOW_CLIP)` to set object overflow mode.

first line indent

Use `lv_spangroup_set_indent(spangroup, 20)` to set the indent of the first line. all modes support pixel units, in addition to LV_SPAN_MODE_FIXED and LV_SPAN_MODE_BREAK mode supports percentage units too.

lines

Use `lv_spangroup_set_lines(spangroup, 10)` to set the maximum number of lines to be displayed in LV_SPAN_MODE_BREAK mode, negative values indicate no limit.

6.25.4 Events

No special events are sent by this widget.

Learn more about *Events*.

6.25.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.25.6 Example

Span with custom styles

```
#include "../../lv_examples.h"
#if LV_USE_SPAN && LV_BUILD_EXAMPLES

/**
 * Create span.
 */
void lv_example_span_1(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_border_width(&style, 1);
    lv_style_set_border_color(&style, lv_palette_main(LV_PALETTE_ORANGE));
    lv_style_set_pad_all(&style, 2);

    lv_obj_t * spans = lv_spangroup_create(lv_scr_act());
    lv_obj_set_width(spans, 300);
    lv_obj_set_height(spans, 300);
    lv_obj_center(spans);
    lv_obj_add_style(spans, &style, 0);

    lv_spangroup_set_align(spans, LV_TEXT_ALIGN_LEFT);
    lv_spangroup_set_overflow(spans, LV_SPAN_OVERFLOW_CLIP);
    lv_spangroup_set_indent(spans, 20);
    lv_spangroup_set_mode(spans, LV_SPAN_MODE_BREAK);

    lv_span_t * span = lv_spangroup_new_span(spans);
    lv_span_set_text(span, "China is a beautiful country.");
    lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_RED));
    lv_style_set_text_decor(&span->style, LV_TEXT_DECOR_UNDERLINE);
    lv_style_set_text_opa(&span->style, LV_OPA_50);

    span = lv_spangroup_new_span(spans);
    lv_span_set_text_static(span, "good good study, day day up.");
#if LV_FONT_MONTSERRAT_24
    lv_style_set_text_font(&span->style,  &lv_font_montserrat_24);
#endif
    lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_GREEN));

    span = lv_spangroup_new_span(spans);
    lv_span_set_text_static(span, "LVGL is an open-source graphics library.");
    lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_BLUE));

    span = lv_spangroup_new_span(spans);
    lv_span_set_text_static(span, "the boy no name.");
    lv_style_set_text_color(&span->style, lv_palette_main(LV_PALETTE_GREEN));
#if LV_FONT_MONTSERRAT_20
    lv_style_set_text_font(&span->style, &lv_font_montserrat_20);
#endif
    lv_style_set_text_decor(&span->style, LV_TEXT_DECOR_UNDERLINE);

    span = lv_spangroup_new_span(spans);
    lv_span_set_text(span, "I have a dream that hope to come true.");
    lv_style_set_text_decor(&span->style, LV_TEXT_DECOR_STRIKETHROUGH);
```

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```
    lv_spangroup_refr_mode(spans);
}

#endif
```

```
#
# Create span
#
style = lv.style_t()
style.init()
style.set_border_width(1)
style.set_border_color(lv.palette_main(lv.PALETTE.ORANGE))
style.set_pad_all(2)

spans = lv.spangroup(lv.scr_act())
spans.set_width(300)
spans.set_height(300)
spans.center()
spans.add_style(style, 0)

spans.set_align(lv.TEXT_ALIGN.LEFT)
spans.set_overflow(lv.SPAN_OVERFLOW.CLIP)
spans.set_indent(20)
spans.set_mode(lv.SPAN_MODE.BREAK)

span = spans.new_span()
span.set_text("china is a beautiful country.")
span.style.set_text_color(lv.palette_main(lv.PALETTE.RED))
span.style.set_text_decor(lv.TEXT_DECOR.STRIKETHROUGH | lv.TEXT_DECOR.UNDERLINE)
span.style.set_text_opa(lv.OPA._30)

span = spans.new_span()
span.set_text_static("good good study, day day up.")
#if LV_FONT_MONTSERRAT_24
#    lv_style_set_text_font(&span->style,  &lv_font_montserrat_24);
#endif
span.style.set_text_color(lv.palette_main(lv.PALETTE.GREEN))

span = spans.new_span()
span.set_text_static("LVGL is an open-source graphics library.")
span.style.set_text_color(lv.palette_main(lv.PALETTE.BLUE))

span = spans.new_span()
span.set_text_static("the boy no name.")
span.style.set_text_color(lv.palette_main(lv.PALETTE.GREEN))
#if LV_FONT_MONTSERRAT_20
#    lv_style_set_text_font(&span->style, &lv_font_montserrat_20);
#endif
span.style.set_text_decor(lv.TEXT_DECOR.UNDERLINE)

span = spans.new_span()
span.set_text("I have a dream that hope to come true.")

spans.refr_mode()
```

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```
# lv_span_del(spans, span);
# lv_obj_del(spans);
```

6.25.7 API

Typedefs

typedef uint8_t **lv_span_overflow_t**

typedef uint8_t **lv_span_mode_t**

Enums

enum **[anonymous]**

Values:

enumerator **LV_SPAN_OVERFLOW_CLIP**

enumerator **LV_SPAN_OVERFLOW_ELLIPSIS**

enum **[anonymous]**

Values:

enumerator **LV_SPAN_MODE_FIXED**

fixed the obj size

enumerator **LV_SPAN_MODE_EXPAND**

Expand the object size to the text size

enumerator **LV_SPAN_MODE_BREAK**

Keep width, break the too long lines and expand height

Functions

lv_obj_t ***lv_spangroup_create**(*lv_obj_t* *par)

Create a spangroup object

Parameters **par** -- pointer to an object, it will be the parent of the new spangroup

Returns pointer to the created spangroup *lv_span_t* ***lv_spangroup_new_span**(*lv_obj_t* *obj)

Create a span string descriptor and add to spangroup.

Parameters **obj** -- pointer to a spangroup object.

Returns pointer to the created span.

void **lv_spangroup_del_span**(*lv_obj_t* *obj, *lv_span_t* *span)

Remove the span from the spangroup and free memory.

Parameters

- **obj** -- pointer to a spangroup object.
- **span** -- pointer to a span.

void **lv_span_set_text**(*lv_span_t* *span, const char *text)

Set a new text for a span. Memory will be allocated to store the text by the span.

Parameters

- **span** -- pointer to a span.
- **text** -- pointer to a text.

void **lv_span_set_text_static**(*lv_span_t* *span, const char *text)

Set a static text. It will not be saved by the span so the 'text' variable has to be 'alive' while the span exist.

Parameters

- **span** -- pointer to a span.
- **text** -- pointer to a text.

void **lv_spangroup_set_align**(*lv_obj_t* *obj, lv_text_align_t align)

Set the align of the spangroup.

Parameters

- **obj** -- pointer to a spangroup object.
- **align** -- see lv_text_align_t for details.

void **lv_spangroup_set_overflow**(*lv_obj_t* *obj, *lv_span_overflow_t* overflow)

Set the overflow of the spangroup.

Parameters

- **obj** -- pointer to a spangroup object.
- **overflow** -- see lv_span_overflow_t for details.

void **lv_spangroup_set_indent**(*lv_obj_t* *obj, lv_coord_t indent)

Set the indent of the spangroup.

Parameters

- **obj** -- pointer to a spangroup object.
- **indent** -- The first line indentation

void **lv_spangroup_set_mode**(*lv_obj_t* *obj, *lv_span_mode_t* mode)

Set the mode of the spangroup.

Parameters

- **obj** -- pointer to a spangroup object.

- **mode** -- see lv_span_mode_t for details.

void **lv_spangroup_set_lines**(*lv_obj_t* *obj, int32_t lines)

Set lines of the spangroup.

Parameters

- **obj** -- pointer to a spangroup object.
- **lines** -- max lines that can be displayed in LV_SPAN_MODE_BREAK mode. < 0 means no limit.

lv_span_t ***lv_spangroup_get_child**(const *lv_obj_t* *obj, int32_t id)

Get a spangroup child by its index.

Parameters

- **obj** -- The spangroup object
- **id** -- the index of the child. 0: the oldest (firstly created) child 1: the second oldest child count-1: the youngest -1: the youngest -2: the second youngest

Returns The child span at index `id`, or NULL if the ID does not exist

uint32_t **lv_spangroup_get_child_cnt**(const *lv_obj_t* *obj)

Parameters **obj** -- The spangroup object to get the child count of.

Returns The span count of the spangroup.

lv_text_align_t **lv_spangroup_get_align**(*lv_obj_t* *obj)

get the align of the spangroup.

Parameters **obj** -- pointer to a spangroup object.

Returns the align value.

lv_span_overflow_t **lv_spangroup_get_overflow**(*lv_obj_t* *obj)

get the overflow of the spangroup.

Parameters **obj** -- pointer to a spangroup object.

Returns the overflow value.

lv_coord_t **lv_spangroup_get_indent**(*lv_obj_t* *obj)

get the indent of the spangroup.

Parameters **obj** -- pointer to a spangroup object.

Returns the indent value.

lv_span_mode_t **lv_spangroup_get_mode**(*lv_obj_t* *obj)

get the mode of the spangroup.

Parameters **obj** -- pointer to a spangroup object.

int32_t **lv_spangroup_get_lines**(*lv_obj_t* *obj)

get lines of the spangroup.

Parameters **obj** -- pointer to a spangroup object.

Returns the lines value.

lv_coord_t **`lv_spangroup_get_max_line_h`**(*lv_obj_t* *obj)

get max line height of all span in the spangroup.

Parameters **`obj`** -- pointer to a spangroup object.

uint32_t **`lv_spangroup_get_expand_width`**(*lv_obj_t* *obj, uint32_t max_width)

get the text content width when all span of spangroup on a line.

Parameters

- **`obj`** -- pointer to a spangroup object.
- **`max_width`** -- if text content width >= max_width, return max_width to reduce computation, if max_width == 0, returns the text content width.

Returns text content width or max_width.

lv_coord_t **`lv_spangroup_get_expand_height`**(*lv_obj_t* *obj, lv_coord_t width)

get the text content height with width fixed.

Parameters **`obj`** -- pointer to a spangroup object.

void **`lv_spangroup_refr_mode`**(*lv_obj_t* *obj)

update the mode of the spangroup.

Parameters **`obj`** -- pointer to a spangroup object.

Variables

const lv_obj_class_t **`lv_spangroup_class`**

struct **`lv_span_t`**

Public Members

char ***`txt`**

lv_obj_t ***`spangroup`**

lv_style_t **`style`**

uint8_t **`static_flag`**

struct **`lv_spangroup_t`**

#include <lv_span.h> Data of label

Public Members

lv_obj_t **obj**

int32_t **lines**

lv_coord_t **indent**

lv_coord_t **cache_w**

lv_coord_t **cache_h**

lv_ll_t **child_ll**

uint8_t **mode**

uint8_t **overflow**

uint8_t **refresh**

6.26 Spinbox (lv_spinbox)

6.26.1 Overview

The Spinbox contains a number as text which can be increased or decreased by *Keys* or API functions. Under the hood the Spinbox is a modified *Text area*.

6.26.2 Parts and Styles

The parts of the Spinbox are identical to the *Text area*.

Value, range and step

`lv_spinbox_set_value(spinbox, 1234)` sets a new value on the Spinbox.

`lv_spinbox_increment(spinbox)` and `lv_spinbox_decrement(spinbox)` increments/decrements the value of the Spinbox according to the currently selected digit.

`lv_spinbox_set_range(spinbox, -1000, 2500)` sets a range. If the value is changed by `lv_spinbox_set_value`, by *Keys*,`lv_spinbox_increment/decrement` this range will be respected.

`lv_spinbox_set_step(spinbox, 100)` sets which digits to change on increment/decrement. Only multiples of ten can be set, and not for example 3.

`lv_spinbox_set_cursor_pos(spinbox, 1)` sets the cursor to a specific digit to change on increment/decrement. For example position '0' sets the cursor to the least significant digit.

If an encoder is used as input device, the selected digit is shifted to the right by default whenever the encoder button is clicked. To change this behaviour to shifting to the left, the `lv_spinbox_set_digit_step_direction(spinbox, LV_DIR_LEFT)` can be used

Format

`lv_spinbox_set_digit_format(spinbox, digit_count, separator_position)` sets the number format. `digit_count` is the number of digits excluding the decimal separator and the sign. `separator_position` is the number of digits before the decimal point. If 0, no decimal point is displayed.

Rollover

`lv_spinbox_set_rollover(spinbox, true/false)` enables/disabled rollover mode. If either the minimum or maximum value is reached with rollover enabled, the value will change to the other limit. If rollover is disabled the value will remain at the minimum or maximum value.

6.26.3 Events

- `LV_EVENT_VALUE_CHANGED` Sent when the value has changed.

See the events of the *Text area* too.

Learn more about *Events*.

6.26.4 Keys

- `LV_KEY_LEFT/RIGHT` With *Keypad* move the cursor left/right. With *Encoder* decrement/increment the selected digit.
- `LV_KEY_UP/DOWN` With *Keypad* and *Encoder* increment/decrement the value.
- `LV_KEY_ENTER` With *Encoder* got the net digit. Jump to the first after the last.

6.26.5 Example

Simple Spinbox

```c
#include "../../lv_examples.h"
#if LV_USE_SPINBOX && LV_BUILD_EXAMPLES

static lv_obj_t * spinbox;


static void lv_spinbox_increment_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_SHORT_CLICKED || code  == LV_EVENT_LONG_PRESSED_REPEAT) {
        lv_spinbox_increment(spinbox);
    }
}
```

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```
static void lv_spinbox_decrement_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_SHORT_CLICKED || code == LV_EVENT_LONG_PRESSED_REPEAT) {
        lv_spinbox_decrement(spinbox);
    }
}


void lv_example_spinbox_1(void)
{
    spinbox = lv_spinbox_create(lv_scr_act());
    lv_spinbox_set_range(spinbox, -1000, 25000);
    lv_spinbox_set_digit_format(spinbox, 5, 2);
    lv_spinbox_step_prev(spinbox);
    lv_obj_set_width(spinbox, 100);
    lv_obj_center(spinbox);

    lv_coord_t h = lv_obj_get_height(spinbox);

    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, h, h);
    lv_obj_align_to(btn, spinbox, LV_ALIGN_OUT_RIGHT_MID, 5, 0);
    lv_obj_set_style_bg_img_src(btn, LV_SYMBOL_PLUS, 0);
    lv_obj_add_event(btn, lv_spinbox_increment_event_cb, LV_EVENT_ALL,  NULL);

    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_size(btn, h, h);
    lv_obj_align_to(btn, spinbox, LV_ALIGN_OUT_LEFT_MID, -5, 0);
    lv_obj_set_style_bg_img_src(btn, LV_SYMBOL_MINUS, 0);
    lv_obj_add_event(btn, lv_spinbox_decrement_event_cb, LV_EVENT_ALL, NULL);
}

#endif
```

```
def increment_event_cb(e):
    code = e.get_code()
    if code == lv.EVENT.SHORT_CLICKED or code  == lv.EVENT.LONG_PRESSED_REPEAT:
        spinbox.increment()

def decrement_event_cb(e):
    code = e.get_code()
    if code == lv.EVENT.SHORT_CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
        spinbox.decrement()

spinbox = lv.spinbox(lv.scr_act())
spinbox.set_range(-1000, 25000)
spinbox.set_digit_format(5, 2)
spinbox.step_prev()
spinbox.set_width(100)
spinbox.center()

h = spinbox.get_height()

btn = lv.btn(lv.scr_act())
btn.set_size(h, h)
```

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```
btn.align_to(spinbox, lv.ALIGN.OUT_RIGHT_MID, 5, 0)
btn.set_style_bg_img_src(lv.SYMBOL.PLUS, 0)
btn.add_event(increment_event_cb, lv.EVENT.ALL,  None)

btn = lv.btn(lv.scr_act())
btn.set_size(h, h)
btn.align_to(spinbox, lv.ALIGN.OUT_LEFT_MID, -5, 0)
btn.set_style_bg_img_src(lv.SYMBOL.MINUS, 0)
btn.add_event(decrement_event_cb, lv.EVENT.ALL, None)
```

6.26.6 API

Functions

lv_obj_t ***lv_spinbox_create**(*lv_obj_t* *parent)

Create a Spinbox object

Parameters **parent** -- pointer to an object, it will be the parent of the new spinbox

Returns pointer to the created spinbox

void **lv_spinbox_set_value**(*lv_obj_t* *obj, int32_t i)

Set spinbox value

Parameters

- **obj** -- pointer to spinbox
- **i** -- value to be set

void **lv_spinbox_set_rollover**(*lv_obj_t* *obj, bool b)

Set spinbox rollover function

Parameters

- **obj** -- pointer to spinbox
- **b** -- true or false to enable or disable (default)

void **lv_spinbox_set_digit_format**(*lv_obj_t* *obj, uint8_t digit_count, uint8_t separator_position)

Set spinbox digit format (digit count and decimal format)

Parameters

- **obj** -- pointer to spinbox
- **digit_count** -- number of digit excluding the decimal separator and the sign
- **separator_position** -- number of digit before the decimal point. If 0, decimal point is not shown

void **lv_spinbox_set_step**(*lv_obj_t* *obj, uint32_t step)

Set spinbox step

Parameters

- **obj** -- pointer to spinbox
- **step** -- steps on increment/decrement. Can be 1, 10, 100, 1000, etc the digit that will change.

void **`lv_spinbox_set_range`**(*lv_obj_t* *obj, int32_t range_min, int32_t range_max)

Set spinbox value range

Parameters

- **`obj`** -- pointer to spinbox
- **`range_min`** -- maximum value, inclusive
- **`range_max`** -- minimum value, inclusive

void **`lv_spinbox_set_cursor_pos`**(*lv_obj_t* *obj, uint8_t pos)

Set cursor position to a specific digit for edition

Parameters

- **`obj`** -- pointer to spinbox
- **`pos`** -- selected position in spinbox

void **`lv_spinbox_set_digit_step_direction`**(*lv_obj_t* *obj, lv_dir_t direction)

Set direction of digit step when clicking an encoder button while in editing mode

Parameters

- **`obj`** -- pointer to spinbox
- **`direction`** -- the direction (LV_DIR_RIGHT or LV_DIR_LEFT)

bool **`lv_spinbox_get_rollover`**(*lv_obj_t* *obj)

Get spinbox rollover function status

Parameters **`obj`** -- pointer to spinbox

int32_t **`lv_spinbox_get_value`**(*lv_obj_t* *obj)

Get the spinbox numeral value (user has to convert to float according to its digit format)

Parameters **`obj`** -- pointer to spinbox

Returns value integer value of the spinbox

int32_t **`lv_spinbox_get_step`**(*lv_obj_t* *obj)

Get the spinbox step value (user has to convert to float according to its digit format)

Parameters **`obj`** -- pointer to spinbox

Returns value integer step value of the spinbox

void **`lv_spinbox_step_next`**(*lv_obj_t* *obj)

Select next lower digit for edition by dividing the step by 10

Parameters **`obj`** -- pointer to spinbox

void **`lv_spinbox_step_prev`**(*lv_obj_t* *obj)

Select next higher digit for edition by multiplying the step by 10

Parameters **`obj`** -- pointer to spinbox

void **`lv_spinbox_increment`**(*lv_obj_t* *obj)

Increment spinbox value by one step

Parameters **`obj`** -- pointer to spinbox void **`lv_spinbox_decrement`**(*lv_obj_t* *obj)

Decrement spinbox value by one step

Parameters **`obj`** -- pointer to spinbox

Variables

const lv_obj_class_t **`lv_spinbox_class`**

struct **`lv_spinbox_t`**

Public Members

lv_textarea_t **`ta`**

int32_t **`value`**

int32_t **`range_max`**

int32_t **`range_min`**

int32_t **`step`**

uint16_t **`digit_count`**

uint16_t **`dec_point_pos`**

uint16_t **`rollover`**

uint16_t **`digit_step_dir`**

6.26.7 Example

6.27 Spinner (lv_spinner)

6.27.1 Overview

The Spinner object is a spinning arc over a ring.

6.27.2 Parts and Styles

The parts are identical to the parts of *lv_arc*.

6.27.3 Usage

Create a spinner

To create a spinner use `lv_spinner_create(parent, spin_time, arc_length)`. `spin time` sets the spin time in milliseconds, `arc_length` sets the length of the spinning arc in degrees.

6.27.4 Events

No special events are sent to the Spinner.

See the events of the *Arc* too.

Learn more about *Events*.

6.27.5 Keys

No *Keys* are processed by the object type.

Learn more about *Keys*.

6.27.6 Example

Simple spinner

```c
#include "../../lv_examples.h"
#if LV_USE_SPINNER && LV_BUILD_EXAMPLES

void lv_example_spinner_1(void)
{
    /*Create a spinner*/
    lv_obj_t * spinner = lv_spinner_create(lv_scr_act(), 1000, 60);
    lv_obj_set_size(spinner, 100, 100);
    lv_obj_center(spinner);
}

#endif
```

```python
# Create a spinner
spinner = lv.spinner(lv.scr_act(), 1000, 60)
spinner.set_size(100, 100)
spinner.center()
```

6.27.7 API

Functions

lv_obj_t ***lv_spinner_create**(*lv_obj_t* *parent, uint32_t time, uint32_t arc_length)

Variables

const lv_obj_class_t **lv_spinner_class**

6.28 Switch (lv_switch)

6.28.1 Overview

The Switch looks like a little slider and can be used to turn something on and off.

6.28.2 Parts and Styles

- `LV_PART_MAIN` The background of the switch uses all the typical background style properties. `padding` makes the indicator smaller in the respective direction.
- `LV_PART_INDICATOR` The indicator that shows the current state of the switch. Also uses all the typical background style properties.
- `LV_PART_KNOB` A rectangle (or circle) drawn at left or right side of the indicator. Also uses all the typical background properties to describe the knob(s). By default, the knob is square (with an optional corner radius) with side length equal to the smaller side of the slider. The knob can be made larger with the `padding` values. Padding values can be asymmetric too.

6.28.3 Usage

Change state

The switch uses the standard `LV_STATE_CHECKED` state.

To get the current state of the switch (with `true` being on), use `lv_obj_has_state(switch, LV_STATE_CHECKED)`.

Call `lv_obj_add_state(switch, LV_STATE_CHECKED)` to turn it on, or `lv_obj_clear_state(switch, LV_STATE_CHECKED)` to turn it off.

6.28.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when the switch changes state.

See the events of the *Base object* too.

Learn more about *Events*.

6.28.5 Keys

- `LV_KEY_UP/RIGHT` Turns on the slider
- `LV_KEY_DOWN/LEFT` Turns off the slider
- `LV_KEY_ENTER` Toggles the switch

Learn more about *Keys*.

6.28.6 Example

Simple Switch

```
#include "../../lv_examples.h"
#if LV_USE_SWITCH && LV_BUILD_EXAMPLES

static void event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        LV_UNUSED(obj);
        LV_LOG_USER("State: %s\n", lv_obj_has_state(obj, LV_STATE_CHECKED) ? "On" :
↪"Off");
    }
}

void lv_example_switch_1(void)
{
    lv_obj_set_flex_flow(lv_scr_act(), LV_FLEX_FLOW_COLUMN);
    lv_obj_set_flex_align(lv_scr_act(), LV_FLEX_ALIGN_CENTER, LV_FLEX_ALIGN_CENTER,␣
↪LV_FLEX_ALIGN_CENTER);

    lv_obj_t * sw;

    sw = lv_switch_create(lv_scr_act());
    lv_obj_add_event(sw, event_handler, LV_EVENT_ALL, NULL);

    sw = lv_switch_create(lv_scr_act());
    lv_obj_add_state(sw, LV_STATE_CHECKED);
    lv_obj_add_event(sw, event_handler, LV_EVENT_ALL, NULL);

    sw = lv_switch_create(lv_scr_act());
    lv_obj_add_state(sw, LV_STATE_DISABLED);
    lv_obj_add_event(sw, event_handler, LV_EVENT_ALL, NULL);

    sw = lv_switch_create(lv_scr_act());
```

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```c
    lv_obj_add_state(sw, LV_STATE_CHECKED | LV_STATE_DISABLED);
    lv_obj_add_event(sw, event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```python
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.VALUE_CHANGED:
        if obj.has_state(lv.STATE.CHECKED):
            print("State: on")
        else:
            print("State: off")


lv.scr_act().set_flex_flow(lv.FLEX_FLOW.COLUMN)
lv.scr_act().set_flex_align(lv.FLEX_ALIGN.CENTER, lv.FLEX_ALIGN.CENTER, lv.FLEX_ALIGN.
↪CENTER)

sw = lv.switch(lv.scr_act())
sw.add_event(event_handler,lv.EVENT.ALL, None)

sw = lv.switch(lv.scr_act())
sw.add_state(lv.STATE.CHECKED)
sw.add_event(event_handler, lv.EVENT.ALL, None)

sw = lv.switch(lv.scr_act())
sw.add_state(lv.STATE.DISABLED)
sw.add_event(event_handler, lv.EVENT.ALL, None)

sw = lv.switch(lv.scr_act())
sw.add_state(lv.STATE.CHECKED | lv.STATE.DISABLED)
sw.add_event(event_handler, lv.EVENT.ALL, None)
```

6.28.7 API

Functions

lv_obj_t ***lv_switch_create**(*lv_obj_t* *parent)

Create a switch object

Parameters **parent** -- pointer to an object, it will be the parent of the new switch

Returns pointer to the created switch

Variables

const lv_obj_class_t **`lv_switch_class`**

struct **`lv_switch_t`**

Public Members

lv_obj_t **`obj`**

int32_t **`anim_state`**

6.29 Table (lv_table)

6.29.1 Overview

Tables, as usual, are built from rows, columns, and cells containing texts.

The Table object is very lightweight because only the texts are stored. No real objects are created for cells but they are just drawn on the fly.

The Table is added to the default group (if it is set). Besides the Table is an editable object to allow selecting a cell with encoder navigation too.

6.29.2 Parts and Styles

- `LV_PART_MAIN` The background of the table uses all the typical background style properties.
- `LV_PART_ITEMS` The cells of the table also use all the typical background style properties and the text properties.

6.29.3 Usage

Set cell value

The cells can store only text so numbers need to be converted to text before displaying them in a table.

`lv_table_set_cell_value(table, row, col, "Content")`. The text is saved by the table so it can be even a local variable.

Line breaks can be used in the text like `"Value\n60.3"`.

New rows and columns are automatically added is required

Rows and Columns

To explicitly set number of rows and columns use `lv_table_set_row_cnt(table, row_cnt)` and `lv_table_set_col_cnt(table, col_cnt)`

Width and Height

The width of the columns can be set with `lv_table_set_col_width(table, col_id, width)`. The overall width of the Table object will be set to the sum of columns widths.

The height is calculated automatically from the cell styles (font, padding etc) and the number of rows.

Merge cells

Cells can be merged horizontally with `lv_table_add_cell_ctrl(table, row, col, LV_TABLE_CELL_CTRL_MERGE_RIGHT)`. To merge more adjacent cells call this function for each cell.

Scroll

If the label's width or height is set to `LV_SIZE_CONTENT` that size will be used to show the whole table in the respective direction. E.g. `lv_obj_set_size(table, LV_SIZE_CONTENT, LV_SIZE_CONTENT)` automatically sets the table size to show all the columns and rows.

If the width or height is set to a smaller number than the "intrinsic" size then the table becomes scrollable.

6.29.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when a new cell is selected with keys.
- `LV_EVENT_DRAW_PART_BEGIN` and `LV_EVENT_DRAW_PART_END` are sent for the following types:
  - `LV_TABLE_DRAW_PART_CELL` The individual cells of the table
    - `part`: `LV_PART_ITEMS`
    - `draw_area`: area of the indicator
    - `rect_dsc`
    - `label_dsc`
    - `id`: current row × col count + current column

See the events of the *Base object* too.

Learn more about *Events*.

6.29.5 Keys

The following *Keys* are processed by the Tables:

- `LV_KEY_RIGHT/LEFT/UP/DOWN/` Select a cell.

Note that, as usual, the state of `LV_KEY_ENTER` is translated to `LV_EVENT_PRESSED/PRESSING/RELEASED` etc.

`lv_table_get_selected_cell(table, &row, &col)` can be used to get the currently selected cell. Row and column will be set to `LV_TABLE_CELL_NONE` no cell is selected.

Learn more about *Keys*.

6.29.6 Example

Simple table

```c
#include "../../lv_examples.h"
#if LV_USE_TABLE && LV_BUILD_EXAMPLES

static void draw_part_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    /*If the cells are drawn...*/
    if(dsc->part == LV_PART_ITEMS) {
        uint32_t row = dsc->id /  lv_table_get_col_cnt(obj);
        uint32_t col = dsc->id - row * lv_table_get_col_cnt(obj);

        /*Make the texts in the first cell center aligned*/
        if(row == 0) {
            dsc->label_dsc->align = LV_TEXT_ALIGN_CENTER;
            dsc->rect_dsc->bg_color = lv_color_mix(lv_palette_main(LV_PALETTE_BLUE),␣
↪dsc->rect_dsc->bg_color, LV_OPA_20);
            dsc->rect_dsc->bg_opa = LV_OPA_COVER;
        }
        /*In the first column align the texts to the right*/
        else if(col == 0) {
            dsc->label_dsc->align = LV_TEXT_ALIGN_RIGHT;
        }

        /*MAke every 2nd row grayish*/
        if((row != 0 && row % 2) == 0) {
            dsc->rect_dsc->bg_color = lv_color_mix(lv_palette_main(LV_PALETTE_GREY),␣
↪dsc->rect_dsc->bg_color, LV_OPA_10);
            dsc->rect_dsc->bg_opa = LV_OPA_COVER;
        }
    }
}


void lv_example_table_1(void)
{
    lv_obj_t * table = lv_table_create(lv_scr_act());

    /*Fill the first column*/
```

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```
    lv_table_set_cell_value(table, 0, 0, "Name");
    lv_table_set_cell_value(table, 1, 0, "Apple");
    lv_table_set_cell_value(table, 2, 0, "Banana");
    lv_table_set_cell_value(table, 3, 0, "Lemon");
    lv_table_set_cell_value(table, 4, 0, "Grape");
    lv_table_set_cell_value(table, 5, 0, "Melon");
    lv_table_set_cell_value(table, 6, 0, "Peach");
    lv_table_set_cell_value(table, 7, 0, "Nuts");

    /*Fill the second column*/
    lv_table_set_cell_value(table, 0, 1, "Price");
    lv_table_set_cell_value(table, 1, 1, "$7");
    lv_table_set_cell_value(table, 2, 1, "$4");
    lv_table_set_cell_value(table, 3, 1, "$6");
    lv_table_set_cell_value(table, 4, 1, "$2");
    lv_table_set_cell_value(table, 5, 1, "$5");
    lv_table_set_cell_value(table, 6, 1, "$1");
    lv_table_set_cell_value(table, 7, 1, "$9");

    /*Set a smaller height to the table. It'll make it scrollable*/
    lv_obj_set_height(table, 200);
    lv_obj_center(table);

    /*Add an event callback to to apply some custom drawing*/
    lv_obj_add_event(table, draw_part_event_cb, LV_EVENT_DRAW_PART_BEGIN, NULL);
}

#endif
```

```
def draw_part_event_cb(e):
    obj = e.get_target_obj()
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    # If the cells are drawn../
    if dsc.part == lv.PART.ITEMS:
        row = dsc.id //  obj.get_col_cnt()
        col = dsc.id - row * obj.get_col_cnt()

        # Make the texts in the first cell center aligned
        if row == 0:
            dsc.label_dsc.align = lv.TEXT_ALIGN.CENTER
            dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.BLUE).color_mix(dsc.
↪rect_dsc.bg_color, lv.OPA._20)
            dsc.rect_dsc.bg_opa = lv.OPA.COVER

        # In the first column align the texts to the right
        elif col == 0:
            dsc.label_dsc.flag = lv.TEXT_ALIGN.RIGHT

        # Make every 2nd row grayish
        if row != 0 and (row % 2) == 0:
            dsc.rect_dsc.bg_color = lv.palette_main(lv.PALETTE.GREY).color_mix(dsc.
↪rect_dsc.bg_color, lv.OPA._10)
            dsc.rect_dsc.bg_opa = lv.OPA.COVER


table = lv.table(lv.scr_act())
```

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```
# Fill the first column
table.set_cell_value(0, 0, "Name")
table.set_cell_value(1, 0, "Apple")
table.set_cell_value(2, 0, "Banana")
table.set_cell_value(3, 0, "Lemon")
table.set_cell_value(4, 0, "Grape")
table.set_cell_value(5, 0, "Melon")
table.set_cell_value(6, 0, "Peach")
table.set_cell_value(7, 0, "Nuts")

# Fill the second column
table.set_cell_value(0, 1, "Price")
table.set_cell_value(1, 1, "$7")
table.set_cell_value(2, 1, "$4")
table.set_cell_value(3, 1, "$6")
table.set_cell_value(4, 1, "$2")
table.set_cell_value(5, 1, "$5")
table.set_cell_value(6, 1, "$1")
table.set_cell_value(7, 1, "$9")

# Set a smaller height to the table. It'll make it scrollable
table.set_height(200)
table.center()

# Add an event callback to apply some custom drawing
table.add_event(draw_part_event_cb, lv.EVENT.DRAW_PART_BEGIN, None)
```

Lightweighted list from table

```
#include "../../lv_examples.h"
#if LV_USE_TABLE && LV_BUILD_EXAMPLES

#define ITEM_CNT 200

static void draw_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_draw_part_dsc_t * dsc = lv_event_get_draw_part_dsc(e);
    /*If the cells are drawn...*/
    if(dsc->part == LV_PART_ITEMS) {
        bool chk = lv_table_has_cell_ctrl(obj, dsc->id, 0, LV_TABLE_CELL_CTRL_CUSTOM_
↪1);

        lv_draw_rect_dsc_t rect_dsc;
        lv_draw_rect_dsc_init(&rect_dsc);
        rect_dsc.bg_color = chk ? lv_theme_get_color_primary(obj) : lv_palette_
↪lighten(LV_PALETTE_GREY, 2);
        rect_dsc.radius = LV_RADIUS_CIRCLE;

        lv_area_t sw_area;
        sw_area.x1 = dsc->draw_area->x2 - 50;
        sw_area.x2 = sw_area.x1 + 40;
        sw_area.y1 = dsc->draw_area->y1 + lv_area_get_height(dsc->draw_area) / 2 - 10;
```

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```
        sw_area.y2 = sw_area.y1 + 20;
        lv_draw_rect(dsc->draw_ctx, &rect_dsc, &sw_area);

        rect_dsc.bg_color = lv_color_white();
        if(chk) {
            sw_area.x2 -= 2;
            sw_area.x1 = sw_area.x2 - 16;
        }
        else {
            sw_area.x1 += 2;
            sw_area.x2 = sw_area.x1 + 16;
        }
        sw_area.y1 += 2;
        sw_area.y2 -= 2;
        lv_draw_rect(dsc->draw_ctx, &rect_dsc, &sw_area);
    }
}

static void change_event_cb(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    uint16_t col;
    uint16_t row;
    lv_table_get_selected_cell(obj, &row, &col);
    bool chk = lv_table_has_cell_ctrl(obj, row, 0, LV_TABLE_CELL_CTRL_CUSTOM_1);
    if(chk) lv_table_clear_cell_ctrl(obj, row, 0, LV_TABLE_CELL_CTRL_CUSTOM_1);
    else lv_table_add_cell_ctrl(obj, row, 0, LV_TABLE_CELL_CTRL_CUSTOM_1);
}


/**
 * A very light-weighted list created from table
 */
void lv_example_table_2(void)
{
    /*Measure memory usage*/
    lv_mem_monitor_t mon1;
    lv_mem_monitor(&mon1);

    uint32_t t = lv_tick_get();

    lv_obj_t * table = lv_table_create(lv_scr_act());

    /*Set a smaller height to the table. It'll make it scrollable*/
    lv_obj_set_size(table, LV_SIZE_CONTENT, 200);

    lv_table_set_col_width(table, 0, 150);
    lv_table_set_row_cnt(table, ITEM_CNT); /*Not required but avoids a lot of memory␣
↪reallocation lv_table_set_set_value*/
    lv_table_set_col_cnt(table, 1);

    /*Don't make the cell pressed, we will draw something different in the event*/
    lv_obj_remove_style(table, NULL, LV_PART_ITEMS | LV_STATE_PRESSED);

    uint32_t i;
    for(i = 0; i < ITEM_CNT; i++) {
        lv_table_set_cell_value_fmt(table, i, 0, "Item %"LV_PRIu32, i + 1);
```

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```
    }

    lv_obj_align(table, LV_ALIGN_CENTER, 0, -20);

    /*Add an event callback to to apply some custom drawing*/
    lv_obj_add_event(table, draw_event_cb, LV_EVENT_DRAW_PART_END, NULL);
    lv_obj_add_event(table, change_event_cb, LV_EVENT_VALUE_CHANGED, NULL);

    lv_mem_monitor_t mon2;
    lv_mem_monitor(&mon2);

    uint32_t mem_used = mon1.free_size - mon2.free_size;

    uint32_t elaps = lv_tick_elaps(t);

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text_fmt(label, "%"LV_PRIu32" items were created in %"LV_PRIu32" ms\n
↪"
                          "using %"LV_PRIu32" bytes of memory",
                          (uint32_t)ITEM_CNT, elaps, mem_used);

    lv_obj_align(label, LV_ALIGN_BOTTOM_MID, 0, -10);

}

#endif
```

```
from utime import ticks_ms
import gc

ITEM_CNT = 200

def draw_event_cb(e):
    obj = e.get_target_obj()
    dsc = lv.obj_draw_part_dsc_t.__cast__(e.get_param())
    # If the cells are drawn...
    if dsc.part == lv.PART.ITEMS:
        chk = obj.has_cell_ctrl(dsc.id, 0, lv.table.CELL_CTRL.CUSTOM_1)

        rect_dsc = lv.draw_rect_dsc_t()
        rect_dsc.init()

        if chk:
            rect_dsc.bg_color = lv.theme_get_color_primary(obj)
        else:
            rect_dsc.bg_color = lv.palette_lighten(lv.PALETTE.GREY, 2)

        rect_dsc.radius = lv.RADIUS_CIRCLE

        sw_area = lv.area_t()
        sw_area.x1 = dsc.draw_area.x2 - 50
        sw_area.x2 = sw_area.x1 + 40
        sw_area.y1 = dsc.draw_area.y1 + dsc.draw_area.get_height() // 2 - 10
        sw_area.y2 = sw_area.y1 + 20
        dsc.draw_ctx.rect(rect_dsc, sw_area)
```

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```
        rect_dsc.bg_color = lv.color_white()

        if chk:
            sw_area.x2 -= 2
            sw_area.x1 = sw_area.x2 - 16
        else:
            sw_area.x1 += 2
            sw_area.x2 = sw_area.x1 + 16
        sw_area.y1 += 2
        sw_area.y2 -= 2
        dsc.draw_ctx.rect(rect_dsc, sw_area)

def change_event_cb(e):
    obj = e.get_target_obj()
    row = lv.C_Pointer()
    col = lv.C_Pointer()
    table.get_selected_cell(row, col)
    # print("row: ",row.uint_val)

    chk = table.has_cell_ctrl(row.uint_val, 0, lv.table.CELL_CTRL.CUSTOM_1)
    if chk:
        table.clear_cell_ctrl(row.uint_val, 0, lv.table.CELL_CTRL.CUSTOM_1)
    else:
        table.add_cell_ctrl(row.uint_val, 0, lv.table.CELL_CTRL.CUSTOM_1)

#
# A very light-weighted list created from table
#

# Measure memory usage
gc.enable()
gc.collect()
mem_free = gc.mem_free()
print("mem_free: ", mem_free)
t = ticks_ms()
print("ticks: ", t)
table = lv.table(lv.scr_act())

# Set a smaller height to the table. It'll make it scrollable
table.set_size(150, 200)

table.set_col_width(0, 150)
table.set_row_cnt(ITEM_CNT)  # Not required but avoids a lot of memory reallocation␣
↪lv_table_set_set_value
table.set_col_cnt(1)

# Don't make the cell pressed, we will draw something different in the event
table.remove_style(None, lv.PART.ITEMS | lv.STATE.PRESSED)

for i in range(ITEM_CNT):
    table.set_cell_value(i, 0, "Item " + str(i+1))

table.align(lv.ALIGN.CENTER, 0, -20)

# Add an event callback to apply some custom drawing
table.add_event(draw_event_cb, lv.EVENT.DRAW_PART_END, None)
table.add_event(change_event_cb, lv.EVENT.VALUE_CHANGED, None)
```

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```
gc.collect()
mem_used = mem_free - gc.mem_free()
elaps = ticks_ms()-t

label = lv.label(lv.scr_act())
label.set_text(str(ITEM_CNT) + " items were created in " + str(elaps) + " ms\n using
↪" + str(mem_used) + " bytes of memory")
#label.set_text(str(ITEM_CNT) + " items were created in " + str(elaps) + " ms")

label.align(lv.ALIGN.BOTTOM_MID, 0, -10)
```

MicroPython

No examples yet.

6.29.7 API

Typedefs

typedef uint8_t **lv_table_cell_ctrl_t**

Enums

enum **[anonymous]**

Values:

enumerator **LV_TABLE_CELL_CTRL_MERGE_RIGHT**

enumerator **LV_TABLE_CELL_CTRL_TEXT_CROP**

enumerator **LV_TABLE_CELL_CTRL_CUSTOM_1**

enumerator **LV_TABLE_CELL_CTRL_CUSTOM_2**

enumerator **LV_TABLE_CELL_CTRL_CUSTOM_3**

enumerator **LV_TABLE_CELL_CTRL_CUSTOM_4**

enum **lv_table_draw_part_type_t**

type field in lv_obj_draw_part_dsc_t if class_p = lv_table_class Used in LV_EVENT_DRAW_PART_BEGIN and LV_EVENT_DRAW_PART_END

Values:

enumerator **`LV_TABLE_DRAW_PART_CELL`**

A cell

Functions

`LV_EXPORT_CONST_INT`(LV_TABLE_CELL_NONE)

lv_obj_t ***`lv_table_create`**(*lv_obj_t* *parent)

Create a table object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new table

Returns pointer to the created table

void **`lv_table_set_cell_value`**(*lv_obj_t* *obj, uint16_t row, uint16_t col, const char *txt)

Set the value of a cell.

Note: New roes/columns are added automatically if required

Parameters

- **`obj`** -- pointer to a Table object
- **`row`** -- id of the row [0 .. row_cnt -1]
- **`col`** -- id of the column [0 .. col_cnt -1]
- **`txt`** -- text to display in the cell. It will be copied and saved so this variable is not required after this function call.

`void lv_table_set_cell_value_fmt (lv_obj_t *obj, uint16_t row, uint16_t col, const char *fmt,...) LV_FORMAT_ATTRIBUTE(4`

Set the value of a cell. Memory will be allocated to store the text by the table.

Note: New roes/columns are added automatically if required

Parameters

- **`obj`** -- pointer to a Table object
- **`row`** -- id of the row [0 .. row_cnt -1]
- **`col`** -- id of the column [0 .. col_cnt -1]
- **`fmt`** -- `printf`-like format

`void void lv_table_set_row_cnt (lv_obj_t *obj, uint16_t row_cnt)`

Set the number of rows

Parameters

- **`obj`** -- table pointer to a Table object
- **`row_cnt`** -- number of rows

void **lv_table_set_col_cnt**(*lv_obj_t* *obj, uint16_t col_cnt)

Set the number of columns

Parameters

- **obj** -- table pointer to a Table object
- **col_cnt** -- number of columns.

void **lv_table_set_col_width**(*lv_obj_t* *obj, uint16_t col_id, lv_coord_t w)

Set the width of a column

Parameters

- **obj** -- table pointer to a Table object
- **col_id** -- id of the column [0 .. LV_TABLE_COL_MAX -1]
- **w** -- width of the column

void **lv_table_add_cell_ctrl**(*lv_obj_t* *obj, uint16_t row, uint16_t col, *lv_table_cell_ctrl_t* ctrl)

Add control bits to the cell.

Parameters

- **obj** -- pointer to a Table object
- **row** -- id of the row [0 .. row_cnt -1]
- **col** -- id of the column [0 .. col_cnt -1]
- **ctrl** -- OR-ed values from ::lv_table_cell_ctrl_t

void **lv_table_clear_cell_ctrl**(*lv_obj_t* *obj, uint16_t row, uint16_t col, *lv_table_cell_ctrl_t* ctrl)

Clear control bits of the cell.

Parameters

- **obj** -- pointer to a Table object
- **row** -- id of the row [0 .. row_cnt -1]
- **col** -- id of the column [0 .. col_cnt -1]
- **ctrl** -- OR-ed values from ::lv_table_cell_ctrl_t

const char ***lv_table_get_cell_value**(*lv_obj_t* *obj, uint16_t row, uint16_t col)

Get the value of a cell.

Parameters

- **obj** -- pointer to a Table object
- **row** -- id of the row [0 .. row_cnt -1]
- **col** -- id of the column [0 .. col_cnt -1]

Returns text in the cell

uint16_t **lv_table_get_row_cnt**(*lv_obj_t* *obj)

Get the number of rows.

Parameters **obj** -- table pointer to a Table object

Returns number of rows.

uint16_t **`lv_table_get_col_cnt`**(*lv_obj_t* *obj)

Get the number of columns.

Parameters **`obj`** -- table pointer to a Table object

Returns number of columns.

lv_coord_t **`lv_table_get_col_width`**(*lv_obj_t* *obj, uint16_t col)

Get the width of a column

Parameters

- **`obj`** -- table pointer to a Table object
- **`col`** -- id of the column [0 .. LV_TABLE_COL_MAX -1]

Returns width of the column

bool **`lv_table_has_cell_ctrl`**(*lv_obj_t* *obj, uint16_t row, uint16_t col, *lv_table_cell_ctrl_t* ctrl)

Get whether a cell has the control bits

Parameters

- **`obj`** -- pointer to a Table object
- **`row`** -- id of the row [0 .. row_cnt -1]
- **`col`** -- id of the column [0 .. col_cnt -1]
- **`ctrl`** -- OR-ed values from ::lv_table_cell_ctrl_t

Returns true: all control bits are set; false: not all control bits are set

void **`lv_table_get_selected_cell`**(*lv_obj_t* *obj, uint16_t *row, uint16_t *col)

Get the selected cell (pressed and or focused)

Parameters

- **`obj`** -- pointer to a table object
- **`row`** -- pointer to variable to store the selected row (LV_TABLE_CELL_NONE: if no cell selected)
- **`col`** -- pointer to variable to store the selected column (LV_TABLE_CELL_NONE: if no cell selected)

Variables

const lv_obj_class_t **`lv_table_class`**

struct **`lv_table_t`**

Public Members

lv_obj_t **obj**

uint16_t **col_cnt**

uint16_t **row_cnt**

char ****cell_data**

lv_coord_t ***row_h**

lv_coord_t ***col_w**

uint16_t **col_act**

uint16_t **row_act**

6.30 Tabview (lv_tabview)

6.30.1 Overview

The Tab view object can be used to organize content in tabs. The Tab view is built from other widgets:

- Main container: *lv_obj*)
  - Tab buttons: *lv_btnmatrix*
  - Container for the tabs: *lv_obj*
    - Content of the tabs: *lv_obj*

The tab buttons can be positioned on the top, bottom, left and right side of the Tab view.

A new tab can be selected either by clicking on a tab button or by sliding horizontally on the content.

6.30.2 Parts and Styles

There are no special parts on the Tab view but the `lv_obj` and `lv_btnnmatrix` widgets are used to create the Tab view.

6.30.3 Usage

Create a Tab view

`lv_tabview_create(parent, tab_pos, tab_size);` creates a new empty Tab view. `tab_pos` can be `LV_DIR_TOP/BOTTOM/LEFT/RIGHT` to position the tab buttons to a side. `tab_size` is the height (in case of `LV_DIR_TOP/BOTTOM`) or width (in case of `LV_DIR_LEFT/RIGHT`) tab buttons.

Add tabs

New tabs can be added with `lv_tabview_add_tab(tabview, "Tab name")`. This will return a pointer to an *lv_obj* object where the tab's content can be created.

Rename tabs

A tab can be renamed with `lv_tabview_rename_tab(tabview, tab_id, "New Name")`.

Change tab

To select a new tab you can:

- Click on its tab button
- Slide horizontally
- Use `lv_tabview_set_act(tabview, id, LV_ANIM_ON/OFF)` function

Get the parts

`lv_tabview_get_content(tabview)` returns the container for the tabs, `lv_tabview_get_tab_btns(tabview)` returns the Tab buttons object which is a *Button matrix*.

6.30.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when a new tab is selected by sliding or clicking the tab button. `lv_tabview_get_tab_act(tabview)` returns the zero based index of the current tab.

Learn more about *Events*.

6.30.5 Keys

Keys have effect only on the tab buttons (Button matrix). Add manually to a group if required.

Learn more about *Keys*.

6.30.6 Example

Simple Tabview

```c
#include "../../lv_examples.h"
#if LV_USE_TABVIEW && LV_BUILD_EXAMPLES

void lv_example_tabview_1(void)
{
    /*Create a Tab view object*/
    lv_obj_t * tabview;
    tabview = lv_tabview_create(lv_scr_act(), LV_DIR_TOP, 50);

    /*Add 3 tabs (the tabs are page (lv_page) and can be scrolled*/
    lv_obj_t * tab1 = lv_tabview_add_tab(tabview, "Tab 1");
    lv_obj_t * tab2 = lv_tabview_add_tab(tabview, "Tab 2");
    lv_obj_t * tab3 = lv_tabview_add_tab(tabview, "Tab 3");

    /*Add content to the tabs*/
    lv_obj_t * label = lv_label_create(tab1);
    lv_label_set_text(label, "This the first tab\n\n"
                      "If the content\n"
                      "of a tab\n"
                      "becomes too\n"
                      "longer\n"
                      "than the\n"
                      "container\n"
                      "then it\n"
                      "automatically\n"
                      "becomes\n"
                      "scrollable.\n"
                      "\n"
                      "\n"
                      "\n"
                      "Can you see it?");

    label = lv_label_create(tab2);
    lv_label_set_text(label, "Second tab");

    label = lv_label_create(tab3);
    lv_label_set_text(label, "Third tab");

    lv_obj_scroll_to_view_recursive(label, LV_ANIM_ON);

}
#endif
```

```python
# Create a Tab view object
tabview = lv.tabview(lv.scr_act(), lv.DIR.TOP, 50)

# Add 3 tabs (the tabs are page (lv_page) and can be scrolled
tab1 = tabview.add_tab("Tab 1")
tab2 = tabview.add_tab("Tab 2")
tab3 = tabview.add_tab("Tab 3")

# Add content to the tabs
label = lv.label(tab1)
```

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```
label.set_text("""This the first tab

If the content
of a tab
becomes too
longer
than the
container
then it
automatically
becomes
scrollable.



Can you see it?""")

label = lv.label(tab2)
label.set_text("Second tab")

label = lv.label(tab3)
label.set_text("Third tab");

label.scroll_to_view_recursive(lv.ANIM.ON)
```

Tabs on the left, styling and no scrolling

```
#include "../../lv_examples.h"
#if LV_USE_TABVIEW && LV_BUILD_EXAMPLES

static void scroll_begin_event(lv_event_t * e)
{
    /*Disable the scroll animations. Triggered when a tab button is clicked */
    if(lv_event_get_code(e) == LV_EVENT_SCROLL_BEGIN) {
        lv_anim_t * a = lv_event_get_param(e);
        if(a)  a->time = 0;
    }
}

void lv_example_tabview_2(void)
{
    /*Create a Tab view object*/
    lv_obj_t * tabview;
    tabview = lv_tabview_create(lv_scr_act(), LV_DIR_LEFT, 80);
    lv_obj_add_event(lv_tabview_get_content(tabview), scroll_begin_event, LV_EVENT_
↪SCROLL_BEGIN, NULL);

    lv_obj_set_style_bg_color(tabview, lv_palette_lighten(LV_PALETTE_RED, 2), 0);

    lv_obj_t * tab_btns = lv_tabview_get_tab_btns(tabview);
    lv_obj_set_style_bg_color(tab_btns, lv_palette_darken(LV_PALETTE_GREY, 3), 0);
    lv_obj_set_style_text_color(tab_btns, lv_palette_lighten(LV_PALETTE_GREY, 5), 0);
    lv_obj_set_style_border_side(tab_btns, LV_BORDER_SIDE_RIGHT, LV_PART_ITEMS | LV_
↪STATE_CHECKED);
```

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```
    /*Add 3 tabs (the tabs are page (lv_page) and can be scrolled*/
    lv_obj_t * tab1 = lv_tabview_add_tab(tabview, "Tab 1");
    lv_obj_t * tab2 = lv_tabview_add_tab(tabview, "Tab 2");
    lv_obj_t * tab3 = lv_tabview_add_tab(tabview, "Tab 3");
    lv_obj_t * tab4 = lv_tabview_add_tab(tabview, "Tab 4");
    lv_obj_t * tab5 = lv_tabview_add_tab(tabview, "Tab 5");

    lv_obj_set_style_bg_color(tab2, lv_palette_lighten(LV_PALETTE_AMBER, 3), 0);
    lv_obj_set_style_bg_opa(tab2, LV_OPA_COVER, 0);

    /*Add content to the tabs*/
    lv_obj_t * label = lv_label_create(tab1);
    lv_label_set_text(label, "First tab");

    label = lv_label_create(tab2);
    lv_label_set_text(label, "Second tab");

    label = lv_label_create(tab3);
    lv_label_set_text(label, "Third tab");

    label = lv_label_create(tab4);
    lv_label_set_text(label, "Forth tab");

    label = lv_label_create(tab5);
    lv_label_set_text(label, "Fifth tab");

    lv_obj_clear_flag(lv_tabview_get_content(tabview), LV_OBJ_FLAG_SCROLLABLE);
}
#endif
```

```
def scroll_begin_event(e):

    #Disable the scroll animations. Triggered when a tab button is clicked */
    if e.get_code() == lv.EVENT.SCROLL_BEGIN:
        a = lv.anim_t.__cast__(e.get_param())
        if a:
            a.time = 0

# Create a Tab view object
tabview = lv.tabview(lv.scr_act(), lv.DIR.LEFT, 80)
tabview.get_content().add_event(scroll_begin_event, lv.EVENT.SCROLL_BEGIN, None)

tabview.set_style_bg_color(lv.palette_lighten(lv.PALETTE.RED, 2), 0)

tab_btns = tabview.get_tab_btns()
tab_btns.set_style_bg_color(lv.palette_darken(lv.PALETTE.GREY, 3), 0)
tab_btns.set_style_text_color(lv.palette_lighten(lv.PALETTE.GREY, 5), 0)
tab_btns.set_style_border_side(lv.BORDER_SIDE.RIGHT, lv.PART.ITEMS | lv.STATE.CHECKED)


# Add 3 tabs (the tabs are page (lv_page) and can be scrolled
tab1 = tabview.add_tab("Tab 1")
tab2 = tabview.add_tab("Tab 2")
tab3 = tabview.add_tab("Tab 3")
```

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```
tab4 = tabview.add_tab("Tab 4")
tab5 = tabview.add_tab("Tab 5")

tab2.set_style_bg_color(lv.palette_lighten(lv.PALETTE.AMBER, 3), 0)
tab2.set_style_bg_opa(lv.OPA.COVER, 0)

# Add content to the tabs
label = lv.label(tab1)
label.set_text("First tab")

label = lv.label(tab2)
label.set_text("Second tab")

label = lv.label(tab3)
label.set_text("Third tab")

label = lv.label(tab4)
label.set_text("Forth tab")

label = lv.label(tab5)
label.set_text("Fifth tab")

tabview.get_content().clear_flag(lv.obj.FLAG.SCROLLABLE)
```

6.30.7 API

Functions

lv_obj_t ***lv_tabview_create**(*lv_obj_t* *parent, lv_dir_t tab_pos, lv_coord_t tab_size)

lv_obj_t ***lv_tabview_add_tab**(*lv_obj_t* *tv, const char *name)

void **lv_tabview_rename_tab**(*lv_obj_t* *obj, uint32_t tab_id, const char *new_name)

lv_obj_t ***lv_tabview_get_content**(*lv_obj_t* *tv)

lv_obj_t ***lv_tabview_get_tab_btns**(*lv_obj_t* *tv)

void **lv_tabview_set_act**(*lv_obj_t* *obj, uint32_t id, *lv_anim_enable_t* anim_en)

uint16_t **lv_tabview_get_tab_act**(*lv_obj_t* *tv)

Variables

const lv_obj_class_t **lv_tabview_class**

struct **lv_tabview_t**

Public Members

lv_obj_t **`obj`**

char ****`map`**

uint16_t **`tab_cnt`**

uint16_t **`tab_cur`**

lv_dir_t **`tab_pos`**

6.31 Text area (lv_textarea)

6.31.1 Overview

The Text Area is a *Base object* with a *Label* and a cursor on it. Texts or characters can be added to it. Long lines are wrapped and when the text becomes long enough the Text area can be scrolled.

One line mode and password modes are supported.

6.31.2 Parts and Styles

- `LV_PART_MAIN` The background of the text area. Uses all the typical background style properties and the text related style properties including `text_align` to align the text to the left, right or center.
- `LV_PART_SCROLLBAR` The scrollbar that is shown when the text is too long.
- `LV_PART_SELECTED` Determines the style of the selected text. Only `text_color` and `bg_color` style properties can be used. `bg_color` should be set directly on the label of the text area.
- `LV_PART_CURSOR` Marks the position where the characters are inserted. The cursor's area is always the bounding box of the current character. A block cursor can be created by adding a background color and background opacity to `LV_PART_CURSOR`'s style. The create line cursor leave the cursor transparent and set a left border. The `anim_time` style property sets the cursor's blink time.
- `LV_PART_TEXTAREA_PLACEHOLDER` Unique to Text Area, allows styling the placeholder text.

6.31.3 Usage

Add text

You can insert text or characters to the current cursor's position with:

- `lv_textarea_add_char(textarea, 'c')`
- `lv_textarea_add_text(textarea, "insert this text")`

To add wide characters like `'á'`, `'ß'` or CJK characters use `lv_textarea_add_text(ta, "á")`.

`lv_textarea_set_text(ta, "New text")` changes the whole text.

Placeholder

A placeholder text can be specified - which is displayed when the Text area is empty - with `lv_textarea_set_placeholder_text(ta, "Placeholder text")`

Delete character

To delete a character from the left of the current cursor position use `lv_textarea_del_char(textarea)`. To delete from the right use `lv_textarea_del_char_forward(textarea)`

Move the cursor

The cursor position can be modified directly like `lv_textarea_set_cursor_pos(textarea, 10)`. The `0` position means "before the first characters", `LV_TA_CURSOR_LAST` means "after the last character"

You can step the cursor with

- `lv_textarea_cursor_right(textarea)`
- `lv_textarea_cursor_left(textarea)`
- `lv_textarea_cursor_up(textarea)`
- `lv_textarea_cursor_down(textarea)`

If `lv_textarea_set_cursor_click_pos(textarea, true)` is applied the cursor will jump to the position where the Text area was clicked.

Hide the cursor

The cursor is always visible, however it can be a good idea to style it to be visible only in `LV_STATE_FOCUSED` state.

One line mode

The Text area can be configured to be on a single line with `lv_textarea_set_one_line(textarea, true)`. In this mode the height is set automatically to show only one line, line break characters are ignored, and word wrap is disabled.

Password mode

The text area supports password mode which can be enabled with `lv_textarea_set_password_mode(textarea, true)`.

By default, if the • (Bullet, U+2022) character exists in the font, the entered characters are converted to it after some time or when a new character is entered. If • does not exist in the font, `*` will be used. You can override the default character with `lv_textarea_set_password_bullet(textarea, "x")`.

In password mode `lv_textarea_get_text(textarea)` returns the actual text entered, not the bullet characters.

The visibility time can be adjusted with `LV_TEXTAREA_DEF_PWD_SHOW_TIME)` in `lv_conf.h`.

Accepted characters

You can set a list of accepted characters with `lv_textarea_set_accepted_chars(textarea, "0123456789.+-")`. Other characters will be ignored.

Max text length

The maximum number of characters can be limited with `lv_textarea_set_max_length(textarea, max_char_num)`

Very long texts

If there is a very long text in the Text area (e.g. > 20k characters), scrolling and drawing might be slow. However, by enabling `LV_LABEL_LONG_TXT_HINT 1` in `lv_conf.h` the performance can be hugely improved. This will save some additional information about the label to speed up its drawing. Using `LV_LABEL_LONG_TXT_HINT` the scrolling and drawing will as fast as with "normal" short texts.

Select text

Any part of the text can be selected if enabled with `lv_textarea_set_text_selection(textarea, true)`. This works much like when you select text on your PC with your mouse.

6.31.4 Events

- `LV_EVENT_INSERT` Sent right before a character or text is inserted. The event parameter is the text about to be inserted. `lv_textarea_set_insert_replace(textarea, "New text")` replaces the text to insert. The new text cannot be in a local variable which is destroyed when the event callback exists. `""` means do not insert anything.
- `LV_EVENT_VALUE_CHANGED` Sent when the content of the text area has been changed.
- `LV_EVENT_READY` Sent when `LV_KEY_ENTER` is pressed (or sent) to a one line text area.

See the events of the *Base object* too.

Learn more about *Events*.

6.31.5 Keys

- `LV_KEY_UP/DOWN/LEFT/RIGHT` Move the cursor
- `Any character` Add the character to the current cursor position

Learn more about *Keys*.

6.31.6 Example

Simple Text area

```c
#include "../../lv_examples.h"
#if LV_USE_TEXTAREA && LV_BUILD_EXAMPLES

static void textarea_event_handler(lv_event_t * e)
{
    lv_obj_t * ta = lv_event_get_target(e);
    LV_UNUSED(ta);
    LV_LOG_USER("Enter was pressed. The current text is: %s", lv_textarea_get_
↪text(ta));
}

static void btnm_event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_t * ta = lv_event_get_user_data(e);
    const char * txt = lv_btnmatrix_get_btn_text(obj, lv_btnmatrix_get_selected_
↪btn(obj));

    if(strcmp(txt, LV_SYMBOL_BACKSPACE) == 0) lv_textarea_del_char(ta);
    else if(strcmp(txt, LV_SYMBOL_NEW_LINE) == 0) lv_obj_send_event(ta, LV_EVENT_
↪READY, NULL);
    else lv_textarea_add_text(ta, txt);

}

void lv_example_textarea_1(void)
{
    lv_obj_t * ta = lv_textarea_create(lv_scr_act());
    lv_textarea_set_one_line(ta, true);
    lv_obj_align(ta, LV_ALIGN_TOP_MID, 0, 10);
    lv_obj_add_event(ta, textarea_event_handler, LV_EVENT_READY, ta);
    lv_obj_add_state(ta, LV_STATE_FOCUSED); /*To be sure the cursor is visible*/

    static const char * btnm_map[] = {"1", "2", "3", "\n",
                                      "4", "5", "6", "\n",
                                      "7", "8", "9", "\n",
                                      LV_SYMBOL_BACKSPACE, "0", LV_SYMBOL_NEW_LINE, ""
                                     };

    lv_obj_t * btnm = lv_btnmatrix_create(lv_scr_act());
    lv_obj_set_size(btnm, 200, 150);
    lv_obj_align(btnm, LV_ALIGN_BOTTOM_MID, 0, -10);
    lv_obj_add_event(btnm, btnm_event_handler, LV_EVENT_VALUE_CHANGED, ta);
    lv_obj_clear_flag(btnm, LV_OBJ_FLAG_CLICK_FOCUSABLE); /*To keep the text area␣
↪focused on button clicks*/
    lv_btnmatrix_set_map(btnm, btnm_map);
}

#endif
```

```python
def textarea_event_handler(e, ta):
    print("Enter was pressed. The current text is: " + ta.get_text())

```

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```python

def btnm_event_handler(e, ta):
    obj = e.get_target_obj()
    txt = obj.get_btn_text(obj.get_selected_btn())
    if txt == lv.SYMBOL.BACKSPACE:
        ta.del_char()
    elif txt == lv.SYMBOL.NEW_LINE:
        lv.event_send(ta, lv.EVENT.READY, None)
    elif txt:
        ta.add_text(txt)


ta = lv.textarea(lv.scr_act())
ta.set_one_line(True)
ta.align(lv.ALIGN.TOP_MID, 0, 10)
ta.add_event(lambda e: textarea_event_handler(e, ta), lv.EVENT.READY, None)
ta.add_state(lv.STATE.FOCUSED)   # To be sure the cursor is visible

btnm_map = ["1", "2", "3", "\n",
            "4", "5", "6", "\n",
            "7", "8", "9", "\n",
            lv.SYMBOL.BACKSPACE, "0", lv.SYMBOL.NEW_LINE, ""]

btnm = lv.btnmatrix(lv.scr_act())
btnm.set_size(200, 150)
btnm.align(lv.ALIGN.BOTTOM_MID, 0, -10)
btnm.add_event(lambda e: btnm_event_handler(e, ta), lv.EVENT.VALUE_CHANGED, None)
btnm.clear_flag(lv.obj.FLAG.CLICK_FOCUSABLE)    # To keep the text area focused on␣
↪button clicks
btnm.set_map(btnm_map)
```

Text area with password field

```c
#include "../../lv_examples.h"
#if LV_USE_TEXTAREA && LV_USE_KEYBOARD && LV_BUILD_EXAMPLES

static void ta_event_cb(lv_event_t * e);

static lv_obj_t * kb;

void lv_example_textarea_2(void)
{
    /*Create the password box*/
    lv_obj_t * pwd_ta = lv_textarea_create(lv_scr_act());
    lv_textarea_set_text(pwd_ta, "");
    lv_textarea_set_password_mode(pwd_ta, true);
    lv_textarea_set_one_line(pwd_ta, true);
    lv_obj_set_width(pwd_ta, lv_pct(40));
    lv_obj_set_pos(pwd_ta, 5, 20);
    lv_obj_add_event(pwd_ta, ta_event_cb, LV_EVENT_ALL, NULL);

    /*Create a label and position it above the text box*/
    lv_obj_t * pwd_label = lv_label_create(lv_scr_act());
    lv_label_set_text(pwd_label, "Password:");
    lv_obj_align_to(pwd_label, pwd_ta, LV_ALIGN_OUT_TOP_LEFT, 0, 0);
```

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```
    /*Create the one-line mode text area*/
    lv_obj_t * text_ta = lv_textarea_create(lv_scr_act());
    lv_textarea_set_one_line(text_ta, true);
    lv_textarea_set_password_mode(text_ta, false);
    lv_obj_set_width(text_ta, lv_pct(40));
    lv_obj_add_event(text_ta, ta_event_cb, LV_EVENT_ALL, NULL);
    lv_obj_align(text_ta, LV_ALIGN_TOP_RIGHT, -5, 20);


    /*Create a label and position it above the text box*/
    lv_obj_t * oneline_label = lv_label_create(lv_scr_act());
    lv_label_set_text(oneline_label, "Text:");
    lv_obj_align_to(oneline_label, text_ta, LV_ALIGN_OUT_TOP_LEFT, 0, 0);

    /*Create a keyboard*/
    kb = lv_keyboard_create(lv_scr_act());
    lv_obj_set_size(kb,  LV_HOR_RES, LV_VER_RES / 2);

    lv_keyboard_set_textarea(kb, pwd_ta); /*Focus it on one of the text areas to␣
↪start*/
}

static void ta_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * ta = lv_event_get_target(e);
    if(code == LV_EVENT_CLICKED || code == LV_EVENT_FOCUSED) {
        /*Focus on the clicked text area*/
        if(kb != NULL) lv_keyboard_set_textarea(kb, ta);
    }

    else if(code == LV_EVENT_READY) {
        LV_LOG_USER("Ready, current text: %s", lv_textarea_get_text(ta));
    }
}

#endif
```

```
def ta_event_cb(e):
    code = e.get_code()
    ta = e.get_target_obj()
    if code == lv.EVENT.CLICKED or code == lv.EVENT.FOCUSED:
        # Focus on the clicked text area
        if kb != None:
            kb.set_textarea(ta)

    elif code == lv.EVENT.READY:
        print("Ready, current text: " + ta.get_text())


# Create the password box

pwd_ta = lv.textarea(lv.scr_act())
pwd_ta.set_text("")
pwd_ta.set_password_mode(True)
```

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```python
pwd_ta.set_one_line(True)
pwd_ta.set_width(lv.pct(45))
pwd_ta.set_pos(5, 20)
pwd_ta.add_event(ta_event_cb, lv.EVENT.ALL, None)

# Create a label and position it above the text box
pwd_label = lv.label(lv.scr_act())
pwd_label.set_text("Password:")
pwd_label.align_to(pwd_ta, lv.ALIGN.OUT_TOP_LEFT, 0, 0)

# Create the one-line mode text area
text_ta = lv.textarea(lv.scr_act())
text_ta.set_width(lv.pct(45))
text_ta.set_one_line(True)
text_ta.add_event(ta_event_cb, lv.EVENT.ALL, None)
text_ta.set_password_mode(False)

text_ta.align(lv.ALIGN.TOP_RIGHT, -5, 20)

# Create a label and position it above the text box
oneline_label = lv.label(lv.scr_act())
oneline_label.set_text("Text:")
oneline_label.align_to(text_ta, lv.ALIGN.OUT_TOP_LEFT, 0, 0)

# Create a keyboard
kb = lv.keyboard(lv.scr_act())
kb.set_size(lv.pct(100), lv.pct(50))

kb.set_textarea(pwd_ta)  # Focus it on one of the text areas to start
```

Text auto-formatting

```c
#include "../../lv_examples.h"
#if LV_USE_TEXTAREA && LV_USE_KEYBOARD && LV_BUILD_EXAMPLES

static void ta_event_cb(lv_event_t * e);

static lv_obj_t * kb;

/**
 * Automatically format text like a clock. E.g. "12:34"
 * Add the ':' automatically.
 */
void lv_example_textarea_3(void)
{
    /*Create the text area*/
    lv_obj_t * ta = lv_textarea_create(lv_scr_act());
    lv_obj_add_event(ta, ta_event_cb, LV_EVENT_VALUE_CHANGED, NULL);
    lv_textarea_set_accepted_chars(ta, "0123456789:");
    lv_textarea_set_max_length(ta, 5);
    lv_textarea_set_one_line(ta, true);
    lv_textarea_set_text(ta, "");

    /*Create a keyboard*/
```

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```
    kb = lv_keyboard_create(lv_scr_act());
    lv_obj_set_size(kb,  LV_HOR_RES, LV_VER_RES / 2);
    lv_keyboard_set_mode(kb, LV_KEYBOARD_MODE_NUMBER);
    lv_keyboard_set_textarea(kb, ta);
}

static void ta_event_cb(lv_event_t * e)
{
    lv_obj_t * ta = lv_event_get_target(e);
    const char * txt = lv_textarea_get_text(ta);
    if(txt[0] >= '0' && txt[0] <= '9' &&
       txt[1] >= '0' && txt[1] <= '9' &&
       txt[2] != ':') {
        lv_textarea_set_cursor_pos(ta, 2);
        lv_textarea_add_char(ta, ':');
    }
}

#endif
```

```
def ta_event_cb(e):
    ta = e.get_target_obj()
    txt = ta.get_text()
    # print(txt)
    pos = ta.get_cursor_pos()
    # print("cursor pos: ",pos)
    # find position of ":" in text
    colon_pos= txt.find(":")
    # if there are more than 2 digits before the colon, remove the last one entered
    if colon_pos == 3:
        ta.del_char()
    if colon_pos != -1:
        # if there are more than 3 digits after the ":" remove the last one entered
        rest = txt[colon_pos:]
        if len(rest) > 3:
            ta.del_char()

    if len(txt) < 2:
        return
    if ":" in txt:
        return
    if  txt[0] >= '0' and txt[0] <= '9' and \
        txt[1] >= '0' and txt[1] <= '9':
        if len(txt) == 2 or txt[2] != ':' :
            ta.set_cursor_pos(2)
            ta.add_char(ord(':'))
#
# Automatically format text like a clock. E.g. "12:34"
# Add the ':' automatically
#
# Create the text area

ta = lv.textarea(lv.scr_act())
ta.add_event(ta_event_cb, lv.EVENT.VALUE_CHANGED, None)
ta.set_accepted_chars("0123456789:")
ta.set_max_length(5)
```

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```
ta.set_one_line(True)
ta.set_text("")
ta.add_state(lv.STATE.FOCUSED)

# Create a keyboard
kb = lv.keyboard(lv.scr_act())
kb.set_size(lv.pct(100), lv.pct(50))
kb.set_mode(lv.keyboard.MODE.NUMBER)
kb.set_textarea(ta)
```

6.31.7 API

Enums

enum **`[anonymous]`**

Values:

enumerator **`LV_PART_TEXTAREA_PLACEHOLDER`**

Functions

`LV_EXPORT_CONST_INT`(LV_TEXTAREA_CURSOR_LAST)

lv_obj_t ***`lv_textarea_create`**(*lv_obj_t* *parent)

Create a text area object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new text area

Returns pointer to the created text area

void **`lv_textarea_add_char`**(*lv_obj_t* *obj, uint32_t c)

Insert a character to the current cursor position. To add a wide char, e.g. 'Á' use _lv_txt_encoded_conv_wc('Á)`

Parameters

- **`obj`** -- pointer to a text area object
- **`c`** -- a character (e.g. 'a')

void **`lv_textarea_add_text`**(*lv_obj_t* *obj, const char *txt)

Insert a text to the current cursor position

Parameters

- **`obj`** -- pointer to a text area object
- **`txt`** -- a '\0' terminated string to insert

void **`lv_textarea_del_char`**(*lv_obj_t* *obj)

Delete a the left character from the current cursor position

Parameters **`obj`** -- pointer to a text area object void **lv_textarea_del_char_forward**(*lv_obj_t* *obj)

Delete the right character from the current cursor position

Parameters **obj** -- pointer to a text area object

void **lv_textarea_set_text**(*lv_obj_t* *obj, const char *txt)

Set the text of a text area

Parameters

- **obj** -- pointer to a text area object
- **txt** -- pointer to the text

void **lv_textarea_set_placeholder_text**(*lv_obj_t* *obj, const char *txt)

Set the placeholder text of a text area

Parameters

- **obj** -- pointer to a text area object
- **txt** -- pointer to the text

void **lv_textarea_set_cursor_pos**(*lv_obj_t* *obj, int32_t pos)

Set the cursor position

Parameters

- **obj** -- pointer to a text area object
- **pos** -- the new cursor position in character index < 0 : index from the end of the text LV_TEXTAREA_CURSOR_LAST: go after the last character

void **lv_textarea_set_cursor_click_pos**(*lv_obj_t* *obj, bool en)

Enable/Disable the positioning of the cursor by clicking the text on the text area.

Parameters

- **obj** -- pointer to a text area object
- **en** -- true: enable click positions; false: disable

void **lv_textarea_set_password_mode**(*lv_obj_t* *obj, bool en)

Enable/Disable password mode

Parameters

- **obj** -- pointer to a text area object
- **en** -- true: enable, false: disable

void **lv_textarea_set_password_bullet**(*lv_obj_t* *obj, const char *bullet)

Set the replacement characters to show in password mode

Parameters

- **obj** -- pointer to a text area object
- **bullet** -- pointer to the replacement text

void **lv_textarea_set_one_line**(*lv_obj_t* *obj, bool en)

Configure the text area to one line or back to normal

Parameters

- **obj** -- pointer to a text area object

- **en** -- true: one line, false: normal

void **lv_textarea_set_accepted_chars**(*lv_obj_t* *obj, const char *list)

Set a list of characters. Only these characters will be accepted by the text area

Parameters

- **obj** -- pointer to a text area object
- **list** -- list of characters. Only the pointer is saved. E.g. "+-.,0123456789"

void **lv_textarea_set_max_length**(*lv_obj_t* *obj, uint32_t num)

Set max length of a Text Area.

Parameters

- **obj** -- pointer to a text area object
- **num** -- the maximal number of characters can be added (`lv_textarea_set_text` ignores it)

void **lv_textarea_set_insert_replace**(*lv_obj_t* *obj, const char *txt)

In `LV_EVENT_INSERT` the text which planned to be inserted can be replaced by an other text. It can be used to add automatic formatting to the text area.

Parameters

- **obj** -- pointer to a text area object
- **txt** -- pointer to a new string to insert. If `""` no text will be added. The variable must be live after the `event_cb` exists. (Should be `global` or `static`)

void **lv_textarea_set_text_selection**(*lv_obj_t* *obj, bool en)

Enable/disable selection mode.

Parameters

- **obj** -- pointer to a text area object
- **en** -- true or false to enable/disable selection mode

void **lv_textarea_set_password_show_time**(*lv_obj_t* *obj, uint16_t time)

Set how long show the password before changing it to '*'

Parameters

- **obj** -- pointer to a text area object
- **time** -- show time in milliseconds. 0: hide immediately.

void **lv_textarea_set_align**(*lv_obj_t* *obj, lv_text_align_t align)

Deprecated: use the normal text_align style property instead Set the label's alignment. It sets where the label is aligned (in one line mode it can be smaller than the text area) and how the lines of the area align in case of multiline text area

Parameters

- **obj** -- pointer to a text area object
- **align** -- the align mode from ::lv_text_align_t

const char ***lv_textarea_get_text**(const *lv_obj_t* *obj)

Get the text of a text area. In password mode it gives the real text (not '*'s).

Parameters **obj** -- pointer to a text area object

Returns pointer to the text

const char ***lv_textarea_get_placeholder_text**(*lv_obj_t* *obj)

Get the placeholder text of a text area

Parameters **obj** -- pointer to a text area object

Returns pointer to the text

lv_obj_t ***lv_textarea_get_label**(const *lv_obj_t* *obj)

Get the label of a text area

Parameters **obj** -- pointer to a text area object

Returns pointer to the label object

uint32_t **lv_textarea_get_cursor_pos**(const *lv_obj_t* *obj)

Get the current cursor position in character index

Parameters **obj** -- pointer to a text area object

Returns the cursor position

bool **lv_textarea_get_cursor_click_pos**(*lv_obj_t* *obj)

Get whether the cursor click positioning is enabled or not.

Parameters **obj** -- pointer to a text area object

Returns true: enable click positions; false: disable

bool **lv_textarea_get_password_mode**(const *lv_obj_t* *obj)

Get the password mode attribute

Parameters **obj** -- pointer to a text area object

Returns true: password mode is enabled, false: disabled

const char ***lv_textarea_get_password_bullet**(*lv_obj_t* *obj)

Get the replacement characters to show in password mode

Parameters **obj** -- pointer to a text area object

Returns pointer to the replacement text

bool **lv_textarea_get_one_line**(const *lv_obj_t* *obj)

Get the one line configuration attribute

Parameters **obj** -- pointer to a text area object

Returns true: one line configuration is enabled, false: disabled

const char ***lv_textarea_get_accepted_chars**(*lv_obj_t* *obj)

Get a list of accepted characters.

Parameters **obj** -- pointer to a text area object

Returns list of accented characters.

uint32_t **lv_textarea_get_max_length**(*lv_obj_t* *obj)

Get max length of a Text Area.

Parameters **obj** -- pointer to a text area object

Returns the maximal number of characters to be add bool **`lv_textarea_text_is_selected`**(const *lv_obj_t* *obj)

Find whether text is selected or not.

Parameters **`obj`** -- pointer to a text area object

Returns whether text is selected or not

bool **`lv_textarea_get_text_selection`**(*lv_obj_t* *obj)

Find whether selection mode is enabled.

Parameters **`obj`** -- pointer to a text area object

Returns true: selection mode is enabled, false: disabled

uint16_t **`lv_textarea_get_password_show_time`**(*lv_obj_t* *obj)

Set how long show the password before changing it to '*'

Parameters **`obj`** -- pointer to a text area object

Returns show time in milliseconds. 0: hide immediately.

uint32_t **`lv_textarea_get_current_char`**(*lv_obj_t* *obj)

Get a the character from the current cursor position

Parameters **`obj`** -- pointer to a text area object

Returns a the character or 0

void **`lv_textarea_clear_selection`**(*lv_obj_t* *obj)

Clear the selection on the text area.

Parameters **`obj`** -- pointer to a text area object

void **`lv_textarea_cursor_right`**(*lv_obj_t* *obj)

Move the cursor one character right

Parameters **`obj`** -- pointer to a text area object

void **`lv_textarea_cursor_left`**(*lv_obj_t* *obj)

Move the cursor one character left

Parameters **`obj`** -- pointer to a text area object

void **`lv_textarea_cursor_down`**(*lv_obj_t* *obj)

Move the cursor one line down

Parameters **`obj`** -- pointer to a text area object

void **`lv_textarea_cursor_up`**(*lv_obj_t* *obj)

Move the cursor one line up

Parameters **`obj`** -- pointer to a text area object

Variables

const lv_obj_class_t **`lv_textarea_class`**

struct **`lv_textarea_t`**

Public Members

lv_obj_t **`obj`**

lv_obj_t ***`label`**

char ***`placeholder_txt`**

char ***`pwd_tmp`**

char ***`pwd_bullet`**

const char ***`accepted_chars`**

uint32_t **`max_length`**

uint16_t **`pwd_show_time`**

lv_coord_t **`valid_x`**

uint32_t **`pos`**

lv_area_t **`area`**

uint32_t **`txt_byte_pos`**

uint8_t **`show`**

uint8_t **`click_pos`**

struct *lv_textarea_t*::[anonymous] **`cursor`**

uint32_t **`sel_start`**

uint32_t **`sel_end`**

uint8_t **`text_sel_in_prog`**

uint8_t **`text_sel_en`**

uint8_t **`pwd_mode`**

uint8_t **`one_line`**

6.32 Tile view (lv_tileview)

6.32.1 Overview

The Tile view is a container object whose elements (called *tiles*) can be arranged in grid form. A user can navigate between the tiles by swiping. Any direction of swiping can be disabled on the tiles individually to not allow moving from one tile to another.

If the Tile view is screen sized, the user interface resembles what you may have seen on smartwatches.

6.32.2 Parts and Styles

The Tile view is built from an *lv_obj* container and *lv_obj* tiles.

The parts and styles work the same as for *lv_obj*.

6.32.3 Usage

Add a tile

`lv_tileview_add_tile(tileview, row_id, col_id, dir)` creates a new tile on the `row_id`th row and `col_id`th column. `dir` can be `LV_DIR_LEFT/RIGHT/TOP/BOTTOM/HOR/VER/ALL` or OR-ed values to enable moving to the adjacent tiles into the given direction by swiping.

The returned value is an `lv_obj_t *` on which the content of the tab can be created.

Change tile

The Tile view can scroll to a tile with `lv_obj_set_tile(tileview, tile_obj, LV_ANIM_ON/OFF)` or `lv_obj_set_tile_id(tileviewv, col_id, row_id, LV_ANIM_ON/OFF);`

6.32.4 Events

- `LV_EVENT_VALUE_CHANGED` Sent when a new tile loaded by scrolling. `lv_tileview_get_tile_act(tabview)` can be used to get current tile.

6.32.5 Keys

Keys are not handled by the Tile view.

Learn more about *Keys*.

6.32.6 Example

Tileview with content

```c
#include "../../lv_examples.h"
#if LV_USE_TILEVIEW && LV_BUILD_EXAMPLES

/**
 * Create a 2x2 tile view and allow scrolling only in an "L" shape.
 * Demonstrate scroll chaining with a long list that
 * scrolls the tile view when it can't be scrolled further.
 */
void lv_example_tileview_1(void)
{
    lv_obj_t * tv = lv_tileview_create(lv_scr_act());

    /*Tile1: just a label*/
    lv_obj_t * tile1 = lv_tileview_add_tile(tv, 0, 0, LV_DIR_BOTTOM);
    lv_obj_t * label = lv_label_create(tile1);
    lv_label_set_text(label, "Scroll down");
    lv_obj_center(label);


    /*Tile2: a button*/
    lv_obj_t * tile2 = lv_tileview_add_tile(tv, 0, 1, LV_DIR_TOP | LV_DIR_RIGHT);

    lv_obj_t * btn = lv_btn_create(tile2);

    label = lv_label_create(btn);
    lv_label_set_text(label, "Scroll up or right");

    lv_obj_set_size(btn, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_center(btn);

    /*Tile3: a list*/
    lv_obj_t * tile3 = lv_tileview_add_tile(tv, 1, 1, LV_DIR_LEFT);
    lv_obj_t * list = lv_list_create(tile3);
    lv_obj_set_size(list, LV_PCT(100), LV_PCT(100));

    lv_list_add_btn(list, NULL, "One");
    lv_list_add_btn(list, NULL, "Two");
    lv_list_add_btn(list, NULL, "Three");
    lv_list_add_btn(list, NULL, "Four");
```

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```
    lv_list_add_btn(list, NULL, "Five");
    lv_list_add_btn(list, NULL, "Six");
    lv_list_add_btn(list, NULL, "Seven");
    lv_list_add_btn(list, NULL, "Eight");
    lv_list_add_btn(list, NULL, "Nine");
    lv_list_add_btn(list, NULL, "Ten");

}

#endif
```

```
#
# Create a 2x2 tile view and allow scrolling only in an "L" shape.
# Demonstrate scroll chaining with a long list that
# scrolls the tile view when it can't be scrolled further.
#
tv = lv.tileview(lv.scr_act())

# Tile1: just a label
tile1 = tv.add_tile(0, 0, lv.DIR.BOTTOM)
label = lv.label(tile1)
label.set_text("Scroll down")
label.center()

# Tile2: a button
tile2 = tv.add_tile(0, 1, lv.DIR.TOP | lv.DIR.RIGHT)

btn = lv.btn(tile2)

label = lv.label(btn)
label.set_text("Scroll up or right")

btn.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
btn.center()

# Tile3: a list
tile3 = tv.add_tile(1, 1, lv.DIR.LEFT)
list = lv.list(tile3)
list.set_size(lv.pct(100), lv.pct(100))

list.add_btn(None, "One")
list.add_btn(None, "Two")
list.add_btn(None, "Three")
list.add_btn(None, "Four")
list.add_btn(None, "Five")
list.add_btn(None, "Six")
list.add_btn(None, "Seven")
list.add_btn(None, "Eight")
list.add_btn(None, "Nine")
list.add_btn(None, "Ten")
```

6.32.7 API

Functions

lv_obj_t ***lv_tileview_create**(*lv_obj_t* *parent)

Create a Tileview object

Parameters **parent** -- pointer to an object, it will be the parent of the new tileview

Returns pointer to the created tileview

lv_obj_t ***lv_tileview_add_tile**(*lv_obj_t* *tv, uint8_t col_id, uint8_t row_id, lv_dir_t dir)

void **lv_obj_set_tile**(*lv_obj_t* *tv, *lv_obj_t* *tile_obj, *lv_anim_enable_t* anim_en)

void **lv_obj_set_tile_id**(*lv_obj_t* *tv, uint32_t col_id, uint32_t row_id, *lv_anim_enable_t* anim_en)

lv_obj_t ***lv_tileview_get_tile_act**(*lv_obj_t* *obj)

Variables

const lv_obj_class_t **lv_tileview_class**

const lv_obj_class_t **lv_tileview_tile_class**

struct **lv_tileview_t**

Public Members

lv_obj_t **obj**

lv_obj_t ***tile_act**

struct **lv_tileview_tile_t**

Public Members

lv_obj_t **obj**

lv_dir_t **dir**

6.33 Window (lv_win)

6.33.1 Overview

The Window is container-like object built from a header with title and buttons and a content area.

6.33.2 Parts and Styles

The Window is built from other widgets so you can check their documentation for details:

- Background: *lv_obj*
- Header on the background: *lv_obj*
- Title on the header: *lv_label*
- Buttons on the header: *lv_btn*
- Content area on the background: *lv_obj*

6.33.3 Usage

Create a Window

`lv_win_create(parent, header_height)` creates a Window with an empty header.

Title and buttons

Any number of texts (but typically only one) can be added to the header with `lv_win_add_title(win, "The title")`.

Control buttons can be added to the window's header with `lv_win_add_btn(win, icon, btn_width)`. `icon` can be any image source, and `btn_width` is the width of the button.

The title and the buttons will be added in the order the functions are called. So adding a button, a text and two other buttons will result in a button on the left, a title, and 2 buttons on the right. The width of the title is set to take all the remaining space on the header. In other words: it pushes to the right all the buttons that are added after the title.

6.33.4 Get the parts

`lv_win_get_header(win)` returns a pointer to the header, `lv_win_get_content(win)` returns a pointer to the content container to which the content of the window can be added.

6.33.5 Events

No special events are sent by the windows, however events can be added manually to the return value of `lv_win_add_btn`.

Learn more about *Events*.

6.33.6 Keys

No *Keys* are handled by the window.

Learn more about *Keys*.

6.33.7 Example

Simple window

```
#include "../../lv_examples.h"
#if LV_USE_WIN && LV_BUILD_EXAMPLES


static void event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    LV_UNUSED(obj);
    LV_LOG_USER("Button %d clicked", (int)lv_obj_get_index(obj));
}

void lv_example_win_1(void)
{
    lv_obj_t * win = lv_win_create(lv_scr_act(), 40);
    lv_obj_t * btn;
    btn = lv_win_add_btn(win, LV_SYMBOL_LEFT, 40);
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    lv_win_add_title(win, "A title");

    btn = lv_win_add_btn(win, LV_SYMBOL_RIGHT, 40);
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    btn = lv_win_add_btn(win, LV_SYMBOL_CLOSE, 60);
    lv_obj_add_event(btn, event_handler, LV_EVENT_CLICKED, NULL);

    lv_obj_t * cont = lv_win_get_content(win);  /*Content can be added here*/
    lv_obj_t * label = lv_label_create(cont);
    lv_label_set_text(label, "This is\n"
                      "a pretty\n"
                      "long text\n"
                      "to see how\n"
                      "the window\n"
                      "becomes\n"
                      "scrollable.\n"
                      "\n"
                      "\n"
                      "Some more\n"
```

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```
                      "text to be\n"
                      "sure it\n"
                      "overflows. :)");


}

#endif
```

```
def event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
    if code == lv.EVENT.CLICKED:
        print("Button {:d} clicked".format(obj.get_child_id()))


win = lv.win(lv.scr_act(), 60)
btn1 = win.add_btn(lv.SYMBOL.LEFT, 40)
btn1.add_event(event_handler, lv.EVENT.ALL, None)
win.add_title("A title")
btn2=win.add_btn(lv.SYMBOL.RIGHT, 40)
btn2.add_event(event_handler, lv.EVENT.ALL, None)
btn3 = win.add_btn(lv.SYMBOL.CLOSE, 60)
btn3.add_event(event_handler, lv.EVENT.ALL, None)

cont = win.get_content()  # Content can be added here
label = lv.label(cont)
label.set_text("""This is
a pretty
long text
to see how
the window
becomes
scrollable.


We need
quite some text
and we will
even put
some more
text to be
sure it
overflows.
""")
```

6.33.8 API

Functions

lv_obj_t ***lv_win_create**(*lv_obj_t* *parent, lv_coord_t header_height)

lv_obj_t ***lv_win_add_title**(*lv_obj_t* *win, const char *txt)

lv_obj_t ***lv_win_add_btn**(*lv_obj_t* *win, const void *icon, lv_coord_t btn_w)

lv_obj_t ***lv_win_get_header**(*lv_obj_t* *win)

lv_obj_t ***lv_win_get_content**(*lv_obj_t* *win)

Variables

const lv_obj_class_t **lv_win_class**

struct **lv_win_t**

Public Members

lv_obj_t **obj**

CHAPTER

SEVEN

LAYOUTS

7.1 Flex

7.1.1 Overview

The Flexbox (or Flex for short) is a subset of CSS Flexbox.

It can arrange items into rows or columns (tracks), handle wrapping, adjust the spacing between the items and tracks, handle *grow* to make the item(s) fill the remaining space with respect to min/max width and height.

To make an object flex container call `lv_obj_set_layout(obj, LV_LAYOUT_FLEX)`.

Note that the flex layout feature of LVGL needs to be globally enabled with `LV_USE_FLEX` in `lv_conf.h`.

7.1.2 Terms

- tracks: the rows or columns
- main direction: row or column, the direction in which the items are placed
- cross direction: perpendicular to the main direction
- wrap: if there is no more space in the track a new track is started
- grow: if set on an item it will grow to fill the remaining space on the track. The available space will be distributed among items respective to their grow value (larger value means more space)
- gap: the space between the rows and columns or the items on a track

7.1.3 Simple interface

With the following functions you can set a Flex layout on any parent.

Flex flow

`lv_obj_set_flex_flow(obj, flex_flow)`

The possible values for `flex_flow` are:

- `LV_FLEX_FLOW_ROW` Place the children in a row without wrapping
- `LV_FLEX_FLOW_COLUMN` Place the children in a column without wrapping
- `LV_FLEX_FLOW_ROW_WRAP` Place the children in a row with wrapping
- `LV_FLEX_FLOW_COLUMN_WRAP` Place the children in a column with wrapping
- `LV_FLEX_FLOW_ROW_REVERSE` Place the children in a row without wrapping but in reversed order
- `LV_FLEX_FLOW_COLUMN_REVERSE` Place the children in a column without wrapping but in reversed order
- `LV_FLEX_FLOW_ROW_WRAP_REVERSE` Place the children in a row with wrapping but in reversed order
- `LV_FLEX_FLOW_COLUMN_WRAP_REVERSE` Place the children in a column with wrapping but in reversed order

Flex align

To manage the placement of the children use `lv_obj_set_flex_align(obj, main_place, cross_place, track_cross_place)`

- `main_place` determines how to distribute the items in their track on the main axis. E.g. flush the items to the right on `LV_FLEX_FLOW_ROW_WRAP`. (It's called `justify-content` in CSS)
- `cross_place` determines how to distribute the items in their track on the cross axis. E.g. if the items have different height place them to the bottom of the track. (It's called `align-items` in CSS)
- `track_cross_place` determines how to distribute the tracks (It's called `align-content` in CSS)

The possible values are:

- `LV_FLEX_ALIGN_START` means left on a horizontally and top vertically. (default)
- `LV_FLEX_ALIGN_END` means right on a horizontally and bottom vertically
- `LV_FLEX_ALIGN_CENTER` simply center
- `LV_FLEX_ALIGN_SPACE_EVENLY` items are distributed so that the spacing between any two items (and the space to the edges) is equal. Does not apply to `track_cross_place`.
- `LV_FLEX_ALIGN_SPACE_AROUND` items are evenly distributed in the track with equal space around them. Note that visually the spaces aren't equal, since all the items have equal space on both sides. The first item will have one unit of space against the container edge, but two units of space between the next item because that next item has its own spacing that applies. Not applies to `track_cross_place`.
- `LV_FLEX_ALIGN_SPACE_BETWEEN` items are evenly distributed in the track: first item is on the start line, last item on the end line. Not applies to `track_cross_place`.

Flex grow

Flex grow can be used to make one or more children fill the available space on the track. When more children have grow parameters, the available space will be distributed proportionally to the grow values. For example, there is 400 px remaining space and 4 objects with grow:

- `A` with grow = 1
- `B` with grow = 1
- `C` with grow = 2

`A` and `B` will have 100 px size, and `C` will have 200 px size.

Flex grow can be set on a child with `lv_obj_set_flex_grow(child, value)`. `value` needs to be > 1 or 0 to disable grow on the child.

7.1.4 Style interface

All the Flex-related values are style properties under the hood and you can use them similarly to any other style property. The following flex related style properties exist:

- `FLEX_FLOW`
- `FLEX_MAIN_PLACE`
- `FLEX_CROSS_PLACE`
- `FLEX_TRACK_PLACE`
- `FLEX_GROW`

Internal padding

To modify the minimum space flexbox inserts between objects, the following properties can be set on the flex container style:

- `pad_row` Sets the padding between the rows.
- `pad_column` Sets the padding between the columns.

These can for example be used if you don't want any padding between your objects: `lv_style_set_pad_column(&row_container_style,0)`

7.1.5 Other features

RTL

If the base direction of the container is set the `LV_BASE_DIR_RTL` the meaning of `LV_FLEX_ALIGN_START` and `LV_FLEX_ALIGN_END` is swapped on `ROW` layouts. I.e. `START` will mean right.

The items on `ROW` layouts, and tracks of `COLUMN` layouts will be placed from right to left.

New track

You can force Flex to put an item into a new line with `lv_obj_add_flag(child, LV_OBJ_FLAG_FLEX_IN_NEW_TRACK)`.

7.1.6 Example

A simple row and a column layout with flexbox

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * A simple row and a column layout with flexbox
 */
void lv_example_flex_1(void)
{
    /*Create a container with ROW flex direction*/
    lv_obj_t * cont_row = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont_row, 300, 75);
    lv_obj_align(cont_row, LV_ALIGN_TOP_MID, 0, 5);
    lv_obj_set_flex_flow(cont_row, LV_FLEX_FLOW_ROW);

    /*Create a container with COLUMN flex direction*/
    lv_obj_t * cont_col = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont_col, 200, 150);
    lv_obj_align_to(cont_col, cont_row, LV_ALIGN_OUT_BOTTOM_MID, 0, 5);
    lv_obj_set_flex_flow(cont_col, LV_FLEX_FLOW_COLUMN);

    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_obj_t * obj;
        lv_obj_t * label;

        /*Add items to the row*/
        obj = lv_btn_create(cont_row);
        lv_obj_set_size(obj, 100, LV_PCT(100));

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "Item: %"LV_PRIu32"", i);
        lv_obj_center(label);

        /*Add items to the column*/
        obj = lv_btn_create(cont_col);
        lv_obj_set_size(obj, LV_PCT(100), LV_SIZE_CONTENT);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "Item: %"LV_PRIu32, i);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# A simple row and a column layout with flexbox
#

# Create a container with ROW flex direction
cont_row = lv.obj(lv.scr_act())
cont_row.set_size(300, 75)
cont_row.align(lv.ALIGN.TOP_MID, 0, 5)
cont_row.set_flex_flow(lv.FLEX_FLOW.ROW)

# Create a container with COLUMN flex direction
cont_col = lv.obj(lv.scr_act())
cont_col.set_size(200, 150)
cont_col.align_to(cont_row, lv.ALIGN.OUT_BOTTOM_MID, 0, 5)
cont_col.set_flex_flow(lv.FLEX_FLOW.COLUMN)

for i in range(10):
    # Add items to the row
    obj = lv.btn(cont_row)
    obj.set_size(100, lv.pct(100))

    label = lv.label(obj)
    label.set_text("Item: {:d}".format(i))
    label.center()

    # Add items to the column
    obj = lv.btn(cont_col)
    obj.set_size(lv.pct(100), lv.SIZE_CONTENT)

    label = lv.label(obj)
    label.set_text("Item: {:d}".format(i))
    label.center()
```

Arrange items in rows with wrap and even spacing

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * Arrange items in rows with wrap and place the items to get even space around them.
 */
void lv_example_flex_2(void)
{
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_flex_flow(&style, LV_FLEX_FLOW_ROW_WRAP);
    lv_style_set_flex_main_place(&style, LV_FLEX_ALIGN_SPACE_EVENLY);
    lv_style_set_layout(&style, LV_LAYOUT_FLEX);

    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_add_style(cont, &style, 0);
```

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```
    uint32_t i;
    for(i = 0; i < 8; i++) {
        lv_obj_t * obj = lv_obj_create(cont);
        lv_obj_set_size(obj, 70, LV_SIZE_CONTENT);
        lv_obj_add_flag(obj, LV_OBJ_FLAG_CHECKABLE);

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%"LV_PRIu32, i);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Arrange items in rows with wrap and place the items to get even space around them.
#
style = lv.style_t()
style.init()
style.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)
style.set_flex_main_place(lv.FLEX_ALIGN.SPACE_EVENLY)
style.set_layout(lv.LAYOUT_FLEX.value)

cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.add_style(style, 0)

for i in range(8):
    obj = lv.obj(cont)
    obj.set_size(70, lv.SIZE_CONTENT)

    label = lv.label(obj)
    label.set_text("{:d}".format(i))
    label.center()
```

Demonstrate flex grow

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * Demonstrate flex grow.
 */
void lv_example_flex_3(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_ROW);

    lv_obj_t * obj;
    obj = lv_obj_create(cont);
```

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```
    lv_obj_set_size(obj, 40, 40);           /*Fix size*/

    obj = lv_obj_create(cont);
    lv_obj_set_height(obj, 40);
    lv_obj_set_flex_grow(obj, 1);           /*1 portion from the free space*/

    obj = lv_obj_create(cont);
    lv_obj_set_height(obj, 40);
    lv_obj_set_flex_grow(obj, 2);           /*2 portion from the free space*/

    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, 40, 40);           /*Fix size. It is flushed to the right by␣
↪the "grow" items*/
}

#endif
```

```
#
# Demonstrate flex grow.
#

cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.ROW)

obj = lv.obj(cont)
obj.set_size(40, 40)            # Fix size

obj = lv.obj(cont)
obj.set_height(40)
obj.set_flex_grow(1)            # 1 portion from the free space

obj = lv.obj(cont)
obj.set_height(40)
obj.set_flex_grow(2)            # 2 portion from the free space

obj = lv.obj(cont)
obj.set_size(40, 40)            # Fix size. It is flushed to the right by the "grow"␣
↪items
```

Demonstrate flex grow.

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * Reverse the order of flex items
 */
void lv_example_flex_4(void)
{

    lv_obj_t * cont = lv_obj_create(lv_scr_act());
```

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```
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_COLUMN_REVERSE);

    uint32_t i;
    for(i = 0; i < 6; i++) {
        lv_obj_t * obj = lv_obj_create(cont);
        lv_obj_set_size(obj, 100, 50);

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "Item: %"LV_PRIu32, i);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Reverse the order of flex items
#
cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.COLUMN_REVERSE)

for i  in range(6):
    obj = lv.obj(cont)
    obj.set_size(100, 50)

    label = lv.label(obj)
    label.set_text("Item: " + str(i))
    label.center()
```

Demonstrate column and row gap style properties

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

static void row_gap_anim(void * obj, int32_t v)
{
    lv_obj_set_style_pad_row(obj, v, 0);
}

static void column_gap_anim(void * obj, int32_t v)
{
    lv_obj_set_style_pad_column(obj, v, 0);
}

/**
 * Demonstrate the effect of column and row gap style properties
 */
void lv_example_flex_5(void)
{
```

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```
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_ROW_WRAP);

    uint32_t i;
    for(i = 0; i < 9; i++) {
        lv_obj_t * obj = lv_obj_create(cont);
        lv_obj_set_size(obj, 70, LV_SIZE_CONTENT);

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%"LV_PRIu32, i);
        lv_obj_center(label);
    }

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, cont);
    lv_anim_set_values(&a, 0, 10);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);

    lv_anim_set_exec_cb(&a, row_gap_anim);
    lv_anim_set_time(&a, 500);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_start(&a);

    lv_anim_set_exec_cb(&a, column_gap_anim);
    lv_anim_set_time(&a, 3000);
    lv_anim_set_playback_time(&a, 3000);
    lv_anim_start(&a);
}

#endif
```

```
def row_gap_anim(obj, v):
    obj.set_style_pad_row(v, 0)


def column_gap_anim(obj, v):
    obj.set_style_pad_column(v, 0)

#
# Demonstrate the effect of column and row gap style properties
#

cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)

for i in range(9):
    obj = lv.obj(cont)
    obj.set_size(70, lv.SIZE_CONTENT)

    label = lv.label(obj)
    label.set_text(str(i))
```

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```
    label.center()

a_row = lv.anim_t()
a_row.init()
a_row.set_var(cont)
a_row.set_values(0, 10)
a_row.set_repeat_count(lv.ANIM_REPEAT_INFINITE)

a_row.set_time(500)
a_row.set_playback_time(500)
a_row.set_custom_exec_cb(lambda a,val: row_gap_anim(cont,val))
lv.anim_t.start(a_row)

a_col = lv.anim_t()
a_col.init()
a_col.set_var(cont)
a_col.set_values(0, 10)
a_col.set_repeat_count(lv.ANIM_REPEAT_INFINITE)

a_col.set_time(3000)
a_col.set_playback_time(3000)
a_col.set_custom_exec_cb(lambda a,val: column_gap_anim(cont,val))

lv.anim_t.start(a_col)
```

RTL base direction changes order of the items

```
#include "../../lv_examples.h"
#if LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * RTL base direction changes order of the items.
 * Also demonstrate how horizontal scrolling works with RTL.
 */
void lv_example_flex_6(void)
{
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_style_base_dir(cont, LV_BASE_DIR_RTL, 0);
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_flex_flow(cont, LV_FLEX_FLOW_ROW_WRAP);

    uint32_t i;
    for(i = 0; i < 20; i++) {
        lv_obj_t * obj = lv_obj_create(cont);
        lv_obj_set_size(obj, 70, LV_SIZE_CONTENT);

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%"LV_PRIu32, i);
        lv_obj_center(label);
    }
}
#endif
```

```
#
# RTL base direction changes order of the items.
# Also demonstrate how horizontal scrolling works with RTL.
#

cont = lv.obj(lv.scr_act())
cont.set_style_base_dir(lv.BASE_DIR.RTL,0)
cont.set_size(300, 220)
cont.center()
cont.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)

for i in range(20):
    obj = lv.obj(cont)
    obj.set_size(70, lv.SIZE_CONTENT)

    label = lv.label(obj)
    label.set_text(str(i))
    label.center()
```

7.1.7 API

Enums

enum **`lv_flex_align_t`**

Values:

enumerator **`LV_FLEX_ALIGN_START`**

enumerator **`LV_FLEX_ALIGN_END`**

enumerator **`LV_FLEX_ALIGN_CENTER`**

enumerator **`LV_FLEX_ALIGN_SPACE_EVENLY`**

enumerator **`LV_FLEX_ALIGN_SPACE_AROUND`**

enumerator **`LV_FLEX_ALIGN_SPACE_BETWEEN`**

enum **`lv_flex_flow_t`**

Values:

enumerator **`LV_FLEX_FLOW_ROW`**

enumerator **`LV_FLEX_FLOW_COLUMN`**

enumerator **`LV_FLEX_FLOW_ROW_WRAP`**

enumerator **LV_FLEX_FLOW_ROW_REVERSE**

enumerator **LV_FLEX_FLOW_ROW_WRAP_REVERSE**

enumerator **LV_FLEX_FLOW_COLUMN_WRAP**

enumerator **LV_FLEX_FLOW_COLUMN_REVERSE**

enumerator **LV_FLEX_FLOW_COLUMN_WRAP_REVERSE**

Functions

LV_EXPORT_CONST_INT(LV_OBJ_FLAG_FLEX_IN_NEW_TRACK)

void **lv_flex_init**(void)

Initialize a flex layout the default values

Parameters **flex** -- pointer to a flex layout descriptor

void **lv_obj_set_flex_flow**(*lv_obj_t* *obj, *lv_flex_flow_t* flow)

Set hot the item should flow

Parameters

- **flex** -- pointer to a flex layout descriptor
- **flow** -- an element of `lv_flex_flow_t`.

void **lv_obj_set_flex_align**(*lv_obj_t* *obj, *lv_flex_align_t* main_place, *lv_flex_align_t* cross_place, *lv_flex_align_t* track_cross_place)

Set how to place (where to align) the items and tracks

Parameters

- **flex** -- pointer: to a flex layout descriptor
- **main_place** -- where to place the items on main axis (in their track). Any value of `lv_flex_align_t`.
- **cross_place** -- where to place the item in their track on the cross axis. `LV_FLEX_ALIGN_START/END/CENTER`
- **track_place** -- where to place the tracks in the cross direction. Any value of `lv_flex_align_t`.

void **lv_obj_set_flex_grow**(*lv_obj_t* *obj, uint8_t grow)

Sets the width or height (on main axis) to grow the object in order fill the free space

Parameters

- **obj** -- pointer to an object. The parent must have flex layout else nothing will happen.
- **grow** -- a value to set how much free space to take proportionally to other growing items.

void **lv_style_set_flex_flow**(*lv_style_t* *style, *lv_flex_flow_t* value)

void **lv_style_set_flex_main_place**(*lv_style_t* *style, *lv_flex_align_t* value) void **lv_style_set_flex_cross_place**(*lv_style_t* *style, *lv_flex_align_t* value)

void **lv_style_set_flex_track_place**(*lv_style_t* *style, *lv_flex_align_t* value)

void **lv_style_set_flex_grow**(*lv_style_t* *style, uint8_t value)

void **lv_obj_set_style_flex_flow**(*lv_obj_t* *obj, *lv_flex_flow_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_flex_main_place**(*lv_obj_t* *obj, *lv_flex_align_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_flex_cross_place**(*lv_obj_t* *obj, *lv_flex_align_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_flex_track_place**(*lv_obj_t* *obj, *lv_flex_align_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_flex_grow**(*lv_obj_t* *obj, uint8_t value, lv_style_selector_t selector)

static inline *lv_flex_flow_t* **lv_obj_get_style_flex_flow**(const *lv_obj_t* *obj, uint32_t part)

static inline *lv_flex_align_t* **lv_obj_get_style_flex_main_place**(const *lv_obj_t* *obj, uint32_t part)

static inline *lv_flex_align_t* **lv_obj_get_style_flex_cross_place**(const *lv_obj_t* *obj, uint32_t part)

static inline *lv_flex_align_t* **lv_obj_get_style_flex_track_place**(const *lv_obj_t* *obj, uint32_t part)

static inline uint8_t **lv_obj_get_style_flex_grow**(const *lv_obj_t* *obj, uint32_t part)

Variables

uint16_t **LV_LAYOUT_FLEX**

lv_style_prop_t **LV_STYLE_FLEX_FLOW**

lv_style_prop_t **LV_STYLE_FLEX_MAIN_PLACE**

lv_style_prop_t **LV_STYLE_FLEX_CROSS_PLACE**

lv_style_prop_t **LV_STYLE_FLEX_TRACK_PLACE**

lv_style_prop_t **LV_STYLE_FLEX_GROW**

7.2 Grid

7.2.1 Overview

The Grid layout is a subset of CSS Flexbox.

It can arrange items into a 2D "table" that has rows or columns (tracks). The item can span through multiple columns or rows. The track's size can be set in pixel, to the largest item (`LV_GRID_CONTENT`) or in "Free unit" (FR) to distribute the free space proportionally.

To make an object a grid container call `lv_obj_set_layout(obj, LV_LAYOUT_GRID)`.

Note that the grid layout feature of LVGL needs to be globally enabled with `LV_USE_GRID` in `lv_conf.h`.

7.2.2 Terms

- tracks: the rows or columns
- free unit (FR): if set on track's size is set in `FR` it will grow to fill the remaining space on the parent.
- gap: the space between the rows and columns or the items on a track

7.2.3 Simple interface

With the following functions you can easily set a Grid layout on any parent.

Grid descriptors

First you need to describe the size of rows and columns. It can be done by declaring 2 arrays and the track sizes in them. The last element must be `LV_GRID_TEMPLATE_LAST`.

For example:

```
static lv_coord_t column_dsc[] = {100, 400, LV_GRID_TEMPLATE_LAST};   /*2 columns␣
↪with 100 and 400 ps width*/
static lv_coord_t row_dsc[] = {100, 100, 100, LV_GRID_TEMPLATE_LAST}; /*3 100 px tall␣
↪rows*/
```

To set the descriptors on a parent use `lv_obj_set_grid_dsc_array(obj, col_dsc, row_dsc)`.

Besides simple settings the size in pixel you can use two special values:

- `LV_GRID_CONTENT` set the width to the largest children on this track
- `LV_GRID_FR(X)` tell what portion of the remaining space should be used by this track. Larger value means larger space.

Grid items

By default, the children are not added to the grid. They need to be added manually to a cell.

To do this call `lv_obj_set_grid_cell(child, column_align, column_pos, column_span, row_align, row_pos, row_span)`.

`column_align` and `row_align` determine how to align the children in its cell. The possible values are:

- `LV_GRID_ALIGN_START` means left on a horizontally and top vertically. (default)
- `LV_GRID_ALIGN_END` means right on a horizontally and bottom vertically
- `LV_GRID_ALIGN_CENTER` simply center

`colum_pos` and `row_pos` means the zero based index of the cell into the item should be placed.

`colum_span` and `row_span` means how many tracks should the item involve from the start cell. Must be > 1.

Grid align

If there are some empty space the track can be aligned several ways:

- `LV_GRID_ALIGN_START` means left on a horizontally and top vertically. (default)
- `LV_GRID_ALIGN_END` means right on a horizontally and bottom vertically
- `LV_GRID_ALIGN_CENTER` simply center
- `LV_GRID_ALIGN_SPACE_EVENLY` items are distributed so that the spacing between any two items (and the space to the edges) is equal. Not applies to `track_cross_place`.
- `LV_GRID_ALIGN_SPACE_AROUND` items are evenly distributed in the track with equal space around them. Note that visually the spaces aren't equal, since all the items have equal space on both sides. The first item will have one unit of space against the container edge, but two units of space between the next item because that next item has its own spacing that applies. Not applies to `track_cross_place`.
- `LV_GRID_ALIGN_SPACE_BETWEEN` items are evenly distributed in the track: first item is on the start line, last item on the end line. Not applies to `track_cross_place`.

To set the track's alignment use `lv_obj_set_grid_align(obj, column_align, row_align)`.

7.2.4 Style interface

All the Grid related values are style properties under the hood and you can use them similarly to any other style properties. The following Grid related style properties exist:

- `GRID_COLUMN_DSC_ARRAY`
- `GRID_ROW_DSC_ARRAY`
- `GRID_COLUMN_ALIGN`
- `GRID_ROW_ALIGN`
- `GRID_CELL_X_ALIGN`
- `GRID_CELL_COLUMN_POS`
- `GRID_CELL_COLUMN_SPAN`
- `GRID_CELL_Y_ALIGN`
- `GRID_CELL_ROW_POS`

- `GRID_CELL_ROW_SPAN`

Internal padding

To modify the minimum space Grid inserts between objects, the following properties can be set on the Grid container style:

- `pad_row` Sets the padding between the rows.
- `pad_column` Sets the padding between the columns.

7.2.5 Other features

RTL

If the base direction of the container is set to `LV_BASE_DIR_RTL`, the meaning of `LV_GRID_ALIGN_START` and `LV_GRID_ALIGN_END` is swapped. I.e. `START` will mean right-most.

The columns will be placed from right to left.

7.2.6 Example

A simple grid

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

/**
 * A simple grid
 */
void lv_example_grid_1(void)
{
    static lv_coord_t col_dsc[] = {70, 70, 70, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {50, 50, 50, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_style_grid_column_dsc_array(cont, col_dsc, 0);
    lv_obj_set_style_grid_row_dsc_array(cont, row_dsc, 0);
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_layout(cont, LV_LAYOUT_GRID);

    lv_obj_t * label;
    lv_obj_t * obj;

    uint32_t i;
    for(i = 0; i < 9; i++) {
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_btn_create(cont);
        /*Stretch the cell horizontally and vertically too
         *Set span to 1 to make the cell 1 column/row sized*/
```

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```
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "c%d, r%d", col, row);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# A simple grid
#

col_dsc = [70, 70, 70, lv.GRID_TEMPLATE_LAST]
row_dsc = [50, 50, 50, lv.GRID_TEMPLATE_LAST]

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_style_grid_column_dsc_array(col_dsc, 0)
cont.set_style_grid_row_dsc_array(row_dsc, 0)
cont.set_size(300, 220)
cont.center()
cont.set_layout(lv.LAYOUT_GRID.value)

for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.btn(cont)
    # Stretch the cell horizontally and vertically too
    # Set span to 1 to make the cell 1 column/row sized
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)

    label = lv.label(obj)
    label.set_text("c" +str(col) +  "r" +str(row))
    label.center()
```

Demonstrate cell placement and span

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES


/**
 * Demonstrate cell placement and span
 */
void lv_example_grid_2(void)
{
    static lv_coord_t col_dsc[] = {70, 70, 70, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {50, 50, 50, LV_GRID_TEMPLATE_LAST};
```

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```
    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);

    lv_obj_t * label;
    lv_obj_t * obj;

    /*Cell to 0;0 and align to to the start (left/top) horizontally and vertically␣
↪too*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_START, 0, 1,
                         LV_GRID_ALIGN_START, 0, 1);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c0, r0");

    /*Cell to 1;0 and align to to the start (left) horizontally and center vertically␣
↪too*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_START, 1, 1,
                         LV_GRID_ALIGN_CENTER, 0, 1);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c1, r0");

    /*Cell to 2;0 and align to to the start (left) horizontally and end (bottom)␣
↪vertically too*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_START, 2, 1,
                         LV_GRID_ALIGN_END, 0, 1);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c2, r0");

    /*Cell to 1;1 but 2 column wide (span = 2).Set width and height to stretched.*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, 1, 2,
                         LV_GRID_ALIGN_STRETCH, 1, 1);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c1-2, r1");

    /*Cell to 0;1 but 2 rows tall (span = 2).Set width and height to stretched.*/
    obj = lv_obj_create(cont);
    lv_obj_set_size(obj, LV_SIZE_CONTENT, LV_SIZE_CONTENT);
    lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, 0, 1,
                         LV_GRID_ALIGN_STRETCH, 1, 2);
    label = lv_label_create(obj);
    lv_label_set_text(label, "c0\nr1-2");
}

#endif
```

```
#
# Demonstrate cell placement and span
#

col_dsc = [70, 70, 70, lv.GRID_TEMPLATE_LAST]
row_dsc = [50, 50, 50, lv.GRID_TEMPLATE_LAST]

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_grid_dsc_array(col_dsc, row_dsc)
cont.set_size(300, 220)
cont.center()

# Cell to 0;0 and align to the start (left/top) horizontally and vertically too
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.START, 0, 1,
                  lv.GRID_ALIGN.START, 0, 1)
label = lv.label(obj)
label.set_text("c0, r0")

# Cell to 1;0 and align to the start (left) horizontally and center vertically too
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.START, 1, 1,
                  lv.GRID_ALIGN.CENTER, 0, 1)
label = lv.label(obj)
label.set_text("c1, r0")

# Cell to 2;0 and align to the start (left) horizontally and end (bottom) vertically␣
↪too
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.START, 2, 1,
                  lv.GRID_ALIGN.END, 0, 1)
label = lv.label(obj)
label.set_text("c2, r0")

# Cell to 1;1 but 2 column wide (span = 2).Set width and height to stretched.
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, 1, 2,
                  lv.GRID_ALIGN.STRETCH, 1, 1)
label = lv.label(obj)
label.set_text("c1-2, r1")

# Cell to 0;1 but 2 rows tall (span = 2).Set width and height to stretched.
obj = lv.obj(cont)
obj.set_size(lv.SIZE_CONTENT, lv.SIZE_CONTENT)
obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, 0, 1,
                  lv.GRID_ALIGN.STRETCH, 1, 2)
label = lv.label(obj)
label.set_text("c0\nr1-2")
```

Demonstrate grid's "free unit"

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

/**
 * Demonstrate grid's "free unit"
 */
void lv_example_grid_3(void)
{
    /*Column 1: fix width 60 px
     *Column 2: 1 unit from the remaining free space
     *Column 3: 2 unit from the remaining free space*/
    static lv_coord_t col_dsc[] = {60, LV_GRID_FR(1), LV_GRID_FR(2), LV_GRID_TEMPLATE_
↪LAST};

    /*Row 1: fix width 50 px
     *Row 2: 1 unit from the remaining free space
     *Row 3: fix width 50 px*/
    static lv_coord_t row_dsc[] = {50, LV_GRID_FR(1), 50, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);

    lv_obj_t * label;
    lv_obj_t * obj;
    uint32_t i;
    for(i = 0; i < 9; i++) {
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_obj_create(cont);
        /*Stretch the cell horizontally and vertically too
         *Set span to 1 to make the cell 1 column/row sized*/
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%d,%d", col, row);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Demonstrate grid's "free unit"
#

# Column 1: fix width 60 px
# Column 2: 1 unit from the remaining free space
# Column 3: 2 unit from the remaining free space

col_dsc = [60, lv.grid_fr(1), lv.grid_fr(2), lv.GRID_TEMPLATE_LAST]
```

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```
# Row 1: fix width 60 px
# Row 2: 1 unit from the remaining free space
# Row 3: fix width 60 px

row_dsc = [40, lv.grid_fr(1), 40, lv.GRID_TEMPLATE_LAST]

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_grid_dsc_array(col_dsc, row_dsc)

for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.obj(cont)
    # Stretch the cell horizontally and vertically too
    # Set span to 1 to make the cell 1 column/row sized
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)

    label = lv.label(obj)
    label.set_text("%d,%d"%(col, row))
    label.center()
```

Demonstrate track placement

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

/**
 * Demonstrate track placement
 */
void lv_example_grid_4(void)
{
    static lv_coord_t col_dsc[] = {60, 60, 60, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {45, 45, 45, LV_GRID_TEMPLATE_LAST};


    /*Add space between the columns and move the rows to the bottom (end)*/

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_grid_align(cont, LV_GRID_ALIGN_SPACE_BETWEEN, LV_GRID_ALIGN_END);
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);

    lv_obj_t * label;
    lv_obj_t * obj;
    uint32_t i;
    for(i = 0; i < 9; i++) {
```

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```
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_obj_create(cont);
        /*Stretch the cell horizontally and vertically too
         *Set span to 1 to make the cell 1 column/row sized*/
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%d,%d", col, row);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Demonstrate track placement
#

col_dsc = [60, 60, 60, lv.GRID_TEMPLATE_LAST]
row_dsc = [40, 40, 40, lv.GRID_TEMPLATE_LAST]


# Add space between the columns and move the rows to the bottom (end)

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_grid_align(lv.GRID_ALIGN.SPACE_BETWEEN, lv.GRID_ALIGN.END)
cont.set_grid_dsc_array(col_dsc, row_dsc)
cont.set_size(300, 220)
cont.center()


for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.obj(cont)
    # Stretch the cell horizontally and vertically too
    # Set span to 1 to make the cell 1 column/row sized
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)

    label = lv.label(obj)
    label.set_text("{:d}{:d}".format(col, row))
    label.center()
```

Demonstrate column and row gap

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

static void row_gap_anim(void * obj, int32_t v)
{
    lv_obj_set_style_pad_row(obj, v, 0);
}

static void column_gap_anim(void * obj, int32_t v)
{
    lv_obj_set_style_pad_column(obj, v, 0);
}

/**
 * Demonstrate column and row gap
 */
void lv_example_grid_5(void)
{

    /*60x60 cells*/
    static lv_coord_t col_dsc[] = {60, 60, 60, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {45, 45, 45, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);

    lv_obj_t * label;
    lv_obj_t * obj;
    uint32_t i;
    for(i = 0; i < 9; i++) {
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_obj_create(cont);
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);
        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%d,%d", col, row);
        lv_obj_center(label);
    }

    lv_anim_t a;
    lv_anim_init(&a);
    lv_anim_set_var(&a, cont);
    lv_anim_set_values(&a, 0, 10);
    lv_anim_set_repeat_count(&a, LV_ANIM_REPEAT_INFINITE);

    lv_anim_set_exec_cb(&a, row_gap_anim);
    lv_anim_set_time(&a, 500);
    lv_anim_set_playback_time(&a, 500);
    lv_anim_start(&a);
```

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```
    lv_anim_set_exec_cb(&a, column_gap_anim);
    lv_anim_set_time(&a, 3000);
    lv_anim_set_playback_time(&a, 3000);
    lv_anim_start(&a);
}

#endif
```

```
def row_gap_anim(obj, v):
    obj.set_style_pad_row(v, 0)

def column_gap_anim(obj, v):
    obj.set_style_pad_column(v, 0)

#
# Demonstrate column and row gap
#

# 60x60 cells
col_dsc = [60, 60, 60, lv.GRID_TEMPLATE_LAST]
row_dsc = [40, 40, 40, lv.GRID_TEMPLATE_LAST]

# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_grid_dsc_array(col_dsc, row_dsc)

for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.obj(cont)
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)
    label = lv.label(obj)
    label.set_text("{:d},{:d}".format(col, row))
    label.center()

    a_row = lv.anim_t()
    a_row.init()
    a_row.set_var(cont)
    a_row.set_values(0, 10)
    a_row.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
    a_row.set_time(500)
    a_row.set_playback_time(500)
    a_row. set_custom_exec_cb(lambda a,val: row_gap_anim(cont,val))
    lv.anim_t.start(a_row)

    a_col = lv.anim_t()
    a_col.init()
    a_col.set_var(cont)
    a_col.set_values(0, 10)
    a_col.set_repeat_count(lv.ANIM_REPEAT_INFINITE)
    a_col.set_time(500)
```

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```
    a_col.set_playback_time(500)
    a_col. set_custom_exec_cb(lambda a,val: column_gap_anim(cont,val))
    lv.anim_t.start(a_col)
```

Demonstrate RTL direction on grid

```
#include "../../lv_examples.h"
#if LV_USE_GRID && LV_BUILD_EXAMPLES

/**
 * Demonstrate RTL direction on grid
 */
void lv_example_grid_6(void)
{

    static lv_coord_t col_dsc[] = {60, 60, 60, LV_GRID_TEMPLATE_LAST};
    static lv_coord_t row_dsc[] = {45, 45, 45, LV_GRID_TEMPLATE_LAST};

    /*Create a container with grid*/
    lv_obj_t * cont = lv_obj_create(lv_scr_act());
    lv_obj_set_size(cont, 300, 220);
    lv_obj_center(cont);
    lv_obj_set_style_base_dir(cont, LV_BASE_DIR_RTL, 0);
    lv_obj_set_grid_dsc_array(cont, col_dsc, row_dsc);

    lv_obj_t * label;
    lv_obj_t * obj;
    uint32_t i;
    for(i = 0; i < 9; i++) {
        uint8_t col = i % 3;
        uint8_t row = i / 3;

        obj = lv_obj_create(cont);
        /*Stretch the cell horizontally and vertically too
         *Set span to 1 to make the cell 1 column/row sized*/
        lv_obj_set_grid_cell(obj, LV_GRID_ALIGN_STRETCH, col, 1,
                             LV_GRID_ALIGN_STRETCH, row, 1);

        label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%d,%d", col, row);
        lv_obj_center(label);
    }
}

#endif
```

```
#
# Demonstrate RTL direction on grid
#
col_dsc = [60, 60, 60, lv.GRID_TEMPLATE_LAST]
row_dsc = [40, 40, 40, lv.GRID_TEMPLATE_LAST]
```

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```
# Create a container with grid
cont = lv.obj(lv.scr_act())
cont.set_size(300, 220)
cont.center()
cont.set_style_base_dir(lv.BASE_DIR.RTL,0)
cont.set_grid_dsc_array(col_dsc, row_dsc)

for i in range(9):
    col = i % 3
    row = i // 3

    obj = lv.obj(cont)
    # Stretch the cell horizontally and vertically too
    # Set span to 1 to make the cell 1 column/row sized
    obj.set_grid_cell(lv.GRID_ALIGN.STRETCH, col, 1,
                      lv.GRID_ALIGN.STRETCH, row, 1)

    label = lv.label(obj)
    label.set_text("{:d},{:d}".format(col, row))
    label.center()
```

7.2.7 API

Enums

enum **lv_grid_align_t**

Values:

enumerator **LV_GRID_ALIGN_START**

enumerator **LV_GRID_ALIGN_CENTER**

enumerator **LV_GRID_ALIGN_END**

enumerator **LV_GRID_ALIGN_STRETCH**

enumerator **LV_GRID_ALIGN_SPACE_EVENLY**

enumerator **LV_GRID_ALIGN_SPACE_AROUND**

enumerator **LV_GRID_ALIGN_SPACE_BETWEEN**

Functions

`LV_EXPORT_CONST_INT`(LV_GRID_CONTENT)

`LV_EXPORT_CONST_INT`(LV_GRID_TEMPLATE_LAST)

void **`lv_grid_init`**(void)

void **`lv_obj_set_grid_dsc_array`**(*lv_obj_t* *obj, const lv_coord_t col_dsc[], const lv_coord_t row_dsc[])

void **`lv_obj_set_grid_align`**(*lv_obj_t* *obj, *lv_grid_align_t* column_align, *lv_grid_align_t* row_align)

void **`lv_obj_set_grid_cell`**(*lv_obj_t* *obj, *lv_grid_align_t* column_align, lv_coord_t col_pos, lv_coord_t col_span, *lv_grid_align_t* row_align, lv_coord_t row_pos, lv_coord_t row_span)

Set the cell of an object. The object's parent needs to have grid layout, else nothing will happen

Parameters

- **`obj`** -- pointer to an object
- **`column_align`** -- the vertical alignment in the cell. `LV_GRID_START/END/CENTER/STRETCH`
- **`col_pos`** -- column ID
- **`col_span`** -- number of columns to take (>= 1)
- **`row_align`** -- the horizontal alignment in the cell. `LV_GRID_START/END/CENTER/STRETCH`
- **`row_pos`** -- row ID
- **`row_span`** -- number of rows to take (>= 1)

static inline lv_coord_t **`lv_grid_fr`**(uint8_t x)

Just a wrapper to `LV_GRID_FR` for bindings.

void **`lv_style_set_grid_row_dsc_array`**(*lv_style_t* *style, const lv_coord_t value[])

void **`lv_style_set_grid_column_dsc_array`**(*lv_style_t* *style, const lv_coord_t value[])

void **`lv_style_set_grid_row_align`**(*lv_style_t* *style, *lv_grid_align_t* value)

void **`lv_style_set_grid_column_align`**(*lv_style_t* *style, *lv_grid_align_t* value)

void **`lv_style_set_grid_cell_column_pos`**(*lv_style_t* *style, lv_coord_t value)

void **`lv_style_set_grid_cell_column_span`**(*lv_style_t* *style, lv_coord_t value)

void **`lv_style_set_grid_cell_row_pos`**(*lv_style_t* *style, lv_coord_t value)

void **`lv_style_set_grid_cell_row_span`**(*lv_style_t* *style, lv_coord_t value)

void **`lv_style_set_grid_cell_x_align`**(*lv_style_t* *style, *lv_grid_align_t* value)

void **`lv_style_set_grid_cell_y_align`**(*lv_style_t* *style, *lv_grid_align_t* value)

void **`lv_obj_set_style_grid_row_dsc_array`**(*lv_obj_t* *obj, const lv_coord_t value[], lv_style_selector_t selector)

void **`lv_obj_set_style_grid_column_dsc_array`**(*lv_obj_t* *obj, const lv_coord_t value[], lv_style_selector_t selector) void **lv_obj_set_style_grid_row_align**(*lv_obj_t* *obj, *lv_grid_align_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_grid_column_align**(*lv_obj_t* *obj, *lv_grid_align_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_grid_cell_column_pos**(*lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_grid_cell_column_span**(*lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_grid_cell_row_pos**(*lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_grid_cell_row_span**(*lv_obj_t* *obj, lv_coord_t value, lv_style_selector_t selector)

void **lv_obj_set_style_grid_cell_x_align**(*lv_obj_t* *obj, *lv_grid_align_t* value, lv_style_selector_t selector)

void **lv_obj_set_style_grid_cell_y_align**(*lv_obj_t* *obj, *lv_grid_align_t* value, lv_style_selector_t selector)

static inline const lv_coord_t ***lv_obj_get_style_grid_row_dsc_array**(const *lv_obj_t* *obj, uint32_t part)

static inline const lv_coord_t ***lv_obj_get_style_grid_column_dsc_array**(const *lv_obj_t* *obj, uint32_t part)

static inline *lv_grid_align_t* **lv_obj_get_style_grid_row_align**(const *lv_obj_t* *obj, uint32_t part)

static inline *lv_grid_align_t* **lv_obj_get_style_grid_column_align**(const *lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_grid_cell_column_pos**(const *lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_grid_cell_column_span**(const *lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_grid_cell_row_pos**(const *lv_obj_t* *obj, uint32_t part)

static inline lv_coord_t **lv_obj_get_style_grid_cell_row_span**(const *lv_obj_t* *obj, uint32_t part)

static inline *lv_grid_align_t* **lv_obj_get_style_grid_cell_x_align**(const *lv_obj_t* *obj, uint32_t part)

static inline *lv_grid_align_t* **lv_obj_get_style_grid_cell_y_align**(const *lv_obj_t* *obj, uint32_t part)

Variables

uint16_t **LV_LAYOUT_GRID**

lv_style_prop_t **LV_STYLE_GRID_COLUMN_DSC_ARRAY**

lv_style_prop_t **LV_STYLE_GRID_COLUMN_ALIGN**

lv_style_prop_t **LV_STYLE_GRID_ROW_DSC_ARRAY** *lv_style_prop_t* **LV_STYLE_GRID_ROW_ALIGN**

lv_style_prop_t **LV_STYLE_GRID_CELL_COLUMN_POS**

lv_style_prop_t **LV_STYLE_GRID_CELL_COLUMN_SPAN**

lv_style_prop_t **LV_STYLE_GRID_CELL_X_ALIGN**

lv_style_prop_t **LV_STYLE_GRID_CELL_ROW_POS**

lv_style_prop_t **LV_STYLE_GRID_CELL_ROW_SPAN**

lv_style_prop_t **LV_STYLE_GRID_CELL_Y_ALIGN**

CHAPTER

EIGHT

3RD PARTY LIBRARIES

8.1 File System Interfaces

LVGL has a File system module to provide an abstraction layer for various file system drivers.

LVG has built in support for:

- FATFS
- STDIO (Linux and Windows using C standard function .e.g fopen, fread)
- POSIX (Linux and Windows using POSIX function .e.g open, read)
- WIN32 (Windows using Win32 API function .e.g CreateFileA, ReadFile)

You still need to provide the drivers and libraries, this extension provides only the bridge between FATFS, STDIO, POSIX, WIN32 and LVGL.

8.1.1 Usage

In `lv_conf.h` enable `LV_USE_FS_...` and assign an upper cased letter to `LV_FS_..._LETTER` (e.g. `'S'`). After that you can access files using that driver letter. E.g. `"S:path/to/file.txt"`.

The work directory can be set with `LV_FS_..._PATH`. E.g. `"/home/joe/projects/"` The actual file/directory paths will be appended to it.

Cached reading is also supported if `LV_FS_..._CACHE_SIZE` is set to not `0` value. `lv_fs_read` caches this size of data to lower the number of actual reads from the storage.

8.2 BMP decoder

This extension allows the use of BMP images in LVGL. This implementation uses bmp-decoder library. The pixels are read on demand (not the whole image is loaded) so using BMP images requires very little RAM.

If enabled in `lv_conf.h` by `LV_USE_BMP` LVGL will register a new image decoder automatically so BMP files can be directly used as image sources. For example:

```
lv_img_set_src(my_img, "S:path/to/picture.bmp");
```

Note that, a file system driver needs to registered to open images from files. Read more about it here or just enable one in `lv_conf.h` with `LV_USE_FS_...`

8.2.1 Limitations

- Only BMP files are supported and BMP images as C array (`lv_img_dsc_t`) are not. It's because there is no practical differences between how the BMP files and LVGL's image format stores the image data.
- BMP files can be loaded only from file. If you want to store them in flash it's better to convert them to C array with LVGL's image converter.
- The BMP files color format needs to match with `LV_COLOR_DEPTH`. Use GIMP to save the image in the required format. Both RGB888 and ARGB888 works with `LV_COLOR_DEPTH 32`
- Palette is not supported.
- Because not the whole image is read in can not be zoomed or rotated.

8.2.2 Example

Open a BMP image from file

```c
#include "../../lv_examples.h"
#if LV_USE_BMP && LV_BUILD_EXAMPLES

/**
 * Open a BMP file from a file
 */
void lv_example_bmp_1(void)
{
    lv_obj_t * img = lv_img_create(lv_scr_act());
    /* Assuming a File system is attached to letter 'A'
     * E.g. set LV_USE_FS_STDIO 'A' in lv_conf.h */
#if LV_COLOR_DEPTH == 32
    lv_img_set_src(img, "A:lvgl/examples/libs/bmp/example_32bit.bmp");
#elif LV_COLOR_DEPTH == 16
    lv_img_set_src(img, "A:lvgl/examples/libs/bmp/example_16bit.bmp");
#endif
    lv_obj_center(img);

}

#endif
```

```python
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver
import fs_driver

fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'S')

img = lv.img(lv.scr_act())
# The File system is attached to letter 'S'

img.set_src("S:example_32bit.bmp")
img.center()
```

8.2.3 API

Functions

void **lv_bmp_init**(void)

8.3 JPG decoder

Allow the use of JPG images in LVGL. Besides that it also allows the use of a custom format, called Split JPG (SJPG), which can be decoded in more optimal way on embedded systems.

8.3.1 Overview

- Supports both normal JPG and the custom SJPG formats.
- Decoding normal JPG consumes RAM with the size fo the whole uncompressed image (recommended only for devices with more RAM)
- SJPG is a custom format based on "normal" JPG and specially made for LVGL.
- SJPG is 'split-jpeg' which is a bundle of small jpeg fragments with an sjpg header.
- SJPG size will be almost comparable to the jpg file or might be a slightly larger.
- File read from file and c-array are implemented.
- SJPEG frame fragment cache enables fast fetching of lines if available in cache.
- By default the sjpg image cache will be image width * 2 * 16 bytes (can be modified)
- Currently only 16 bit image format is supported (TODO)
- Only the required partion of the JPG and SJPG images are decoded, therefore they can't be zoomed or rotated.

8.3.2 Usage

If enabled in `lv_conf.h` by `LV_USE_SJPG` LVGL will register a new image decoder automatically so JPG and SJPG files can be directly used as image sources. For example:

```
lv_img_set_src(my_img, "S:path/to/picture.jpg");
```

Note that, a file system driver needs to registered to open images from files. Read more about it here or just enable one in `lv_conf.h` with `LV_USE_FS_...`

8.3.3 Converter

Converting JPG to C array

- Use lvgl online tool https://lvgl.io/tools/imageconverter
- Color format = RAW, output format = C Array

Converting JPG to SJPG

python3 and the PIL library required. (PIL can be installed with `pip3 install pillow`)

To create SJPG from JPG:

- Copy the image to convert into `lvgl/scripts`
- `cd lvgl/scripts`
- `python3 jpg_to_sjpg.py image_to_convert.jpg`. It creates both a C files and an SJPG image.

The expected result is:

```
Conversion started...

Input:
        image_to_convert.jpg
        RES = 640 x 480

Output:
        Time taken = 1.66 sec
        bin size = 77.1 KB
        walpaper.sjpg           (bin file)
        walpaper.c              (c array)

All good!
```

8.3.4 Example

Load an SJPG image

```
#include "../../lv_examples.h"
#if LV_USE_SJPG && LV_BUILD_EXAMPLES

/**
 * Load an SJPG image
 */
void lv_example_sjpg_1(void)
{
    lv_obj_t * wp;

    wp = lv_img_create(lv_scr_act());
    /* Assuming a File system is attached to letter 'A'
     * E.g. set LV_USE_FS_STDIO 'A' in lv_conf.h */
    lv_img_set_src(wp, "A:lvgl/examples/libs/sjpg/small_image.sjpg");
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver
import fs_driver

fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'S')
```

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```
wp = lv.img(lv.scr_act())
# The File system is attached to letter 'S'

wp.set_src("S:small_image.sjpg")
wp.center()
```

8.3.5 API

Functions

void **lv_split_jpeg_init**(void)

8.4 PNG decoder

Allow the use of PNG images in LVGL. This implementation uses lodepng library.

If enabled in `lv_conf.h` by `LV_USE_PNG` LVGL will register a new image decoder automatically so PNG files can be directly used as any other image sources.

Note that, a file system driver needs to registered to open images from files. Read more about it here or just enable one in `lv_conf.h` with `LV_USE_FS_...`

The whole PNG image is decoded so during decoding RAM equals to `image width x image height x 4` bytes are required.

As it might take significant time to decode PNG images LVGL's images caching feature can be useful.

8.4.1 Example

Open a PNG image from file and variable

```
#include "../../lv_examples.h"
#if LV_USE_PNG && LV_USE_IMG && LV_BUILD_EXAMPLES

/**
 * Open a PNG image from a file and a variable
 */
void lv_example_png_1(void)
{
    LV_IMG_DECLARE(img_wink_png);
    lv_obj_t * img;

    img = lv_img_create(lv_scr_act());
    lv_img_set_src(img, &img_wink_png);
    lv_obj_align(img, LV_ALIGN_LEFT_MID, 20, 0);

    img = lv_img_create(lv_scr_act());
    /* Assuming a File system is attached to letter 'A'
     * E.g. set LV_USE_FS_STDIO 'A' in lv_conf.h */
    lv_img_set_src(img, "A:lvgl/examples/libs/png/wink.png");
```

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```
    lv_obj_align(img, LV_ALIGN_RIGHT_MID, -20, 0);
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver
from img_wink_png import img_wink_png_map

img_wink_png = lv.img_dsc_t(
    {
        "header": {"always_zero": 0, "w": 50, "h": 50,  "cf": lv.COLOR_FORMAT.RAW_
↪ALPHA},
        "data_size": 5158,
        "data": img_wink_png_map,
    }
)
img1 = lv.img(lv.scr_act())
img1.set_src(img_wink_png)
img1.align(lv.ALIGN.RIGHT_MID, -250, 0)

# Create an image from the png file
try:
    with open('wink.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find wink.png")
    sys.exit()

wink_argb = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

img2 = lv.img(lv.scr_act())
img2.set_src(wink_argb)
img2.align(lv.ALIGN.RIGHT_MID, -150, 0)
```

8.4.2 API

Functions

void **lv_png_init**(void)

Register the PNG decoder functions in LVGL

8.5 GIF decoder

Allow using GIF images in LVGL. Based on https://github.com/lecram/gifdec

When enabled in `lv_conf.h` with `LV_USE_GIF` `lv_gif_create(parent)` can be used to create a gif widget.

`lv_gif_set_src(obj, src)` works very similarly to `lv_img_set_src`. As source, it also accepts images as variables (`lv_img_dsc_t`) or files.

8.5.1 Convert GIF files to C array

To convert a GIF file to byte values array use LVGL's online converter. Select "Raw" color format and "C array" Output format.

8.5.2 Use GIF images from file

For example:

```
lv_gif_set_src(obj, "S:path/to/example.gif");
```

Note that, a file system driver needs to be registered to open images from files. Read more about it here or just enable one in `lv_conf.h` with `LV_USE_FS_...`

8.5.3 Memory requirements

To decode and display a GIF animation the following amount of RAM is required:

- `LV_COLOR_DEPTH 8`: 3 x image width x image height
- `LV_COLOR_DEPTH 16`: 4 x image width x image height
- `LV_COLOR_DEPTH 32`: 5 x image width x image height

8.5.4 Example

Open a GIF image from file and variable

```
#include "../../lv_examples.h"
#if LV_USE_GIF && LV_BUILD_EXAMPLES

/**
 * Open a GIF image from a file and a variable
 */
void lv_example_gif_1(void)
{
    LV_IMG_DECLARE(img_bulb_gif);
    lv_obj_t * img;

    img = lv_gif_create(lv_scr_act());
    lv_gif_set_src(img, &img_bulb_gif);
    lv_obj_align(img, LV_ALIGN_LEFT_MID, 20, 0);

```

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```
    img = lv_gif_create(lv_scr_act());
    /* Assuming a File system is attached to letter 'A'
     * E.g. set LV_USE_FS_STDIO 'A' in lv_conf.h */
    lv_gif_set_src(img, "A:lvgl/examples/libs/gif/bulb.gif");
    lv_obj_align(img, LV_ALIGN_RIGHT_MID, -20, 0);
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver
import fs_driver
from img_bulb_gif import img_bulb_gif_map

fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'S')
#
# Open a GIF image from a file and a variable
#
img_bulb_gif = lv.img_dsc_t(
    {
        "header": {"always_zero": 0, "w": 0, "h": 0,  "cf": lv.COLOR_FORMAT.RAW},
        "data_size": 0,
        "data": img_bulb_gif_map,
    }
)
img1 = lv.gif(lv.scr_act())
img1.set_src(img_bulb_gif)
img1.align(lv.ALIGN.RIGHT_MID, -150, 0)

img2 = lv.gif(lv.scr_act())
# The File system is attached to letter 'S'

img2.set_src("S:bulb.gif")
img2.align(lv.ALIGN.RIGHT_MID, -250, 0)
```

8.5.5 API

Functions

lv_obj_t ***lv_gif_create**(*lv_obj_t* *parent)

void **lv_gif_set_src**(*lv_obj_t* *obj, const void *src)

void **lv_gif_restart**(*lv_obj_t* *gif)

Variables

const lv_obj_class_t **`lv_gif_class`**

struct **`lv_gif_t`**

Public Members

lv_img_t **`img`**

gd_GIF ***`gif`**

lv_timer_t ***`timer`**

lv_img_dsc_t **`imgdsc`**

uint32_t **`last_call`**

8.6 FreeType support

Interface to FreeType to generate font bitmaps run time.

8.6.1 Add FreeType to your project

First, Download FreeType from here.

There are two ways to use FreeType:

For UNIX

For UNIX systems, it is recommended to use the way of compiling and installing libraries.

- Enter the FreeType source code directory.
- `make`
- `sudo make install`
- Add include path: `/usr/include/freetype2` (for GCC: `-I/usr/include/freetype2 -L/usr/local/lib`)
- Link library: `freetype` (for GCC: `-L/usr/local/lib -lfreetype`)

For Embedded Devices

For embedded devices, it is more recommended to use the FreeType configuration file provided by LVGL, which only includes the most commonly used functions, which is very meaningful for saving limited FLASH space.

- Copy the FreeType source code to your project directory.
- Refer to the following `Makefile` for configuration:

```
# FreeType custom configuration header file
CFLAGS += -DFT2_BUILD_LIBRARY
CFLAGS += -DFT_CONFIG_MODULES_H=<lvgl/src/libs/freetype/ftmodule.h>
CFLAGS += -DFT_CONFIG_OPTIONS_H=<lvgl/src/libs/freetype/ftoption.h>

# FreeType include path
CFLAGS += -Ifreetype/include

# FreeType C source file
FT_CSRCS += freetype/src/base/ftbase.c
FT_CSRCS += freetype/src/base/ftbitmap.c
FT_CSRCS += freetype/src/base/ftdebug.c
FT_CSRCS += freetype/src/base/ftglyph.c
FT_CSRCS += freetype/src/base/ftinit.c
FT_CSRCS += freetype/src/cache/ftcache.c
FT_CSRCS += freetype/src/gzip/ftgzip.c
FT_CSRCS += freetype/src/sfnt/sfnt.c
FT_CSRCS += freetype/src/smooth/smooth.c
FT_CSRCS += freetype/src/truetype/truetype.c
CSRCS += $(FT_CSRCS)
```

8.6.2 Usage

Enable `LV_USE_FREETYPE` in `lv_conf.h`.

Cache configuration:

- `LV_FREETYPE_CACHE_SIZE` - Maximum memory(Bytes) used to cache font bitmap, outline, character maps, etc. **Note:** This value does not include the memory used by 'FT_Face' and 'FT_Size' objects
- `LV_FREETYPE_CACHE_FT_FACES` - Maximum open number of `FT_Face` objects.
- `LV_FREETYPE_CACHE_FT_SIZES` - Maximum open number of `FT_Size` objects.

When you are sure that all the used font sizes will not be greater than 256, you can enable `LV_FREETYPE_SBIT_CACHE`, which is much more memory efficient for small bitmaps.

By default, the FreeType extension doesn't use LVGL's file system. You can simply pass the path to the font as usual on your operating system or platform.

If you want FreeType to use lvgl's memory allocation and file system interface, you can enable `LV_FREETYPE_USE_LVGL_PORT` in `lv_conf.h`, convenient for unified management.

The font style supports *Italic* and **Bold** fonts processed by software, and can be set with reference to the following values:

- `LV_FREETYPE_FONT_STYLE_NORMAL` - Default style.
- `LV_FREETYPE_FONT_STYLE_ITALIC` - Italic style.
- `LV_FREETYPE_FONT_STYLE_BOLD` - Bold style.

They can be combined.eg: `LV_FREETYPE_FONT_STYLE_BOLD | LV_FREETYPE_FONT_STYLE_ITALIC`.

Use the `lv_freetype_font_create()` function to create a font. To delete a font, use `lv_freetype_font_del()`. For more detailed usage, please refer to example code.

8.6.3 Example

Open a front with FreeType

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES
#if LV_USE_FREETYPE

#if LV_FREETYPE_USE_LVGL_PORT
    #define PATH_PREFIX "A:"
#else
    #define PATH_PREFIX "./"
#endif

/**
 * Load a font with FreeType
 */
void lv_example_freetype_1(void)
{
    /*Create a font*/
    lv_font_t * font = lv_freetype_font_create(PATH_PREFIX "lvgl/examples/libs/
↪freetype/Lato-Regular.ttf",
                                               24,
                                               LV_FREETYPE_FONT_STYLE_NORMAL);

    if(!font) {
        LV_LOG_ERROR("freetype font create failed.");
        return;
    }

    /*Create style with the new font*/
    static lv_style_t style;
    lv_style_init(&style);
    lv_style_set_text_font(&style, font);
    lv_style_set_text_align(&style, LV_TEXT_ALIGN_CENTER);

    /*Create a label with the new style*/
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_obj_add_style(label, &style, 0);
    lv_label_set_text(label, "Hello world\nI'm a font created with FreeType");
    lv_obj_center(label);
}
#else

void lv_example_freetype_1(void)
{
    /*TODO
     *fallback for online examples*/

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "FreeType is not installed");
```

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```
    lv_obj_center(label);
}

#endif
#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver
import fs_driver

font = lv.freetype_font_create("./Lato-Regular.ttf", 24, lv.FREETYPE_FONT_STYLE.
↪NORMAL)

# Create style with the new font
style = lv.style_t()
style.init()
style.set_text_font(font)
style.set_text_align(lv.TEXT_ALIGN.CENTER)

# Create a label with the new style
label = lv.label(lv.scr_act())
label.add_style(style, 0)
label.set_text("Hello world\nI'm a font created with FreeType")
label.center()
```

8.6.4 Learn more

- FreeType tutorial
- LVGL's font interface

8.6.5 API

Enums

enum **lv_freetype_font_style_t**

Values:

enumerator **LV_FREETYPE_FONT_STYLE_NORMAL**

enumerator **LV_FREETYPE_FONT_STYLE_ITALIC**

enumerator **LV_FREETYPE_FONT_STYLE_BOLD**

Functions

lv_res_t **`lv_freetype_init`**(uint16_t max_faces, uint16_t max_sizes, uint32_t max_bytes)

Initialize the freetype library.

Parameters

- **`max_faces`** -- Maximum number of opened FT_Face objects managed by this cache instance. Use 0 for defaults.
- **`max_sizes`** -- Maximum number of opened FT_Size objects managed by this cache instance. Use 0 for defaults.
- **`max_bytes`** -- Maximum number of bytes to use for cached data nodes. Use 0 for defaults. Note that this value does not account for managed FT_Face and FT_Size objects.

Returns LV_RES_OK on success, otherwise LV_RES_INV.

void **`lv_freetype_uninit`**(void)

Uninitialize the freetype library

lv_font_t ***`lv_freetype_font_create`**(const char *pathname, uint16_t size, uint16_t style)

Create a freetype font.

Parameters

- **`pathname`** -- font file path.
- **`size`** -- font size.
- **`style`** -- font style(see lv_freetype_font_style_t for details).

Returns Created font, or NULL on failure.

void **`lv_freetype_font_del`**(lv_font_t *font)

Delete a freetype font.

Parameters **`font`** -- freetype font to be deleted.

8.7 Tiny TTF font engine

8.7.1 Usage

Allow using TrueType fonts LVGL. Based on https://github.com/nothings/stb

When enabled in `lv_conf.h` with `LV_USE_TINY_TTF` `lv_tiny_ttf_create_data(data, data_size, line_height)` can be used to create a TTF font instance at the specified line height. You can then use that font anywhere `lv_font_t` is accepted.

By default, the TTF or OTF file must be embedded as an array, either in a header, or loaded into RAM in order to function.

However, if `LV_TINY_TTF_FILE_SUPPORT` is enabled, `lv_tiny_ttf_create_file(path, line_height)` will also be available, allowing tiny_ttf to stream from a file. The file must remain open the entire time the font is being used.

After a font is created, you can change the size by using `lv_tiny_ttf_set_size(font, line_height)`.

By default, a font will use up to 4KB of cache to speed up rendering glyphs. This maximum can be changed by using `lv_tiny_ttf_create_data_ex(data, data_size, line_height, cache_size)` or `lv_tiny_ttf_create_file_ex(path, line_height, cache_size)` (when available). The cache size is indicated in bytes.

8.7.2 Example

Open a front with Tiny TTF from data array

```c
#include "../../lv_examples.h"
#if LV_USE_TINY_TTF && LV_BUILD_EXAMPLES

#include "ubuntu_font.h"

/**
 * Load a font with Tiny_TTF
 */
void lv_example_tiny_ttf_1(void)
{
    /*Create style with the new font*/
    static lv_style_t style;
    lv_style_init(&style);
    lv_font_t * font = lv_tiny_ttf_create_data(ubuntu_font, sizeof(ubuntu_font), 30);
    lv_style_set_text_font(&style, font);
    lv_style_set_text_align(&style, LV_TEXT_ALIGN_CENTER);

    /*Create a label with the new style*/
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_obj_add_style(label, &style, 0);
    lv_label_set_text(label, "Hello world\nI'm a font\ncreated\nwith Tiny TTF");
    lv_obj_center(label);
}
#endif
```

```python
from ubuntu_font import ubuntu_font
#
# Load a font with Tiny_TTF
#
#Create style with the new font
style = lv.style_t()
style.init()
font = lv.tiny_ttf_create_data(ubuntu_font, len(ubuntu_font), 30)
style.set_text_font(font)
style.set_text_align(lv.TEXT_ALIGN.CENTER)

# Create a label with the new style
label = lv.label(lv.scr_act())
label.add_style(style, 0)
label.set_text("Hello world\nI'm a font created with Tiny TTF")
label.center()
```

Load a font with Tiny_TTF from file

```c
#include "../../lv_examples.h"
#if LV_USE_TINY_TTF && LV_TINY_TTF_FILE_SUPPORT && LV_BUILD_EXAMPLES

/**
 * Load a font with Tiny_TTF from file
 */
void lv_example_tiny_ttf_2(void)
{
    /*Create style with the new font*/
    static lv_style_t style;
    lv_style_init(&style);
    lv_font_t * font = lv_tiny_ttf_create_file("A:lvgl/examples/libs/tiny_ttf/Ubuntu-
↪Medium.ttf", 30);
    lv_style_set_text_font(&style, font);
    lv_style_set_text_align(&style, LV_TEXT_ALIGN_CENTER);

    /*Create a label with the new style*/
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_obj_add_style(label, &style, 0);
    lv_label_set_text(label, "Hello world\nI'm a font\ncreated\nwith Tiny TTF");
    lv_obj_center(label);
}
#endif
```

```python
import fs_driver

# needed for dynamic font loading
fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'S')

# get the directory in which the script is running
try:
    script_path = __file__[:__file__.rfind('/')] if __file__.find('/') >= 0 else '.'
except NameError:
    script_path = ''

#
# Load a font with Tiny_TTF from file
#
# Create style with the new font
style = lv.style_t()
style.init()
font = lv.tiny_ttf_create_file("S:" + script_path + "/Ubuntu-Medium.ttf", 30)
style.set_text_font(font)
style.set_text_align(lv.TEXT_ALIGN.CENTER)

# Create a label with the new style
label = lv.label(lv.scr_act())
label.add_style(style, 0)
label.set_text("Hello world\nI'm a font created with Tiny TTF")
label.center()
```

8.7.3 API

Functions

lv_font_t ***lv_tiny_ttf_create_file**(const char *path, lv_coord_t line_height)

lv_font_t ***lv_tiny_ttf_create_file_ex**(const char *path, lv_coord_t line_height, size_t cache_size)

lv_font_t ***lv_tiny_ttf_create_data**(const void *data, size_t data_size, lv_coord_t line_height)

lv_font_t ***lv_tiny_ttf_create_data_ex**(const void *data, size_t data_size, lv_coord_t line_height, size_t cache_size)

void **lv_tiny_ttf_set_size**(lv_font_t *font, lv_coord_t line_height)

void **lv_tiny_ttf_destroy**(lv_font_t *font)

8.8 QR code

QR code generation with LVGL. Uses QR-Code-generator by nayuki.

8.8.1 Usage

Enable `LV_USE_QRCODE` in `lv_conf.h`.

Use `lv_qrcode_create()` to create a qrcode object, and use `lv_qrcode_update()` to generate a QR code.

If you need to re-modify the size and color, use `lv_qrcode_set_size()` and `lv_qrcode_set_dark/light_color()`, and call `lv_qrcode_update()` again to regenerate the QR code.

8.8.2 Notes

- QR codes with less data are smaller, but they scaled by an integer number to best fit to the given size.

8.8.3 Example

Create a QR Code

```
#include "../../lv_examples.h"
#if LV_USE_QRCODE && LV_BUILD_EXAMPLES

/**
 * Create a QR Code
 */
void lv_example_qrcode_1(void)
{
    lv_color_t bg_color = lv_palette_lighten(LV_PALETTE_LIGHT_BLUE, 5);
    lv_color_t fg_color = lv_palette_darken(LV_PALETTE_BLUE, 4);

    lv_obj_t * qr = lv_qrcode_create(lv_scr_act());
    lv_qrcode_set_size(qr, 150);
```

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```
    lv_qrcode_set_dark_color(qr, fg_color);
    lv_qrcode_set_light_color(qr, bg_color);

    /*Set data*/
    const char * data = "https://lvgl.io";
    lv_qrcode_update(qr, data, strlen(data));
    lv_obj_center(qr);

    /*Add a border with bg_color*/
    lv_obj_set_style_border_color(qr, bg_color, 0);
    lv_obj_set_style_border_width(qr, 5, 0);
}

#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver

bg_color = lv.palette_lighten(lv.PALETTE.LIGHT_BLUE, 5)
fg_color = lv.palette_darken(lv.PALETTE.BLUE, 4)

qr = lv.qrcode(lv.scr_act())
qr.set_size(150)
qr.set_dark_color(fg_color)
qr.set_light_color(bg_color)

# Set data
data = "https://lvgl.io"
qr.update(data,len(data))
qr.center()

# Add a border with bg_color
qr.set_style_border_color(bg_color, 0)
qr.set_style_border_width(5, 0)
```

8.8.4 API

Functions

lv_obj_t ***lv_qrcode_create**(*lv_obj_t* *parent)

Create an empty QR code (an `lv_canvas`) object.

Parameters **`parent`** -- point to an object where to create the QR code

Returns pointer to the created QR code object

void **lv_qrcode_set_size**(*lv_obj_t* *obj, lv_coord_t size)

Set QR code size.

Parameters

- **`obj`** -- pointer to a QR code object
- **`size`** -- width and height of the QR code

void **lv_qrcode_set_dark_color**(*lv_obj_t* *obj, lv_color_t color)

Set QR code dark color.

Parameters

- **obj** -- pointer to a QR code object
- **color** -- dark color of the QR code

void **lv_qrcode_set_light_color**(*lv_obj_t* *obj, lv_color_t color)

Set QR code light color.

Parameters

- **obj** -- pointer to a QR code object
- **color** -- light color of the QR code

lv_res_t **lv_qrcode_update**(*lv_obj_t* *obj, const void *data, uint32_t data_len)

Set the data of a QR code object

Parameters

- **obj** -- pointer to a QR code object
- **data** -- data to display
- **data_len** -- length of data in bytes

Returns LV_RES_OK: if no error; LV_RES_INV: on error

Variables

const lv_obj_class_t **lv_qrcode_class**

struct **lv_qrcode_t**

Public Members

lv_canvas_t **canvas**

lv_color_t **dark_color**

lv_color_t **light_color**

8.9 Barcode

Barcode generation with LVGL. Uses code128 by fhunleth.

8.9.1 Usage

Enable `LV_USE_BARCODE` in `lv_conf.h`.

Use `lv_barcode_create()` to create a barcode object, and use `lv_barcode_update()` to generate a barcode.

Call `lv_barcode_set_scale()` or `lv_barcode_set_dark/light_color()` to adjust scaling and color, and call `lv_barcode_update()` again to regenerate the barcode.

8.9.2 Notes

- It is best not to manually set the width of the barcode, because when the width of the object is lower than the width of the barcode, the display will be incomplete due to truncation.
- The scale adjustment can only be an integer multiple, for example, `lv_barcode_set_scale(barcode, 2)` means 2x scaling.

8.9.3 Example

Create a Barcode

```
#include "../../lv_examples.h"
#if LV_USE_BARCODE && LV_BUILD_EXAMPLES

/**
 * Create a Barcode
 */
void lv_example_barcode_1(void)
{
    lv_color_t bg_color = lv_palette_lighten(LV_PALETTE_LIGHT_BLUE, 5);
    lv_color_t fg_color = lv_palette_darken(LV_PALETTE_BLUE, 4);

    lv_obj_t * barcode = lv_barcode_create(lv_scr_act());
    lv_obj_set_height(barcode, 50);
    lv_obj_center(barcode);

    /*Set color*/
    lv_barcode_set_dark_color(barcode, lv_color_to32(fg_color));
    lv_barcode_set_light_color(barcode, lv_color_to32(bg_color));

    /*Add a border with bg_color*/
    lv_obj_set_style_border_color(barcode, bg_color, 0);
    lv_obj_set_style_border_width(barcode, 5, 0);

    /*Set data*/
    lv_barcode_update(barcode, "https://lvgl.io");
}

#endif
```

```python
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver

bg_color = lv.palette_lighten(lv.PALETTE.LIGHT_BLUE, 5)
fg_color = lv.palette_darken(lv.PALETTE.BLUE, 4)

barcode = lv.barcode(lv.scr_act())
barcode.set_height(50)
barcode.center()

# Set color
barcode.set_dark_color(fg_color)
barcode.set_light_color(bg_color)

# Add a border with bg_color
barcode.set_style_border_color(bg_color, 0)
barcode.set_style_border_width(5, 0)

# Set data
barcode.update("https://lvgl.io")
```

8.9.4 API

Functions

lv_obj_t ***lv_barcode_create**(*lv_obj_t* *parent)

Create an empty barcode (an `lv_canvas`) object.

Parameters **parent** -- point to an object where to create the barcode

Returns pointer to the created barcode object

void **lv_barcode_set_dark_color**(*lv_obj_t* *obj, *lv_color32_t* color)

Set the dark color of a barcode object

Parameters

- **obj** -- pointer to barcode object
- **color** -- dark color of the barcode

void **lv_barcode_set_light_color**(*lv_obj_t* *obj, *lv_color32_t* color)

Set the light color of a barcode object

Parameters

- **obj** -- pointer to barcode object
- **color** -- light color of the barcode

void **lv_barcode_set_scale**(*lv_obj_t* *obj, uint16_t scale)

Set the scale of a barcode object

Parameters

- **obj** -- pointer to barcode object
- **scale** -- scale factor

lv_res_t **`lv_barcode_update`**(*lv_obj_t* *obj, const char *data)

Set the data of a barcode object

Parameters

- **`obj`** -- pointer to barcode object
- **`data`** -- data to display

Returns LV_RES_OK: if no error; LV_RES_INV: on error

lv_color32_t **`lv_barcode_get_dark_color`**(*lv_obj_t* *obj)

Get the dark color of a barcode object

Parameters **`obj`** -- pointer to barcode object

Returns dark color of the barcode

lv_color32_t **`lv_barcode_get_light_color`**(*lv_obj_t* *obj)

Get the light color of a barcode object

Parameters **`obj`** -- pointer to barcode object

Returns light color of the barcode

uint16_t **`lv_barcode_get_scale`**(*lv_obj_t* *obj)

Get the scale of a barcode object

Parameters **`obj`** -- pointer to barcode object

Returns scale factor

Variables

const lv_obj_class_t **`lv_barcode_class`**

struct **`lv_barcode_t`**

Public Members

lv_canvas_t **`canvas`**

lv_color32_t **`dark_color`**

lv_color32_t **`light_color`**

uint16_t **`scale`**

8.10 Lottie player

Allows to use Lottie animations in LVGL. Taken from this base repository

LVGL provides the interface to Samsung/rlottie library's C API. That is the actual Lottie player is not part of LVGL, it needs to be built separately.

8.10.1 Build Rlottie

To build Samsung's Rlottie C++14-compatible compiler and optionally CMake 3.14 or higher is required.

To build on desktop you can follow the instructions from Rlottie's README. In the most basic case it looks like this:

```
mkdir rlottie_workdir
cd rlottie_workdir
git clone https://github.com/Samsung/rlottie.git
mkdir build
cd build
cmake ../rlottie
make -j
sudo make install
```

And finally add the `-lrlottie` flag to your linker.

On embedded systems you need to take care of integrating Rlottie to the given build system.

ESP-IDF example at bottom

8.10.2 Usage

You can use animation from files or raw data (text). In either case first you need to enable `LV_USE_RLOTTIE` in `lv_conf.h`.

The `width` and `height` of the object be set in the *create* function and the animation will be scaled accordingly.

Use Rlottie from file

To create a Lottie animation from file use:

```
  lv_obj_t * lottie = lv_rlottie_create_from_file(parent, width, height, "path/to/
↪lottie.json");
```

Note that, Rlottie uses the standard STDIO C file API, so you can use the path "normally" and no LVGL specific driver letter is required.

Use Rlottie from raw string data

`lv_example_rlottie_approve.c` contains an example animation in raw format. Instead storing the JSON string a hex array is stored for the following reasons:

- avoid escaping `"` in the JSON file
- some compilers don't support very long strings

`lvgl/scripts/filetohex.py` can be used to convert a Lottie file a hex array. E.g.:

```
./filetohex.py path/to/lottie.json > out.txt
```

To create an animation from raw data:

```
extern const uint8_t lottie_data[];
lv_obj_t* lottie = lv_rlottie_create_from_raw(parent, width, height, (const char␣
↪*)lottie_data);
```

8.10.3 Getting animations

Lottie is standard and popular format so you can find many animation files on the web. For example: https://lottiefiles.com/

You can also create your own animations with Adobe After Effects or similar software.

8.10.4 Controlling animations

LVGL provides two functions to control the animation mode: `lv_rlottie_set_play_mode` and `lv_rlottie_set_current_frame`. You'll combine your intentions when calling the first method, like in these examples:

```
lv_obj_t * lottie = lv_rlottie_create_from_file(scr, 128, 128, "test.json");
lv_obj_center(lottie);
// Pause to a specific frame
lv_rlottie_set_current_frame(lottie, 50);
lv_rlottie_set_play_mode(lottie, LV_RLOTTIE_CTRL_PAUSE); // The specified frame will␣
↪be displayed and then the animation will pause

// Play backward and loop
lv_rlottie_set_play_mode(lottie, LV_RLOTTIE_CTRL_PLAY | LV_RLOTTIE_CTRL_BACKWARD | LV_
↪RLOTTIE_CTRL_LOOP);

// Play forward once (no looping)
lv_rlottie_set_play_mode(lottie, LV_RLOTTIE_CTRL_PLAY | LV_RLOTTIE_CTRL_FORWARD);
```

The default animation mode is **play forward with loop**.

If you don't enable looping, a `LV_EVENT_READY` is sent when the animation can not make more progress without looping.

To get the number of frames in an animation or the current frame index, you can cast the `lv_obj_t` instance to a `lv_rlottie_t` instance and inspect the `current_frame` and `total_frames` members.

8.10.5 ESP-IDF Example

Background

Rlottie can be expensive to render on embedded hardware. Lottie animations tend to use a large amount of CPU time and can use large portions of RAM. This will vary from lottie to lottie but in general for best performance:

- Limit total # of frames in the animation
- Where possible, try to avoid bezier type animations
- Limit animation render size

If your ESP32 chip does not have SPIRAM you will face severe limitations in render size.

To give a better idea on this, lets assume you want to render a 240x320 lottie animation.

In order to pass initialization of the lv_rlottie_t object, you need 240x320x32/8 (307k) available memory. The latest ESP32-S3 has 256kb RAM available for this (before freeRtos and any other initialization starts taking chunks out). So while you can probably start to render a 50x50 animation without SPIRAM, PSRAM is highly recommended.

Additionally, while you might be able to pass initialization of the lv_rlottie_t object, as rlottie renders frame to frame, this consumes additional memory. A 30 frame animation that plays over 1 second probably has minimal issues, but a 300 frame animation playing over 10 seconds could very easily crash due to lack of memory as rlottie renders, depending on the complexity of the animation.

Rlottie will not compile for the IDF using the -02 compiler option at this time.

For stability in lottie animations, I found that they run best in the IDF when enabling LV_MEM_CUSTOM (using stdlib.h)

For all its faults, when running right-sized animations, they provide a wonderful utility to LVGL on embedded LCDs and can look really good when done properly.

When picking/designing a lottie animation consider the following limitations:

- Build the lottie animation to be sized for the intended size - it can scale/resize, but performance will be best when the base lottie size is as intended
- Limit total number of frames, the longer the lottie animation is, the more memory it will consume for rendering (rlottie consumes IRAM for rendering)
- Build the lottie animation for the intended frame rate - default lottie is 60fps, embedded LCDs likely wont go above 30fps

IDF Setup

Where the LVGL simulator uses the installed rlottie lib, the IDF works best when using rlottie as a submodule under the components directory.

```
cd 'your/project/directory'
git add submodule
git add submodule https://github.com/Samsung/rlottie.git ./components/rlottie/rlottie
git submodule update --init --recursive
```

Now, Rlottie is available as a component in the IDF, but it requires some additional changes and a CMakeLists file to tell the IDF how to compile.

Rlottie patch file

Rlottie relies on a dynamic linking for an image loader lib. This needs to be disabled as the IDF doesn't play nice with dynamic linking.

A patch file is available in lvgl uner: /env_support/esp/rlottie/0001-changes-to-compile-with-esp-idf.patch

Apply the patch file to your rlottie submodule.

CMakeLists for IDF

An example CMakeLists file has been provided at /env_support/esp/rlottie/CMakeLists.txt

Copy this CMakeLists file to 'your-project-directory'/components/rlottie/

In addition to the component CMakeLists file, you'll also need to tell your project level CMakeLists in your IDF project to require rlottie:

```
REQUIRES "lvgl" "rlottie"
```

From here, you should be able to use lv_rlottie objects in your ESP-IDF project as any other widget in LVGL ESP examples. Please remember that these animations can be highly resource constrained and this does not guarantee that every animation will work.

Additional Rlottie considerations in ESP-IDF

While unecessary, removing the rlottie/rlottie/example folder can remove many un-needed files for this embedded LVGL application

From here, you can use the relevant LVGL lv_rlottie functions to create lottie animations in LVGL on embedded hardware!

Please note, that while lottie animations are capable of running on many ESP chips, below is recommended for best performance.

- ESP32-S3-WROOM-1-N16R8
  - 16mb quad spi flash
  - 8mb octal spi PSRAM
- IDF4.4 or higher

The Esp-box devkit meets this spec and https://github.com/espressif/esp-box is a great starting point to adding lottie animations.

you'll need to enable LV_USE_RLOTTIE through idf.py menuconfig under LVGL component settings.

Additional changes to make use of SPIRAM

lv_alloc/realloc do not make use of SPIRAM. Given the high memory usage of lottie animations, it is recommended to shift as much out of internal DRAM into SPIRAM as possible. In order to do so, SPIRAM will need to be enabled in the menuconfig options for your given espressif chip.

There may be a better solution for this, but for the moment the recommendation is to make local modifications to the lvgl component in your espressif project. This is as simple as swapping lv_alloc/lv_realloc calls in lv_rlottie.c with heap_caps_malloc (for IDF) with the appropriate MALLOC_CAP call - for SPIRAM usage this is MALLOC_CAP_SPIRAM.

```
rlottie->allocated_buf = heap_caps_malloc(allocaled_buf_size+1, MALLOC_CAP_SPIRAM);
```

8.10.6 Example

Load a Lottie animation from raw data

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES
#if LV_USE_RLOTTIE

/**
 * Load an lottie animation from flash
 */
void lv_example_rlottie_1(void)
{
    extern const uint8_t lv_example_rlottie_approve[];
    lv_obj_t * lottie = lv_rlottie_create_from_raw(lv_scr_act(), 100, 100, (const␣
↪void *)lv_example_rlottie_approve);
    lv_obj_center(lottie);
}

#else
void lv_example_rlottie_1(void)
{
    /*TODO
     *fallback for online examples*/

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Rlottie is not installed");
    lv_obj_center(label);
}

#endif
#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver
#
# Load a lottie animation from flash
#
from lv_example_rlottie_approve import lv_example_rlottie_approve

lottie = lv.rlottie_create_from_raw(lv.scr_act(), 100, 100, lv_example_rlottie_
↪approve)
lottie.center()
```

Load a Lottie animation from a file

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES
#if LV_USE_RLOTTIE

/**
 * Load an lottie animation from file
 */
void lv_example_rlottie_2(void)
{
    /*The rlottie library uses STDIO file API, so there is no driver letter for LVGL*/
    lv_obj_t * lottie = lv_rlottie_create_from_file(lv_scr_act(), 100, 100,
                                                   "lvgl/examples/libs/rlottie/lv_
↪example_rlottie_approve.json");
    lv_obj_center(lottie);
}

#else
void lv_example_rlottie_2(void)
{
    /*TODO
     *fallback for online examples*/

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "Rlottie is not installed");
    lv_obj_center(label);
}

#endif
#endif
```

```
#!/opt/bin/lv_micropython -i
import lvgl as lv
import display_driver

lottie = lv.rlottie_create_from_file(lv.scr_act(), 100, 100,"lv_example_rlottie_
↪approve.json")
lottie.center()
```

8.10.7 API

Enums

enum **lv_rlottie_ctrl_t**

Values:

enumerator **LV_RLOTTIE_CTRL_FORWARD**

enumerator **LV_RLOTTIE_CTRL_BACKWARD**

enumerator **LV_RLOTTIE_CTRL_PAUSE**

enumerator **LV_RLOTTIE_CTRL_PLAY**

enumerator **LV_RLOTTIE_CTRL_LOOP**

Functions

lv_obj_t ***lv_rlottie_create_from_file**(*lv_obj_t* *parent, lv_coord_t width, lv_coord_t height, const char *path)

lv_obj_t ***lv_rlottie_create_from_raw**(*lv_obj_t* *parent, lv_coord_t width, lv_coord_t height, const char *rlottie_desc)

void **lv_rlottie_set_play_mode**(*lv_obj_t* *rlottie, const *lv_rlottie_ctrl_t* ctrl)

void **lv_rlottie_set_current_frame**(*lv_obj_t* *rlottie, const size_t goto_frame)

Variables

const lv_obj_class_t **lv_rlottie_class**

struct **lv_rlottie_t**

Public Members

lv_img_t **img_ext**

struct Lottie_Animation_S ***animation**

lv_timer_t ***task**

lv_img_dsc_t **imgdsc**

size_t **total_frames**

size_t **current_frame**

size_t **framerate**

uint32_t ***allocated_buf**

size_t **allocated_buffer_size**

size_t **scanline_width**

lv_rlottie_ctrl_t **play_ctrl**

size_t **dest_frame**

8.11 FFmpeg support

FFmpeg A complete, cross-platform solution to record, convert and stream audio and video.

8.11.1 Install FFmpeg

- Download FFmpeg from here
- `./configure --disable-all --disable-autodetect --disable-podpages --disable-asm --enable-avcodec --enable-avformat --enable-decoders --enable-encoders --enable-demuxers --enable-parsers --enable-protocol='file' --enable-swscale --enable-zlib`
- `make`
- `sudo make install`

8.11.2 Add FFmpeg to your project

- Add library: `FFmpeg` (for GCC: `-lavformat -lavcodec -lavutil -lswscale -lm -lz -lpthread`)

8.11.3 Usage

Enable `LV_USE_FFMPEG` in `lv_conf.h`.

See the examples below.

Note that, the FFmpeg extension doesn't use LVGL's file system. You can simply pass the path to the image or video as usual on your operating system or platform.

8.11.4 Example

Decode image

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES
#if LV_USE_FFMPEG


/**
 * Open an image from a file
 */
void lv_example_ffmpeg_1(void)
{
```

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```
    lv_obj_t * img = lv_img_create(lv_scr_act());
    lv_img_set_src(img, "./lvgl/examples/libs/ffmpeg/ffmpeg.png");
    lv_obj_center(img);
}

#else

void lv_example_ffmpeg_1(void)
{
    /*TODO
     *fallback for online examples*/

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "FFmpeg is not installed");
    lv_obj_center(label);
}

#endif
#endif
```

```
#!/opt/bin/lv_micropython-ffmpeg -i
import sys
import lvgl as lv
import display_driver

try:
    #
    # Open an image from a file
    #
    img = lv.img(lv.scr_act())
    img.set_src("ffmpeg.png")
    img.center()
except Exception as e:
    print(e)
    # TODO
    # fallback for online examples

    label = lv.label(lv.scr_act())
    label.set_text("FFmpeg is not installed")
    label.center()
```

Decode video

```
#include "../../lv_examples.h"
#if LV_BUILD_EXAMPLES
#if LV_USE_FFMPEG

/**
 * Open a video from a file
 */
void lv_example_ffmpeg_2(void)
{
    /*birds.mp4 is downloaded from http://www.videezy.com (Free Stock Footage by␣
↪Videezy!)
```

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```
     *https://www.videezy.com/abstract/44864-silhouettes-of-birds-over-the-sunset*/
    lv_obj_t * player = lv_ffmpeg_player_create(lv_scr_act());
    lv_ffmpeg_player_set_src(player, "./lvgl/examples/libs/ffmpeg/birds.mp4");
    lv_ffmpeg_player_set_auto_restart(player, true);
    lv_ffmpeg_player_set_cmd(player, LV_FFMPEG_PLAYER_CMD_START);
    lv_obj_center(player);
}

#else

void lv_example_ffmpeg_2(void)
{
    /*TODO
     *fallback for online examples*/

    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "FFmpeg is not installed");
    lv_obj_center(label);
}

#endif
#endif
```

```
#!/opt/bin/lv_micropython-ffmpeg -i
import sys
import lvgl as lv
import display_driver

#
# Open a video from a file
#

# birds.mp4 is downloaded from http://www.videezy.com (Free Stock Footage by Videezy!)
# https://www.videezy.com/abstract/44864-silhouettes-of-birds-over-the-sunset
player = lv.ffmpeg_player(lv.scr_act())
player.player_set_src("birds.mp4")
player.player_set_auto_restart(True)
player.player_set_cmd(lv.ffmpeg_player.PLAYER_CMD.START)
# player.player_set_cmd(0)
player.center()
```

8.11.5 API

Enums

enum **`lv_ffmpeg_player_cmd_t`**

Values:

enumerator **`LV_FFMPEG_PLAYER_CMD_START`**

enumerator **`LV_FFMPEG_PLAYER_CMD_STOP`** enumerator **`LV_FFMPEG_PLAYER_CMD_PAUSE`**

enumerator **`LV_FFMPEG_PLAYER_CMD_RESUME`**

enumerator **`_LV_FFMPEG_PLAYER_CMD_LAST`**

Functions

void **`lv_ffmpeg_init`**(void)

Register FFMPEG image decoder

int **`lv_ffmpeg_get_frame_num`**(const char *path)

Get the number of frames contained in the file

Parameters **`path`** -- image or video file name

Returns Number of frames, less than 0 means failed

lv_obj_t ***`lv_ffmpeg_player_create`**(*lv_obj_t* *parent)

Create ffmpeg_player object

Parameters **`parent`** -- pointer to an object, it will be the parent of the new player

Returns pointer to the created ffmpeg_player

lv_res_t **`lv_ffmpeg_player_set_src`**(*lv_obj_t* *obj, const char *path)

Set the path of the file to be played

Parameters

- **`obj`** -- pointer to a ffmpeg_player object
- **`path`** -- video file path

Returns LV_RES_OK: no error; LV_RES_INV: can't get the info.

void **`lv_ffmpeg_player_set_cmd`**(*lv_obj_t* *obj, *lv_ffmpeg_player_cmd_t* cmd)

Set command control video player

Parameters

- **`obj`** -- pointer to a ffmpeg_player object
- **`cmd`** -- control commands

void **`lv_ffmpeg_player_set_auto_restart`**(*lv_obj_t* *obj, bool en)

Set the video to automatically replay

Parameters

- **`obj`** -- pointer to a ffmpeg_player object
- **`en`** -- true: enable the auto restart

Variables

const lv_obj_class_t **lv_ffmpeg_player_class**

struct **lv_ffmpeg_player_t**

Public Members

lv_img_t **img**

lv_timer_t ***timer**

lv_img_dsc_t **imgdsc**

bool **auto_restart**

struct ffmpeg_context_s ***ffmpeg_ctx**

CHAPTER NINE

OTHERS

9.1 Snapshot

Snapshot provides APIs to take snapshot image for LVGL object together with its children. The image will look exactly like the object.

9.1.1 Usage

Simply call API `lv_snapshot_take` to generate the image descriptor which can be set as image object src using `lv_img_set_src`.

Note, only below color formats are supported for now:

- LV_IMG_CF_TRUE_COLOR
- LV_IMG_CF_TRUE_COLOR_ALPHA
- LV_IMG_CF_ALPHA_8BIT

Free the Image

The memory `lv_snapshot_take` uses are dynamically allocated using `lv_mem_alloc`. Use API `lv_snapshot_free` to free the memory it takes. This will firstly free memory the image data takes, then the image descriptor.

Take caution to free the snapshot but not delete the image object. Before free the memory, be sure to firstly unlink it from image object, using `lv_img_set_src(NULL)` and `lv_img_cache_invalidate_src(src)`.

Below code snippet explains usage of this API.

```
void update_snapshot(lv_obj_t * obj, lv_obj_t * img_snapshot)
{
    lv_img_dsc_t* snapshot = (void*)lv_img_get_src(img_snapshot);
    if(snapshot) {
        lv_snapshot_free(snapshot);
    }
    snapshot = lv_snapshot_take(obj, LV_IMG_CF_TRUE_COLOR_ALPHA);
    lv_img_set_src(img_snapshot, snapshot);
}
```

Use Existing Buffer

If the snapshot needs update now and then, or simply caller provides memory, use API `lv_res_t lv_snapshot_take_to_buf(lv_obj_t * obj, lv_img_cf_t cf, lv_img_dsc_t * dsc, void * buf, uint32_t buff_size);` for this case. It's caller's responsibility to alloc/free the memory.

If snapshot is generated successfully, the image descriptor is updated and image data will be stored to provided `buf`.

Note that snapshot may fail if provided buffer is not enough, which may happen when object size changes. It's recommended to use API `lv_snapshot_buf_size_needed` to check the needed buffer size in byte firstly and resize the buffer accordingly.

9.1.2 Example

Simple snapshot example

```c
#include "../../lv_examples.h"
#if LV_USE_SNAPSHOT && LV_BUILD_EXAMPLES

static void event_cb(lv_event_t * e)
{
    lv_obj_t * snapshot_obj = lv_event_get_user_data(e);
    lv_obj_t * img = lv_event_get_target(e);

    if(snapshot_obj) {
        lv_img_dsc_t * snapshot = (void *)lv_img_get_src(snapshot_obj);
        if(snapshot) {
            lv_snapshot_free(snapshot);
        }

        /*Update the snapshot, we know parent of object is the container.*/
        snapshot = lv_snapshot_take(img->parent, LV_COLOR_FORMAT_NATIVE_ALPHA);
        if(snapshot == NULL)
            return;
        lv_img_set_src(snapshot_obj, snapshot);
    }
}

void lv_example_snapshot_1(void)
{
    LV_IMG_DECLARE(img_star);
    lv_obj_t * root = lv_scr_act();
    lv_obj_set_style_bg_color(root, lv_palette_main(LV_PALETTE_LIGHT_BLUE), 0);

    /*Create an image object to show snapshot*/
    lv_obj_t * snapshot_obj = lv_img_create(root);
    lv_obj_set_style_bg_color(snapshot_obj, lv_palette_main(LV_PALETTE_PURPLE), 0);
    lv_obj_set_style_bg_opa(snapshot_obj, LV_OPA_100, 0);
    lv_img_set_zoom(snapshot_obj, 128);
    lv_img_set_angle(snapshot_obj, 300);

    /*Create the container and its children*/
    lv_obj_t * container = lv_obj_create(root);

    lv_obj_center(container);
    lv_obj_set_size(container, 180, 180);
```

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```
    lv_obj_set_flex_flow(container, LV_FLEX_FLOW_ROW_WRAP);
    lv_obj_set_flex_align(container, LV_FLEX_ALIGN_SPACE_EVENLY, LV_FLEX_ALIGN_CENTER,
↪ LV_FLEX_ALIGN_CENTER);
    lv_obj_set_style_radius(container, 50, 0);
    lv_obj_t * img;
    int i;
    for(i = 0; i < 4; i++) {
        img = lv_img_create(container);
        lv_img_set_src(img, &img_star);
        lv_obj_set_style_bg_color(img, lv_color_black(), 0);
        lv_obj_set_style_bg_opa(img, LV_OPA_COVER, 0);
        lv_obj_set_style_transform_zoom(img, 400, LV_STATE_PRESSED);
        lv_obj_add_flag(img, LV_OBJ_FLAG_CLICKABLE);
        lv_obj_add_event(img, event_cb, LV_EVENT_PRESSED, snapshot_obj);
        lv_obj_add_event(img, event_cb, LV_EVENT_RELEASED, snapshot_obj);
    }
}

#endif
```

```
import gc
import lvgl as lv

# Measure memory usage
gc.enable()
gc.collect()
mem_free = gc.mem_free()

label = lv.label(lv.scr_act())
label.align(lv.ALIGN.BOTTOM_MID, 0, -10)
label.set_text(" memory free:" + str(mem_free/1024) + " kB")

# Create an image from the png file
try:
    with open('../../assets/img_star.png','rb') as f:
        png_data = f.read()
except:
    print("Could not find star.png")
    sys.exit()

img_star = lv.img_dsc_t({
  'data_size': len(png_data),
  'data': png_data
})

def event_cb(e, snapshot_obj):
    img = e.get_target_obj()

    if snapshot_obj:
        # no need to free the old source for snapshot_obj, gc will free it for us.

        # take a new snapshot, overwrite the old one
        dsc = lv.snapshot_take(img.get_parent(), lv.img.CF.TRUE_COLOR_ALPHA)
        snapshot_obj.set_src(dsc)

    gc.collect()
```

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```
    mem_used = mem_free - gc.mem_free()
    label.set_text("memory used:" + str(mem_used/1024) + " kB")

root = lv.scr_act()
root.set_style_bg_color(lv.palette_main(lv.PALETTE.LIGHT_BLUE), 0)

# Create an image object to show snapshot
snapshot_obj = lv.img(root)
snapshot_obj.set_style_bg_color(lv.palette_main(lv.PALETTE.PURPLE), 0)
snapshot_obj.set_style_bg_opa(lv.OPA.COVER, 0)
snapshot_obj.set_zoom(128)

# Create the container and its children
container = lv.obj(root)
container.align(lv.ALIGN.CENTER, 0, 0)
container.set_size(180, 180)
container.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)
container.set_flex_align(lv.FLEX_ALIGN.SPACE_EVENLY, lv.FLEX_ALIGN.CENTER, lv.FLEX_
↪ALIGN.CENTER)
container.set_style_radius(50, 0)

for i in range(4):
    img = lv.img(container)
    img.set_src(img_star)
    img.set_style_bg_color(lv.palette_main(lv.PALETTE.GREY), 0)
    img.set_style_bg_opa(lv.OPA.COVER, 0)
    img.set_style_transform_zoom(400, lv.STATE.PRESSED)
    img.add_flag(img.FLAG.CLICKABLE)
    img.add_event(lambda e: event_cb(e, snapshot_obj), lv.EVENT.PRESSED, None)
    img.add_event(lambda e: event_cb(e, snapshot_obj), lv.EVENT.RELEASED, None)
```

9.1.3 API

Functions

lv_img_dsc_t ***lv_snapshot_take**(*lv_obj_t* *obj, *lv_color_format_t* cf)

Take snapshot for object with its children.

Parameters

- **obj** -- The object to generate snapshot.
- **cf** -- color format for generated image.

Returns a pointer to an image descriptor, or NULL if failed.

void **lv_snapshot_free**(*lv_img_dsc_t* *dsc)

Free the snapshot image returned by *lv_snapshot_take*

It will firstly free the data image takes, then the image descriptor.

Parameters **dsc** -- The image descriptor generated by lv_snapshot_take.

uint32_t **lv_snapshot_buf_size_needed**(*lv_obj_t* *obj, *lv_color_format_t* cf)

Get the buffer needed for object snapshot image.

Parameters

- **obj** -- The object to generate snapshot.
- **cf** -- color format for generated image.

Returns the buffer size needed in bytes

lv_res_t **lv_snapshot_take_to_buf**(*lv_obj_t* *obj, *lv_color_format_t* cf, *lv_img_dsc_t* *dsc, void *buf, uint32_t buff_size)

Take snapshot for object with its children, save image info to provided buffer.

Parameters

- **obj** -- The object to generate snapshot.
- **cf** -- color format for generated image.
- **dsc** -- image descriptor to store the image result.
- **buff** -- the buffer to store image data.
- **buff_size** -- provided buffer size in bytes.

Returns LV_RES_OK on success, LV_RES_INV on error.

9.2 Monkey

A simple monkey test. Use random input to stress test the application.

9.2.1 Usage

Enable `LV_USE_MONKEY` in `lv_conf.h`.

First configure monkey, use `lv_monkey_config_t` to define the configuration structure, set the `type` (check *input devices* for the supported types), and then set the range of `period_range` and `input_range`, the monkey will output random operations at random times within this range. Call `lv_monkey_create` to create monkey. Finally call `lv_monkey_set_enable(monkey, true)` to enable monkey.

If you want to pause the monkey, call `lv_monkey_set_enable(monkey, false)`. To delete the monkey, call `lv_monkey_del(monkey)`.

Note that `input_range` has different meanings in different `type`:

- `LV_INDEV_TYPE_POINTER` No effect, click randomly within the pixels of the screen resolution.
- `LV_INDEV_TYPE_ENCODER` The minimum and maximum values of `enc_diff`.
- `LV_INDEV_TYPE_BUTTON` The minimum and maximum values of `btn_id`. Use `lv_monkey_get_indev()` to get the input device, and use `lv_indev_set_button_points()` to map the key ID to the coordinates.
- `LV_INDEV_TYPE_KEYPAD` No effect, Send random *Keys*.

9.2.2 Example

Touchpad monkey example

```
#include "../../lv_examples.h"
#if LV_USE_MONKEY && LV_BUILD_EXAMPLES

void lv_example_monkey_1(void)
{
    /*Create pointer monkey test*/
    lv_monkey_config_t config;
    lv_monkey_config_init(&config);
    config.type = LV_INDEV_TYPE_POINTER;
    config.period_range.min = 10;
    config.period_range.max = 100;
    lv_monkey_t * monkey = lv_monkey_create(&config);

    /*Start monkey test*/
    lv_monkey_set_enable(monkey, true);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/others/
↪monkey/lv_example_monkey_1.py
```

Encoder monkey example

```
#include "../../lv_examples.h"
#if LV_USE_MONKEY && LV_BUILD_EXAMPLES

void lv_example_monkey_2(void)
{
    /*Create encoder monkey test*/
    lv_monkey_config_t config;
    lv_monkey_config_init(&config);
    config.type = LV_INDEV_TYPE_ENCODER;
    config.period_range.min = 50;
    config.period_range.max = 500;
    config.input_range.min = -5;
    config.input_range.max = 5;
    lv_monkey_t * monkey = lv_monkey_create(&config);

    /*Set the default group*/
    lv_group_t * group = lv_group_create();
    lv_indev_set_group(lv_monkey_get_indev(monkey), group);
    lv_group_set_default(group);

    /*Start monkey test*/
    lv_monkey_set_enable(monkey, true);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/others/
↪monkey/lv_example_monkey_2.py
```

Button monkey example

```
#include "../../lv_examples.h"
#if LV_USE_MONKEY && LV_BUILD_EXAMPLES

void lv_example_monkey_3(void)
{
    static lv_point_t btn_points[3];
    lv_coord_t hor_res = LV_HOR_RES;

    /*Create button monkey test*/
    lv_monkey_config_t config;
    lv_monkey_config_init(&config);
    config.type = LV_INDEV_TYPE_BUTTON;
    config.period_range.min = 50;
    config.period_range.max = 500;
    config.input_range.min = 0;
    config.input_range.max = sizeof(btn_points) / sizeof(lv_point_t) - 1;
    lv_monkey_t * monkey = lv_monkey_create(&config);

    /*Set the coordinates bound to the button*/
    btn_points[0].x = hor_res / 4;
    btn_points[0].y = 10;
    btn_points[1].x = hor_res / 2;
    btn_points[1].y = 10;
    btn_points[2].x = hor_res * 3 / 4;
    btn_points[2].y = 10;

    lv_indev_set_button_points(lv_monkey_get_indev(monkey), btn_points);

    /*Start monkey test*/
    lv_monkey_set_enable(monkey, true);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/others/
↪monkey/lv_example_monkey_3.py
```

9.2.3 API

Typedefs

typedef struct _lv_monkey **`lv_monkey_t`**

Functions

void **`lv_monkey_config_init`**(*lv_monkey_config_t* *config)

Initialize a monkey config with default values

Parameters **`config`** -- pointer to '*lv_monkey_config_t*' variable to initialize

lv_monkey_t ***`lv_monkey_create`**(const *lv_monkey_config_t* *config)

Create monkey for test

Parameters **`config`** -- pointer to '*lv_monkey_config_t*' variable

Returns pointer to the created monkey

lv_indev_t ***`lv_monkey_get_indev`**(*lv_monkey_t* *monkey)

Get monkey input device

Parameters **`monkey`** -- pointer to a monkey

Returns pointer to the input device

void **`lv_monkey_set_enable`**(*lv_monkey_t* *monkey, bool en)

Enable monkey

Parameters

- **`monkey`** -- pointer to a monkey
- **`en`** -- set to true to enable

bool **`lv_monkey_get_enable`**(*lv_monkey_t* *monkey)

Get whether monkey is enabled

Parameters **`monkey`** -- pointer to a monkey

Returns return true if monkey enabled

void **`lv_monkey_set_user_data`**(*lv_monkey_t* *monkey, void *user_data)

Set the user_data field of the monkey

Parameters

- **`monkey`** -- pointer to a monkey
- **`user_data`** -- pointer to the new user_data.

void ***`lv_monkey_get_user_data`**(*lv_monkey_t* *monkey)

Get the user_data field of the monkey

Parameters **`monkey`** -- pointer to a monkey

Returns the pointer to the user_data of the monkey

void **`lv_monkey_del`**(*lv_monkey_t* *monkey)

Delete monkey

Parameters **`monkey`** -- pointer to monkey

struct **`lv_monkey_config_t`**

Public Members

lv_indev_type_t **type**

< Input device type Monkey execution period

uint32_t **min**

uint32_t **max**

struct *lv_monkey_config_t*::[anonymous] **period_range**

The range of input value

int32_t **min**

int32_t **max**

struct *lv_monkey_config_t*::[anonymous] **input_range**

9.3 Grid navigation

Grid navigation (gridnav for short) is a feature that changes the currently focused child object as arrow keys are pressed.

If the children are arranged into a grid-like layout then the up, down, left and right arrows move focus to the nearest sibling in the respective direction.

It doesn't matter how the children are positioned, as only the current x and y coordinates are considered. This means that gridnav works with manually positioned children, as well as *Flex* and *Grid* layouts.

Gridnav also works if the children are arranged into a single row or column. That makes it useful, for example, to simplify navigation on a *List widget*.

Gridnav assumes that the object to which gridnav is added is part of a group. This way, if the object with gridnav is focused, the arrow key presses are automatically forwarded to the object so that gridnav can process the arrow keys.

To move the focus to the next widget of the group use `LV_KEY_NEXT/PREV` or `lv_group_focus_next/prev()` or the `TAB` key on keyboard as usual.

If the container is scrollable and the focused child is out of the view, gridnav will automatically scroll the child into view.

9.3.1 Usage

To add the gridnav feature to an object use `lv_gridnav_add(cont, flags)`.

`flags` control the behavior of gridnav:

- `LV_GRIDNAV_CTRL_NONE` Default settings
- `LV_GRIDNAV_CTRL_ROLLOVER` If there is no next/previous object in a direction, the focus goes to the object in the next/previous row (on left/right keys) or first/last row (on up/down keys

- `LV_GRIDNAV_CTRL_SCROLL_FIRST` If an arrow is pressed and the focused object can be scrolled in that direction then it will be scrolled instead of going to the next/previous object. If there is no more room for scrolling the next/previous object will be focused normally

`lv_gridnav_remove(cont)` Removes gridnav from an object.

9.3.2 Focusable objects

An object needs to be clickable or click focusable (`LV_OBJ_FLAG_CLICKABLE` or `LV_OBJ_FLAG_CLICK_FOCUSABLE`) and not hidden (`LV_OBJ_FLAG_HIDDEN`) to be focusable by gridnav.

9.3.3 Example

Basic grid navigation

```
#include "../../lv_examples.h"
#if LV_USE_GRIDNAV && LV_USE_FLEX && LV_BUILD_EXAMPLES

/**
 * Demonstrate a a basic grid navigation
 */
void lv_example_gridnav_1(void)
{
    /*It's assumed that the default group is set and
     *there is a keyboard indev*/

    lv_obj_t * cont1 = lv_obj_create(lv_scr_act());
    lv_gridnav_add(cont1, LV_GRIDNAV_CTRL_NONE);

    /*Use flex here, but works with grid or manually placed objects as well*/
    lv_obj_set_flex_flow(cont1, LV_FLEX_FLOW_ROW_WRAP);
    lv_obj_set_style_bg_color(cont1, lv_palette_lighten(LV_PALETTE_BLUE, 5), LV_STATE_
↪FOCUSED);
    lv_obj_set_size(cont1, lv_pct(50), lv_pct(100));

    /*Only the container needs to be in a group*/
    lv_group_add_obj(lv_group_get_default(), cont1);

    lv_obj_t * label = lv_label_create(cont1);
    lv_label_set_text_fmt(label, "No rollover");

    uint32_t i;
    for(i = 0; i < 10; i++) {
        lv_obj_t * obj = lv_btn_create(cont1);
        lv_obj_set_size(obj, 70, LV_SIZE_CONTENT);
        lv_obj_add_flag(obj, LV_OBJ_FLAG_CHECKABLE);
        lv_group_remove_obj(obj);   /*Not needed, we use the gridnav instead*/

        lv_obj_t * label = lv_label_create(obj);
        lv_label_set_text_fmt(label, "%"LV_PRIu32"", i);
        lv_obj_center(label);
    }
```

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```
    /* Create a second container with rollover grid nav mode.*/

    lv_obj_t * cont2 = lv_obj_create(lv_scr_act());
    lv_gridnav_add(cont2, LV_GRIDNAV_CTRL_ROLLOVER);
    lv_obj_set_style_bg_color(cont2, lv_palette_lighten(LV_PALETTE_BLUE, 5), LV_STATE_
↪FOCUSED);
    lv_obj_set_size(cont2, lv_pct(50), lv_pct(100));
    lv_obj_align(cont2, LV_ALIGN_RIGHT_MID, 0, 0);

    label = lv_label_create(cont2);
    lv_obj_set_width(label, lv_pct(100));
    lv_label_set_text_fmt(label, "Rollover\nUse tab to focus the other container");

    /*Only the container needs to be in a group*/
    lv_group_add_obj(lv_group_get_default(), cont2);

    /*Add and place some children manually*/
    lv_obj_t * ta = lv_textarea_create(cont2);
    lv_obj_set_size(ta, lv_pct(100), 80);
    lv_obj_set_pos(ta, 0, 80);
    lv_group_remove_obj(ta);   /*Not needed, we use the gridnav instead*/

    lv_obj_t * cb = lv_checkbox_create(cont2);
    lv_obj_set_pos(cb, 0, 170);
    lv_group_remove_obj(cb);   /*Not needed, we use the gridnav instead*/

    lv_obj_t * sw1 = lv_switch_create(cont2);
    lv_obj_set_pos(sw1, 0, 200);
    lv_group_remove_obj(sw1);   /*Not needed, we use the gridnav instead*/

    lv_obj_t * sw2 = lv_switch_create(cont2);
    lv_obj_set_pos(sw2, lv_pct(50), 200);
    lv_group_remove_obj(sw2);   /*Not needed, we use the gridnav instead*/
}

#endif
```

```
#
# Demonstrate a a basic grid navigation
#
# It's assumed that the default group is set and
# there is a keyboard indev

cont1 = lv.obj(lv.scr_act())
lv.gridnav_add(cont1, lv.GRIDNAV_CTRL.NONE)

# Use flex here, but works with grid or manually placed objects as well
cont1.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)
cont1.set_style_bg_color(lv.palette_lighten(lv.PALETTE.BLUE, 5), lv.STATE.FOCUSED)
cont1.set_size(lv.pct(50), lv.pct(100))

# Only the container needs to be in a group
lv.group_get_default().add_obj(cont1)

label = lv.label(cont1)
label.set_text("No rollover")
```

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```
for i in range(10):
    obj = lv.btn(cont1)
    obj.set_size(70, lv.SIZE_CONTENT)
    obj.add_flag(lv.obj.FLAG.CHECKABLE)
    lv.group_remove_obj(obj)   # Not needed, we use the gridnav instead

    label = lv.label(obj)
    label.set_text("{:d}".format(i))
    label.center()

# Create a second container with rollover grid nav mode.

cont2 = lv.obj(lv.scr_act())
lv.gridnav_add(cont2,lv.GRIDNAV_CTRL.ROLLOVER)
cont2.set_style_bg_color(lv.palette_lighten(lv.PALETTE.BLUE, 5), lv.STATE.FOCUSED)
cont2.set_size(lv.pct(50), lv.pct(100))
cont2.align(lv.ALIGN.RIGHT_MID, 0, 0)

label = lv.label(cont2)
label.set_width(lv.pct(100))
label.set_text("Rollover\nUse tab to focus the other container")

# Only the container needs to be in a group
lv.group_get_default().add_obj(cont2)

# Add and place some children manually
ta = lv.textarea(cont2)
ta.set_size(lv.pct(100), 80)
ta.set_pos(0, 80);
lv.group_remove_obj(ta)   # Not needed, we use the gridnav instead

cb = lv.checkbox(cont2)
cb.set_pos(0, 170)
lv.group_remove_obj(cb)   # Not needed, we use the gridnav instead

sw1 = lv.switch(cont2)
sw1.set_pos(0, 200);
lv.group_remove_obj(sw1)  # Not needed, we use the gridnav instead

sw2 = lv.switch(cont2)
sw2.set_pos(lv.pct(50), 200)
lv.group_remove_obj(sw2)  # Not needed, we use the gridnav instead
```

Grid navigation on a list

```
#include "../../lv_examples.h"
#if LV_USE_GRIDNAV && LV_USE_LIST && LV_BUILD_EXAMPLES

/**
 * Grid navigation on a list
 */
void lv_example_gridnav_2(void)
{
```

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```
    /*It's assumed that the default group is set and
     *there is a keyboard indev*/

    lv_obj_t * list1 = lv_list_create(lv_scr_act());
    lv_gridnav_add(list1, LV_GRIDNAV_CTRL_NONE);
    lv_obj_set_size(list1, lv_pct(45), lv_pct(80));
    lv_obj_align(list1, LV_ALIGN_LEFT_MID, 5, 0);
    lv_obj_set_style_bg_color(list1, lv_palette_lighten(LV_PALETTE_BLUE, 5), LV_STATE_
↪FOCUSED);
    lv_group_add_obj(lv_group_get_default(), list1);


    char buf[32];
    uint32_t i;
    for(i = 0; i < 15; i++) {
        lv_snprintf(buf, sizeof(buf), "File %d", i + 1);
        lv_obj_t * item = lv_list_add_btn(list1, LV_SYMBOL_FILE, buf);
        lv_obj_set_style_bg_opa(item, 0, 0);
        lv_group_remove_obj(item);   /*Not needed, we use the gridnav instead*/
    }

    lv_obj_t * list2 = lv_list_create(lv_scr_act());
    lv_gridnav_add(list2, LV_GRIDNAV_CTRL_ROLLOVER);
    lv_obj_set_size(list2, lv_pct(45), lv_pct(80));
    lv_obj_align(list2, LV_ALIGN_RIGHT_MID, -5, 0);
    lv_obj_set_style_bg_color(list2, lv_palette_lighten(LV_PALETTE_BLUE, 5), LV_STATE_
↪FOCUSED);
    lv_group_add_obj(lv_group_get_default(), list2);

    for(i = 0; i < 15; i++) {
        lv_snprintf(buf, sizeof(buf), "Folder %d", i + 1);
        lv_obj_t * item = lv_list_add_btn(list2, LV_SYMBOL_DIRECTORY, buf);
        lv_obj_set_style_bg_opa(item, 0, 0);
        lv_group_remove_obj(item);
    }
}

#endif
```

```
#
# Grid navigation on a list
#
# It's assumed that the default group is set and
# there is a keyboard indev

list1 = lv.list(lv.scr_act())
lv.gridnav_add(list1, lv.GRIDNAV_CTRL.NONE)
list1.set_size(lv.pct(45), lv.pct(80))
list1.align(lv.ALIGN.LEFT_MID, 5, 0)
list1.set_style_bg_color(lv.palette_lighten(lv.PALETTE.BLUE, 5), lv.STATE.FOCUSED)
lv.group_get_default().add_obj(list1)

for i in range(15):
    item_text = "File {:d}".format(i)
    item = list1.add_btn(lv.SYMBOL.FILE, item_text)
    item.set_style_bg_opa(0, 0)
```

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```
    lv.group_remove_obj(item)   # Not needed, we use the gridnav instead

list2 = lv.list(lv.scr_act())
lv.gridnav_add(list2, lv.GRIDNAV_CTRL.ROLLOVER)
list2.set_size(lv.pct(45), lv.pct(80))
list2.align(lv.ALIGN.RIGHT_MID, -5, 0)
list2.set_style_bg_color(lv.palette_lighten(lv.PALETTE.BLUE, 5), lv.STATE.FOCUSED)
lv.group_get_default().add_obj(list2)

for i in range(15):
    item_text = "Folder {:d}".format(i)
    item = list2.add_btn(lv.SYMBOL.DIRECTORY, item_text)
    item.set_style_bg_opa(0, 0)
    lv.group_remove_obj(item)
```

Nested grid navigations

```
#include "../../lv_examples.h"
#if LV_USE_GRIDNAV && LV_USE_FLEX && LV_BUILD_EXAMPLES

static void cont_sub_event_cb(lv_event_t * e)
{
    uint32_t k = lv_event_get_key(e);
    lv_obj_t * obj = lv_event_get_current_target(e);
    if(k == LV_KEY_ENTER) {
        lv_group_focus_obj(obj);
    }
    else if(k == LV_KEY_ESC) {
        lv_group_focus_next(lv_obj_get_group(obj));
    }

}

/**
 * Nested grid navigations
 */
void lv_example_gridnav_3(void)
{
    /*It's assumed that the default group is set and
     *there is a keyboard indev*/

    lv_obj_t * cont_main = lv_obj_create(lv_scr_act());
    lv_gridnav_add(cont_main, LV_GRIDNAV_CTRL_ROLLOVER | LV_GRIDNAV_CTRL_SCROLL_
↪FIRST);

    /*Only the container needs to be in a group*/
    lv_group_add_obj(lv_group_get_default(), cont_main);

    /*Use flex here, but works with grid or manually placed objects as well*/
    lv_obj_set_flex_flow(cont_main, LV_FLEX_FLOW_ROW_WRAP);
    lv_obj_set_style_bg_color(cont_main, lv_palette_lighten(LV_PALETTE_BLUE, 5), LV_
↪STATE_FOCUSED);
    lv_obj_set_size(cont_main, lv_pct(80), LV_SIZE_CONTENT);
```

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```
    lv_obj_t * btn;
    lv_obj_t * label;

    btn = lv_btn_create(cont_main);
    lv_group_remove_obj(btn);
    label = lv_label_create(btn);
    lv_label_set_text(label, "Button 1");

    btn = lv_btn_create(cont_main);
    lv_group_remove_obj(btn);
    label = lv_label_create(btn);
    lv_label_set_text(label, "Button 2");


    /*Create an other container with long text to show how LV_GRIDNAV_CTRL_SCROLL_
↪FIRST works*/
    lv_obj_t * cont_sub1 = lv_obj_create(cont_main);
    lv_obj_set_size(cont_sub1, lv_pct(100), 100);

    label = lv_label_create(cont_sub1);
    lv_obj_set_style_bg_color(cont_sub1, lv_palette_lighten(LV_PALETTE_RED, 5), LV_
↪STATE_FOCUSED);
    lv_obj_set_width(label, lv_pct(100));
    lv_label_set_text(label,
                      "I'm a very long text which is makes my container scrollable. "
                      "As LV_GRIDNAV_FLAG_SCROLL_FIRST is enabled arrow will scroll␣
↪me first "
                      "and a new objects will be focused only when an edge is reached␣
↪with the scrolling.\n\n"
                      "This is only some placeholder text to be sure the parent will␣
↪be scrollable. \n\n"
                      "Hello world!\n"
                      "Hello world!\n"
                      "Hello world!\n"
                      "Hello world!\n"
                      "Hello world!\n"
                      "Hello world!");

    /*Create a third container that can be focused with ENTER and contains an other␣
↪grid nav*/
    lv_obj_t * cont_sub2 = lv_obj_create(cont_main);
    lv_gridnav_add(cont_sub2, LV_GRIDNAV_CTRL_ROLLOVER);
    /*Only the container needs to be in a group*/
    lv_group_add_obj(lv_group_get_default(), cont_sub2);

    lv_obj_add_event(cont_sub2, cont_sub_event_cb, LV_EVENT_KEY, NULL);

    /*Use flex here, but works with grid or manually placed objects as well*/
    lv_obj_set_flex_flow(cont_sub2, LV_FLEX_FLOW_ROW_WRAP);
    lv_obj_set_style_bg_color(cont_sub2, lv_palette_lighten(LV_PALETTE_RED, 5), LV_
↪STATE_FOCUSED);
    lv_obj_set_size(cont_sub2, lv_pct(100), LV_SIZE_CONTENT);

    label = lv_label_create(cont_sub2);
    lv_label_set_text(label, "Use ENTER/ESC to focus/defocus this container");
    lv_obj_set_width(label, lv_pct(100));
```

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```
    btn = lv_btn_create(cont_sub2);
    lv_group_remove_obj(btn);
    label = lv_label_create(btn);
    lv_label_set_text(label, "Button 3");

    btn = lv_btn_create(cont_sub2);
    lv_group_remove_obj(btn);
    label = lv_label_create(btn);
    lv_label_set_text(label, "Button 4");




}

#endif
```

```
def cont_sub_event_cb(e):
    k = e.get_key()
    obj = e.get_current_target()
    if k == lv.KEY.ENTER:
        lv.group_focus_obj(obj)

    elif k == lv.KEY.ESC:
        obj.get_group().focus_next()

#
# Nested grid navigations
#
# It's assumed that the default group is set and
# there is a keyboard indev*/

cont_main = lv.obj(lv.scr_act())
lv.gridnav_add(cont_main,lv.GRIDNAV_CTRL.ROLLOVER | lv.GRIDNAV_CTRL.SCROLL_FIRST)

# Only the container needs to be in a group
lv.group_get_default().add_obj(cont_main)

# Use flex here, but works with grid or manually placed objects as well
cont_main.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)
cont_main.set_style_bg_color(lv.palette_lighten(lv.PALETTE.BLUE, 5), lv.STATE.FOCUSED)
cont_main.set_size(lv.pct(80), lv.SIZE_CONTENT)

btn = lv.btn(cont_main)
lv.group_remove_obj(btn)
label = lv.label(btn)
label.set_text("Button 1")

btn = lv.btn(cont_main)
lv.group_remove_obj(btn)
label = lv.label(btn)
label.set_text("Button 2");


# Create an other container with long text to show how LV_GRIDNAV_CTRL_SCROLL_FIRST␣
↪works
```

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```
cont_sub1 = lv.obj(cont_main)
cont_sub1.set_size(lv.pct(100), 100)

label = lv.label(cont_sub1)
cont_sub1.set_style_bg_color(lv.palette_lighten(lv.PALETTE.RED, 5), lv.STATE.FOCUSED)
label.set_width(lv.pct(100));
label.set_text(
    """I'm a very long text which makes my container scrollable.
    As LV_GRIDNAV_FLAG_SCROLL_FIRST is enabled arrows will scroll me first
    and a new objects will be focused only when an edge is reached with the scrolling.
↪\n
    This is only some placeholder text to be sure the parent will be scrollable. \n
    Hello world!
    Hello world!
    Hello world!
    Hello world!
    Hello world!
    Hello world!
    """)

# Create a third container that can be focused with ENTER and contains an other grid␣
↪nav
cont_sub2 = lv.obj(cont_main)
lv.gridnav_add(cont_sub2, lv.GRIDNAV_CTRL.ROLLOVER)
#Only the container needs to be in a group
lv.group_get_default().add_obj(cont_sub2)

cont_sub2.add_event(cont_sub_event_cb, lv.EVENT.KEY, None)

# Use flex here, but works with grid or manually placed objects as well
cont_sub2.set_flex_flow(lv.FLEX_FLOW.ROW_WRAP)
cont_sub2.set_style_bg_color(lv.palette_lighten(lv.PALETTE.RED, 5), lv.STATE.FOCUSED)
cont_sub2.set_size(lv.pct(100), lv.SIZE_CONTENT)

label = lv.label(cont_sub2)
label.set_text("Use ENTER/ESC to focus/defocus this container")
label.set_width(lv.pct(100))

btn = lv.btn(cont_sub2)
lv.group_remove_obj(btn)
label = lv.label(btn)
label.set_text("Button 3")

btn = lv.btn(cont_sub2)
lv.group_remove_obj(btn)
label = lv.label(btn)
label.set_text("Button 4")
```

Simple navigation on a list widget

```c
#include "../../lv_examples.h"
#if LV_USE_GRIDNAV && LV_USE_FLEX && LV_BUILD_EXAMPLES


static void event_handler(lv_event_t * e)
{
    lv_obj_t * obj = lv_event_get_target(e);
    lv_obj_t * list = lv_obj_get_parent(obj);
    LV_LOG_USER("Clicked: %s", lv_list_get_btn_text(list, obj));
}

/**
 * Simple navigation on a list widget
 */
void lv_example_gridnav_4(void)
{
    /*It's assumed that the default group is set and
     *there is a keyboard indev*/

    lv_obj_t * list = lv_list_create(lv_scr_act());
    lv_gridnav_add(list, LV_GRIDNAV_CTRL_ROLLOVER);
    lv_obj_align(list, LV_ALIGN_LEFT_MID, 0, 10);
    lv_group_add_obj(lv_group_get_default(), list);

    uint32_t i;
    for(i = 0; i < 20; i++) {
        char buf[32];

        /*Add some separators too, they are not focusable by gridnav*/
        if((i % 5) == 0) {
            lv_snprintf(buf, sizeof(buf), "Section %d", i / 5 + 1);
            lv_list_add_text(list, buf);
        }

        lv_snprintf(buf, sizeof(buf), "File %d", i + 1);
        lv_obj_t * item = lv_list_add_btn(list, LV_SYMBOL_FILE, buf);
        lv_obj_add_event(item, event_handler, LV_EVENT_CLICKED, NULL);
        lv_group_remove_obj(item);  /*The default group adds it automatically*/
    }

    lv_obj_t * btn = lv_btn_create(lv_scr_act());
    lv_obj_align(btn, LV_ALIGN_RIGHT_MID, 0, -10);
    lv_obj_t * label = lv_label_create(btn);
    lv_label_set_text(label, "Button");
}

#endif
```

```python
def event_handler(e):
    obj = e.get_target_obj()
    list = obj.get_parent()
    print("Clicked: " + list.get_btn_text(obj))



#
```

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```
# Simple navigation on a list widget
#
# It's assumed that the default group is set and
# there is a keyboard indev

list = lv.list(lv.scr_act())
lv.gridnav_add(list, lv.GRIDNAV_CTRL.ROLLOVER)
list.align(lv.ALIGN.LEFT_MID, 0, 10)
lv.group_get_default().add_obj(list)

for i in range(20):

    # Add some separators too, they are not focusable by gridnav
    if i % 5 == 0:
        txt = "Section {:d}".format(i // 5 + 1)
        # lv_snprintf(buf, sizeof(buf), "Section %d", i / 5 + 1);
        list.add_text(txt)

    txt = "File {:d}".format(i + 1)
    #lv_snprintf(buf, sizeof(buf), "File %d", i + 1);
    item = list.add_btn(lv.SYMBOL.FILE, txt)
    item.add_event(event_handler, lv.EVENT.CLICKED, None)
    lv.group_remove_obj(item)  # The default group adds it automatically

btn = lv.btn(lv.scr_act())
btn.align(lv.ALIGN.RIGHT_MID, 0, -10)
label = lv.label(btn)
label.set_text("Button")
```

9.3.4 API

Typedefs

typedef int **`_keep_pedantic_happy`**

Enums

enum **`lv_gridnav_ctrl_t`**

Values:

enumerator **`LV_GRIDNAV_CTRL_NONE`**

enumerator **`LV_GRIDNAV_CTRL_ROLLOVER`**

If there is no next/previous object in a direction, the focus goes to the object in the next/previous row (on left/right keys) or first/last row (on up/down keys)

enumerator **`LV_GRIDNAV_CTRL_SCROLL_FIRST`**

If an arrow is pressed and the focused object can be scrolled in that direction then it will be scrolled instead of going to the next/previous object. If there is no more room for scrolling the next/previous object will be focused normally

Functions

void **lv_gridnav_add**(*lv_obj_t* *obj, *lv_gridnav_ctrl_t* ctrl)

Add grid navigation feature to an object. It expects the children to be arranged into a grid-like layout. Although it's not required to have pixel perfect alignment. This feature makes possible to use keys to navigate among the children and focus them. The keys other than arrows and press/release related events are forwarded to the focused child.

Parameters

- **obj** -- pointer to an object on which navigation should be applied.
- **ctrl** -- control flags from `lv_gridnav_ctrl_t`.

void **lv_gridnav_remove**(*lv_obj_t* *obj)

Remove the grid navigation support from an object

Parameters **obj** -- pointer to an object

void **lv_gridnav_set_focused**(*lv_obj_t* *cont, *lv_obj_t* *to_focus, *lv_anim_enable_t* anim_en)

Manually focus an object on gridnav container

Parameters

- **cont** -- pointer to a gridnav container
- **to_focus** -- pointer to an object to focus
- **anim_en** -- LV_ANIM_ON/OFF

9.4 File Explorer

`lv_file_explorer` provides an API to browse the contents of the file system. `lv_file_explorer` only provides the file browsing function, but does not provide the actual file operation function. In other words, you can't click a picture file to open and view the picture like a PC. `lv_file_explorer` will tell you the full path and name of the currently clicked file. The file operation function needs to be implemented by the user.

The file list in `lv_file_explorer` is based on *lv_table*, and the quick access bar is based on *lv_list*. Therefore, care should be taken to ensure that *lv_table* and *lv_list* are enabled.

`lv_file_explorer` □□API□□□□□□□□□□□□□□□□□□`lv_file_explorer` □□PC□□
□□□

`lv_file_explorer` □□□□□□□□ *lv_table* □□□□□□□□□□□ *lv_list* □□□□□□□□□□□□□□□□ `lv_table` □ `lv_list`□

9.4.1 Usage

Enable `LV_USE_FILE_EXPLORER` in `lv_conf.h`.

First use `lv_file_explorer_create(lv_scr_act())` to create a file explorer, The default size is the screen size. After that, you can customize the style like widget.

□ `lv_conf.h` □□□ `LV_USE_FILE_EXPLORER`□

□□□□ `lv_file_explorer_create(lv_scr_act())` □□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

Quick access

The quick access bar is optional. You can turn off `LV_FILE_EXPLORER_QUICK_ACCESS` in `lv_conf.h` so that the quick access bar will not be created. This can save some memory, but not much. After the quick access bar is created, it can be hidden by clicking the button at the top left corner of the browsing area, which is very useful for small screen devices.

You can use `lv_file_explorer_set_quick_access_path(file_explorer, LV_FILE_EXPLORER_QA_XX, "path")` to set the path of the quick access bar. The items of the quick access bar are fixed. Currently, there are the following items:

- `LV_FILE_EXPLORER_QA_HOME`
- `LV_FILE_EXPLORER_QA_MUSIC`
- `LV_FILE_EXPLORER_QA_PICTURES`
- `LV_FILE_EXPLORER_QA_VIDEO`
- `LV_FILE_EXPLORER_QA_DOCS`
- `LV_FILE_EXPLORER_QA_MNT`
- `LV_FILE_EXPLORER_QA_FS`

□□□□□□□□□□□□ `lv_conf.h` □□□ `LV_FILE_EXPLORER_QUICK_ACCESS`□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□ `lv_file_explorer_set_quick_access_path(file_explorer, LV_FILE_EXPLORER_QA_XX, "path")` □□□□□□□□□□□□□□□□□□□□□□□□□□

- `LV_FILE_EXPLORER_QA_HOME`
- `LV_FILE_EXPLORER_QA_MUSIC`
- `LV_FILE_EXPLORER_QA_PICTURES`
- `LV_FILE_EXPLORER_QA_VIDEO`
- `LV_FILE_EXPLORER_QA_DOCS`
- `LV_FILE_EXPLORER_QA_MNT`
- `LV_FILE_EXPLORER_QA_FS`

Sort

You can use `lv_file_explorer_set_sort(file_explorer, LV_EXPLORER_SORT_XX)` to set sorting method. There are the following sorting methods:

- `LV_EXPLORER_SORT_NONE`
- `LV_EXPLORER_SORT_KIND`

You can customize the sorting. Before custom sort, please set the default sorting to `LV_EXPLORER_SORT_NONE`. The default is `LV_EXPLORER_SORT_NONE`.

□□□□ `lv_file_explorer_set_sort(file_explorer, LV_EXPLORER_SORT_XX)` □□□□□□□□□□□□□□□

- `LV_EXPLORER_SORT_NONE`
- `LV_EXPLORER_SORT_KIND`

□□□□□□□□□□□□□□□□□□□□□□□□□ `LV_EXPLORER_SORT_NONE` □□□ `LV_EVENT_READY` □□□□□□□□□□□□□□ `LV_EXPLORER_SORT_NONE`

9.4.2 Event

- `LV_EVENT_READY` sent shen a directory is opened. You can customize the sort.
- `LV_EVENT_VALUE_CHANGED` sent when an item(file) in the file list is clicked.

You can use `lv_file_explorer_get_cur_path` to get the current path and `lv_file_explorer_get_sel_fn` to get the name of the currently selected file in the event processing function. For example:

```
static void file_explorer_event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        char * cur_path =  lv_file_explorer_get_cur_path(obj);
        char * sel_fn = lv_file_explorer_get_sel_fn(obj);
        LV_LOG_USER("%s%s", cur_path, sel_fn);
    }
}
```

You can also save the obtained **path** and **file** name into an array through functions such as *strcpy* and *strcat* for later use.

- □□□□□□□□□□□ `LV_EVENT_READY` □□□□□□□□□□□□□□□□
- □□□□□□□□□□□□□□□□□□□ `LV_EVENT_VALUE_CHANGED` □□□

□□□□□□□□□□□□ `lv_file_explorer_get_cur_path` □□□□□□□□□□□□ `lv_file_explorer_get_sel_fn` □□□□□□□□□□□□□□□

```
static void file_explorer_event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        char * cur_path =  lv_file_explorer_get_cur_path(obj);
```

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```
        char * sel_fn = lv_file_explorer_get_sel_fn(obj);
        LV_LOG_USER("%s%s", cur_path, sel_fn);
    }
}
```

□□□□□□□□□□ □□ □ □□□□ □□□□ strcpy □ strcat □□□□□□□□□□□□□□□□□□□□□

9.4.3 Example

Simple File Explorer

```
#include "../../lv_examples.h"

#if LV_USE_TABLE && LV_USE_FILE_EXPLORER && (LV_USE_FS_STDIO || LV_USE_FS_POSIX || LV_
↪USE_FS_WIN32 || LV_USE_FS_FATFS) && LV_BUILD_EXAMPLES

#include <stdlib.h>
#include <string.h>

static void file_explorer_event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        const char * cur_path =  lv_file_explorer_get_current_path(obj);
        const char * sel_fn = lv_file_explorer_get_selected_file_name(obj);
        uint16_t path_len = strlen(cur_path);
        uint16_t fn_len = strlen(sel_fn);

        if((path_len + fn_len) <= LV_FILE_EXPLORER_PATH_MAX_LEN) {
            char file_info[LV_FILE_EXPLORER_PATH_MAX_LEN];

            strcpy(file_info, cur_path);
            strcat(file_info, sel_fn);

            LV_LOG_USER("%s", file_info);
        }
        else    LV_LOG_USER("%s%s", cur_path, sel_fn);
    }
}

void lv_example_file_explorer_1(void)
{
    lv_obj_t * file_explorer = lv_file_explorer_create(lv_scr_act());
    lv_file_explorer_set_sort(file_explorer, LV_EXPLORER_SORT_KIND);

#if LV_USE_FS_WIN32
    lv_file_explorer_open_dir(file_explorer, "D:");
#if LV_FILE_EXPLORER_QUICK_ACCESS
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_HOME_DIR, "C:/
↪Users/Public/Desktop");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_VIDEO_DIR, "C:/
↪Users/Public/Videos");
```

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```
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_PICTURES_DIR,
↪"C:/Users/Public/Pictures");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_MUSIC_DIR, "C:/
↪Users/Public/Music");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_DOCS_DIR, "C:/
↪Users/Public/Documents");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_FS_DIR, "D:");
#endif

#else
    /* linux */
    lv_file_explorer_open_dir(file_explorer, "A:/");

#if LV_FILE_EXPLORER_QUICK_ACCESS
    char * envvar = "HOME";
    char home_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(home_dir, "A:");
    // get the user's home directory from the HOME enviroment variable
    strcat(home_dir, getenv(envvar));
    LV_LOG_USER("home_dir: %s\n", home_dir);
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_HOME_DIR, home_
↪dir);
    char video_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(video_dir, home_dir);
    strcat(video_dir, "/Videos");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_VIDEO_DIR,␣
↪video_dir);
    char picture_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(picture_dir, home_dir);
    strcat(picture_dir, "/Pictures");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_PICTURES_DIR,␣
↪picture_dir);
    char music_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(music_dir, home_dir);
    strcat(music_dir, "/Music");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_MUSIC_DIR,␣
↪music_dir);
    char document_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(document_dir, home_dir);
    strcat(document_dir, "/Documents");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_DOCS_DIR,␣
↪document_dir);

    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_FS_DIR, "A:/");
#endif
#endif

    lv_obj_add_event(file_explorer, file_explorer_event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```
import fs_driver
import os

LV_FILE_EXPLORER_QUICK_ACCESS = True
```

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```
LV_USE_FS_WIN32 = False
LV_FILE_EXPLORER_PATH_MAX_LEN = 128

def file_explorer_event_handler(e) :

    code = e.get_code()
    obj = e.get_target_obj()

    if code == lv.EVENT.VALUE_CHANGED:
        cur_path =  obj.explorer_get_current_path()
        sel_fn = obj.explorer_get_selected_file_name()
        # print("cur_path: " + str(cur_path), " sel_fn: " + str(sel_fn))
        print(str(cur_path) + str(sel_fn))

file_explorer = lv.file_explorer(lv.scr_act())
file_explorer.explorer_set_sort(lv.EXPLORER_SORT.KIND)


if LV_USE_FS_WIN32 :
    file_explorer.explorer_open_dir("D:")
    if LV_FILE_EXPLORER_QUICK_ACCESS :
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER.HOME_DIR, "C:/Users/
↪Public/Desktop")
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER.VIDEO_DIR, "C:/Users/
↪Public/Videos")
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_PICTURES_DIR, "C:/
↪Users/Public/Pictures");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_MUSIC_DIR, "C:/Users/
↪Public/Music");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_DOCS_DIR, "C:/Users/
↪Public/Documents");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_FS_DIR, "D:");

# linux
file_explorer.explorer_open_dir("A:/")

if LV_FILE_EXPLORER_QUICK_ACCESS :
    home_dir = "A:" + os.getenv('HOME')
    print("quick access: " + home_dir)
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.HOME_DIR, home_dir)
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.VIDEO_DIR, home_dir + "/
↪Videos")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.PICTURES_DIR, home_dir +
↪"/Pictures")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.MUSIC_DIR, home_dir + "/
↪Music")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.DOCS_DIR, home_dir + "/
↪Documents")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.FS_DIR, "A:/")

file_explorer.add_event(file_explorer_event_handler, lv.EVENT.ALL, None)
```

Control File Explorer

```c
#include "../../lv_examples.h"

#if LV_USE_TABLE && LV_USE_FILE_EXPLORER && (LV_USE_FS_STDIO || LV_USE_FS_POSIX || LV_
↪USE_FS_WIN32 || LV_USE_FS_FATFS) && LV_BUILD_EXAMPLES

#include <stdlib.h>
#include <string.h>

static void file_explorer_event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        const char * cur_path =  lv_file_explorer_get_current_path(obj);
        const char * sel_fn = lv_file_explorer_get_selected_file_name(obj);
        uint16_t path_len = strlen(cur_path);
        uint16_t fn_len = strlen(sel_fn);

        if((path_len + fn_len) <= LV_FILE_EXPLORER_PATH_MAX_LEN) {
            char file_info[LV_FILE_EXPLORER_PATH_MAX_LEN];

            strcpy(file_info, cur_path);
            strcat(file_info, sel_fn);

            LV_LOG_USER("%s", file_info);
        }
        else    LV_LOG_USER("%s%s", cur_path, sel_fn);
    }
}

static void btn_event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * btn = lv_event_get_target(e);
    lv_obj_t * file_explorer = lv_event_get_user_data(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        if(lv_obj_has_state(btn, LV_STATE_CHECKED))
            lv_obj_add_flag(file_explorer, LV_OBJ_FLAG_HIDDEN);
        else
            lv_obj_clear_flag(file_explorer, LV_OBJ_FLAG_HIDDEN);
    }
}

static void dd_event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * dd = lv_event_get_target(e);
    lv_obj_t * fe_quick_access_obj = lv_event_get_user_data(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        char buf[32];
        lv_dropdown_get_selected_str(dd, buf, sizeof(buf));
```

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```
        if(strcmp(buf, "NONE") == 0) {
            lv_file_explorer_set_sort(fe_quick_access_obj, LV_EXPLORER_SORT_NONE);
        }
        else if(strcmp(buf, "KIND") == 0) {
            lv_file_explorer_set_sort(fe_quick_access_obj, LV_EXPLORER_SORT_KIND);
        }
    }
}

void lv_example_file_explorer_2(void)
{
    lv_obj_t * file_explorer = lv_file_explorer_create(lv_scr_act());

#if LV_USE_FS_WIN32
    lv_file_explorer_open_dir(file_explorer, "D:");
#if LV_FILE_EXPLORER_QUICK_ACCESS
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_HOME_DIR, "C:/
↪Users/Public/Desktop");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_VIDEO_DIR, "C:/
↪Users/Public/Videos");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_PICTURES_DIR,
↪"C:/Users/Public/Pictures");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_MUSIC_DIR, "C:/
↪Users/Public/Music");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_DOCS_DIR, "C:/
↪Users/Public/Documents");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_FS_DIR, "D:");
#endif

#else
    /* linux */
    lv_file_explorer_open_dir(file_explorer, "A:/");
#if LV_FILE_EXPLORER_QUICK_ACCESS
    char * envvar = "HOME";
    char home_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(home_dir, "A:");
    // get the user's home directory from the HOME enviroment variable
    strcat(home_dir, getenv(envvar));
    LV_LOG_USER("home_dir: %s\n", home_dir);
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_HOME_DIR, home_
↪dir);
    char video_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(video_dir, home_dir);
    strcat(video_dir, "/Videos");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_VIDEO_DIR,␣
↪video_dir);
    char picture_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(picture_dir, home_dir);
    strcat(picture_dir, "/Pictures");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_PICTURES_DIR,␣
↪picture_dir);
    char music_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(music_dir, home_dir);
    strcat(music_dir, "/Music");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_MUSIC_DIR,␣
↪music_dir);
    char document_dir[LV_FS_MAX_PATH_LENGTH];
```

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```
    strcpy(document_dir, home_dir);
    strcat(document_dir, "/Documents");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_DOCS_DIR,␣
↪document_dir);

    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_FS_DIR, "A:/");
#endif
#endif

    lv_obj_add_event(file_explorer, file_explorer_event_handler, LV_EVENT_ALL, NULL);

    /*Quick access status control button*/
    lv_obj_t * fe_quick_access_obj = lv_file_explorer_get_quick_access_area(file_
↪explorer);
    lv_obj_t * fe_header_obj = lv_file_explorer_get_header(file_explorer);
    lv_obj_t * btn = lv_btn_create(fe_header_obj);
    lv_obj_set_style_radius(btn, 2, 0);
    lv_obj_set_style_pad_all(btn, 4, 0);
    lv_obj_align(btn, LV_ALIGN_LEFT_MID, 0, 0);
    lv_obj_add_flag(btn, LV_OBJ_FLAG_CHECKABLE);

    lv_obj_t * label = lv_label_create(btn);
    lv_label_set_text(label, LV_SYMBOL_LIST);
    lv_obj_center(label);

    lv_obj_add_event(btn, btn_event_handler, LV_EVENT_VALUE_CHANGED, fe_quick_access_
↪obj);

    /*Sort control*/
    static const char * opts = "NONE\n"
                               "KIND";

    lv_obj_t * dd = lv_dropdown_create(fe_header_obj);
    lv_obj_set_style_radius(dd, 4, 0);
    lv_obj_set_style_pad_all(dd, 0, 0);
    lv_obj_set_size(dd, LV_PCT(30), LV_SIZE_CONTENT);
    lv_dropdown_set_options_static(dd, opts);
    lv_obj_align(dd, LV_ALIGN_RIGHT_MID, 0, 0);
    //lv_obj_align_to(dd, btn, LV_ALIGN_OUT_RIGHT_MID, 0, 0);

    lv_obj_add_event(dd, dd_event_handler, LV_EVENT_VALUE_CHANGED, file_explorer);
}

#endif
```

```
import fs_driver
import os

LV_FILE_EXPLORER_QUICK_ACCESS = True
LV_USE_FS_WIN32 = False
LV_FILE_EXPLORER_PATH_MAX_LEN = 128

def file_explorer_event_handler(e):
    code = e.get_code()
    obj = e.get_target_obj()
```

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```
    if code == lv.EVENT.VALUE_CHANGED:
        cur_path =  obj.explorer_get_current_path()
        sel_fn = obj.explorer_get_selected_file_name()
        print(str(cur_path) + str(sel_fn))

def btn_event_handler(e,fe_quick_access_obj):

    code = e.get_code()
    btn = e.get_target_obj()
    # lv_obj_t * file_explorer = lv_event_get_user_data(e);

    if code == lv.EVENT.VALUE_CHANGED :
        if btn.has_state(lv.STATE.CHECKED) :
            fe_quick_access_obj.add_flag(lv.obj.FLAG.HIDDEN)
        else :
            fe_quick_access_obj.clear_flag(lv.obj.FLAG.HIDDEN)

def dd_event_handler(e, file_explorer):

    code = e.get_code()
    dd = e.get_target_obj()
    # fe_quick_access_obj = lv_event_get_user_data(e);

    if code == lv.EVENT.VALUE_CHANGED :
        buf = bytearray(32)
        lv.dropdown.get_selected_str(dd,buf,len(buf))

        if buf[:4] == b"NONE":
            # print("set sort to NONE")
            file_explorer.explorer_set_sort(lv.EXPLORER_SORT.NONE)
        elif buf[:4] == b"KIND" :
            # print("set sort to KIND")
            file_explorer.explorer_set_sort(lv.EXPLORER_SORT.KIND)

file_explorer = lv.file_explorer(lv.scr_act())

if LV_USE_FS_WIN32 :
    file_explorer.explorer_open_dir("D:")
    if LV_FILE_EXPLORER_QUICK_ACCESS :
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER.HOME_DIR, "C:/Users/
↪Public/Desktop")
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER.VIDEO_DIR, "C:/Users/
↪Public/Videos")
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_PICTURES_DIR, "C:/
↪Users/Public/Pictures");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_MUSIC_DIR, "C:/Users/
↪Public/Music");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_DOCS_DIR, "C:/Users/
↪Public/Documents");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_FS_DIR, "D:");

# linux
file_explorer.explorer_open_dir("A:/")

if LV_FILE_EXPLORER_QUICK_ACCESS :
    home_dir = "A:" + os.getenv('HOME')
    print("quick access: " + home_dir)
```

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```
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.HOME_DIR, home_dir)
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.VIDEO_DIR, home_dir + "/
↪Videos")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.PICTURES_DIR, home_dir +
↪"/Pictures")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.MUSIC_DIR, home_dir + "/
↪Music")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.DOCS_DIR, home_dir + "/
↪Documents")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.FS_DIR, "A:/")

file_explorer.add_event(file_explorer_event_handler, lv.EVENT.ALL, None)

# Quick access status control button
fe_quick_access_obj = file_explorer.explorer_get_quick_access_area()
fe_header_obj = file_explorer.explorer_get_header()
btn = lv.btn(fe_header_obj)
btn.set_style_radius(2, 0)
btn.set_style_pad_all(4, 0)
btn.align(lv.ALIGN.LEFT_MID, 0, 0)
btn.add_flag(lv.obj.FLAG.CHECKABLE)

label = lv.label(btn)
label.set_text(lv.SYMBOL.LIST)
label.center()

btn.add_event(lambda evt: btn_event_handler(evt,fe_quick_access_obj), lv.EVENT.VALUE_
↪CHANGED, None)
#btn.add_event(lambda evt: btn_event_handler(evt,file_explorer), lv.EVENT.VALUE_
↪CHANGED, None)

# Sort control
opts = "NONE\nKIND"

dd = lv.dropdown(fe_header_obj)
dd.set_style_radius(4, 0)
dd.set_style_pad_all(0, 0)
dd.set_size(lv.pct(30), lv.SIZE_CONTENT)
dd.set_options_static(opts)
dd.align(lv.ALIGN.RIGHT_MID, 0, 0)
# lv_obj_align_to(dd, btn, LV_ALIGN_OUT_RIGHT_MID, 0, 0);

dd.add_event(lambda evt: dd_event_handler(evt,file_explorer), lv.EVENT.VALUE_CHANGED,␣
↪None)
#dd.add_event(lambda evt: dd_event_handler(evt,fe_quick_access_obj), lv.EVENT.VALUE_
↪CHANGED, None)
```

Custom sort

```c
#include "../../lv_examples.h"

#if LV_USE_TABLE && LV_USE_FILE_EXPLORER && (LV_USE_FS_STDIO || LV_USE_FS_POSIX || LV_
↪USE_FS_WIN32 || LV_USE_FS_FATFS) && LV_BUILD_EXAMPLES

#include <stdlib.h>
#include <string.h>

static void exch_table_item(lv_obj_t * tb, int16_t i, int16_t j)
{
    const char * tmp;
    tmp = lv_table_get_cell_value(tb, i, 0);
    lv_table_set_cell_value(tb, 0, 2, tmp);
    lv_table_set_cell_value(tb, i, 0, lv_table_get_cell_value(tb, j, 0));
    lv_table_set_cell_value(tb, j, 0, lv_table_get_cell_value(tb, 0, 2));

    tmp = lv_table_get_cell_value(tb, i, 1);
    lv_table_set_cell_value(tb, 0, 2, tmp);
    lv_table_set_cell_value(tb, i, 1, lv_table_get_cell_value(tb, j, 1));
    lv_table_set_cell_value(tb, j, 1, lv_table_get_cell_value(tb, 0, 2));
}


/*Quick sort 3 way*/
static void sort_by_file_kind(lv_obj_t * tb, int16_t lo, int16_t hi)
{
    if(lo >= hi) return;

    int16_t lt = lo;
    int16_t i = lo + 1;
    int16_t gt = hi;
    const char * v = lv_table_get_cell_value(tb, lo, 1);
    while(i <= gt) {
        if(strcmp(lv_table_get_cell_value(tb, i, 1), v) < 0)
            exch_table_item(tb, lt++, i++);
        else if(strcmp(lv_table_get_cell_value(tb, i, 1), v) > 0)
            exch_table_item(tb, i, gt--);
        else
            i++;
    }

    sort_by_file_kind(tb, lo, lt - 1);
    sort_by_file_kind(tb, gt + 1, hi);
}


static void file_explorer_event_handler(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * obj = lv_event_get_target(e);

    if(code == LV_EVENT_VALUE_CHANGED) {
        const char * cur_path =  lv_file_explorer_get_current_path(obj);
        const char * sel_fn = lv_file_explorer_get_selected_file_name(obj);
```

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```
        uint16_t path_len = strlen(cur_path);
        uint16_t fn_len = strlen(sel_fn);

        if((path_len + fn_len) <= LV_FILE_EXPLORER_PATH_MAX_LEN) {
            char file_info[LV_FILE_EXPLORER_PATH_MAX_LEN];

            strcpy(file_info, cur_path);
            strcat(file_info, sel_fn);

            LV_LOG_USER("%s", file_info);
        }
        else    LV_LOG_USER("%s%s", cur_path, sel_fn);
    }
    else if(code == LV_EVENT_READY) {
        lv_obj_t * tb = lv_file_explorer_get_file_table(obj);
        uint16_t sum = lv_table_get_row_cnt(tb);

        sort_by_file_kind(tb, 0, (sum - 1));
    }
}

void lv_example_file_explorer_3(void)
{
    lv_obj_t * file_explorer = lv_file_explorer_create(lv_scr_act());
    /*Before custom sort, please set the default sorting to NONE. The default is NONE.
↪*/
    lv_file_explorer_set_sort(file_explorer, LV_EXPLORER_SORT_NONE);

#if LV_USE_FS_WIN32
    lv_file_explorer_open_dir(file_explorer, "D:");
#if LV_FILE_EXPLORER_QUICK_ACCESS
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_HOME_DIR, "C:/
↪Users/Public/Desktop");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_VIDEO_DIR, "C:/
↪Users/Public/Videos");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_PICTURES_DIR,
↪"C:/Users/Public/Pictures");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_MUSIC_DIR, "C:/
↪Users/Public/Music");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_DOCS_DIR, "C:/
↪Users/Public/Documents");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_FS_DIR, "D:");
#endif

#else
    /* linux */
    lv_file_explorer_open_dir(file_explorer, "A:/");
#if LV_FILE_EXPLORER_QUICK_ACCESS
    char * envvar = "HOME";
    char home_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(home_dir, "A:");
    // get the user's home directory from the HOME enviroment variable
    strcat(home_dir, getenv(envvar));
    LV_LOG_USER("home_dir: %s\n", home_dir);
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_HOME_DIR, home_
↪dir);
    char video_dir[LV_FS_MAX_PATH_LENGTH];
```

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```
    strcpy(video_dir, home_dir);
    strcat(video_dir, "/Videos");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_VIDEO_DIR,␣
↪video_dir);
    char picture_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(picture_dir, home_dir);
    strcat(picture_dir, "/Pictures");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_PICTURES_DIR,␣
↪picture_dir);
    char music_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(music_dir, home_dir);
    strcat(music_dir, "/Music");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_MUSIC_DIR,␣
↪music_dir);
    char document_dir[LV_FS_MAX_PATH_LENGTH];
    strcpy(document_dir, home_dir);
    strcat(document_dir, "/Documents");
    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_DOCS_DIR,␣
↪document_dir);

    lv_file_explorer_set_quick_access_path(file_explorer, LV_EXPLORER_FS_DIR, "A:/");
#endif
#endif

    lv_obj_add_event(file_explorer, file_explorer_event_handler, LV_EVENT_ALL, NULL);
}

#endif
```

```
import fs_driver
import os

LV_FILE_EXPLORER_QUICK_ACCESS = True
LV_USE_FS_WIN32 = False
LV_FILE_EXPLORER_PATH_MAX_LEN = 128

def exch_table_item(tb, i, j):
    tmp = tb.get_cell_value(i, 0)
    tb.set_cell_value(0, 2, tmp)
    tb.set_cell_value(i, 0, tb.get_cell_value(j, 0))
    tb.set_cell_value(j, 0, tb.get_cell_value(0, 2))

    tmp = tb.get_cell_value(i, 1)
    tb.set_cell_value(0, 2, tmp)
    tb.set_cell_value(i, 1, tb.get_cell_value(j, 1))
    tb.set_cell_value(j, 1, tb.get_cell_value(0, 2))

# Quick sort 3 way
def sort_by_file_kind(tb, lo, hi) :
    if lo >= hi:
        return;

    lt = lo
    i = lo + 1
    gt = hi
    v = tb.get_cell_value(lo, 1)
```

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```
    while i <= gt :

        if tb.get_cell_value(i, 1) < v :
            lt += 1
            i  += 1
            exch_table_item(tb, lt, i)
        elif tb.get_cell_value(i, 1) >  v:
            gt -= 1
            exch_table_item(tb, i, gt)
        else :
            i += 1
    sort_by_file_kind(tb, lo, lt - 1);
    sort_by_file_kind(tb, gt + 1, hi);


def file_explorer_event_handler(e) :

    code = e.get_code()
    obj = e.get_target_obj()

    if code == lv.EVENT.VALUE_CHANGED:
        cur_path =  obj.explorer_get_current_path()
        sel_fn = obj.explorer_get_selected_file_name()
        print(str(cur_path) + str(sel_fn))

    elif code == lv.EVENT.READY :
        tb = obj.explorer_get_file_table()
        sum = tb.get_row_cnt()
        # print("sum: ",sum)
        sort_by_file_kind(tb, 0, (sum - 1));

file_explorer = lv.file_explorer(lv.scr_act())
# Before custom sort, please set the default sorting to NONE. The default is NONE.
file_explorer.explorer_set_sort(lv.EXPLORER_SORT.NONE)

file_explorer = lv.file_explorer(lv.scr_act())

if LV_USE_FS_WIN32 :
    file_explorer.explorer_open_dir("D:")
    if LV_FILE_EXPLORER_QUICK_ACCESS :
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER.HOME_DIR, "C:/Users/
↪Public/Desktop")
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER.VIDEO_DIR, "C:/Users/
↪Public/Videos")
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_PICTURES_DIR, "C:/
↪Users/Public/Pictures");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_MUSIC_DIR, "C:/Users/
↪Public/Music");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_DOCS_DIR, "C:/Users/
↪Public/Documents");
        file_explorer.explorer_set_quick_access_path(lv.EXPLORER_FS_DIR, "D:");

# linux
file_explorer.explorer_open_dir("A:/")

if LV_FILE_EXPLORER_QUICK_ACCESS :
```

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```
    home_dir = "A:" + os.getenv('HOME')
    print("quick access: " + home_dir)
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.HOME_DIR, home_dir)
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.VIDEO_DIR, home_dir + "/
↪Videos")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.PICTURES_DIR, home_dir +
↪"/Pictures")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.MUSIC_DIR, home_dir + "/
↪Music")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.DOCS_DIR, home_dir + "/
↪Documents")
    file_explorer.explorer_set_quick_access_path(lv.EXPLORER.FS_DIR, "A:/")

    file_explorer.add_event(file_explorer_event_handler, lv.EVENT.ALL, None)
```

9.4.4 API

Enums

enum **lv_file_explorer_sort_t**

Values:

enumerator **LV_EXPLORER_SORT_NONE**

enumerator **LV_EXPLORER_SORT_KIND**

enum **lv_file_explorer_dir_t**

Values:

enumerator **LV_EXPLORER_HOME_DIR**

enumerator **LV_EXPLORER_MUSIC_DIR**

enumerator **LV_EXPLORER_PICTURES_DIR**

enumerator **LV_EXPLORER_VIDEO_DIR**

enumerator **LV_EXPLORER_DOCS_DIR**

enumerator **LV_EXPLORER_FS_DIR**

Functions

lv_obj_t ***lv_file_explorer_create**(*lv_obj_t* *parent)

void **lv_file_explorer_set_quick_access_path**(*lv_obj_t* *obj, *lv_file_explorer_dir_t* dir, const char *path)

Set file_explorer

Parameters

- **obj** -- pointer to a label object
- **dir** -- the dir from 'lv_file_explorer_dir_t' enum.

void **lv_file_explorer_set_sort**(*lv_obj_t* *obj, *lv_file_explorer_sort_t* sort)

Set file_explorer sort

Parameters

- **obj** -- pointer to a file explorer object
- **sort** -- the sort from 'lv_file_explorer_sort_t' enum.

const char ***lv_file_explorer_get_selected_file_name**(const *lv_obj_t* *obj)

Get file explorer Selected file

Parameters **obj** -- pointer to a file explorer object

Returns pointer to the file explorer selected file name

const char ***lv_file_explorer_get_current_path**(const *lv_obj_t* *obj)

Get file explorer cur path

Parameters **obj** -- pointer to a file explorer object

Returns pointer to the file explorer cur path

lv_obj_t ***lv_file_explorer_get_header**(*lv_obj_t* *obj)

Get file explorer head area obj

Parameters **obj** -- pointer to a file explorer object

Returns pointer to the file explorer head area obj(lv_obj)

lv_obj_t ***lv_file_explorer_get_quick_access_area**(*lv_obj_t* *obj)

Get file explorer head area obj

Parameters **obj** -- pointer to a file explorer object

Returns pointer to the file explorer quick access area obj(lv_obj)

lv_obj_t ***lv_file_explorer_get_path_label**(*lv_obj_t* *obj)

Get file explorer path obj(label)

Parameters **obj** -- pointer to a file explorer object

Returns pointer to the file explorer path obj(lv_label)

lv_obj_t ***lv_file_explorer_get_places_list**(*lv_obj_t* *obj)

Get file explorer places list obj(lv_list)

Parameters **obj** -- pointer to a file explorer object

Returns pointer to the file explorer places list obj(lv_list) *lv_obj_t* ***lv_file_explorer_get_device_list**(*lv_obj_t* *obj)

Get file explorer device list obj(lv_list)

Parameters **obj** -- pointer to a file explorer object

Returns pointer to the file explorer device list obj(lv_list)

lv_obj_t ***lv_file_explorer_get_file_table**(*lv_obj_t* *obj)

Get file explorer file list obj(lv_table)

Parameters **obj** -- pointer to a file explorer object

Returns pointer to the file explorer file table obj(lv_table)

lv_file_explorer_sort_t **lv_file_explorer_get_sort**(const *lv_obj_t* *obj)

Set file_explorer sort

Parameters **obj** -- pointer to a file explorer object

Returns the current mode from 'lv_file_explorer_sort_t'

void **lv_file_explorer_open_dir**(*lv_obj_t* *obj, const char *dir)

Open a specified path

Parameters

- **obj** -- pointer to a file explorer object
- **dir** -- pointer to the path

Variables

const lv_obj_class_t **lv_file_explorer_class**

struct **lv_file_explorer_t**

Public Members

lv_obj_t **obj**

lv_obj_t ***cont**

lv_obj_t ***head_area**

lv_obj_t ***browser_area**

lv_obj_t ***file_table**

lv_obj_t ***path_label**

lv_obj_t ***quick_access_area**

lv_obj_t ***list_device**

lv_obj_t ***list_places**

char ***home_dir**

char ***music_dir**

char ***pictures_dir**

char ***video_dir**

char ***docs_dir**

char ***fs_dir**

const char ***sel_fn**

char **current_path**[LV_FILE_EXPLORER_PATH_MAX_LEN]

lv_file_explorer_sort_t **sort**

9.5 Fragment

Fragment is a concept copied from Android.

It represents a reusable portion of your app's UI. A fragment defines and manages its own layout, has its own lifecycle, and can handle its own events. Like Android's Fragment that must be hosted by an activity or another fragment, Fragment in LVGL needs to be hosted by an object, or another fragment. The fragment's view hierarchy becomes part of, or attaches to, the host's view hierarchy.

Such concept also has some similarities to UiViewController on iOS.

Fragment Manager is a manager holding references to fragments attached to it, and has an internal stack to achieve navigation. You can use fragment manager to build navigation stack, or multi pane application easily.

9.5.1 Usage

Enable `LV_USE_FRAGMENT` in `lv_conf.h`.

Create Fragment Class

```
struct sample_fragment_t {
    /* IMPORTANT: don't miss this part */
    lv_fragment_t base;
    /* States, object references and data fields for this fragment */
    const char *title;
};

const lv_fragment_class_t sample_cls = {
        /* Initialize something needed */
        .constructor_cb = sample_fragment_ctor,
        /* Create view objects */
        .create_obj_cb = sample_fragment_create_obj,
        /* IMPORTANT: size of your fragment struct */
        .instance_size = sizeof(struct sample_fragment_t)
};
```

Use `lv_fragment_manager`

```
/* Create fragment instance, and objects will be added to container */
lv_fragment_manager_t *manager = lv_fragment_manager_create(container, NULL);
/* Replace current fragment with instance of sample_cls, and init_argument is user␣
↪defined pointer */
lv_fragment_manager_replace(manager, &sample_cls, init_argument);
```

Fragment Based Navigation

```
/* Add one instance into manager stack. View object of current fragment will be␣
↪destroyed,
 * but instances created in class constructor will be kept.
 */
lv_fragment_manager_push(manager, &sample_cls, NULL);

/* Remove the top most fragment from the stack, and bring back previous one. */
lv_fragment_manager_pop(manager);
```

9.5.2 Example

Basic fragment usage

```
/**
 * @file lv_example_fragment_1.c
 * @brief Basic usage of obj fragment
 */
#include "../../lv_examples.h"

#if LV_USE_FRAGMENT && LV_BUILD_EXAMPLES

static void sample_fragment_ctor(lv_fragment_t * self, void * args);
```

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```
static lv_obj_t * sample_fragment_create_obj(lv_fragment_t * self, lv_obj_t * parent);

static void sample_container_del(lv_event_t * e);

static lv_obj_t * root = NULL;

struct sample_fragment_t {
    lv_fragment_t base;
    const char * name;
};

static const lv_fragment_class_t sample_cls = {
    .constructor_cb = sample_fragment_ctor,
    .create_obj_cb = sample_fragment_create_obj,
    .instance_size = sizeof(struct sample_fragment_t)
};

void lv_example_fragment_1(void)
{
    root = lv_obj_create(lv_scr_act());
    lv_obj_set_size(root, LV_PCT(100), LV_PCT(100));
    lv_fragment_manager_t * manager = lv_fragment_manager_create(NULL);
    /* Clean up the fragment manager before objects in containers got deleted */
    lv_obj_add_event(root, sample_container_del, LV_EVENT_DELETE, manager);

    lv_fragment_t * fragment = lv_fragment_create(&sample_cls, "Fragment");
    lv_fragment_manager_replace(manager, fragment, &root);
}


static void sample_fragment_ctor(lv_fragment_t * self, void * args)
{
    ((struct sample_fragment_t *) self)->name = args;
}

static lv_obj_t * sample_fragment_create_obj(lv_fragment_t * self, lv_obj_t * parent)
{
    lv_obj_t * label = lv_label_create(parent);
    lv_obj_set_style_bg_opa(label, LV_OPA_COVER, 0);;
    lv_label_set_text_fmt(label, "Hello, %s!", ((struct sample_fragment_t *) self)->
↪name);
    return label;
}

static void sample_container_del(lv_event_t * e)
{
    lv_fragment_manager_t * manager = (lv_fragment_manager_t *) lv_event_get_user_
↪data(e);
    lv_fragment_manager_del(manager);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/others/
↪fragment/lv_example_fragment_1.py
```

Stack navigation example

```
/**
 * @file lv_example_fragment_2.c
 * @brief Navigation stack using obj fragment
 */
#include "../../lv_examples.h"

#if LV_USE_FRAGMENT && LV_USE_WIN && LV_BUILD_EXAMPLES

static void sample_fragment_ctor(lv_fragment_t * self, void * args);

static lv_obj_t * sample_fragment_create_obj(lv_fragment_t * self, lv_obj_t * parent);

static void sample_push_click(lv_event_t * e);

static void sample_pop_click(lv_event_t * e);

static void sample_container_del(lv_event_t * e);

static void sample_fragment_inc_click(lv_event_t * e);

typedef struct sample_fragment_t {
    lv_fragment_t base;
    lv_obj_t * label;
    int depth;
    int counter;
} sample_fragment_t;

static const lv_fragment_class_t sample_cls = {
    .constructor_cb = sample_fragment_ctor,
    .create_obj_cb = sample_fragment_create_obj,
    .instance_size = sizeof(sample_fragment_t)
};

static lv_obj_t * container = NULL;

void lv_example_fragment_2(void)
{
    lv_obj_t * root = lv_obj_create(lv_scr_act());
    lv_obj_set_size(root, LV_PCT(100), LV_PCT(100));
    lv_obj_set_layout(root, LV_LAYOUT_GRID);
    static const lv_coord_t col_dsc[] = {LV_GRID_FR(1), LV_GRID_FR(1), LV_GRID_
↪TEMPLATE_LAST};
    static const lv_coord_t row_dsc[] = {LV_GRID_FR(1), LV_GRID_CONTENT, LV_GRID_
↪TEMPLATE_LAST};
    lv_obj_set_grid_dsc_array(root, col_dsc, row_dsc);
    container = lv_obj_create(root);
    lv_obj_remove_style_all(container);
    lv_obj_set_grid_cell(container, LV_GRID_ALIGN_STRETCH, 0, 2, LV_GRID_ALIGN_
↪STRETCH, 0, 1);

    lv_obj_t * push_btn = lv_btn_create(root);
    lv_obj_t * push_label = lv_label_create(push_btn);
    lv_label_set_text(push_label, "Push");

    lv_obj_t * pop_btn = lv_btn_create(root);
```

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```
    lv_obj_t * pop_label = lv_label_create(pop_btn);
    lv_label_set_text(pop_label, "Pop");
    lv_obj_set_grid_cell(push_btn, LV_GRID_ALIGN_START, 0, 1, LV_GRID_ALIGN_CENTER, 1,
↪ 1);
    lv_obj_set_grid_cell(pop_btn, LV_GRID_ALIGN_END, 1, 1, LV_GRID_ALIGN_CENTER, 1,␣
↪1);

    lv_fragment_manager_t * manager = lv_fragment_manager_create(NULL);
    /* Clean up the fragment manager before objects in containers got deleted */
    lv_obj_add_event(root, sample_container_del, LV_EVENT_DELETE, manager);

    int depth = 0;
    lv_fragment_t * fragment = lv_fragment_create(&sample_cls, &depth);
    lv_fragment_manager_push(manager, fragment, &container);
    lv_obj_add_event(push_btn, sample_push_click, LV_EVENT_CLICKED, manager);
    lv_obj_add_event(pop_btn, sample_pop_click, LV_EVENT_CLICKED, manager);
}


static void sample_fragment_ctor(lv_fragment_t * self, void * args)
{
    LV_UNUSED(args);
    ((sample_fragment_t *) self)->depth = *((int *) args);
    ((sample_fragment_t *) self)->counter = 0;
}

static lv_obj_t * sample_fragment_create_obj(lv_fragment_t * self, lv_obj_t * parent)
{
    sample_fragment_t * fragment = (sample_fragment_t *) self;
    lv_obj_t * content = lv_obj_create(parent);
    lv_obj_remove_style_all(content);
    lv_obj_set_style_bg_opa(content, LV_OPA_50, 0);
    lv_obj_set_style_bg_color(content, lv_palette_main(LV_PALETTE_YELLOW), 0);
    lv_obj_set_size(content, LV_PCT(100), LV_PCT(100));
    lv_obj_set_flex_flow(content, LV_FLEX_FLOW_COLUMN);
    lv_obj_t * depth = lv_label_create(content);
    lv_label_set_text_fmt(depth, "Depth: %d", fragment->depth);
    lv_obj_t * label = lv_label_create(content);
    fragment->label = label;
    lv_label_set_text_fmt(label, "The button has been pressed %d times", fragment->
↪counter);

    lv_obj_t * inc_btn = lv_btn_create(content);
    lv_obj_t * inc_label = lv_label_create(inc_btn);
    lv_label_set_text(inc_label, "+1");
    lv_obj_add_event(inc_btn, sample_fragment_inc_click, LV_EVENT_CLICKED, fragment);

    return content;
}

static void sample_push_click(lv_event_t * e)
{
    lv_fragment_manager_t * manager = (lv_fragment_manager_t *) lv_event_get_user_
↪data(e);
    size_t stack_size = lv_fragment_manager_get_stack_size(manager);
    lv_fragment_t * fragment = lv_fragment_create(&sample_cls, &stack_size);
    lv_fragment_manager_push(manager, fragment, &container);
```

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```
}

static void sample_pop_click(lv_event_t * e)
{
    lv_fragment_manager_t * manager = (lv_fragment_manager_t *) lv_event_get_user_
↪data(e);
    lv_fragment_manager_pop(manager);
}

static void sample_container_del(lv_event_t * e)
{
    lv_fragment_manager_t * manager = (lv_fragment_manager_t *) lv_event_get_user_
↪data(e);
    lv_fragment_manager_del(manager);
}

static void sample_fragment_inc_click(lv_event_t * e)
{
    sample_fragment_t * fragment = (sample_fragment_t *) lv_event_get_user_data(e);
    fragment->counter++;
    lv_label_set_text_fmt(fragment->label, "The button has been pressed %d times",␣
↪fragment->counter);
}

#endif
```

```
Error encountered while trying to open /home/runner/work/lvgl/lvgl/examples/others/
↪fragment/lv_example_fragment_2.py
```

language c

9.5.3 API

Public header for Fragment

Typedefs

typedef struct _lv_fragment_manager_t **`lv_fragment_manager_t`**

typedef struct *_lv_fragment_t* **`lv_fragment_t`**

typedef struct *_lv_fragment_class_t* **`lv_fragment_class_t`**

typedef struct *_lv_fragment_managed_states_t* **`lv_fragment_managed_states_t`**

Fragment states

Functions

lv_fragment_manager_t ***lv_fragment_manager_create**(*lv_fragment_t* *parent)

Create fragment manager instance

Parameters **parent** -- Parent fragment if this manager is placed inside another fragment, can be null.

Returns Fragment manager instance

void **lv_fragment_manager_del**(*lv_fragment_manager_t* *manager)

Destroy fragment manager instance

Parameters **manager** -- Fragment manager instance

void **lv_fragment_manager_create_obj**(*lv_fragment_manager_t* *manager)

Create object of all fragments managed by this manager.

Parameters **manager** -- Fragment manager instance

void **lv_fragment_manager_del_obj**(*lv_fragment_manager_t* *manager)

Delete object created by all fragments managed by this manager. Instance of fragments will not be deleted.

Parameters **manager** -- Fragment manager instance

void **lv_fragment_manager_add**(*lv_fragment_manager_t* *manager, *lv_fragment_t* *fragment, *lv_obj_t* *const *container)

Attach fragment to manager, and add to container.

Parameters

- **manager** -- Fragment manager instance
- **fragment** -- Fragment instance
- **container** -- Pointer to container object for manager to add objects to

void **lv_fragment_manager_remove**(*lv_fragment_manager_t* *manager, *lv_fragment_t* *fragment)

Detach and destroy fragment. If fragment is in navigation stack, remove from it.

Parameters

- **manager** -- Fragment manager instance
- **fragment** -- Fragment instance

void **lv_fragment_manager_push**(*lv_fragment_manager_t* *manager, *lv_fragment_t* *fragment, *lv_obj_t* *const *container)

Attach fragment to manager and add to navigation stack.

Parameters

- **manager** -- Fragment manager instance
- **fragment** -- Fragment instance
- **container** -- Pointer to container object for manager to add objects to

bool **lv_fragment_manager_pop**(*lv_fragment_manager_t* *manager)

Remove the top-most fragment for stack

Parameters **manager** -- Fragment manager instance

Returns true if there is fragment to pop void **`lv_fragment_manager_replace`**(*lv_fragment_manager_t* *manager, *lv_fragment_t* *fragment, *lv_obj_t* *const *container)

Replace fragment. Old item in the stack will be removed.

Parameters

- **`manager`** -- Fragment manager instance
- **`fragment`** -- Fragment instance
- **`container`** -- Pointer to container object for manager to add objects to

bool **`lv_fragment_manager_send_event`**(*lv_fragment_manager_t* *manager, int code, void *userdata)

Send event to top-most fragment

Parameters

- **`manager`** -- Fragment manager instance
- **`code`** -- User-defined ID of event
- **`userdata`** -- User-defined data

Returns true if fragment returned true

size_t **`lv_fragment_manager_get_stack_size`**(*lv_fragment_manager_t* *manager)

Get stack size of this fragment manager

Parameters **`manager`** -- Fragment manager instance

Returns Stack size of this fragment manager

lv_fragment_t ***`lv_fragment_manager_get_top`**(*lv_fragment_manager_t* *manager)

Get top most fragment instance

Parameters **`manager`** -- Fragment manager instance

Returns Top most fragment instance

lv_fragment_t ***`lv_fragment_manager_find_by_container`**(*lv_fragment_manager_t* *manager, const *lv_obj_t* *container)

Find first fragment instance in the container

Parameters

- **`manager`** -- Fragment manager instance
- **`container`** -- Container which target fragment added to

Returns First fragment instance in the container

lv_fragment_t ***`lv_fragment_manager_get_parent_fragment`**(*lv_fragment_manager_t* *manager)

Get parent fragment

Parameters **`manager`** -- Fragment manager instance

Returns Parent fragment instance

lv_fragment_t ***`lv_fragment_create`**(const *lv_fragment_class_t* *cls, void *args)

Create a fragment instance.

Parameters

- **`cls`** -- Fragment class. This fragment must return non null object.
- **`args`** -- Arguments assigned by fragment manager

Returns Fragment instance

void **`lv_fragment_del`**(*lv_fragment_t* *fragment)

Destroy a fragment.

Parameters **`fragment`** -- Fragment instance.

lv_fragment_manager_t ***`lv_fragment_get_manager`**(*lv_fragment_t* *fragment)

Get associated manager of this fragment

Parameters **`fragment`** -- Fragment instance

Returns Fragment manager instance

lv_obj_t *const ***`lv_fragment_get_container`**(*lv_fragment_t* *fragment)

Get container object of this fragment

Parameters **`fragment`** -- Fragment instance

Returns Reference to container object

lv_fragment_t ***`lv_fragment_get_parent`**(*lv_fragment_t* *fragment)

Get parent fragment of this fragment

Parameters **`fragment`** -- Fragment instance

Returns Parent fragment

lv_obj_t ***`lv_fragment_create_obj`**(*lv_fragment_t* *fragment, *lv_obj_t* *container)

Create object by fragment.

Parameters

- **`fragment`** -- Fragment instance.
- **`container`** -- Container of the objects should be created upon.

Returns Created object

void **`lv_fragment_del_obj`**(*lv_fragment_t* *fragment)

Delete created object of a fragment

Parameters **`fragment`** -- Fragment instance.

void **`lv_fragment_recreate_obj`**(*lv_fragment_t* *fragment)

Destroy obj in fragment, and recreate them.

Parameters **`fragment`** -- Fragment instance

struct **`_lv_fragment_t`**

Public Members

const *lv_fragment_class_t* ***`cls`**

Class of this fragment

lv_fragment_managed_states_t ***managed***

Managed fragment states. If not null, then this fragment is managed.

Warning: Don't modify values inside this struct!

lv_fragment_manager_t ***child_manager***

Child fragment manager

lv_obj_t ***obj***

lv_obj returned by create_obj_cb

struct **_lv_fragment_class_t**

Public Members

void (***constructor_cb**)(*lv_fragment_t* *self, void *args)

Constructor function for fragment class

Param self Fragment instance

Param args Arguments assigned by fragment manager

void (***destructor_cb**)(*lv_fragment_t* *self)

Destructor function for fragment class

Param self Fragment instance, will be freed after this call

void (***attached_cb**)(*lv_fragment_t* *self)

Fragment attached to manager

Param self Fragment instance

void (***detached_cb**)(*lv_fragment_t* *self)

Fragment detached from manager

Param self Fragment instance

lv_obj_t *(***create_obj_cb**)(*lv_fragment_t* *self, *lv_obj_t* *container)

Create objects

Param self Fragment instance

Param container Container of the objects should be created upon

Return Created object, NULL if multiple objects has been created

void (***obj_created_cb**)(*lv_fragment_t* *self, *lv_obj_t* *obj)

Param self Fragment instance

Param obj lv_obj returned by create_obj_cb

void (***obj_will_delete_cb**)(*lv_fragment_t* *self, *lv_obj_t* *obj)

Called before objects in the fragment will be deleted.

Param self Fragment instance

Param obj object with this fragment

void (***obj_deleted_cb**)(*lv_fragment_t* *self, *lv_obj_t* *obj)

Called when the object created by fragment received `LV_EVENT_DELETE` event

Param self Fragment instance

Param obj object with this fragment

bool (***event_cb**)(*lv_fragment_t* *self, int code, void *userdata)

Handle event

Param self Fragment instance

Param which User-defined ID of event

Param data1 User-defined data

Param data2 User-defined data

size_t **instance_size**

REQUIRED: Allocation size of fragment

struct **_lv_fragment_managed_states_t**

#include <lv_fragment.h> Fragment states

Public Members

const *lv_fragment_class_t* ***cls**

Class of the fragment

lv_fragment_manager_t ***manager**

Manager the fragment attached to

lv_obj_t *const ***container**

Container object the fragment adding view to

lv_fragment_t ***instance**

Fragment instance

bool **obj_created**

true between `create_obj_cb` and `obj_deleted_cb` bool **destroying_obj**

true before `lv_fragment_del_obj` is called. Don't touch any object if this is true

bool **in_stack**

true if this fragment is in navigation stack that can be popped

9.6 Messaging

Messaging (`lv_msg`) is a classic publisher subscriber implementation for LVGL.

9.6.1 IDs

Both the publishers and the subscribers needs to know the message identifiers. In `lv_msg` these are simple integers. For example:

```
#define MSG_DOOR_OPENED             1
#define MSG_DOOR_CLOSED             2
#define MSG_USER_NAME_CHANGED       100
#define MSG_USER_AVATAR_CHANGED     101
```

You can organize the message IDs as you wish.

Both parties also need to know about the format of the payload. E.g. in the above example `MSG_DOOR_OPENED` and `MSG_DOOR_CLOSED` might have no payload but `MSG_USER_NAME_CHANGED` can have a `const char *` payload containing the user name, and `MSG_USER_AVATAR_CHANGED` a `const void *` image source with the new avatar image.

To be more precise the message ID's type is declared like this:

```
typedef lv_uintptr_t lv_msg_id_t;
```

This way, if a value in stored in a global variable (e.g. the current temperature) then the address of that variable can be used as message ID too by simply casting it to `lv_msg_id_t`. It saves the creation of message IDs manually as the variable itself serves as message ID too.

9.6.2 Subscribe to a message

`lv_msg_subscribe(msg_id, callback, user_data)` can be used to subscribe to message.

Don't forget that `msg_id` can be a constant or a variable address too:

```
lv_msg_subscribe(45, my_callback_1, NULL);

int v;
lv_msg_subscribe((lv_msg_id_t)&v, my_callback_2, NULL);
```

The callback should look like this:

```

static void user_name_subscriber_cb(lv_msg_t * m)
{
```

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```
    /*m: a message object with the msg_id, payload, and user_data (set during␣
↪subscription)*/

    ...do something...
}
```

From `lv_msg_t` the followings can be used to get some data:

- `lv_msg_get_id(m)`
- `lv_msg_get_payload(m)`
- `lv_msg_get_user_data(m)`

9.6.3 Subscribe with an lv_obj

It's quite typical that an LVGL widget is interested in some messages. To make it simpler `lv_msg_subsribe_obj(msg_id, obj, user_data)` can be used. If a new message is published with `msg_id` an `LV_EVENT_MSG_RECEIVED` event will be sent to the object.

For example:

```
lv_obj_add_event(user_name_label, user_name_label_event_cb, LV_EVENT_MSG_RECEIVED,␣
↪NULL);
lv_msg_subsribe_obj(MSG_USER_NAME_CHANGED, user_name_label, NULL);

...

void user_name_label_event_cb(lv_event_t * e)
{
    lv_obj_t * label = lv_event_get_target(e);
    lv_msg_t * m = lv_event_get_msg(e);
    lv_label_set_text(label, lv_msg_get_payload(m));
}
```

Here `msg_id` also can be a variable's address:

```
char name[64];
lv_msg_subsribe_obj(name, user_name_label, NULL);
```

Unsubscribe

`lv_msg_subscribe` returns a pointer which can be used to unsubscribe:

```
void * s1;
s1 = lv_msg_subscribe(MSG_USER_DOOR_OPENED, some_callback, NULL);

...

lv_msg_unsubscribe(s1);
```

9.6.4 Send message

Messages can be sent with `lv_msg_send(msg_id, payload)`. E.g.

```
lv_msg_send(MSG_USER_DOOR_OPENED, NULL);
lv_msg_send(MSG_USER_NAME_CHANGED, "John Smith");
```

If have subscribed to a variable with `lv_msg_subscribe((lv_msg_id_t)&v, callback, NULL)` and changed the variable's value the subscribers can be notified like this:

```
v = 10;
lv_msg_update_value(&v); //Notify all the subscribers of `(lv_msg_id_t)&v`
```

It's handy way of creating API for the UI too. If the UI provides some global variables (e.g. `int current_tempereature;`) and anyone can read and write this variable. After writing they can notify all the elements who are interested in that value. E.g. an `lv_label` can subscribe to `(lv_msg_id_t)&current_tempereature` and update its text when it's notified about the new temperature.

9.6.5 Example

Slider to label messaging

```
#include "../../lv_examples.h"
#if LV_USE_MSG && LV_USE_SLIDER && LV_USE_LABEL && LV_BUILD_EXAMPLES

/*Define a message ID*/
#define MSG_NEW_TEMPERATURE     1

static void slider_event_cb(lv_event_t * e);
static void label_event_cb(lv_event_t * e);

/**
 * A slider sends a message on value change and a label display's that value
 */
void lv_example_msg_1(void)
{
    /*Create a slider in the center of the display*/
    lv_obj_t * slider = lv_slider_create(lv_scr_act());
    lv_obj_center(slider);
    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_VALUE_CHANGED, NULL);

    /*Create a label below the slider*/
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_obj_add_event(label, label_event_cb, LV_EVENT_MSG_RECEIVED, NULL);
    lv_label_set_text(label, "0%");
    lv_obj_align(label, LV_ALIGN_CENTER, 0, 30);

    /*Subscribe the label to a message. Also use the user_data to set a format string␣
↪here.*/
    lv_msg_subscribe_obj(MSG_NEW_TEMPERATURE, label, "%d °C");
}

static void slider_event_cb(lv_event_t * e)
{
```

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```
    /*Notify all subscribers (only the label now) that the slider value has been␣
↪changed*/
    lv_obj_t * slider = lv_event_get_target(e);
    int32_t v = lv_slider_get_value(slider);
    lv_msg_send(MSG_NEW_TEMPERATURE, &v);
}

static void label_event_cb(lv_event_t * e)
{
    lv_obj_t * label = lv_event_get_target(e);
    lv_msg_t * m = lv_event_get_msg(e);

    const char * fmt = lv_msg_get_user_data(m);
    const int32_t * v = lv_msg_get_payload(m);

    lv_label_set_text_fmt(label, fmt, *v);
}

#endif
```

```
# Define a message ID
MSG_NEW_TEMPERATURE = const(1)

# Define the object that will be sent as msg payload
class Temperature:
    def __init__(self, value):
        self.value = value
    def __repr__(self):
        return f"{self.value} °C"

def slider_event_cb(e):
    slider = e.get_target_obj()
    v = slider.get_value()
    # Notify all subscribers (only the label now) that the slider value has been␣
↪changed
    lv.msg_send(MSG_NEW_TEMPERATURE, Temperature(v))

def label_event_cb(e):
    label = e.get_target_obj()
    msg = e.get_msg()
    # Respond only to MSG_NEW_TEMPERATURE message
    if msg.get_id() == MSG_NEW_TEMPERATURE:
        payload = msg.get_payload()
        temprature = payload.__cast__()
        label.set_text(str(temprature))

# Create a slider in the center of the display
slider = lv.slider(lv.scr_act())
slider.center()
slider.add_event(slider_event_cb, lv.EVENT.VALUE_CHANGED, None)

# Create a label below the slider
label = lv.label(lv.scr_act())
label.add_event(label_event_cb, lv.EVENT.MSG_RECEIVED, None)
label.set_text("0%")
```

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```
label.align(lv.ALIGN.CENTER, 0, 30)

# Subscribe the label to a message
lv.msg_subscribe_obj(MSG_NEW_TEMPERATURE, label, None)
```

Handling login and its states

```
#include "../../lv_examples.h"
#if LV_USE_MSG && LV_USE_SLIDER && LV_USE_LABEL && LV_BUILD_EXAMPLES

/*Define a message ID*/
#define MSG_LOGIN_ATTEMPT   1
#define MSG_LOG_OUT         2
#define MSG_LOGIN_ERROR     3
#define MSG_LOGIN_OK        4

static void auth_manager(lv_msg_t * m);
static void textarea_event_cb(lv_event_t * e);
static void log_out_event_cb(lv_event_t * e);
static void start_engine_msg_event_cb(lv_event_t * e);
static void info_label_msg_event_cb(lv_event_t * e);

/**
 * Simple PIN login screen.
 * No global variables are used, all state changes are communicated via messages.
 */
void lv_example_msg_2(void)
{
    lv_msg_subscribe(MSG_LOGIN_ATTEMPT, auth_manager, "hello");

    /*Create a slider in the center of the display*/
    lv_obj_t * ta = lv_textarea_create(lv_scr_act());
    lv_obj_set_pos(ta, 10, 10);
    lv_obj_set_width(ta, 200);
    lv_textarea_set_one_line(ta, true);
    lv_textarea_set_password_mode(ta, true);
    lv_textarea_set_placeholder_text(ta, "The password is: hello");
    lv_obj_add_event(ta, textarea_event_cb, LV_EVENT_ALL, NULL);
    lv_msg_subscribe_obj(MSG_LOGIN_ERROR, ta, NULL);
    lv_msg_subscribe_obj(MSG_LOGIN_OK, ta, NULL);
    lv_msg_subscribe_obj(MSG_LOG_OUT, ta, NULL);

    lv_obj_t * kb = lv_keyboard_create(lv_scr_act());
    lv_keyboard_set_textarea(kb, ta);

    lv_obj_t * btn;
    lv_obj_t * label;

    /*Create a log out button which will be active only when logged in*/
    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_pos(btn, 240, 10);
    lv_obj_add_event(btn, log_out_event_cb, LV_EVENT_ALL, NULL);
    lv_msg_subscribe_obj(MSG_LOGIN_OK, btn, NULL);
    lv_msg_subscribe_obj(MSG_LOG_OUT, btn, NULL);
```

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```
    label = lv_label_create(btn);
    lv_label_set_text(label, "LOG OUT");

    /*Create a label to show info*/
    label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "");
    lv_obj_add_event(label, info_label_msg_event_cb, LV_EVENT_MSG_RECEIVED, NULL);
    lv_obj_set_pos(label, 10, 60);
    lv_msg_subscribe_obj(MSG_LOGIN_ERROR, label, NULL);
    lv_msg_subscribe_obj(MSG_LOGIN_OK, label, NULL);
    lv_msg_subscribe_obj(MSG_LOG_OUT, label, NULL);

    /*Create button which will be active only when logged in*/
    btn = lv_btn_create(lv_scr_act());
    lv_obj_set_pos(btn, 10, 80);
    lv_obj_add_event(btn, start_engine_msg_event_cb, LV_EVENT_MSG_RECEIVED, NULL);
    lv_obj_add_flag(btn, LV_OBJ_FLAG_CHECKABLE);
    lv_msg_subscribe_obj(MSG_LOGIN_OK, btn, NULL);
    lv_msg_subscribe_obj(MSG_LOG_OUT, btn, NULL);

    label = lv_label_create(btn);
    lv_label_set_text(label, "START ENGINE");

    lv_msg_send(MSG_LOG_OUT, NULL);
}

static void auth_manager(lv_msg_t * m)
{
    const char * pin_act = lv_msg_get_payload(m);
    const char * pin_expexted = lv_msg_get_user_data(m);
    if(strcmp(pin_act, pin_expexted) == 0) {
        lv_msg_send(MSG_LOGIN_OK, NULL);
    }
    else {
        lv_msg_send(MSG_LOGIN_ERROR, "Incorrect PIN");
    }

}

static void textarea_event_cb(lv_event_t * e)
{
    lv_obj_t * ta = lv_event_get_target(e);
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_READY) {
        lv_msg_send(MSG_LOGIN_ATTEMPT, lv_textarea_get_text(ta));
    }
    else if(code == LV_EVENT_MSG_RECEIVED) {
        lv_msg_t * m = lv_event_get_msg(e);
        switch(lv_msg_get_id(m)) {
            case MSG_LOGIN_ERROR:
                /*If there was an error, clean the text area*/
                if(strlen(lv_msg_get_payload(m))) lv_textarea_set_text(ta, "");
                break;
            case MSG_LOGIN_OK:
                lv_obj_add_state(ta, LV_STATE_DISABLED);
                lv_obj_clear_state(ta, LV_STATE_FOCUSED | LV_STATE_FOCUS_KEY);
                break;
```

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```
            case MSG_LOG_OUT:
                lv_textarea_set_text(ta, "");
                lv_obj_clear_state(ta, LV_STATE_DISABLED);
                break;
        }
    }
}

static void log_out_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_CLICKED) {
        lv_msg_send(MSG_LOG_OUT, NULL);
    }
    else if(code == LV_EVENT_MSG_RECEIVED) {
        lv_msg_t * m = lv_event_get_msg(e);
        lv_obj_t * btn = lv_event_get_target(e);
        switch(lv_msg_get_id(m)) {
            case MSG_LOGIN_OK:
                lv_obj_clear_state(btn, LV_STATE_DISABLED);
                break;
            case MSG_LOG_OUT:
                lv_obj_add_state(btn, LV_STATE_DISABLED);
                break;
        }
    }
}

static void start_engine_msg_event_cb(lv_event_t * e)
{
    lv_msg_t * m = lv_event_get_msg(e);
    lv_obj_t * btn = lv_event_get_target(e);
    switch(lv_msg_get_id(m)) {
        case MSG_LOGIN_OK:
            lv_obj_clear_state(btn, LV_STATE_DISABLED);
            break;
        case MSG_LOG_OUT:
            lv_obj_add_state(btn, LV_STATE_DISABLED);
            break;
    }
}

static void info_label_msg_event_cb(lv_event_t * e)
{
    lv_obj_t * label = lv_event_get_target(e);
    lv_msg_t * m = lv_event_get_msg(e);
    switch(lv_msg_get_id(m)) {
        case MSG_LOGIN_ERROR:
            lv_label_set_text(label, lv_msg_get_payload(m));
            lv_obj_set_style_text_color(label, lv_palette_main(LV_PALETTE_RED), 0);
            break;
        case MSG_LOGIN_OK:
            lv_label_set_text(label, "Login successful");
            lv_obj_set_style_text_color(label, lv_palette_main(LV_PALETTE_GREEN), 0);
            break;
        case MSG_LOG_OUT:
            lv_label_set_text(label, "Logged out");
```

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```
            lv_obj_set_style_text_color(label, lv_palette_main(LV_PALETTE_GREY), 0);
            break;
        default:
            break;
    }
}

#endif
```

```
from micropython import const

# Define a message ID
MSG_LOGIN_ATTEMPT = const(1)
MSG_LOG_OUT       = const(2)
MSG_LOGIN_ERROR   = const(3)
MSG_LOGIN_OK      = const(4)

# Define the object that will be sent as msg payload
class Message:
    def __init__(self, value):
        self.value = value
    def message(self):
        return self.value

def auth_manager(m,passwd):
    payload = m.get_payload()
    pin_act = payload.__cast__().message()
    # print("pin act: ",pin_act,end="")
    # print(", pin axpected: ",passwd)
    pin_expected = passwd
    if pin_act == pin_expected:
        lv.msg_send(MSG_LOGIN_OK, None)
    else:
        lv.msg_send(MSG_LOGIN_ERROR, Message("Incorrect PIN"))

def textarea_event_cb(e):
    ta = e.get_target_obj()
    code = e.get_code()
    if code == lv.EVENT.READY:
        passwd = Message(ta.get_text())
        lv.msg_send(MSG_LOGIN_ATTEMPT, passwd)
    elif code == lv.EVENT.MSG_RECEIVED:
        m = e.get_msg()
        id = m.get_id()
        if id == MSG_LOGIN_ERROR:
            # If there was an error, clean the text area
            msg = m.get_payload().__cast__()
            if len(msg.message()):
                    ta.set_text("")
        elif id == MSG_LOGIN_OK:
            ta.add_state(lv.STATE.DISABLED)
            ta.clear_state(lv.STATE.FOCUSED | lv.STATE.FOCUS_KEY)
        elif id == MSG_LOG_OUT:
            ta.set_text("");
            ta.clear_state(lv.STATE.DISABLED)
```

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```
def log_out_event_cb(e):
    code = e.get_code()
    if code == lv.EVENT.CLICKED:
        lv.msg_send(MSG_LOG_OUT, None)
    elif code == lv.EVENT.MSG_RECEIVED:
        m = e.get_msg()
        btn = e.get_target_obj()
        id = m.get_id()
        if id == MSG_LOGIN_OK:
            btn.clear_state(lv.STATE.DISABLED)
        elif id == MSG_LOG_OUT:
            btn.add_state(lv.STATE.DISABLED)

def start_engine_msg_event_cb(e):

    m = e.get_msg()
    btn = e.get_target_obj()
    id = m.get_id()
    if id == MSG_LOGIN_OK:
        btn.clear_state(lv.STATE.DISABLED)
    elif id == MSG_LOG_OUT:
        btn.add_state(lv.STATE.DISABLED)


def info_label_msg_event_cb(e):
    label = e.get_target_obj()
    m = e.get_msg()
    id = m.get_id()
    if id ==  MSG_LOGIN_ERROR:
        payload = m.get_payload()
        label.set_text(payload.__cast__().message())
        label.set_style_text_color(lv.palette_main(lv.PALETTE.RED), 0)
    elif id == MSG_LOGIN_OK:
        label.set_text("Login successful")
        label.set_style_text_color(lv.palette_main(lv.PALETTE.GREEN), 0)
    elif id == MSG_LOG_OUT:
        label.set_text("Logged out")
        label.set_style_text_color(lv.palette_main(lv.PALETTE.GREY), 0)

def register_auth(msg_id,auth_msg):
    lv.msg_subscribe(MSG_LOGIN_ATTEMPT, lambda m: auth_msg(m,"hello"), None)
#
# Simple PIN login screen.
# No global variables are used, all state changes are communicated via messages.

register_auth(MSG_LOGIN_ATTEMPT,auth_manager)
# lv.msg_subscribe_obj(MSG_LOGIN_ATTEMPT, auth_manager, "Hello")

# Create a slider in the center of the display
ta = lv.textarea(lv.scr_act())
ta.set_pos(10, 10)
ta.set_width(200)
ta.set_one_line(True)
ta.set_password_mode(True)
ta.set_placeholder_text("The password is: hello")
ta.add_event(textarea_event_cb, lv.EVENT.ALL, None)
lv.msg_subscribe_obj(MSG_LOGIN_ERROR, ta, None)
```

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```
lv.msg_subscribe_obj(MSG_LOGIN_OK, ta, None)
lv.msg_subscribe_obj(MSG_LOG_OUT, ta, None)

kb = lv.keyboard(lv.scr_act())
kb.set_textarea(ta)

# Create a log out button which will be active only when logged in
btn = lv.btn(lv.scr_act())
btn.set_pos(240, 10)
btn.add_event(log_out_event_cb, lv.EVENT.ALL, None)
lv.msg_subscribe_obj(MSG_LOGIN_OK, btn, None)
lv.msg_subscribe_obj(MSG_LOG_OUT, btn, None)

label = lv.label(btn);
label.set_text("LOG OUT")

# Create a label to show info
label = lv.label(lv.scr_act());
label.set_text("")
label.add_event(info_label_msg_event_cb, lv.EVENT.MSG_RECEIVED, None)
label.set_pos(10, 60)
lv.msg_subscribe_obj(MSG_LOGIN_ERROR, label, None)
lv.msg_subscribe_obj(MSG_LOGIN_OK, label, None)
lv.msg_subscribe_obj(MSG_LOG_OUT, label, None)

#Create button which will be active only when logged in
btn = lv.btn(lv.scr_act())
btn.set_pos(10, 80)
btn.add_event(start_engine_msg_event_cb, lv.EVENT.MSG_RECEIVED, None)
btn.add_flag(lv.obj.FLAG.CHECKABLE)
lv.msg_subscribe_obj(MSG_LOGIN_OK, btn, None)
lv.msg_subscribe_obj(MSG_LOG_OUT, btn, None)

label = lv.label(btn)
label.set_text("START ENGINE")

lv.msg_send(MSG_LOG_OUT, None)
```

Setting the same value from many sources

```
#include "../../lv_examples.h"
#if LV_USE_MSG && LV_USE_SLIDER && LV_USE_LABEL && LV_BUILD_EXAMPLES

static int32_t limit_value(int32_t v);
static void btn_event_cb(lv_event_t * e);
static void label_event_cb(lv_event_t * e);
static void slider_event_cb(lv_event_t * e);

static int32_t power_value;

/**
 * Show how an increment button, a decrement button, as slider can set a value
 * and a label display it.
 * The current value (i.e. the system's state) is stored only in one static variable␣
↪in a function
```

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```
 * and no global variables are required.
 */
void lv_example_msg_3(void)
{

    lv_obj_t * panel = lv_obj_create(lv_scr_act());
    lv_obj_set_size(panel, 250, LV_SIZE_CONTENT);
    lv_obj_center(panel);
    lv_obj_set_flex_flow(panel, LV_FLEX_FLOW_ROW);
    lv_obj_set_flex_align(panel, LV_FLEX_ALIGN_SPACE_BETWEEN, LV_FLEX_ALIGN_CENTER,␣
↪LV_FLEX_ALIGN_START);

    lv_obj_t * btn;
    lv_obj_t * label;

    /*Up button*/
    btn = lv_btn_create(panel);
    lv_obj_set_flex_grow(btn, 1);
    lv_obj_add_event(btn, btn_event_cb, LV_EVENT_ALL, NULL);
    label = lv_label_create(btn);
    lv_label_set_text(label, LV_SYMBOL_LEFT);
    lv_obj_center(label);

    /*Current value*/
    label = lv_label_create(panel);
    lv_obj_set_flex_grow(label, 2);
    lv_obj_set_style_text_align(label, LV_TEXT_ALIGN_CENTER, 0);
    lv_label_set_text(label, "?");
    lv_msg_subscribe_obj((lv_msg_id_t)&power_value, label, NULL);
    lv_obj_add_event(label, label_event_cb, LV_EVENT_MSG_RECEIVED, NULL);

    /*Down button*/
    btn = lv_btn_create(panel);
    lv_obj_set_flex_grow(btn, 1);
    lv_obj_add_event(btn, btn_event_cb, LV_EVENT_ALL, NULL);
    label = lv_label_create(btn);
    lv_label_set_text(label, LV_SYMBOL_RIGHT);
    lv_obj_center(label);

    /*Slider*/
    lv_obj_t * slider = lv_slider_create(panel);
    lv_obj_set_flex_grow(slider, 1);
    lv_obj_add_flag(slider, LV_OBJ_FLAG_FLEX_IN_NEW_TRACK);
    lv_msg_subscribe_obj((lv_msg_id_t)&power_value, slider, NULL);
    lv_obj_add_event(slider, slider_event_cb, LV_EVENT_ALL, NULL);

    power_value = 30;
    lv_msg_update_value(&power_value);
}

static int32_t limit_value(int32_t v)
{
    return LV_CLAMP(30, v, 80);
}


static void btn_event_cb(lv_event_t * e)
```

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```
{
    lv_obj_t * btn = lv_event_get_target(e);
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_CLICKED || code == LV_EVENT_LONG_PRESSED_REPEAT) {
        if(lv_obj_get_index(btn) == 0) {    /*First object is the dec. button*/
            power_value = limit_value(power_value - 1);
            lv_msg_update_value(&power_value);
        }
        else {
            power_value = limit_value(power_value + 1);
            lv_msg_update_value(&power_value);
        }
    }
}

static void label_event_cb(lv_event_t * e)
{
    lv_obj_t * label = lv_event_get_target(e);
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_MSG_RECEIVED) {
        lv_msg_t * m = lv_event_get_msg(e);
        const int32_t * v = lv_msg_get_payload(m);
        lv_label_set_text_fmt(label, "%"LV_PRId32" %%", *v);
    }
}

static void slider_event_cb(lv_event_t * e)
{
    lv_obj_t * slider = lv_event_get_target(e);
    lv_event_code_t code = lv_event_get_code(e);
    if(code == LV_EVENT_VALUE_CHANGED) {
        power_value = limit_value(lv_slider_get_value(slider));
        lv_msg_update_value(&power_value);
    }
    else if(code == LV_EVENT_MSG_RECEIVED) {
        lv_msg_t * m = lv_event_get_msg(e);
        const int32_t * v = lv_msg_get_payload(m);
        lv_slider_set_value(slider, *v, LV_ANIM_OFF);
    }
}

#endif
```

```
# Define a message ID
MSG_INC            = 1
MSG_DEC            = 2
MSG_SET            = 3
MSG_UPDATE         = 4
MSG_UPDATE_REQUEST = 5

# Define the object that will be sent as msg payload
class NewValue:
    def __init__(self, value):
        self.value = value
    def __repr__(self):
        return f"{self.value} %"
```

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```
class LV_Example_Msg_2:

    def __init__(self):
        self.value = 10
        lv.msg_subscribe(MSG_INC, self.value_handler, None)
        lv.msg_subscribe(MSG_DEC, self.value_handler, None)
        lv.msg_subscribe(MSG_SET, self.value_handler, None)
        lv.msg_subscribe(MSG_UPDATE, self.value_handler, None)
        lv.msg_subscribe(MSG_UPDATE_REQUEST, self.value_handler, None)

        panel = lv.obj(lv.scr_act())
        panel.set_size(250, lv.SIZE_CONTENT)
        panel.center()
        panel.set_flex_flow(lv.FLEX_FLOW.ROW)
        panel.set_flex_align(lv.FLEX_ALIGN.SPACE_BETWEEN, lv.FLEX_ALIGN.CENTER, lv.
↪FLEX_ALIGN.START)

        # Up button
        btn = lv.btn(panel)
        btn.set_flex_grow(1)
        btn.add_event(self.btn_event_cb, lv.EVENT.ALL, None)
        label = lv.label(btn)
        label.set_text(lv.SYMBOL.LEFT)
        label.center()

        # Current value
        label = lv.label(panel)
        label.set_flex_grow(2)
        label.set_style_text_align(lv.TEXT_ALIGN.CENTER, 0)
        label.set_text("?")
        lv.msg_subscribe_obj(MSG_UPDATE, label, None)
        label.add_event(self.label_event_cb, lv.EVENT.MSG_RECEIVED, None)

        # Down button
        btn = lv.btn(panel)
        btn.set_flex_grow(1)
        btn.add_event(self.btn_event_cb, lv.EVENT.ALL, None)
        label = lv.label(btn)
        label.set_text(lv.SYMBOL.RIGHT)
        label.center()

        # Slider
        slider = lv.slider(panel)
        slider.set_flex_grow(1)
        slider.add_flag(lv.OBJ_FLAG_FLEX_IN_NEW_TRACK)
        slider.add_event(self.slider_event_cb, lv.EVENT.ALL, None)
        lv.msg_subscribe_obj(MSG_UPDATE, slider, None)


        # As there are new UI elements that don't know the system's state
        # send an UPDATE REQUEST message which will trigger an UPDATE message with␣
↪the current value
        lv.msg_send(MSG_UPDATE_REQUEST, None)

    def value_handler(self,m):
        old_value = self.value
        id = m.get_id()
```

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```
        if id == MSG_INC:
            if self.value < 100:
                self.value +=1
        elif id == MSG_DEC:
            if self.value > 0:
                self.value -=1
        elif id == MSG_SET:
            payload = m.get_payload()
            new_value=payload.__cast__()
            self.value = new_value.value
            # print("value_handler: new value: {:d}".format(new_value.value))
        elif id == MSG_UPDATE_REQUEST:
            lv.msg_send(MSG_UPDATE, NewValue(self.value))

        if self.value != old_value:
                lv.msg_send(MSG_UPDATE, NewValue(self.value));

    def btn_event_cb(self,e):
        btn = e.get_target_obj()
        code = e.get_code()
        if code == lv.EVENT.CLICKED or code == lv.EVENT.LONG_PRESSED_REPEAT:
            if btn.get_index() == 0:      # rst object is the dec. button
                lv.msg_send(MSG_DEC, None)
            else :
                lv.msg_send(MSG_INC, None)

    def label_event_cb(self,e):
        label = e.get_target_obj()
        code = e.get_code()
        if code == lv.EVENT.MSG_RECEIVED:
            m = e.get_msg()
            if m.get_id() == MSG_UPDATE:
                payload = m.get_payload()
                value=payload.__cast__()
                # print("label_event_cb: " + str(value))
                label.set_text(str(value))

    def slider_event_cb(self,e):
        slider = e.get_target_obj()
        code = e.get_code()
        if code == lv.EVENT.VALUE_CHANGED:
            v = slider.get_value()
            # print("slider_event_cb: {:d}".format(v))
            lv.msg_send(MSG_SET, NewValue(v))

        elif code == lv.EVENT.MSG_RECEIVED:
            m = e.get_msg()
            if m.get_id() == MSG_UPDATE:
                v = m.get_payload()
                value = v.__cast__()
                slider.set_value(value.value, lv.ANIM.OFF)

lv_example_msg_2 = LV_Example_Msg_2()
```

9.6.6 API

Typedefs

typedef lv_uintptr_t **`lv_msg_id_t`**

typedef void (***`lv_msg_subscribe_cb_t`**)(*lv_msg_t* *msg)

Functions

void **`lv_msg_init`**(void)

Called internally to initialize the message module

void ***`lv_msg_subscribe`**(*lv_msg_id_t* msg_id, *lv_msg_subscribe_cb_t* cb, void *user_data)

Subscribe to an `msg_id`

Parameters

- **`msg_id`** -- the message ID to listen to
- **`cb`** -- callback to call if a message with `msg_id` was sent
- **`user_data`** -- arbitrary data which will be available in `cb` too

Returns pointer to a "subscribe object". It can be used the unsubscribe.

void ***`lv_msg_subscribe_obj`**(*lv_msg_id_t* msg_id, *lv_obj_t* *obj, void *user_data)

Subscribe an `lv_obj` to a message. `LV_EVENT_MSG_RECEIVED` will be triggered if a message with matching ID was sent

Parameters

- **`msg_id`** -- the message ID to listen to
- **`obj`** -- pointer to an `lv_obj`
- **`user_data`** -- arbitrary data which will be available in `cb` too

Returns pointer to a "subscribe object". It can be used the unsubscribe.

void **`lv_msg_unsubscribe`**(void *s)

Cancel a previous subscription

Parameters **`s`** -- pointer to a "subscibe object". Return value of `lv_msg_subscribe` or `lv_msg_subscribe_obj`

void **`lv_msg_send`**(*lv_msg_id_t* msg_id, const void *payload)

Send a message with a given ID and payload

Parameters

- **`msg_id`** -- ID of the message to send
- **`data`** -- pointer to the data to send

void **lv_msg_update_value**(void *v)

Send a message where the message ID is `v` (the value of the pointer) and the payload is `v`. It can be used to send unique messages when a variable changed.

Note: to subscribe to a variable use `lv_msg_subscribe((lv_msg_id_t)v, msg_cb, user_data)` or `lv_msg_subscribe_obj((lv_msg_id_t)v, obj, user_data)`

Parameters **v** -- pointer to a variable.

lv_msg_id_t **lv_msg_get_id**(*lv_msg_t* *m)

Get the ID of a message object. Typically used in the subscriber callback.

Parameters **m** -- pointer to a message object

Returns the ID of the message

const void ***lv_msg_get_payload**(*lv_msg_t* *m)

Get the payload of a message object. Typically used in the subscriber callback.

Parameters **m** -- pointer to a message object

Returns the payload of the message

void ***lv_msg_get_user_data**(*lv_msg_t* *m)

Get the user data of a message object. Typically used in the subscriber callback.

Parameters **m** -- pointer to a message object

Returns the user data of the message

lv_msg_t ***lv_event_get_msg**(*lv_event_t* *e)

Get the message object from an event object. Can be used in `LV_EVENT_MSG_RECEIVED` events.

Parameters **e** -- pointer to an event object

Returns the message object or NULL if called with unrelated event code.

struct **lv_msg_t**

Public Members

lv_msg_id_t **id**

void ***user_data**

void ***_priv_data**

const void ***payload**

9.7 Image font (imgfont)

Draw image in label or span obj with imgfont. This is often used to display Unicode emoji icons in text. Supported image formats: determined by LVGL image decoder.

9.7.1 Usage

Enable `LV_USE_IMGFONT` in `lv_conf.h`.

To create a new imgfont use `lv_imgfont_create(height, path_cb)`.

`height` used to indicate the size of a imgfont. `path_cb` Used to get the image path of the specified unicode.

Use `lv_imgfont_destroy(imgfont)` to destroy a imgfont that is no longer used.

9.7.2 Example

Use emojis in a text.

```c
#include "../../lv_examples.h"
#include <stdio.h>

#if LV_BUILD_EXAMPLES
#if LV_USE_IMGFONT

LV_IMG_DECLARE(emoji_F617)
static bool get_imgfont_path(const lv_font_t * font, void * img_src,
                             uint16_t len, uint32_t unicode, uint32_t unicode_next,
                             lv_coord_t * offset_y, void * user_data)
{
    LV_UNUSED(font);
    LV_UNUSED(unicode_next);
    LV_UNUSED(offset_y);
    LV_UNUSED(user_data);
    LV_ASSERT_NULL(img_src);

    if(unicode < 0xF000) return false;

    if(unicode == 0xF617) {
        memcpy(img_src, &emoji_F617, sizeof(lv_img_dsc_t));
    }
    else {
        char * path = (char *)img_src;
#if LV_USE_FFMPEG
        lv_snprintf(path, len, "%s/%04X.png", "lvgl/examples/assets/emoji", unicode);
#elif LV_USE_PNG
        lv_snprintf(path, len, "%s/%04X.png", "A:lvgl/examples/assets/emoji",␣
↪unicode);
#endif
    }

    return true;
}

/**
```

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```
 * draw img in label or span obj
 */
void lv_example_imgfont_1(void)
{
    lv_font_t * imgfont = lv_imgfont_create(80, get_imgfont_path, NULL);
    if(imgfont == NULL) {
        LV_LOG_ERROR("imgfont init error");
        return;
    }

    imgfont->fallback = LV_FONT_DEFAULT;

    lv_obj_t * label1 = lv_label_create(lv_scr_act());
    lv_label_set_text(label1, "12\uF600\uF617AB");
    lv_obj_set_style_text_font(label1, imgfont, LV_PART_MAIN);
    lv_obj_center(label1);
}
#else

void lv_example_imgfont_1(void)
{
    lv_obj_t * label = lv_label_create(lv_scr_act());
    lv_label_set_text(label, "imgfont is not installed");
    lv_obj_center(label);
}

#endif
#endif
```

```
import fs_driver
import sys

# set LV_USE_FFMPEG to True if it is enabled in lv_conf.h
LV_USE_FFMPEG = True
LV_FONT_DEFAULT = lv.font_montserrat_14

fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'A')

# get the directory in which the script is running
try:
    script_path = __file__[:__file__.rfind('/')] if __file__.find('/') >= 0 else '.'
except NameError:
    script_path = ''

def get_imgfont_path(font, img_src, length, unicode, unicode_next, offset_y, user_
↪data) :
    if unicode < 0xf600:
        return
    if LV_USE_FFMPEG:
        path = bytes(script_path + "/../../assets/emoji/{:04X}.png".format(unicode) +
↪"\0","ascii")
    else:
        path = bytes("A:"+ script_path + "/../../assets/emoji/{:04X}.png".
↪format(unicode) + "\0","ascii")
    # print("image path: ",path)
```

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```
    img_src.__dereference__(length)[0:len(path)] = path
    return True

#
# draw img in label or span obj
#
imgfont = lv.imgfont_create(80, get_imgfont_path, None)
if imgfont == None:
    print("imgfont init error")
    sys.exit(1)

imgfont.fallback = LV_FONT_DEFAULT

label1 = lv.label(lv.scr_act())
label1.set_text("12\uF600\uF617AB")
label1.set_style_text_font(imgfont, lv.PART.MAIN)
label1.center()
```

9.7.3 API

Typedefs

typedef bool (***`lv_imgfont_get_path_cb_t`**)(const lv_font_t *font, void *img_src, uint16_t len, uint32_t unicode, uint32_t unicode_next, lv_coord_t *offset_y, void *user_data)

Functions

lv_font_t ***`lv_imgfont_create`**(uint16_t height, *lv_imgfont_get_path_cb_t* path_cb, void *user_data)

Creates a image font with info parameter specified.

Parameters

- **`height`** -- font size
- **`path_cb`** -- a function to get the image path name of character.

Returns pointer to the new imgfont or NULL if create error.

void **`lv_imgfont_destroy`**(lv_font_t *font)

Destroy a image font that has been created.

Parameters **`font`** -- pointer to image font handle.

9.8 Pinyin IME

Pinyin IME provides API to provide Chinese Pinyin input method (Chinese input) for keyboard object, which supports 26 key and 9 key input modes. You can think of `lv_ime_pinyin` as a Pinyin input method plug-in for keyboard objects.

Normally, an environment where *lv_keyboard* can run can also run `lv_ime_pinyin`. There are two main influencing factors: the size of the font file and the size of the dictionary.

`lv_ime_pinyin`[illegible]*[illegible]*[illegible]([illegible])[illegible]26[illegible]9[illegible] `lv_ime_pinyin` [illegible]

[illegible]*[illegible]*[illegible] `lv_ime_pinyin` [illegible]

9.8.1 Usage

Enable `LV_USE_IME_PINYIN` in `lv_conf.h`.

First use `lv_ime_pinyin_create(lv_scr_act())` to create a Pinyin input method plug-in, then use `lv_ime_pinyin_set_keyboard(pinyin_ime, kb)` to add the `keyboard` you created to the Pinyin input method plug-in. You can use `lv_ime_pinyin_set_dict(pinyin_ime, your_dict)` to use a custom dictionary (if you don't want to use the built-in dictionary at first, you can disable `LV_IME_PINYIN_USE_DEFAULT_DICT` in `lv_conf.h`, which can save a lot of memory space).

The built-in thesaurus is customized based on the **LV_FONT_SIMSUN_16_CJK** font library, which currently only has more than `1,000` most common CJK radicals, so it is recommended to use custom fonts and thesaurus.

In the process of using the Pinyin input method plug-in, you can change the keyboard and dictionary at any time.

[illegible] `lv_conf.h` [illegible] `LV_USE_IME_PINYIN`[illegible]

[illegible] `lv_ime_pinyin_create(lv_scr_act())` [illegible] [illegible] `lv_ime_pinyin_set_keyboard(pinyin_ime, kb)` [illegible]

[illegible] LVGL [illegible] **LV_FONT_SIMSUN_16_CJK** [illegible] `1000` [illegible] CJK [illegible]

[illegible] `lv_ime_pinyin_set_dict(pinyin_ime, your_dict)` [illegible] `lv_conf.h` [illegible] `LV_IME_PINYIN_USE_DEFAULT_DICT` [illegible]

9.8.2 Custom dictionary

If you don't want to use the built-in Pinyin dictionary, you can use the custom dictionary. Or if you think that the built-in phonetic dictionary consumes a lot of memory, you can also use a custom dictionary.

Customizing the dictionary is very simple.

First, set `LV_IME_PINYIN_USE_DEFAULT_DICT` to `0` in `lv_conf.h`

Then, write a dictionary in the following format.

[illegible]

[illegible] [illegible] `lv_conf.h` [illegible] `LV_IME_PINYIN_USE_DEFAULT_DICT` [illegible] 0[illegible] [illegible]

Dictionary format

The arrangement order of each pinyin syllable is very important. You need to customize your own thesaurus according to the Hanyu Pinyin syllable table. You can read here to learn about the Hanyu Pinyin syllables and the syllable table.

Then, write your own dictionary according to the following format:

⍰⍰⍰⍰

⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰

```
lv_100ask_pinyin_dict_t your_pinyin_dict[] = {
            { "a", "□□□□" },
            { "ai", "□□□□□□□□□□□□□" },
            { "an", "□□□□□□□□□□□□□□□□□□□□" },
            { "ang", "□□□□" },
            { "ao", "□□□□□□□□□" },
            { "ba", "□□□□□□□□□□□□□□□□□□" },
            { "bai", "□□□□□□□□□" },
            /* ...... */
            { "zuo", "□□□□□□□□□□"},
            {NULL, NULL}
```

The last item must end with `{null, null}` , or it will not work properly.

Apply new dictionary

After writing a dictionary according to the above dictionary format, you only need to call this function to set up and use your dictionary:

⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰⍰ `lv_100ask_pinyin_ime_set_dict(pinyin_ime, your_pinyin_dict)` ⍰⍰⍰⍰⍰⍰⍰⍰⍰

```
    lv_obj_t * pinyin_ime = lv_100ask_pinyin_ime_create(lv_scr_act());
    lv_100ask_pinyin_ime_set_dict(pinyin_ime, your_pinyin_dict);
```

9.8.3 Modes

The lv_ime_pinyin have the following modes:

- `LV_IME_PINYIN_MODE_K26` Pinyin 26 key input mode
- `LV_IME_PINYIN_MODE_K9` Pinyin 9 key input mode
- `LV_IME_PINYIN_MODE_K9_NUMBER` Numeric keypad mode

The `TEXT` modes' layout contains buttons to change mode.

To set the mode manually, use `lv_ime_pinyin_set_mode(pinyin_ime, mode)` . The default mode is `LV_IME_PINYIN_MODE_K26` .

lv_ime_pinyin ⍰⍰⍰⍰

- `LV_IME_PINYIN_MODE_K26` ⍰⍰26⍰
- `LV_IME_PINYIN_MODE_K9` ⍰⍰9⍰(⍰⍰⍰)
- `LV_IME_PINYIN_MODE_K9_NUMBER` ⍰⍰⍰⍰⍰⍰⍰

□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□ `lv_keyboard_set_mode(kb, mode)` □□□□□□□□□□□□□□□□□ `LV_IME_PINYIN_MODE_K26` □

9.8.4 Example

Pinyin IME 26 key input

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_USE_TEXTAREA && LV_FONT_SIMSUN_16_CJK && LV_USE_IME_PINYIN &&␣
↪LV_BUILD_EXAMPLES

static void ta_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * ta = lv_event_get_target(e);
    lv_obj_t * kb = lv_event_get_user_data(e);

    if(code == LV_EVENT_FOCUSED) {
        if(lv_indev_get_type(lv_indev_get_act()) != LV_INDEV_TYPE_KEYPAD) {
            lv_keyboard_set_textarea(kb, ta);
            lv_obj_clear_flag(kb, LV_OBJ_FLAG_HIDDEN);
        }
    }
    else if(code == LV_EVENT_CANCEL) {
        lv_obj_add_flag(kb, LV_OBJ_FLAG_HIDDEN);
        lv_obj_clear_state(ta, LV_STATE_FOCUSED);
        lv_indev_reset(NULL, ta);   /*To forget the last clicked object to make it␣
↪focusable again*/
    }
}

void lv_example_ime_pinyin_1(void)
{
    lv_obj_t * pinyin_ime = lv_ime_pinyin_create(lv_scr_act());
    lv_obj_set_style_text_font(pinyin_ime, &lv_font_simsun_16_cjk, 0);
    //lv_ime_pinyin_set_dict(pinyin_ime, your_dict); // Use a custom dictionary. If␣
↪it is not set, the built-in dictionary will be used.

    /* ta1 */
    lv_obj_t * ta1 = lv_textarea_create(lv_scr_act());
    lv_textarea_set_one_line(ta1, true);
    lv_obj_set_style_text_font(ta1, &lv_font_simsun_16_cjk, 0);
    lv_obj_align(ta1, LV_ALIGN_TOP_LEFT, 0, 0);

    /*Create a keyboard and add it to ime_pinyin*/
    lv_obj_t * kb = lv_keyboard_create(lv_scr_act());
    lv_ime_pinyin_set_keyboard(pinyin_ime, kb);
    lv_keyboard_set_textarea(kb, ta1);

    lv_obj_add_event(ta1, ta_event_cb, LV_EVENT_ALL, kb);

    /*Get the cand_panel, and adjust its size and position*/
    lv_obj_t * cand_panel = lv_ime_pinyin_get_cand_panel(pinyin_ime);
    lv_obj_set_size(cand_panel, LV_PCT(100), LV_PCT(10));
    lv_obj_align_to(cand_panel, kb, LV_ALIGN_OUT_TOP_MID, 0, 0);
```

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```
    /*Try using ime_pinyin to output the Chinese below in the ta1 above*/
    lv_obj_t * cz_label = lv_label_create(lv_scr_act());
    lv_label_set_text(cz_label,
                      "□□□□□□Embedded System□□\n□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□");
    lv_obj_set_style_text_font(cz_label, &lv_font_simsun_16_cjk, 0);
    lv_obj_set_width(cz_label, 310);
    lv_obj_align_to(cz_label, ta1, LV_ALIGN_OUT_BOTTOM_LEFT, 0, 0);
}

#endif
```

```
import fs_driver

def ta_event_cb(e,kb):
    code = e.get_code()
    ta = e.get_target_obj()

    if code == lv.EVENT.FOCUSED:
        if lv.indev_get_act() != None and lv.indev_get_act().get_type() != lv.INDEV_
↪TYPE.KEYPAD :
            kb.set_textarea(ta)
            kb.clear_flag(lv.obj.FLAG.HIDDEN)
        elif code == lv.EVENT.CANCEL:
            kb.add_flag(lv.obj.FLAG.HIDDEN)
            ta.clear_state(ta, LV_STATE_FOCUSED);
            lv.indev_reset(None, ta)   # To forget the last clicked object to make it␣
↪focusable again

fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'S')
font_simsun_16_cjk = lv.font_load("S:../../assets/font/lv_font_simsun_16_cjk.fnt")
if font_simsun_16_cjk == None:
    print("Error when loading chinese font")

pinyin_ime = lv.ime_pinyin(lv.scr_act())
pinyin_ime.set_style_text_font(font_simsun_16_cjk, 0)
# pinyin_ime.pinyin_set_dict(your_dict)  # Use a custom dictionary. If it is not set,␣
↪the built-in dictionary will be used.

# ta1
ta1 = lv.textarea(lv.scr_act())
ta1.set_one_line(True)
ta1.set_style_text_font(font_simsun_16_cjk, 0)
ta1.align(lv.ALIGN.TOP_LEFT, 0, 0)

# Create a keyboard and add it to ime_pinyin
kb = lv.keyboard(lv.scr_act())
pinyin_ime.pinyin_set_keyboard(kb)
kb.set_textarea(ta1)

ta1.add_event(lambda evt: ta_event_cb(evt,kb), lv.EVENT.ALL, None)

# Get the cand_panel, and adjust its size and position
cand_panel = pinyin_ime.pinyin_get_cand_panel()
cand_panel.set_size(lv.pct(100), lv.pct(10))
```

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```
cand_panel.align_to(kb, lv.ALIGN.OUT_TOP_MID, 0, 0)

# Try using ime_pinyin to output the Chinese below in the ta1 above
cz_label = lv.label(lv.scr_act())
cz_label.set_text("□□□□□□Embedded System□□\n□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□")
cz_label.set_style_text_font(font_simsun_16_cjk, 0)
cz_label.set_width(310)
cz_label.align_to(ta1, lv.ALIGN.OUT_BOTTOM_LEFT, 0, 0)
```

Pinyin IME 9 key input

```
#include "../../lv_examples.h"
#if LV_USE_LABEL && LV_USE_TEXTAREA && LV_FONT_SIMSUN_16_CJK && LV_USE_IME_PINYIN &&␣
↪LV_IME_PINYIN_USE_K9_MODE && LV_BUILD_EXAMPLES

static void ta_event_cb(lv_event_t * e)
{
    lv_event_code_t code = lv_event_get_code(e);
    lv_obj_t * ta = lv_event_get_target(e);
    lv_obj_t * kb = lv_event_get_user_data(e);

    if(code == LV_EVENT_FOCUSED) {
        if(lv_indev_get_type(lv_indev_get_act()) != LV_INDEV_TYPE_KEYPAD) {
            lv_keyboard_set_textarea(kb, ta);
            lv_obj_clear_flag(kb, LV_OBJ_FLAG_HIDDEN);
        }
    }
    else if(code == LV_EVENT_READY) {
        lv_obj_add_flag(kb, LV_OBJ_FLAG_HIDDEN);
        lv_obj_clear_state(ta, LV_STATE_FOCUSED);
        lv_indev_reset(NULL, ta);   /*To forget the last clicked object to make it␣
↪focusable again*/
    }
}

void lv_example_ime_pinyin_2(void)
{
    lv_obj_t * pinyin_ime = lv_ime_pinyin_create(lv_scr_act());
    lv_obj_set_style_text_font(pinyin_ime, &lv_font_simsun_16_cjk, 0);
    //lv_ime_pinyin_set_dict(pinyin_ime, your_dict); // Use a custom dictionary. If␣
↪it is not set, the built-in dictionary will be used.

    /* ta1 */
    lv_obj_t * ta1 = lv_textarea_create(lv_scr_act());
    lv_textarea_set_one_line(ta1, true);
    lv_obj_set_style_text_font(ta1, &lv_font_simsun_16_cjk, 0);
    lv_obj_align(ta1, LV_ALIGN_TOP_LEFT, 0, 0);

    /*Create a keyboard and add it to ime_pinyin*/
    lv_obj_t * kb = lv_keyboard_create(lv_scr_act());
    lv_keyboard_set_textarea(kb, ta1);

    lv_ime_pinyin_set_keyboard(pinyin_ime, kb);
    lv_ime_pinyin_set_mode(pinyin_ime,
```

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```
                                LV_IME_PINYIN_MODE_K9);  // Set to 9-key input mode.␣
↪Default: 26-key input(k26) mode.
    lv_obj_add_event(ta1, ta_event_cb, LV_EVENT_ALL, kb);

    /*Get the cand_panel, and adjust its size and position*/
    lv_obj_t * cand_panel = lv_ime_pinyin_get_cand_panel(pinyin_ime);
    lv_obj_set_size(cand_panel, LV_PCT(100), LV_PCT(10));
    lv_obj_align_to(cand_panel, kb, LV_ALIGN_OUT_TOP_MID, 0, 0);

    /*Try using ime_pinyin to output the Chinese below in the ta1 above*/
    lv_obj_t * cz_label = lv_label_create(lv_scr_act());
    lv_label_set_text(cz_label,
                      "□□□□□□Embedded System□□\n□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□");
    lv_obj_set_style_text_font(cz_label, &lv_font_simsun_16_cjk, 0);
    lv_obj_set_width(cz_label, 310);
    lv_obj_align_to(cz_label, ta1, LV_ALIGN_OUT_BOTTOM_LEFT, 0, 0);
}

#endif
```

```
import fs_driver

def ta_event_cb(e,kb):
    code = e.get_code()
    ta = e.get_target_obj()

    if code == lv.EVENT.FOCUSED:
        if lv.indev_get_act() != None and lv.indev_get_act().get_type() != lv.INDEV_
↪TYPE.KEYPAD :
            kb.set_textarea(ta)
            kb.clear_flag(lv.obj.FLAG.HIDDEN)
        elif code == lv.EVENT.READY:
            kb.add_flag(lv.obj.FLAG.HIDDEN)
            ta.clear_state(ta, LV_STATE_FOCUSED);
            lv.indev_reset(None, ta)   # To forget the last clicked object to make it␣
↪focusable again

fs_drv = lv.fs_drv_t()
fs_driver.fs_register(fs_drv, 'S')
font_simsun_16_cjk = lv.font_load("S:../../assets/font/lv_font_simsun_16_cjk.fnt")
if font_simsun_16_cjk == None:
    print("Error when loading chinese font")

pinyin_ime = lv.ime_pinyin(lv.scr_act())
pinyin_ime.set_style_text_font(font_simsun_16_cjk, 0)
# pinyin_ime.pinyin_set_dict(your_dict)  # Use a custom dictionary. If it is not set,␣
↪the built-in dictionary will be used.

# ta1
ta1 = lv.textarea(lv.scr_act())
ta1.set_one_line(True)
ta1.set_style_text_font(font_simsun_16_cjk, 0)
ta1.align(lv.ALIGN.TOP_LEFT, 0, 0)

# Create a keyboard and add it to ime_pinyin
kb = lv.keyboard(lv.scr_act())
```

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```
kb.set_textarea(ta1)

pinyin_ime.pinyin_set_keyboard(kb)
pinyin_ime.pinyin_set_mode(lv.ime_pinyin.PINYIN_MODE.K9)    #  Set to 9-key input␣
↪mode. Default: 26-key input(k26) mode.

ta1.add_event(lambda evt: ta_event_cb(evt,kb), lv.EVENT.ALL, None)

# Get the cand_panel, and adjust its size and position
cand_panel = pinyin_ime.pinyin_get_cand_panel()
cand_panel.set_size(lv.pct(100), lv.pct(10))
cand_panel.align_to(kb, lv.ALIGN.OUT_TOP_MID, 0, 0)

# Try using ime_pinyin to output the Chinese below in the ta1 above
cz_label = lv.label(lv.scr_act())
cz_label.set_text("□□□□□□Embedded System□□\n□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□")
cz_label.set_style_text_font(font_simsun_16_cjk, 0)
cz_label.set_width(310)
cz_label.align_to(ta1, lv.ALIGN.OUT_BOTTOM_LEFT, 0, 0)
```

9.8.5 API

Enums

enum **`lv_ime_pinyin_mode_t`**

Values:

enumerator **`LV_IME_PINYIN_MODE_K26`**

enumerator **`LV_IME_PINYIN_MODE_K9`**

enumerator **`LV_IME_PINYIN_MODE_K9_NUMBER`**

Functions

lv_obj_t ***`lv_ime_pinyin_create`**(*lv_obj_t* *parent)

void **`lv_ime_pinyin_set_keyboard`**(*lv_obj_t* *obj, *lv_obj_t* *kb)

Set the keyboard of Pinyin input method.

Parameters

- **`obj`** -- pointer to a Pinyin input method object
- **`dict`** -- pointer to a Pinyin input method keyboard

void **`lv_ime_pinyin_set_dict`**(*lv_obj_t* *obj, *lv_pinyin_dict_t* *dict)

Set the dictionary of Pinyin input method.

Parameters

- **obj** -- pointer to a Pinyin input method object
- **dict** -- pointer to a Pinyin input method dictionary

void **lv_ime_pinyin_set_mode**(*lv_obj_t* *obj, *lv_ime_pinyin_mode_t* mode)

Set mode, 26-key input(k26) or 9-key input(k9).

Parameters

- **obj** -- pointer to a Pinyin input method object
- **mode** -- the mode from 'lv_ime_pinyin_mode_t'

lv_obj_t ***lv_ime_pinyin_get_kb**(*lv_obj_t* *obj)

Set the dictionary of Pinyin input method.

Parameters **obj** -- pointer to a Pinyin IME object

Returns pointer to the Pinyin IME keyboard

lv_obj_t ***lv_ime_pinyin_get_cand_panel**(*lv_obj_t* *obj)

Set the dictionary of Pinyin input method.

Parameters **obj** -- pointer to a Pinyin input method object

Returns pointer to the Pinyin input method candidate panel

lv_pinyin_dict_t ***lv_ime_pinyin_get_dict**(*lv_obj_t* *obj)

Set the dictionary of Pinyin input method.

Parameters **obj** -- pointer to a Pinyin input method object

Returns pointer to the Pinyin input method dictionary

Variables

const lv_obj_class_t **lv_ime_pinyin_class**

struct **lv_pinyin_dict_t**

Public Members

const char *const **py**

const char *const **py_mb**

struct **ime_pinyin_k9_py_str_t**

Public Members

char **py_str**[7]

struct **lv_ime_pinyin_t**

Public Members

lv_obj_t **obj**

lv_obj_t ***kb**

lv_obj_t ***cand_panel**

lv_pinyin_dict_t ***dict**

lv_ll_t **k9_legal_py_ll**

char ***cand_str**

char **input_char**[16]

char **k9_input_str**[LV_IME_PINYIN_K9_MAX_INPUT]

uint16_t **k9_py_ll_pos**

uint16_t **k9_legal_py_count**

uint16_t **k9_input_str_len**

uint16_t **ta_count**

uint16_t **cand_num**

uint16_t **py_page**

uint16_t **py_num**[26]

uint16_t **py_pos**[26]

lv_ime_pinyin_mode_t **mode**

CHAPTER

TEN

CONTRIBUTING

10.1 Introduction

Join LVGL's community and leave your footprint in the library!

There are a lot of ways to contribute to LVGL even if you are new to the library or even new to programming.

It might be scary to make the first step but you have nothing to be afraid of. A friendly and helpful community is waiting for you. Get to know like-minded people and make something great together.

So let's find which contribution option fits you the best and help you join the development of LVGL!

Before getting started here are some guidelines to make contribution smoother:

- Be kind and friendly.
- Be sure to read the relevant part of the documentation before posting a question.
- Ask questions in the Forum and use GitHub for development-related discussions.
- Always fill out the post or issue templates in the Forum or GitHub (or at least provide equivalent information). It makes understanding your contribution or issue easier and you will get a useful response faster.
- If possible send an absolute minimal but buildable code example in order to reproduce the issue. Be sure it contains all the required variable declarations, constants, and assets (images, fonts).
- Use Markdown to format your posts. You can learn it in 10 minutes.
- Speak about one thing in one issue or topic. It makes your post easier to find later for someone with the same question.
- Give feedback and close the issue or mark the topic as solved if your question is answered.
- For non-trivial fixes and features, it's better to open an issue first to discuss the details instead of sending a pull request directly.
- Please read and follow the Coding style guide.

10.2 Pull request

Merging new code into the lvgl, documentation, blog, examples, and other repositories happen via *Pull requests* (PR for short). A PR is a notification like "Hey, I made some updates to your project. Here are the changes, you can add them if you want." To do this you need a copy (called fork) of the original project under your account, make some changes there, and notify the original repository about your updates. You can see what it looks like on GitHub for LVGL here: https://github.com/lvgl/lvgl/pulls.

To add your changes you can edit files online on GitHub and send a new Pull request from there (recommended for small changes) or add the updates in your favorite editor/IDE and use git to publish the changes (recommended for more complex updates).

10.2.1 From GitHub

1. Navigate to the file you want to edit.
2. Click the Edit button in the top right-hand corner.
3. Add your changes to the file.
4. Add a commit message on the bottom of the page.
5. Click the *Propose changes* button.

10.2.2 From command line

The instructions describe the main `lvgl` repository but it works the same way for the other repositories.

1. Fork the lvgl repository. To do this click the "Fork" button in the top right corner. It will "copy" the `lvgl` repository to your GitHub account (`https://github.com/<YOUR_NAME>?tab=repositories`)
2. Clone your forked repository.
3. Add your changes. You can create a *feature branch* from *master* for the updates: `git checkout -b the-new-feature`
4. Commit and push your changes to the forked `lvgl` repository.
5. Create a PR on GitHub from the page of your `lvgl` repository (`https://github.com/<YOUR_NAME>/lvgl`) by clicking the *"New pull request"* button. Don't forget to select the branch where you added your changes.
6. Set the base branch. It means where you want to merge your update. In the `lvgl` repo both the fixes and new features go to `master` branch.
7. Describe what is in the update. An example code is welcome if applicable.
8. If you need to make more changes, just update your forked `lvgl` repo with new commits. They will automatically appear in the PR.

10.2.3 Commit message format

The commit messages format is inspired by Angular Commit Format.

The following structure should be used:

```
<type>(<scope>): <subject>
<BLANK LINE>
<body>
<BLANK LINE>
<footer>
```

Possible `<type>`s:

- `fix` bugfix in the source code.
- `feat` new feature
- `arch` architectural changes
- `perf` changes that affect the performance
- `example` anything related to examples (even fixes and new examples)
- `docs` anything related to the documentation (even fixes, formatting, and new pages)
- `test` anything related to tests (new and updated tests or CI actions)
- `chore` any minor formatting or style changes that would make the changelog noisy

`<scope>` is the module, file, or sub-system that is affected by the commit. It's usually one word and can be chosen freely. For example `img`, `layout`, `txt`, `anim`. The scope can be omitted.

`<subject>` contains a short description of the change:

- use the imperative, present tense: "change" not "changed" nor "changes"
- don't capitalize the first letter
- no dot (.) at the end
- max 90 characters

`<body>` optional and can be used to describe the details of this change.

`<footer>` shall contain

- the words "BREAKING CHANGE" if the changes break the API
- reference to the GitHub issue or Pull Request if applicable.

Some examples:

```
fix(img): update size if a new source is set
```

```
fix(bar): fix memory leak

The animations weren't deleted in the destructor.

Fixes: #1234
```

```
feat: add span widget

The span widget allows mixing different font sizes, colors and styles.
It's similar to HTML <span>
```

```
docs(porting): fix typo
```

10.3 Developer Certification of Origin (DCO)

10.3.1 Overview

To ensure all licensing criteria are met for every repository of the LVGL project, we apply a process called DCO (Developer's Certificate of Origin).

The text of DCO can be read here: https://developercertificate.org/.

By contributing to any repositories of the LVGL project you agree that your contribution complies with the DCO.

If your contribution fulfills the requirements of the DCO no further action is needed. If you are unsure feel free to ask us in a comment.

10.3.2 Accepted licenses and copyright notices

To make the DCO easier to digest, here are some practical guides about specific cases:

Your own work

The simplest case is when the contribution is solely your own work. In this case you can just send a Pull Request without worrying about any licensing issues.

Use code from online source

If the code you would like to add is based on an article, post or comment on a website (e.g. StackOverflow) the license and/or rules of that site should be followed.

For example in case of StackOverflow a notice like this can be used:

```
/* The original version of this code-snippet was published on StackOverflow.
 * Post: http://stackoverflow.com/questions/12345
 * Author: http://stackoverflow.com/users/12345/username
 * The following parts of the snippet were changed:
 * - Check this or that
 * - Optimize performance here and there
 */
 ... code snippet here ...
```

Use MIT licensed code

As LVGL is MIT licensed, other MIT licensed code can be integrated without issues. The MIT license requires a copyright notice be added to the derived work. Any derivative work based on MIT licensed code must copy the original work's license file or text.

Use GPL licensed code

The GPL license is not compatible with the MIT license. Therefore, LVGL can not accept GPL licensed code.

10.4 Ways to contribute

Even if you're just getting started with LVGL there are plenty of ways to get your feet wet. Most of these options don't even require knowing a single line of LVGL code.

Below we have collected some opportunities about the ways you can contribute to LVGL.

10.4.1 Give LVGL a Star

Show that you like LVGL by giving it star on GitHub!

Star

This simple click makes LVGL more visible on GitHub and makes it more attractive to other people. So with this, you already helped a lot!

10.4.2 Tell what you have achieved

Have you already started using LVGL in a *Simulator*, a development board, or on your custom hardware? Was it easy or were there some obstacles? Are you happy with the result? Showing your project to others is a win-win situation because it increases your and LVGL's reputation at the same time.

You can post about your project on Twitter, Facebook, LinkedIn, create a YouTube video, and so on. Only one thing: On social media don't forget to add a link to `https://lvgl.io` or `https://github.com/lvgl` and use the hashtag `#lvgl`. Thank you! :)

You can also open a new topic in the My projects category of the Forum.

The LVGL Blog welcomes posts from anyone. It's a good place to talk about a project you created with LVGL, write a tutorial, or share some nice tricks. The latest blog posts are shown on the homepage of LVGL to make your work more visible.

The blog is hosted on GitHub. If you add a post GitHub automatically turns it into a website. See the README of the blog repo to see how to add your post.

Any of these help to spread the word and familiarize new developers with LVGL.

If you don't want to speak about your project publicly, feel free to use Contact form on lvgl.io to private message to us.

10.4.3 Write examples

As you learn LVGL you will probably play with the features of widgets. Why not publish your experiments?

Each widgets' documentation contains examples. For instance, here are the examples of the Drop-down list widget. The examples are directly loaded from the lvgl/examples folder.

So all you need to do is send a *Pull request* to the lvgl repository and follow some conventions:

- Name the examples like `lv_example_<widget_name>_<index>`.
- Make the example as short and simple as possible.
- Add comments to explain what the example does.
- Use 320x240 resolution.
- Update `index.rst` in the example's folder with your new example. To see how other examples are added, look in the lvgl/examples/widgets folder.

10.4.4 Improve the docs

As you read the documentation you might see some typos or unclear sentences. All the documentation is located in the lvgl/docs folder. For typos and straightforward fixes, you can simply edit the file on GitHub.

Note that the documentation is also formatted in Markdown.

10.4.5 Report bugs

As you use LVGL you might find bugs. Before reporting them be sure to check the relevant parts of the documentation.

If it really seems like a bug feel free to open an issue on GitHub.

When filing the issue be sure to fill out the template. It helps find the root of the problem while avoiding extensive questions and exchanges with other developers.

10.4.6 Send fixes

The beauty of open-source software is you can easily dig in to it to understand how it works. You can also fix or adjust it as you wish.

If you found and fixed a bug don't hesitate to send a *Pull request* with the fix.

In your Pull request please also add a line to `CHANGELOG.md`.

10.4.7 Join the conversations in the Forum

It feels great to know you are not alone if something is not working. It's even better to help others when they struggle with something.

While you were learning LVGL you might have had questions and used the Forum to get answers. As a result, you probably have more knowledge about how LVGL works.

One of the best ways to give back is to use the Forum and answer the questions of newcomers - like you were once.

Just read the titles and if you are familiar with the topic don't hesitate to share your thoughts and suggestions.

Participating in the discussions is one of the best ways to become part of the project and get to know like-minded people!

10.4.8 Add features

If you have created a cool widget, or added useful feature to LVGL feel free to open a new PR for it. We collect the optional features (a.k.a. plugins) in lvgl/src/extra folder so if you are interested in adding a new features please use this folder. The README file describes the basics rules of contribution and also lists some ideas.

For further ideas take a look at the *Roadmap* page. If you are interested in any of them feel free to share your opinion and/or participate in the implementation.

Other features which are (still) not on the road map are listed in the Feature request category of the Forum.

When adding a new features the followings also needs to be updated:

- Update lv_conf_template.h
- Add description in the docs
- Add examples
- Update the changelog

10.4.9 Become a maintainer

If you want to become part of the core development team, you can become a maintainer of a repository.

By becoming a maintainer:

- You get write access to that repo:
  - Add code directly without sending a pull request
  - Accept pull requests
  - Close/reopen/edit issues
- Your input has higher impact when we are making decisions

You can become a maintainer by invitation, however the following conditions need to met

1. Have > 50 replies in the Forum. You can look at your stats here
2. Send > 5 non-trivial pull requests to the repo where you would like to be a maintainer

If you are interested, just send a message (e.g. from the Forum) to the current maintainers of the repository. They will check if the prerequisites are met. Note that meeting the prerequisites is not a guarantee of acceptance, i.e. if the conditions are met you won't automatically become a maintainer. It's up to the current maintainers to make the decision.

10.4.10 Move your project repository under LVGL organization

Besides the core `lvgl` repository there are other repos for ports to development boards, IDEs or other environment. If you ported LVGL to a new platform we can host it under the LVGL organization among the other repos.

This way your project will become part of the whole LVGL project and can get more visibility. If you are interested in this opportunity just open an issue in lvgl repo and tell what you have!

If we agree that your port fit well into the LVGL organization, we will open a repository for your project where you will have admin rights.

To make this concept sustainable there a few rules to follow:

- You need to add a README to your repo.
- We expect to maintain the repo to some extent:

  - Follow at least the major versions of LVGL
  - Respond to the issues (in a reasonable time)
- If there is no activity in a repo for 1 year it will be archived

CHAPTER

ELEVEN

CHANGELOG

11.1 v8.3.5 7 February 2023

11.1.1 Performance

- perf(gpu): improve NXP's PXP and VGLite accelerators `3952`
- perf(dam2d): rework stm32 dma2d `3904`

11.1.2 Fixes

- fix(monkey): remove executable permissions from source files `3971`
- fix(ci): set Ubuntu version for MicroPython test `3865`
- fix(Kconfig): fix wrong type of LV_FS_STDIO_CACHE_SIZE (v8.3) `3906`
- docs(indev): fix the name of long_press_repeat_time (was long_press_rep_time) `34c545e`
- fix(roller): consider the recolor setting of the label `39f4247`

11.1.3 Examples

11.1.4 Docs

- docs(indev): fix the name of long_press_repeat_time (was long_press_rep_time) `34c545e`

11.1.5 CI and tests

- ci(esp): fix push to the component registry on tag `e529230`

11.1.6 Others

- chore(cmsis-pack): update cmsis-pack for v8.3.5 `3972`
- chore: add an option to "LV_TICK_CUSTOM" `3879`
- bump version numbers to v8.3.5-dev `47c8f8f`
- Update layer.md `9faca8a`

11.2 v8.3.4 15 December 2022

11.2.1 New Features

- feat(keyboard): ported arabic keyboard from release 7.10.0 `3728`
- feat(table): scroll to the selected cell with key navigation `39d03a8`

11.2.2 Fixes

- fix(rt-thread): sync rt-thread v5.0.0 rt_align `3864`
- fix(draw): SDL2 gradient support #3848 `3856`
- fix(esp.cmake): add demos and examples `3784`
- fix(indev): fix scrolling on transformed obejcts `84cf05d`
- fix(style): add the missing support for pct pivot in tranasform style properties `c8e584f`
- fix(flex): be sure obj->w_layout and h_layout can't be set at the same time `c4c4007`
- fix(chart): fix very dense bar charts `bb2c2ac`
- fix(draw): handle LV_COLOR_DEPTH == 1 too in lv_draw_sw_transform `bd11ad8`
- fix(example): fix warnings `1e3ca25`
- fix(benchmark): fix warnings `1ed026c`
- fix(draw): fix text color with sub pixel rendering and BGR order `e050f5c`
- fix(meter): fix setting part_draw_dsc.id in needle img drawing `716e5e2`
- fix(gridnav): fix stucking in pressed state with encoder `ad56dfa`
- fix(darw): add back the disappeared antialising=0 support `2c17b28`
- fix(msg): fix typos in API by adding wrappers `41fa416`
- fix(draw): fix transformation accuracy `e06f03d`
- fix(style): remove the reduntant define of LV_GRADIENT_MAX_STOPS `903e94b`
- demo(benchmark): fix lv_label_set_text_fmt format strings `ae38258`
- demo(benchmark): fix warning `1173dcb`

11.3 v8.3.3 06 October 2022

v8.3.3 is the same as v8.3.2. It was released only because the version number was set incorrectly in lvgl.h.

11.4 v8.3.2 27 September 2022

11.4.1 Fixes

- fix(fragment): fixed child fragment event dispatch 3683
- fix(sdl): clear streaming/target texture with FillRect 3682
- fix(sdl): transformation with alpha (#3576) 3678
- fix(draw_sw): fix image cache to access the freed stack space 3584
- fix(style): use compile time prop_cnt for const styles 3609
- fix(demo): can not found lvgl.h file 3477
- fix(ci) checkout lv_micropython release/v8 branch 3524
- fix(canvas): fix clipéping on transformation b884aba
- fix(draw): allow drawing outline with LV_DRAW_COMPLEX == 0 too ece3495
- fix(colorwheel): fix updating color when using lv_colorwheel_set_hsv d59bba1
- fix(slider): find the nearest value on click instead of floor dfd14fa
- fix(draw): fix border drawing with thick borders d5b2a9b
- fix(refr): fix true double double buffering logic with transparent screens 8b605cc
- fix(group): be sure obj is removed from its current group in lv_group_add_obj 5156ee0
- fix(style): add missing invalidation in lv_obj_remove_local_style_prop a0515ba

11.4.2 Docs

- docs(draw) remove reference to old lv_fs_add_drv function 3564
- docs(disp): LV_COLOR_SCREEN_TRANSP remove dependency on LV_COLOR_DEPTH_32 as transparency is supported across all color depths 3556

11.4.3 CI and tests

- ci: protect test.c with #if LV_BUILD_TEST be485d7

11.4.4 Others

- chore(rt-thread) backport fixes from v9 `3604`
- chore: fix warnings `7640950`
- remove accidentally added code `5022476`

11.5 v8.3.1 25 July 2022

11.5.1 Fixes

- fix(led): add bg_color draw descriptors back to led draw event to support LV_DRAW_COMPLEX 0 `3515`
- fix(slider): fix knob drawing in symmetrical mode `2967172`
- fix(refr): fix lv_refr_get_top_obj `9750c97`
- fix(arc): fix arc knob invalidation in SYMMETRICAL mode `a283273`

11.5.2 Examples

- example(freetype): Update the Micropython example to use the Lato font `71913d3`
- example(freetype): replace the arial font with lato to avoid licensing issues `8544cc3`

11.5.3 Docs

- docs(readme): fix LVGL version typo (8.3.0) `3462`
- docs(tasmota): support LVGL 8.3.0 (#3511) `62662f6`

11.6 v8.3.0 6 July 2022

11.6.1 Overview

- **Layers** Support transforming (zoom and rotate) any widgets and their children drawn by LVGL. To do this LVGL renders the transformed widgets into a layer and draws that layer as an image applying all the transformations. Layers are also used when `opa` (not `bg_opa`, `border_opa`, etc) and `blend_mode` are set. This way nested objects are blended as one layer to avoid color bleeding. See more here.
- **inherit and initial style properties** Besides setting "normal values" for style properties now you can set them to `inherit` (inherit the parent's value) and `initial` (set the system default). See more here
- **NXP-PXP and VGLITE GPU support** The support for NXP GPUs are added again
- **Color font support** You can use emojis and images in texts with this great new features. See more here.
- **ARM2D GPU support** Get support for Arm's Microcontroller 2D Graphics Acceleration, e.g. Helium based acceleration, DMA-350 based acceleration etc.
- **PubSub messaging** A publisher-subscriber based messaging system is added to make communication between components easier. See more here.

- **Pinyin IME** Add support for Pinyin IME Chinese input. See more here.
- **render_start_cb** A new callback is added to `lv_disp_drv_t` to indicate when the rendering starts. It's useful to make synchronization, e.g. wait for a TE signal.

11.6.2 New Features

- feat(ime_pinyin): add API to support 9-key input mode 3447
- feat(font): add font placeholder drawing configuration 3446
- feat(fsdrv): add posix lseek() error checking 3444
- feat(misc): add asynchronous call function cancellation function 3439
- feat(ime_pinyin): add API to use Pinyin IME(Chinese input) 3408
- feat(style) add 'inherit' and 'initial' CSS properties 3390
- feat(porting): add flushing control to the template 3384
- feat(anim): add deleted callback (#3279) 3295
- feat(cmsis-pack): monthly update for May 3394
- feat(textarea): make it possible to customize the bullet character 3388
- feat(disp): add a temporary invalidation disable interface 3378
- feat(group): add edge callbacks when trying to move focus past beginning or end 3374
- feat(benchmark): make lvgl render at the highest frame rate 3352
- feat(rt-thread): allow users to control refresh period in the lvgl thread 3375
- feat(cmsis-pack): Monthly update for May (alpha) 3359
- feat(demos): add a callback for benchmark 3353
- feat(gpu): Update lv_gpu_arm2d with new features 3340
- feat(draw): improve acceleration for LV_IMG_CF_ALPHA_8BIT 3337
- feat(anim): add the function of getting global animation refresher timer 3331
- feat(demo): add Weighted FPS and Opa speed log output 3326
- feat(gpu): Update gpu arm 2d 3320
- feat(cmsis-pack): Monthly update for April 3300
- feat(fsdrv) fix issues for win32 backends 3284
- feat(cmake-build): Option to allow building shared libraries. 3278
- feat(hal): add render_start_cb to disp_drv 3274
- feat(cmsis-pack): monthly update for April (v1.0.3-alpha) 3271
- feat(benchmark): add trace output for running a specific scenario 3245
- feat(env_support): cmsis pack monthly update 3209
- feat(tabview): support vertical scrolling 3184
- feat(span): add an interface for setting the number of lines 3200
- feat(indev): add possibility to enable/disable all input devices at once 3179

- feat(font): add imgfont - can be used to add emojis to label/span 3160
- feat(gpu): add gpu arm2d 3162
- feat(dma2d): add lv_draw_stm32_dma2d_buffer_copy function 3147
- feat(disp): add screen out animations 3081
- feat(menu): make menu widget more compatible with encoder 3061
- feat(label): added animation style property to apply it to circular scrolling animation of label widget 3128
- feat(script): add pre-commit configuration for code formatting 3092
- feat(refr): prevents dirty areas from being modified during rendering 3107
- feat(log): improve lv_log and add log the result from lv_demo_benchmark 3084
- feat(fragment): add fragment manager (a UI Controller concept) 2940
- feat(porting): add a macro lv_run_timer_handler_in_period to simplify porting 3063
- feat(gpu): reattach nxp pxp vglite accelerators(#3322) 029eef7
- feat(draw): support transforming widgets and improfe sw transform 318146a
- feat(msg): add publisher-subscriber messaging 79a29d7
- feat(benchmark): add an API to run specific scene (#3089) 305ad00
- feat(gpu): add SWM341 gpu support (synwit) 07b7eea
- feat(arc): add lv_arc_align_obj_to_angle and lv_arc_rotate_obj_to_angle a76bb70
- feat(draw): add draw_ctx->buffer_copy d034511
- feat(dropdown): add lv_dropdown_get_option_index 9997fb0
- feat(tabview) add API to rename tab. 2c9695a
- feat(indev): send LV_EVENT_PRESS_LOST on release with wait_until_release cc18518
- feat(style) add 'inherit' and 'initial' CSS properties (#3390) 9a48de0
- feat(draw): improve acceleration for LV_IMG_CF_ALPHA_8BIT (#3337) 8d3c41d
- feat(label): added animation style property to apply it to circular scrolling animation of label widget (#3128) 340d45c
- feat(gridnav): add lv_gridnav_set_focused b6d2daa

11.6.3 Performance

- perf(draw): speed up non normal blend modes 5a06fce
- perf(draw): minor optimiziation in point transformation c6c2864
- perf(layer): cache the layer_type ac2e2f1

11.6.4 Fixes

- fix(draw): conflict with external ALIGN define 3336
- fix(arc): fix bug with LV_ARC_MODE_REVERSE (#3417) 3418
- fix(fragment): memory leak of fragments #3438 3442
- fix(draw): solve memory leaking issue 3437
- fix(gridnav) correct logic in find_last_focusable 3423
- fix(examples) correct comment in slider example 3419
- fix(sdl): add transformation support for the SDL backend 3403
- fix(bmp): fix with LV_COLOR_16_SWAP 3412
- fix(sdl): fix LRU, reported in #3402 3404
- fix(draw) avoid use-after-free when drawing arcs 3399
- fix(subpx): fix subpixel rendering font is not displaying bug 3387
- fix(style): reset style lookup table after gc sweep/lv_deinit 3385
- fix(benchmark): fix the issue that wrong scene number is used 3372
- fix(draw): fix colour supports for indexed and alpha-only 3371
- fix(mem): fix TLSF returning the wrong pointer when the requested size is too large 3325
- fix(demo): fix warning. 3344
- fix(config): add LV_GPU_SDL_LRU_SIZE 3348
- feat(draw): improve acceleration for LV_IMG_CF_ALPHA_8BIT 3337
- fix(txt): fix returned value of lv_txt_iso8859_1_next(..., NULL) 3338
- fix(benchmark): remove redundant string for the small screens 3335
- fix(chart): fix accessing uninitialized point_area 3327
- fix(config): add LV_LAYER_SIMPLE_BUF_SIZE to Kconfig 3312
- fix(config): Keep the sequence of widget in order 3314
- fix(config): fix typo in LV_USE_PERF_MONITOR and LV_USE_MEM_MONITOR 3313
- fix(refr): initializing row_cnt is to silence the warning 3309
- fix(meter): fix typo 3308
- fix(draw): update Makefiles 3303
- fix(lodepng): fix NULL pointer access 3307
- fix(Kconfig): change the type of LV_FS_STDIO_LETTER from string to int 3282
- fix(demo): fix Wformat warning 3290
- fix(snapshot): add missing ASSERT checks 3292
- fix(Kconfig): Add LV_USE_GRIDNAV and LV_USE_FRAGMENT to Kconfig 3270
- fix(msgbox): do not execute init obj when obj == NULL 3264
- fix(menu): use LV_ASSERT_MALLOC check for new_node 3263
- fix(canvas):image cache may expire after set canvas's buff 3267

- fix(obj_style): prevent access to class null pointer 3252
- fix(png): fix possible memory leak when decoding fails 3249
- fix(libs): fix possible buffer underflow caused by extension matching 3250
- fix(fs): track multiple directory handles with win32 backends 3243
- fix(png): use LV_IMG_CF_TRUE_COLOR_ALPHA instead of LV_IMG_CF_RAW_ALPHA 3212
- fix(Keil-AC5): slience warnings in Keil-AC5 3221
- fix(meter): fix infinite loop caused by loop variable type mismatch 3232
- fix(chart): remove invalid decision branches 3231
- fix(gradient): assert before dividing by 0 3228
- fix(calendar): fix infinite loop caused by loop variable type mismatch 3230
- fix(flex): assert before dividing by 0 3237
- fix(hal): fix LV_ASSERT_MALLOC wrong placement 3236
- fix(disp): fix missing null pointer judgment 3238
- fix(obj_class): fix possible memory leak when the default disp is NULL 3235
- fix(draw_sw_letter): fix incorrect use of sizeof for a pointer 3234
- fix(indev): fix null pointer access caused by typo 3229
- fix(event): remove invalid decision branches 3233
- fix(draw_mask): remove invalid decision branches 3225
- fix(spinbox): remove invalid judgment 3227
- fix(gradient): remove invalid decision branches 3226
- fix(txt): return 0 if letter_uni is out of range 3224
- fix(calendar): fix possible array access out of bounds 3223
- fix(style): remove useless null pointer judgment 3222
- fix(obj): scrolling exception when use lv_obj_set_parent() 3210
- fix(libs): fix memcmp memory access overflow 3205
- fix(png): fix possible file leaks 3204
- fix(docs): rename task-handler.md to timer-handler.md 3203
- fix(lru): Fix use of undefined variables 3181
- fix(rt-thread): Sconscript use LOCAL_CFLAGS to replace LOCAL_CCFLAGS 3196
- fix(make) make files under draw/gpu 3202
- fix(docs-CN):fix broken links to docs in dir get-started 3195
- fix broken links to docs in dir get-started 3190
- fix(indev): fix warning about formatting uint32_t with %d 3193
- fix(Kconfig): move LV_USE_IMGFONT to others menu 3176
- fix(draw): src_buf_tmp will be NULL when LV_DRAW_COMPLEX is '0' 3163
- fix(span): align the baselines 3164

- fix(menu): fix crash on delete 3154
- fix(Kconfig): add missing LV_USE_THEME_MONO 3146
- fix(demo/stress): remove the unused assets 3139
- fix(jpg): swap high and low bytes when macro LV_COLOR_16_SWAP is 1 3138
- fix(script): in lv_conf_internal fix some widget dependencies when using Kconfig 3119
- fix(demo): minor fix for benchmark 3114
- fix(misc): in lv_map() handle if maximum value less than minimum value 3113
- fix(extra): adjust image decoder initialization order 3085
- fix(chart): optimize chart invalidation 3028
- fix(refr): fix performance monitor NULL pointer access 3105
- fix(misc): Remove duplicate declaration of _lv_log_add. 3103
- fix(gridnav): get key code from the actual event 3101
- fix(draw_rect): delete **STDC_VERSION** to ensure C++ compatibility 3099
- fix(font):draw placeholder if get_glyph_dsc() returns false 3000
- fix(conf): work around GCC bug 3082
- fix(fsdrv): replacing sprintf with lv_snprintf for safety 3079
- fix(cmsis-pack): add PIDX for cmsis-pack 3064
- feat(gpu): add SWM341 gpu support (synwit) 07b7eea
- fix(fs): fix cached read and add unit test for lv_fs 98660a8
- fix(table): invalidate only the changed cell 306fa19
- fix(draw): handle non BLEND_MODE_NORMAL for ARGB drawing 9ac8ce6
- fix(draw): revert handling of style_opa on not MAIN parts 51a7a61
- fix(draw): clip the bg img to the rectangle's area in lv_draw_sw_rect 77d726e
- fix(obj): fix LV_OBJ_FLAG_OVERFLOW_VISIBLE c742f2c
- fix(scroll): do not fire scroll begin/end event on every scroll step 25ce6e3
- fix(indev): do not send keys to objects in disabled state b0a46c4
- fix(disp): make lv_scr_load work better with lv_scr_load_anim and auto_del = true 52287fd
- fix(draw): create intermediate layer for blend modes too 8b15007
- fix(group): in lv_group_remove() fix if the object to focus is deleted 72cb683
- fix(draw): be sure angle values are in the correct range e624b90
- fix(scroll): send LV_EVENT_SCROLL_BEGIN/END with no animation too 777fe1e
- fix(arc): fix arc image drawing issue 7153e3f
- fix(refr): fix memory write out of bounds issue 13c99fc
- fix(gif): fix rare issue when drawing the gif's background b1e2c06
- fix(chart): fix misaligned horizontal tick lines on bar charts 4572a0c
- fix(font): use 0 width for non printable characters 7cf5709

- revert(group): 72cb683c799f65cd4fbae22dafc3a35c123bb66b `b7b22c1`
- fix(keyboard): don't show popovers on map change `ac202e7`
- fix(refr): consider masks with LV_OBJ_FLAG_OVERFLOW_VISIBLE `a7f9dfa`
- fix(draw): fix the calculation of the transformed coordinates `76de7c6`
- fix(style): fix heap use after free with transition styles `d9ae58b`
- fix(tabview, tileview): fix scrolling `22854ff`
- fix(draw): fix disp_bg_img drawing `dea75d9`
- fix(textarea): fix max length handling `127d8e8`
- fix(btnmatrix): fix extra draw size calculation to not clip shadow `7ada130`
- fix(indev): scroll_ throw_vect cannot converge to 0 when vect is negative `e5c11f1`
- fix(theme): make the basic theme even more simpler `62d6f3c`
- fix(color): color mix rounding error `523062b`
- fix(style): _lv_style_prop_lookup_flags tell all flags for LV_STYLE_PROP_ANY `e53f602`
- fix(list): use for icon `b171f7d`
- fix(layout): fix the handling of FLOATING children `48728a7`
- fix(style): make color filter inherited `5546b9d`
- fix(spinbox): set its default width in its class `3d92972`
- fix: fix warning `6c00552`
- fix(draw): fix transformations on subdivided areas `cbff8e8`
- fix(slider): fix left knob in ranged mode `17f5e0a`
- fix(Kconfig): allow unchecking LV_CONF_SKIP `f3a07a3`
- fix(style): fix using width for both width and height in radius transition `6acbdaa`
- fix(dropdown): fix scrolling when options are CENTER aligned `e651383`
- fix(grid): fix dead branch `46bf27d`
- fix(hal): disable driver->screen_transp by default regardless to LV_COLOR_SCREEN_TRANSP `ff7204e`
- fix(theme): fix mono theme init `5ec6694`
- fix(bmp) fix typo in BPP condition `cbc38af`
- fix(theme): in the basic theme show the textarea cursor only in focuses state `bb03fb1`
- fix(draw): fix img recolor `23eecce`
- fix(theme) add disabled style to textarea in the default theme `00f6759`
- fix(meter): improve the precision of tick line drawing `0255c6d`
- fix(gpu): fix warning with NXP GPU `6be43b8`
- fix(color): compensate rounding error during blending `42d9c07`
- fix(examples) use type-safe function for retrieving event param `71d535d`
- fix(draw) ensure variable is initialized to avoid warning `276f28a`
- feat(draw): improve acceleration for LV_IMG_CF_ALPHA_8BIT (#3337) `8d3c41d`

- fix(spinbox): rename lv_spinbox_set_pos to lv_spinbox_set_cursor_pos a99eb6b
- fix(layout): use uint16_t LV_LAYOUT_FLEX/GRID c596a36
- fix(event) avoid using a boolean as a pointer 06fff4b
- fix(theme): properly disable transitions if LV_THEME_DEFAULT_TRANSITION_TIME==0 242112b
- fix(scroll): fix scroll to view to the left 7c74f65
- fix(fs): mark the read cache as invalid by default 54f9987
- fix(menu): fix crash on delete (#3154) a6c4c13
- fix(roller): fix unexpected jump in infinite mode 18f2d78
- fix(conf): work around GCC bug (#3082) c6b34bc

11.6.5 Examples

- example(ime_pinyin): improved lv_example_ime_pinyin_1 3428
- example(imgfont): fix lvgl.h include path 3405
- example(btnmatrix): update lv_example_btnmatrix_2 to expicitly check which part is drawn 6b2eac1
- example(slider): make lv_example_slider_3 work with dark theme too 4a766c5
- example(span): avoid ambiguous meaing 7bb09e3
- demo(benchmark): add LV_DEMO_BENCHMARK_RGB565A8 option afaa8c9

11.6.6 Docs

- docs(indev): add comment in input device part 3422
- docs(slider) mention that VALUE_CHANGED is not sent on release 3397
- docs(readme): add version portuguese brazilian 3349
- docs(pc-simulator): add MDK with FastModel 3318
- docs(intro): update for v8.2.0 3316
- docs(readme) update link to the PlatformIO Registry 3296
- docs(gesture): fix typo lv_indev_act() -> lv_indev_get_act() 3291
- docs(scroll) add information about scroll coordinates 3088
- docs(msgbox) fix typo 3095
- docs(scroll): use LV_DIR_VER instead of LV_DIR_TOP 3066
- docs: rearrange the get-started section 8a81532
- docs: add section for renderers and gpus 378aaa6
- docs collapse APIs by default ebd20af
- docs(images): fix notes about breaking change inf v8.2 9a1e385
- docs(sim): add link to qt-creator 88bbef1
- docs(chart): describe how to set the space between columns 746917d
- docs(README): fix broken link c2c44c6

- docs(examples) avoid redirects when loading examples `d367bb7`
- docs(gesture): describe how prevent sending events after a gesture `65db5c9`
- docs(get-started): add quick-overview to the index `91ebf81`
- docs(others): add imgfont to the index `656a0e5`

11.6.7 CI and tests

- ci(slider): add unit test `3198`
- test(line): add unit tests for line widget `3104`
- test(table): replicate issue when reducing table cells `3121`
- test(textarea): add unit test `3074`
- test(table): add unit tests `3040`
- ci(docs) replace use of sed with proper configuration variables `1816fa5`
- ci add Makefile test `ea79cee`
- test(mem) add test for #3324 `9700664`
- test(img): fix image error diff handler `48d87e1`
- ci update docs builder to work with Python 3.10 `a3d66c9`
- ci make sure LVGL assertions cause tests to fail `b83c5aa`
- ci remove formatting comment `d345f76`
- ci don't run workflows twice on PRs `fcc1152`
- ci bump test timeout to 30 seconds [skip ci] `85e3e23`
- ci limit tests to 15 seconds `003f18f`
- ci(makefile) fix typo in GitHub action `a101e70`
- ci(switch): fix mem leak test `8481e3a`
- ci(stale) bump action version `5977eef`
- ci use GCC problem matcher on ARM tests as well `9fcefe5`

11.7 v8.2.0 31 January 2022

11.7.1 Overview

Among many fixes and minor updates these are the most important features in v8.2.0:

- Abstract render layer to make it easier to attach external draw engines
- Add `LV_FLAD_OVERFLOW_VISIBLE`. If enabled the children of an object won't be clipped to the boundary of the object
- Add ffmpeg decoder support to play videos and open a wide variety of image formats
- Add font fallback support
- Add gradient dithering support

- Add "monkey test"
- Add cmsis-pack support
- Add Grid navigation (`lv_gridnav`)

The GPU support for NXP microcontrollers is still not updated to the new draw architecture. See #3052

11.7.2 Breaking Changes

- :warning: feat(fs): add caching option for lv_fs-read 2979
- :warning: feat(span): lv_spangroup_get_expand_width() adds a parameter 2968
- :warning: arch(draw): allow replacing the draw engine db53ea9
- :warning: indexed images are not chroma keyed. Use the alpha chaneel instead.

11.7.3 Architectural

- arch(draw): separate SW renderer to allow replacing it 2803
- arch: merge lv_demos 5414652
- arch(sdl): migrated to use new backend architecture 2840
- arch(env): move rt-thread into env_support folder 3025
- arch(env): arch(env): move the cmake folder into the env_support folder 773d50f
- arch(env): move the zephyr folder into the env_support folder 4bd1e7e

11.7.4 New Features

- feat(cmsis-pack): prepare for lvgl v8.2.0 release 3062
- feat(gridnav): add lv_gridnav 2911
- feat: update the cmsis-pack to 0.8.3 3021
- feat(sdl): support rounded images 3012
- feat(cmsis-pack): add cmsis-pack support 2993
- feat(event): add preprocessing and stop bubbling features for events 3003
- feat(draw): add gradient dithering support 2872
- feat(symbols): add guards to LV_SYMBOL_* to allow redefining them 2973
- feat(obj): subdivide LV_OBJ_FLAG_SCROLL_CHAIN into ...CHAIN_HOR and ...CHAIN_VER 2961
- feat(draw): add draw_bg callback to draw_ctx #2934 2935
- feat(docs): add Chinese readme 2919
- feat(txt): add used_width parameter to _lv_txt_get_next_line() 2898
- feat(others) add monkey test 2885
- feat(rlottie): add animation control options 2857
- feat(lv_hal_indev): add missing lv_indev_delete() 2854

- feat(freetype): optimize memory allocation 2849
- feat(Kconfig): add FreeType config 2846
- feat(widgets): add menu widget 2603
- feat(refr): add reset function for FPS statistics 2832
- feat(Kconfig): add monitor position configuration 2834
- feat(examples) add micropython versions of the external library examples 2762
- feat(freetype): support bold and italic 2824
- feat(font) add fallback support and mem. font load option to FreeType 2796
- feat(lib) add ffmpeg video and image decoder 2805
- feat(obj): add LV_OBJ_FLAG_OVERFLOW_VISIBLE e7ac0e4
- feat(scrollbar): add more control over scrollbar paddings 4197b2f
- feat(dropdown): keep the list on open/close for simpler styling 9d3134b
- feat(qrcode) use destructor instead of lv_qrcode_delete() 318edd8
- feat(disp) allow decoupling the disp_refr timer 85cc84a
- feat(obj): add lv_obj_get_event_user_data() 53ececc
- feat(obj) add LV_OBJ_FLAG_SCROLL_WITH_ARROW 70327bd
- feat(slider): consider ext_click_area on the knob with LV_OBJ_FLAG_ADV_HITTEST 9d3fb41

11.7.5 Performance

- perf(sdl): optimize the use of SDL_RenderSetClipRect 2941
- perf(color): add faster lv_color_hex function 2864

11.7.6 Fixes

- fix(micropython) update examples for new API 3059
- fix: increase default value of LV_MEM_SIZE for lv_demo_widgets #3057 3058
- fix(cmsis-pack): fix issue #3032 3056
- fix(porting): add missing function prototypes 3054
- fix(kconfig): add missing default values 3050
- fix(canvas): force canvas to use sw draw 3045
- fix(rt-thread): use ARCH_CPU_BIG_ENDIAN to replace RT_USING_BIG_ENDIAN 3044
- fix(gradient): general cleanup and fix for alignment issues 3036
- fix(draw): rendering issues for vertical gradient with and without dithering 3034
- fix uninitialized variable 3033
- fix(lru): lower dependency for standard C functions 3024
- fix(env_support): move cmsis-pack to env_support folder 3026
- fix(doc): full covering opacity is 255, not 256 3022

- fix uninitialized variables 3023
- fix various issues for esp32 3007
- fix(sdl): fix clipped image drawing 2992
- fix(draw): missed bg_color renaming in the draw function 3002
- fix(porting): fix typo and an unmatched prototype 2998
- fix(conf) add missing LV_LOG_LEVEL default definition 2996
- fix(refr): crash if full_refresh = 1 2999
- fix(Kconfig): adapt to lvgl's built-in demos 2989
- fix(Makefile): compilation errors 2944
- fix(rlottie): fix variable name 2971
- fix(group): in lv_group_del() remove group from indev (lvgl#2963) 2964
- fix(obj): old parent's scroll is not updated in lv_obj_set_parent() 2965
- fix(fatfs) add missing cast 2969
- fix(snapshot) fix memory leak 2970
- fix(examples) move event callback registration outside loop in `lv_example_event_3` 2959
- fix(canvas): off by one error in size check in lv_canvas_copy_buf 2950
- fix(indev) add braces to avoid compiler warning 2947
- fix: fix parameter order in function prototypes 2929
- fix(style):add const qualifier for lv_style_get_prop() 2933
- fix(dropdown): in lv_dropdown_get_selected_str handle if there are no options 2925
- fix: lv_deinit/lv_init crash or hang 2910
- fix(rt-thread): improve the structure 2912
- fix: removed string format warnings for int32_t and uint32_t 2924
- fix(lv_fs_win32): add missing include of <stdio.h> 2918
- fix: use unsigned integer literal for bit shifing. 2888
- chore(lottie) move rlottie_capi.h to lv_rlottie.c 2902
- fix(qrcodegen) add brackets around assert calls 2897
- fix(list) guard image creation with LV_USE_IMG 2881
- fix(snapshot): make fake display size big enough to avoid align issue. 2883
- fix(sdl) correct makefile 2884
- fix(draw): fix set_px_cb memory write overflow crash. 2882
- fix(freetype): fix memset error 2877
- fix(span): fix align and break word 2861
- fix(refr): swap buffers only on the last area with direct mode 2867
- fix(arc) free memory when drawing full-circle arc 2869
- fix(indev): update lv_indev_drv_update to free the read_timer 2850

- fix(draw): fix memory access out of bounds when using blend subtract 2860
- fix(chart) add lv_chart_refresh() to the functions which modify the data 2841
- fix(conf) mismatched macro judgment 2843
- fix(ffmpeg): when disabled LV_FFMPEG_AV_DUMP_FORMAT makes av_log quiet 2838
- fix(rt-thread): fix a bug of log 2811
- fix(log): to allow printf and custom_print_cb to work at same time 2837
- fix(keyboard): add missing functions 2835
- fix(checkbox) remove unnecessary events 2829
- fix(qrcode): replace memcpy() with lv_memcpy() and delete useless macros 2827
- fix(font) improve builtin font source files generation process 2825
- fix(CMake) split CMakeLists.txt, add options, includes and dependencies 2753
- fix(obj): make lv_obj_fade_in/out use the current opa as start value 2819
- fix(qrcode):minimize margins as much as possible 2804
- fix(scripts): switch all scripts to python3 2820
- fix(event): event_send_core crash in special case. 2807
- fix(Kconfig) remove duplicate LV_BUILD_EXAMPLES configuration 2813
- fix(obj): in obj event use the current target instead of target 2785
- fix(draw_label): radius Mask doesn't work in Specific condition 2784
- fix(draw_mask): will crash if get_width/height < 0 2793
- fix(theme) make the basic theme really basic a369f18
- fix(arc): fix knob invalidation 345f688
- fix(theme): add arc, spinner and colorwheel to basic theme adc218a
- fix(conf) define LV_LOG_TRACE_... to 0 in lv_conf_internal.h to avoid warnings 305284c
- fix(draw): consider opa and clip corner on bg_img d51aea4
- fix(draw): add grad_cache_mem to GC_ROOTs 138db9c
- fix(bar, slider): fix shadow drawing on short indicators 364ca3c
- fix(theme): fix theme initialization issue introduced in 6e0072479 d231644
- fix(draw): add lv_draw_sw_bg 49642d3
- fix(draw) border_draw crash is special case 075831a
- fix(theme): fix crash in lv_theme_basic_init ca5f04c
- fix(draw): fix indexed image drawing 5a0dbcc
- fix(roller): clip overflowing text 5709528
- fix(align) fix LV_SIZE_CONTENT size calculation with not LEFT or TOP alignment 9c67642
- fix(draw): futher bg_img draw fixes 81bfb76
- fix(btnmatrix): keep the selected button even on release d47cd1d
- fix(sw): make knob size calculation more intuitive 5ec532d

- fix(switch): make knob height calculation similar to slider 0921dfc
- fix(span): explicitly set span->txt to the return value of lv_mem_realloc(#3005) a9a6cb8
- fix(example): update LVGL_Arduino.ino d79283c
- fix(draw) simplify how outline_pad is compnesated 81d8be1
- fix(obj) make LV_OBJ_FLAG_SCROLL_CHAIN part of the enum instead of define f8d8856
- fix(label): dot not add dots if the label height > 1 font line height 4d61f38
- fix(event): crash if an object was deleted in an event 9810920
- fix(build) fix sdl build with make 43729d1
- fix(config): fix anonymous choice 71c739c
- chore(docs): fix lv_list_add_text a5fbf22
- fix(png) check png magic number to be sure it's a png image 1092550
- fix(btnmatrix): fix crash if an empty btnmatrix is pressed 2392f58
- fix(mem/perf monitor): fix issue introduced in #2910 0788d91
- fix(layout) fix layout recalculation trigger in lv_obj_add/clear_fleg ee65410
- fix(obj) fix lv_obj_fade_in 4931384
- fix(draw): fix clipping children to parent 5c98ac8
- fix: remove symlinks to be accepted as an Ardunio library 6701d36
- chore: fix typos in FATFS config 74091c4
- fix(refr): fix missed buffer switch in double full-screen buffer + direct_mode 731ef5a
- chore(qrcode): fix warnings e9d7080
- docs(event): tell to not adjust widgets in draw events 933d67f
- fix(table, chart): fix memory leaks 8d52de1
- fix(event): handle object deletion in indev->fedback_cb bfc8edf
- fix(roller): snap on press lost fa9340c
- fix(dropdown) be sure the list is the top object on the screen cb7fc2b
- fix(img) fix invalidation issue on transformations d5ede0e
- fix(obj) fix comments of lv_obj_set_pos/x/y b9a5078

11.7.7 Examples

- example: add non-null judgment to lv_example_obj_2 2799
- example(table): fix text alignment b03dc9c

11.7.8 Docs

- docs(demos) update information to reflect new layout 3029
- docs(porting): remove duplicated content 2984
- docs(display) fix typo 2946
- docs(get-started) add introduction for Tasmota and Berry 2874
- docs fix spelling, parameter descriptions, comments, etc 2865
- docs: spelling fixes 2828
- docs(style) minor style fix 2818
- docs(porting/display) fix formatting 2812
- docs(roadmap) update 084439e
- docs(widgets) fix edit links 7ed1a56
- docs(contributing) update commit message format 1cd851f
- docs(porting): add more details about adding lvgl to your project 6ce7348
- docs(indev): add description about gestures 2719862
- docs(style): describe const styles 28ffae8
- docs(faq): add "LVGL doesn't start, nothing is drawn on the display" section 0388d92
- docs add demos 02a6614
- docs(fs): update fs interface description to the latest API 285e6b3
- docs(format) let wrap 4bf49a8
- docs(imgbtn) fix typo d792c5f
- docs(porting) clarify that displays must be registered before input devices 1c64b78
- docs(event) fix lv_event_get_original_target vs lv_event_get_current_target cdd5128
- docs(events) rename LV_EVENT_APPLY to LV_EVENT_READY (#2791) bf6837f
- docs(gpu): link style properties and boxing model 6266851
- docs(gesture): clarify gesture triggering with scrolling e3b43ee
- docs(contributing): remove the mentioning of the dev branch 00d4ef3
- docs(bar) fix default range eeee48b
- docs(event): tell to not adjust widgets in draw events 933d67f
- docs(switch) improve wording b4986ab
- docs(font) fix example to match v8 2f80896

11.7.9 CI and tests

- test(bar): add unit tests `2845`
- test(switch): add initial unit test `2794`
- test(demo) add tests for widget and stress demos `3bd6ad8`
- test(dropdown) fix to pass again `918b3de`
- test add support for using system heap `446b1eb`
- ci remove formatting request workflow `6de89e4`
- ci initial support for cross-architecture tests `7008770`
- ci create handler for formatting requests `7af7849`
- test(style) add test for gradient `da8f345`
- test(event) add test for #2886 `51ef9c2`
- ci add workflow to check code formatting `a2b555e`
- ci attempt to speed up cross tests `80408f7`
- ci apply my updates to the verify-formatting action `02f02fa`
- ci: add arduino linter action `f79b00c`
- ci update action `be9722c`
- ci more formatting action updates `1f6037c`
- ci disable LeakSanitizer on dockerized tests `c9e1927`
- ci one last try at this for tonight `dddafae`
- ci try alternate checkout mechanism `cb3de30`
- test(style) fix compile error `ba083df`
- test(template) simplify _test_template.c `b279f63`
- ci force ccache to be saved every time `a7c590f`
- ci switch to codecov v2 `6b84155`
- ci more debugging for formatting action `2f8e4bc`
- ci inline apt-get commands `90e2b9f`
- ci(micropython) use ESP-IDF 4.4 `b34fe9e`
- ci add 5k stack limit `4122dda`
- ci force use of ccache in PATH `6de3fa8`
- ci add back stack usage check at 4 kilobytes `89135d6`
- ci temporarily disable stack usage check `1900c21`
- ci(cross) use python3 instead of python `df7eaa0`
- ci use specific version tag `59b4769`
- ci fix check style action `5bb3686`
- ci fix typo in formatting action `d1ccbf6`
- ci test formatting action `065d821`

- ci(micropython) switch to newer GCC action `1fa7257`
- ci(style) force color on diff to help highlight whitespace changes `04f47ea`
- ci(cross) install build-essential `772f219`
- ci force pushing to upstream branch `8277f78`
- ci ensure lvgl-bot is used to make commits `9fcf52a`

11.8 v8.1.0 10 November 2021

11.8.1 Overview

v8.1 is a minor release, so besides many fixes it contains a lot of new features too.

Some of the most important features are

- Built in support for SDL based GPU drawing
- Much faster circle drawing in the software renderer
- Several 3rd party libraries are merged directly into LVGL.
- Add LVGL as an RT-Thread and ESP32 component

11.8.2 Breaking Changes

- :warning: feat(calendar): add the header directly into the calendar widget `2e08f80`

11.8.3 Architectural

- arch add small 3rd party libs to lvgl `2569`

11.8.4 New Features

- feat(display) add direct_mode drawing mode `2460`
- feat(conf): make LV_MEM_BUF_MAX_NUM configurable `2747`
- feat(disp): add non-fullscreen display utilities `2724`
- feat(rlottie) add LVGL-Rlottie interface as 3rd party lib `2700`
- feat(rtthread): prepare for porting the device-driver of rt-thread `2719`
- feat(fsdrv) add driver based on Win32 API `2701`
- feat(span) indent supports percent for fix and break mode `2693`
- feat(rt-thread): implement rt-thread sconscirpt `2674`
- feat(lv_spinbox) support both right-to-left and left-to-right digit steps when clicking encoder button `2644`
- feat add support for rt-thread RTOS `2660`
- feat(disp): Enable rendering to display subsection `2583`
- feat(keyboard): add user-defined modes `2651`

- feat(event) add LV_EVENT_CHILD_CREATED/DELETED 2618
- feat(btnmatrix/keyboard): add option to show popovers on button press 2537
- feat(msgbox) add a content area for custom content 2561
- feat(tests): Include debug information to test builds 2568
- feat(drawing) hardware accelerated rendering by SDL2 2484
- feat(msgbox): omit title label unless needed 2539
- feat(msgbox): add function to get selected button index 2538
- feat(make) add lvgl interface target for micropython 2529
- feat(obj) add lv_obj_move_to_index(obj, index), renamed lv_obj_get_child_id(obj) to lv_obj_get_index(obj) 2514
- feat(obj) add lv_obj_swap() function 2461
- feat(mem) LV_MEM_POOL_ALLOC 2458
- feat(switch) add smooth animation when changing state 2442
- feat(anim) add interface for handling lv_anim user data. 2415
- feat(obj) add lv_is_initialized 2402
- feat(obj) Backport keypad and encoder scrolling from v7 `lv_page` to v8 `lv_obj` 2390
- feat(snapshot) add API to take snapshot for object 2353
- feat(anim) add anim timeline 2309
- feat(span) Add missing spangroup functions 2379
- feat(img) add img_size property 2284
- feat(calendar) improve MicroPython example 2366
- feat(spinbox) add function to set cursor to specific position 2314
- feat(timer) check if lv_tick_inc is called aa6641a
- feat(event, widgets) improve the parameter of LV_EVENT_DRAW_PART_BEGIN/END 88c4859
- feat(docs) improvements to examples 4b8c73a
- feat(obj) send LV_EVENT_DRAW_PART_BEGIN/END for MAIN and SCROLLBAR parts b203167
- feat(led) send LV_EVENT_DRAW_PART_BEGIN/END fcd4aa3
- feat(chart) send LV_EVENT_DRAW_PART_BEGIN/END before/after the division line drawing section. e0ae2aa
- feat(tests) upload coverage to codecov 4fff99d
- feat(conf) add better check for Kconfig default f8fe536
- feat(draw) add LV_BLEND_MODE_MULTIPLY cc78ef4
- feat(test) add assert for screenshot compare 2f7a005
- feat(event) pass the scroll animation to LV_EVENT_SCROLL_BEGIN ca54ecf
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- feat(event) add LV_SCREEN_(UN)LOAD_START 7bae9e3
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- feat(docs) add view on GitHub link a716ac6
- feat(event) add LV_EVENT_SCREEN_LOADED/UNLOADED events ee5369e
- feat(textarea) remove the need of lv_textarea_set_align 56ebb1a
- feat(rt-thread): support LVGL projects with GCC/Keil(AC5)/Keil(AC6)/IAR 32d33fe
- feat(docs) lazy load individual examples as well 918d948
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- feat(canvas) add lv_canvas_set_px_opa b3b3ffc
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- perf(refresh) optimize where to wait for lv_disp_flush_ready with 2 buffers d0172f1
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- fix(pxp): update for v8 8a2a4a1
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- fix(flex) fix layout update and invalidation issues 5bd82b0
- fix(indev) focus on objects on release instead of press 76a8293
- fix tests 449952e
- fix(dropdown) forget the selected option on encoder longpress e66b935
- fix(obj) improve how the focusing indev is determined a04f2de
- fix(workflow) speed up MicroPython workflow 38ad5d5
- fix(test) do not including anything in test files when not running tests 9043860
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- fix(imgbtn) use the correct src in LV_EVENT_GET_SELF_SIZE `04c515a`
- fix(color) remove extraneous cast for 8-bit color `157534c`
- fix(workflow) use same Unix port variant for MicroPython submodules `ac68b10`
- fix(README) improve grammar `de81889`
- fix(printf) skip defining attribute if pycparser is used `ee9bbea`
- fix(README) spelling correction `41869f2`
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- fix(docs) consider an example to be visible over a wider area `145a0fa`
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- fix(arc) disable LV_OBJ_FLAG_SCROLL_CHAIN by default `f172eb3`
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- fix(msgbox) handle NULL btn map parameter `769c4a3`
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- fix(img decoder) add error handling if the dsc->data = NULL `d0c1c67`
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- fix(typo) rename LV_OBJ_FLAG_SNAPABLE to LV_OBJ_FLAG_SNAPPABLE `e697807`
- fix(lv_printf.h): to eliminate the errors in Keil and IAR `f6d7dc7`

- fix(draw) fix horizontal gradient drawing 4c034e5
- fix(dropdown) use LV_EVENT_READY/CANCEL on list open/close 4dd1d56
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- fix(test) add #if guard to exclude test related files from the build c12a22e
- fix(test) add #if guard to exclude test related files from the build fc364a4
- fix(freetype) fix underline calculation 76c8ee6
- fix(style) refresh ext. draw pad for padding and bg img 37a5d0c
- fix(draw) underflow in subpixel font drawing 6d5ac70
- fix(scrollbar) hide the scrollbar if the scrollble flag is removed 188a946
- fix(color): minor fixes(#2767) a4978d0
- fix(group) skip object if an of the parents is hidden 5799c10
- fix(obj) fix size invalidation issue on padding change 33ba722
- fix(label) do not bidi process text in lv_label_ins_text e95efc1
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- fix(draw) fix drawing small arcs 8081599
- fix(chart) invalidation with LV_CHART_UPDATE_MODE_SHIFT d61617c
- fix(build) fix micropython build error 54338f6
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- fix(calendar) fix calculation today and highlighted day 8f0b5ab
- fix(style) initialize colors to black instead of zero 524f8dd
- fix(sjpg) remove unnecessary typedefs c2d93f7
- fix(label) fix clipped italic letters 2efa6dc
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- fix(dropdown) add missing invalidations 33b5d4a
- fix(dropdown) adjust the handling of keys sent to the dropdown e41c507
- fix(disp) be sure the pending scr load animation is finished in lv_scr_load_anim eb6ae52
- fix(color) fox color premult precision with 16-bit color depth f334226
- fix(obj_pos) save x,y even if the object is on a layout a9b660c
- fix(scrollbar) hide the scrollbar if the scrollable flag is removed d9c6ad0
- fix(dropdown) fix list position with RTL base direction 79edb37
- fix(obj) fix lv_obj_align_to with RTL base direction 531afcc
- fix(chart) fix sending LV_EVENT_DRAW_PART_BEGIN/END for the cursor 34b8cd9
- fix(arduino) fix the prototype of my_touchpad_read in the LVGL_Arduino.ino 1a62f7a
- fix(checkbox) consider the bg border when positioning the indicator a39dac9
- fix(dropdown) send LV_EVENT_VALUE_CHANGED to allow styling of the list dae7039
- fix(group) fix infinite loop bdce0bc

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- fix(table) fix an off-by-one issue in self size calculation ea2545a
- fix shadowed variable e209260
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- fix(chart) be sure the chart doesn't remain scrolled out on zoom out ad5b1bd
- fix(docs) commit to meta repo as lvgl-bot instead of actual commit author f0e8549
- fix(table) invalidate the table on cell value change cb3692e
- fix(group) allow refocusing objects 1520208
- fix(tabview) fix with left and right tabs 17c5744
- fix(msgbox) create modals on top layer instead of act screen 5cf6303
- fix(theme) show disabled state on buttons of btnmatrix, msgbox and keyboard 0be582b
- fix(label) update lv_label_get_letter_pos to work with LV_BASE_DIR_AUTO too 580e05a
- fix(label) fix in lv_label_get_letter_pos with when pos==line_start 58f3f56
- fix(gif) replace printf statement with LVGL logging 56f62b8
- fix(docs) add fsdrv back 64527a5
- fix(table) remove unnecessary invalidation on pressing 6f90f9c
- fix(chart) draw line chart indicator (bullet) fba37a3
- fix(anim) return the first anim if exec_cb is NULL in lv_anim_get() fb7ea10
- fix(label) fix lv_label_get_letter_on with BIDI enabled 192419e
- fix(checkbox) add missing invalidations bb39e9d
- fix(draw) fix gradient calculation of the rectangle is clipped 13e3470
- fix(chart) fix typo in 655f42b8 6118d63
- fix(example) fix lv_example_chart_2 89081c2
- fix(calendar) fix the position calculation today ad05e19
- fix(tick) minor optimization on lv_tick_inc call test b4305df
- fix(docs) use let instead of const for variable which gets changed 3cf5751
- fix(theme) fix the switch style in the default theme 0c0dc8e
- fix(tlsf) undef printf before define-ing it cc935b8
- fix(msgbox) prevent the buttons being wider than the msgbox 73e036b
- fix(chart) don't draw series lines with < 1 points 655f42b
- fix(tests) remove src/test_runners when cleaning 6726b0f
- fix(label) remove duplicated lv_obj_refresh_self_size a070ecf
- fix(colorwheel) disable LV_OBJ_FLAG_SCROLL_CHAIN by default 48d1c29

- fix(obj) do not set the child's position in lv_obj_set_parent d89a5fb
- feat: add LV_USE_MEM_PERF/MONITOR_POS acd0f4f
- fix(scroll) in scroll to view functions respect disabled LV_OBJ_FLAG_SCROLLABLE 9318e02
- fix(flex) remove unused variable 747b6a2
- feat(canvas) add lv_canvas_set_px_opa b3b3ffc
- fix(textarea) allow using cursor with not full bg_opa c9d3965
- fix(txt) _lv_txt_get_next_line return 0 on empty texts 82f3fbc
- fix(btnmatrix) always update row_cnt 86012ae
- fix(scroll) minor fixes on obj scroll handling a4128a8
- fix(table) consider border width for cell positions f2987b6
- fix(log) be sure LV_LOG_... is not empty if logs are disabled 47734c4
- fix(arc) fix LV_ARC_MODE_REVERSE df3b969
- fix(obj) in lv_obj_move_to_index() do not send LV_EVENT_CHILD_CHANGED on all changed child 32e8276
- feat(event) add lv_obj_remove_event_cb_with_user_data 4eddeb3
- fix(draw) fix shadow drawing with radius=0 4250e3c
- fix(msgbox) directly store the pointer of all children eb5eaa3
- fix(draw) use the filtered colors in lv_obj_init_draw_xxx_dsc() functions 78725f2
- fix(arc) fix full arc invalidation 98b9ce5
- chore(led) expose LV_LED_BRIGHT_MIN/MAX in led.h 3f18b23
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- fix(obj) swap objects in the group too in lv_obj_swap() 52c7558
- fix(theme) use opacity on button's shadow in the default theme c5342e9
- fix(win) enable clip_corner and border_post by default 493ace3
- fix(draw) fix rectangle drawing with clip_corner enabled 01237da
- fix(arc) fix other invalidation issues b0a7337
- feat(obj) add lv_obj_get_x/y_aligned 98bc1fe
- fix(calendar) fix incorrect highlight of today adbac52
- fix(arc, meter) fix invalidation in special cases 0f14f49
- fix(canvas) invalidate the image on delete a1b362c
- fix(msgbox) return the correct pointer from lv_msgbox_get_text 50ea6fb
- fix(bidi) fix the handling of LV_BASE_DIR_AUTO in several widgets 7672847
- fix(build) remove main component dependency (#2420) f2c2393
- fix(meter) fix inner mask usage c28c146
- fix(log) fix warning for empty log macros 4dba8df
- fix(theme) improve button focus of keyboard 2504b7e
- fix(tabview) send LV_EVENT_VALUE_CHANGED only once 933d282

- fix(obj style) fix children reposition if the parent's padding changes. 57cf661
- fix(template) update indev template for v8 d8a3d3d
- fix(obj) detecting which indev sent LV_EVENT_FOCUS f03d4b8
- fix(roller) adjust the size of the selected area correctly 01d1c87
- fix(imgbtn) consider width==LV_SIZE_CONTENT if only mid. img is set 7e49f48
- fix(flex) fix NULL pointer dereference 97ba12f
- fix(obj, switch) do not send LV_EVENT_VALUE_CHANGED twice 713b39e
- fix(coords) fix using large coordinates 428db94
- fix(chart) fix crash if no series are added c728b5c
- fix(meter) fix needle image invalidation 54d8e81
- fix(mem) add lv_ prefix to tlsf functions and types 0d52b59
- fix(pxp) change LV_COLOR_TRANSP to LV_COLOR_CHROMA_KEY to v8 compatibility 81f3068

11.8.7 Examples

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- example(anim) add demo to use cubic-bezier 2393
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- feat(example) add lv_example_chart_8.py 2611
- feat(example) chart example to add gap between the old and new data 2565
- feat(example) add lv example list 2 2545
- feat(examples) add MicroPython version of lv_example_anim_3 and allow loading roller font dynamically 2412
- feat(examples) added MP version of second tabview example 2347
- fix(example):format codes 2731
- fix(example) minor fixes in lv_example_chart_2.py 2601
- feat(example) add text with gradient example 462fbcb
- fix(example_roller_3) mask free param bug 2553
- fix(examples) don't compile assets unless needed 2523
- fix(example) scroll example sqort types 2498
- fix(examples) join usage 2425
- fix(examples) add missing lv.PART.INDICATOR 2423
- fix(examples) use lv.grid_fr for MicroPython 2419
- fix(examples) remove symlinks 2406
- fix(examples) import 'u'-prefixed versions of modules 2365
- fix(examples) remove cast in MP scripts 2354
- fix(examples) fix MicroPython examples and run the examples with CI 2339
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- fix(examples) adjust canvas example for MicroPython API change 52d1c2e
- fix(example) revert test code 77e2c1f
- feat(example) add checkbox example for radio buttons d089b36
- feat(example) add text with gradient example 462fbcb
- fix(examples) exclude example animimg images if animimg is disabled 4d7d306
- fix(example) adjust the object sizes in lv_example_anim_timeline_1() 71a10e4
- fix(example) revert text code from lv_example_checkbox_2 28e9593

11.8.8 Docs

- docs: fix typo 2765
- docs(colorwheel) fix old API names 2643
- docs(display) fix typo 2624
- docs add static for lv_indev_drv_t 2605
- docs(animimg) add to extra widgets index and fix example 2610
- docs(animimg) Add missing animation image page 2609
- docs(group) remove reference to lv_cont which is gone in v8 2580
- docs(style) use correct API name for local styles 2550
- docs(all) Proofread, fix typos and add clarifications in confusing areas 2528
- docs(flex) update flex.md 2517
- docs more spelling fixes 2499
- docs fix typo: arae -> area 2488
- docs(readme) fix typo: hosing → hosting. 2477
- docs update company name and year 2476
- docs fix typos 2472
- docs(overview) fix typo 2465
- docs(bar) fix typos in widget examples 2463
- docs(overview) fix typo 2454
- docs(chart) typos 2427
- docs(layout) add internal padding paragraph to grid and flex layout p… 2392
- docs(porting) fix indev example to remove v7 bool return 2381
- docs(README) fix broken references 2329
- docs(grid) typo fix 2310
- docs(color) language fixes 2302
- docs(lv_obj_style) update add_style and remove_style function headers 2287
- docs(contributing) add commit message format section 3668e54
- docs minor typo fixes 84c0086

- docs(arduino) update some outdated information `9a77102`
- docs(keyboard) add note regarding event handler `255f729`
- docs minor CSS fix `acbb680`
- docs minor CSS improvements `7f367d6`
- docs(keyboard) change `LV_KEYBOARD_MODE_NUM` to `LV_KEYBOARD_MODE_NUMBER` `6e83d37`
- docs(textarea) clarify the use of text selection bg_color `65673c0`
- docs list all examples on one page `25acaf4`
- docs(examples) add MicroPython examples `6f37c4f`
- docs(filesystem) update to v8 `7971ade`
- docs(style) complete the description of style the properties `55e8846`
- docs example list fixes `cd600d1`
- docs(style) complete the description of style the properties `ff087da`
- docs(README) update links, examples, and add services menu `3471bd1`
- docs(color) update colors' docs `9056b5e`
- docs update lv_fs.h, layer and align.png to v8 `31ab062`
- docs(color) minor fix `ac8f453`
- docs update changelog `c386110`
- docs(extra) add extra/README.md `8cd504d`
- docs add lazy load to the iframes of the examples `c49e830`
- docs(os) add example and clarify some points `d996453`
- docs(rlottie) fix build error `ce0b564`
- docs include paths in libs `f5f9562`
- docs libs fixes `8e7bba6`
- docs(obj) add comment lv_obj_get_x/y/width/height about postponed layout recalculation `533066e`
- docs fix example list `ed77ed1`
- docs describe the options to include or skip lv_conf.h `174ef66`
- docs(overview) spelling fixes `d2efb8c`
- docs(table) describe keypad/encoder navigation `749d1b3`
- docs update CHANGELOG `0f8bc18`
- docs(image) mention the frame_id parameter of lv_img_decoder_open `2433732`
- docs(arduino) update how to use the examples `06962a5`
- docs(rlottie): fix typo in commands `ed9169c`
- docs(indev, layer) update lv_obj_set_click() to lv_obj_add_flag() `bcd99e8`
- docs update version support table `e6e98ab`
- docs fix example list `c6f99ad`
- docs(examples) add <hr/> to better separate examples `a1b59e3`

- docs(checkbox) update the comment lv_checkbox_set_text_static 3e0ddd0
- docs(grid) fix missing article da0c97a
- docs(display) fix grammar in one spot 5dbea7d
- docs(style) fix typo in style property descriptions 4e3b860
- docs(flex) fix typo in flex grow section e5fafc4
- docs(indev) clarify purpose of `continue_reading` flag 706f81e
- docs(license) update company name and year 7c1eb00
- docs fix typo 8ab8064
- docs add libs to the main index 1a8fed5
- docs add btn_example.png 8731ef1
- docs(btnmatrix) fix typo with set_all/clear_all parameters 51a82a1

11.8.9 CI and tests

- ci(micropython) fix git fetch 2757
- test(txt) initial unit tests and general code cleanup/fixes 2623
- test add setUp and tearDown to test template 2648
- test(arc) add initial unit tests 2617
- ci(micropython) add ESP32 and STM32 tests 2629
- test(checkbox) add initial tests 2551
- test(ci) build and run tests in parallel. 2515
- ci(tests) run tests using ctest 2503
- ci(tests) add dependency on GNU parallel 2510
- ci(tests) use common script to install development prereqs 2504
- test convert Makefile to CMake 2495
- test Refactor unit test scripts. 2473
- test(font_loader) migrate the existing font loader test bc5b3be
- test add build test again, add dropdown test, integrate gcov and gvocr e35b1d0
- test(dropdown) add tess for keypad and encoder 4143b80
- test add keypad and encoder emulators e536bb6
- tests add mouse emulator 2ba810b
- tests add README b765643
- test add move tests to test_cases and test_runners directories e9e010a
- test fix CI build error c38cae2
- ci add config for 8bpp 3eacc59
- test move more source files to src folder 3672f87
- test update CI for the new tests a3898b9

- test cleaned up report folder b9b4ba5
- test fix build error 61cda59
- test(font_loader) migrate the existing font loader test d6dbbaa
- test add move tests to test_cases and test_runners directories d2e735e
- test add 3rd party libs to all tests and also fix them 7a95fa9
- test(arc): add test case for adv_hittest e83df6f
- ci create check for lv_conf_internal.h 5d8285e
- test fix warning and docs build error d908f31
- ci(micropython) add rp2 port 1ab5c96
- test(dropdown) remove dummy test case 9fb98da
- ci(codecov) hide statuses on commits for now 0b7be77
- ci(docs) run apt-get update before installation f215174
- test fix LV_USE_LOG_LEVEL -> LV_LOG_LEVEL typo 80f0b09
- ci(micropython) add GCC problem matcher ab316a0
- test convert Makefile to CMake (#2495) 9c846ee

11.8.10 Others

- chore: replace (void)xxx with LV_UNUSED(xxx) 2779
- animation improvement 2743
- Improve LV_FORMAT_ATTRIBUTE usage 2673
- Fix typo in commands to build rlottie 2723
- del(.gitmodules): delete .gitmodules 2718
- lv_obj_draw_part_dsc_t.text_length added 2694
- expose LV_COLOR_DEPTH and LV_COLOR_16_SWAP in micropython 2679
- sync lvgl/lv_fs_if 2676
- build: always enable CMake install rule in default configuration 2636
- build: fix lib name in CMakeLists 2641
- build: remove use of 'project' keyword in CMakeLists 2640
- build add install rule to CMakeList.txt 2621
- Fixed row size calculation 2633
- arch add small 3rd party libs to lvgl 2569
- Kconfig: Add missing options 2597
- Espressif IDF component manager 2521
- chore(btnmatrix) removed unnecessary semicolon 2520
- Update README.md 2516
- Corrected a function name in obj.md 2511

- Simple spelling fixes 2496
- added lv_obj_move_up() and lv_obj_move_down() 2467
- Fix buf name error for "lv_port_disp_template.c" and optimize the arduino example 2475
- Fix two examples in the docs with new v8 api 2486
- kconfig: minor fix for default dark theme option 2426
- doc(table) update doc on cell merging 2397
- added example lv_example_anim_timeline_1.py 2387
- refactor(printf) add printf-like function attribute to _lv_txt_set_text_vfmt and lv_label_set_text_fmt 2332
- Update win.md 2352
- Nxp pxp vglite v8 dev 2313
- More Snapable --> Snappable replacements 2304
- Spelling and other language fixes to documentation 2293
- Update quick-overview.md 2295
- adding micropython examples 2286
- format run code-formtter.sh d67dd94
- Update ROADMAP.md 2b1ae3c
- Create .codecov.yml e53aa82
- refactor(examples) drop JS-specific code from header.py ef41450
- make test run on master and release/v8.* 227402a
- Update release.yml 0838f12
- refactor(examples) drop usys import from header.py ad1f91a
- Update ROADMAP.md a38fcf2
- Revert "feat(conf) add better check for Kconfig default" a5793c7
- remove temporary test file a958c29
- start to implement release/patch 1626a0c
- chore(indev) minor formatting 79ab3d2
- add basic patch release script 1c3ecf1
- chore(example) minor improvements on lv_example_list_2 bb6d6b7
- tool: add changelog_gen.sh to automatically generate changelog 6d95521
- update version numbers to v8.1.0-dev 8691611
- chore(test) improve prints ea8bed3
- chore(test) improve prints 0c4bca0
- chore: update lv_conf_internal.h 41c2dd1
- chore(format) lv_conf_template.h minor formatting 3c86d77
- chore(docs) always deploy master to docs/master as well 6d05692
- Update CHANGELOG.md 48fd73d

- Fix compile errors `6c956cc`
- Update textarea.md `6d8799f`
- chore(assert) add warning about higher memory usage if LV_USE_ASSERT_STYLE is enabled `33e4330`
- Update page.html `9573bab`
- chore(docs) force docs rebuild `4a0f413`
- Fix typo error in color.md `572880c`
- Update arc.md `2a9b9e6`
- Update index.rst `9ce2c77`
- chore(docs) minor formatting on example's GitHub link `75209e8`
- chore(lv_conf_template) fix spelling mistake `9d134a9`
- Update CHANGELOG.md `8472360`
- chore(stale) disable on forks `93c1303`
- Revert "fix(tests) remove src/test_runners when cleaning" `ae15a1b`
- style fix usage of clang-format directives `2122583`
- Revert "fix(indev) focus on objects on release instead of press" `f61b2ca`

11.9 v8.0.2 (16.07.2021)

- fix(theme) improve button focus of keyboard
- fix(tabview) send LV_EVENT_VALUE_CHANGED only once
- fix(imgbtn) use the correct src in LV_EVENT_GET_SELF_SIZE
- fix(color) remove extraneous cast for 8-bit color
- fix(obj style) fix children reposition if the parent's padding changes.
- fix(color) remove extraneous _LV_COLOR_MAKE_TYPE_HELPER (#2372)
- fix(spinner) should not be clickable (#2373)
- fix(obj) improve how the focusing indev is determined
- fix(template) update indev template for v8
- fix(printf) skip defining attribute if pycparser is used
- refactor(printf) add printf-like function attribute to _lv_txt_set_text_vfmt and lv_label_set_text_fmt (#2332)
- fix(template) include lvgl.h in lv_port_*_template.c files
- fix(obj) detecting which indev sent LV_EVENT_FOCUS
- fix (span) fill LV_EVENT_GET_SELF_SIZE (#2360)
- fix(arc) disable LV_OBJ_FLAG_SCROLL_CHAIN by default
- fix (draw) fix arc bg image drawing with full arcs
- fix(disp) fix memory leak in lv_disp_remove (#2355)
- fix warnings introduced by 3fb8baf5

- fix(widgets) use lv_obj_class for all the widgets
- fix(obj) move clean ups from lv_obj_del to lv_obj_destructor
- fix(roller) fix partial redraw of the selected area
- fix(roller) adjust the size of the selected area correctly
- fix(obj) delete useless type conversion (#2343)
- fix(lv_obj_scroll.h) typos (#2345)
- fix(scroll) fire LV_EVENT_SCROLL_BEGIN in the same spot for both axes
- fix(btnmatrix) fix button invalidation on focus change
- fix(textarea) style update in oneline mode + improve scroll to cursor
- fix(tlsf) do not use <assert.h>
- fix(imgbtn) consider width==LV_SIZE_CONTENT if only mid. img is set
- fix(refr) reduce the nesting level in lv_refr_area
- fix(txt) enhance the function of break_chars (#2327)
- fix(pxp): update RTOS macro for SDK 2.10
- fix(vglite): update for v8
- fix(pxp): update for v8
- fix(flex) fix layout update and invalidation issues
- fix(flex) fix NULL pointer dereference
- fix(obj, switch) do not send LV_EVENT_VALUE_CHANGED twice
- fix(color) overflow with 16-bit color depth
- fix(coords) fix using large coordinates
- fix(chart) fix crash if no series are added
- fix(chart) invalidation with LV_CHART_UPDATE_MODE_SHIFT
- fix(align) fix lv_obj_align_to G
- fix(table) invalidate the table on cell value change
- fix(label) remove duplicated lv_obj_refresh_self_size
- fix(draw) underflow in subpixel font drawing
- fix (scroll) do not send unnecessary scroll end events

11.10 v8.0.1 (14.06.2021)

- docs(filesystem) update to v8 7971ade4
- fix(msgbox) create modals on top layer instead of act screen 5cf6303e
- fix(colorwheel) disable LV_OBJ_FLAG_SCROLL_CHAIN by default 48d1c292
- docs(grid) typo fix (#2310) 69d109d2
- fix(arduino) fix the prototype of my_touchpad_read in the LVGL_Arduino.ino 1a62f7a6

- fix(meter) fix needle image invalidation 54d8e817
- fix(mem) add lv_ prefix to tlsf functions and types 0d52b59c
- fix(calendar) fix the position calculation today ad05e196
- fix(typo) rename LV_OBJ_FLAG_SNAPABLE to LV_OBJ_FLAG_SNAPPABLE e697807c
- docs(color) language fixes (#2302) 07ecc9f1
- fix(tick) minor optimization on lv_tick_inc call test b4305df5
- Spelling and other language fixes to documentation (#2293) d0aaacaf
- fix(theme) show disabled state on buttons of btnmatrix, msgbox and keyboard 0be582b3
- fix(scroll) keep the scroll position on object deleted 52edbb46
- fix(msgbox) handle NULL btn map parameter 769c4a30
- fix(group) allow refocusing objects 1520208b
- docs(overview) spelling fixes d2efb8c6
- Merge branch 'master' of https://github.com/lvgl/lvgl 45960838
- feat(timer) check if lv_tick_inc is called aa6641a6
- feat(docs) add view on GitHub link a716ac6e
- fix(theme) fix the switch style in the default theme 0c0dc8ea
- docs fix typo 8ab80645
- Merge branch 'master' of https://github.com/lvgl/lvgl e796448f
- feat(event) pass the scroll animation to LV_EVENT_SCROLL_BEGIN ca54ecfe
- fix(tabview) fix with left and right tabs 17c57449
- chore(docs) force docs rebuild 4a0f4139
- chore(docs) always deploy master to docs/master as well 6d05692d
- fix(template) update lv_objx_template to v8 38bb8afc
- docs(extra) add extra/README.md 8cd504d5
- Update CHANGELOG.md 48fd73d2
- Update quick-overview.md (#2295) 5616471c
- fix(pxp) change LV_COLOR_TRANSP to LV_COLOR_CHROMA_KEY to v8 compatibility 81f3068d
- adding micropython examples (#2286) c60ed68e
- docs(color) minor fix ac8f4534
- fix(example) revert test code 77e2c1ff
- fix(draw) with additive blending with 32-bit color depth 786db2af
- docs(color) update colors' docs 9056b5ee
- Merge branch 'master' of https://github.com/lvgl/lvgl a711a1dd
- perf(refresh) optimize where to wait for lv_disp_flush_ready with 2 buffers d0172f14
- docs(lv_obj_style) update add_style and remove_style function headers (#2287) 60f7bcbf
- fix memory leak of spangroup (#2285) 33e0926a

- fix make lv_img_cache.h public because cache invalidation is public 38ebcd81
- Merge branch 'master' of https://github.com/lvgl/lvgl 2b292495
- fix(btnmatrix) fix focus event handling 3b58ef14
- Merge pull request #2280 from lvgl/dependabot/pip/docs/urllib3-1.26.5 a2f45b26
- fix(label) calculating the clip area 57e211cc
- chore(deps): bump urllib3 from 1.26.4 to 1.26.5 in /docs b2f77dfc
- fix(docs) add docs about the default group 29bfe604

11.11 v8.0.0 (01.06.2021)

v8.0 brings many new features like simplified and more powerful scrolling, new layouts inspired by CSS Flexbox and Grid, simplified and improved widgets, more powerful events, hookable drawing, and more.

v8 is a major change and therefore it's not backward compatible with v7.

11.11.1 Directory structure

- The `lv_` prefix is removed from the folder names
- The `docs` is moved to the `lvgl` repository
- The `examples` are moved to the `lvgl` repository
- Create an `src/extra` folder for complex widgets:
  - It makes the core LVGL leaner
  - In `extra` we can have a lot and specific widgets
  - Good place for contributions

11.11.2 Widget changes

- `lv_cont` removed, layout features are moved to `lv_obj`
- `lv_page` removed, scroll features are moved to `lv_obj`
- `lv_objmask` the same can be achieved by events
- `lv_meter` added as the union of `lv_linemeter` and `lv_gauge`
- `lv_span` new widget mimicking HTML `<span>`
- `lv_animimg` new widget for simple slideshow animations
- + many minor changes and improvements

11.11.3 New scrolling

- Support "elastic" scrolling when scrolled in
- Support scroll chaining among any objects types (not only `lv_pages`s)
- Remove `lv_drag`. Similar effect can be achieved by setting the position in `LV_EVENT_PRESSING`
- Add snapping
- Add snap stop to scroll max 1 snap point

11.11.4 New layouts

- CSS Grid-like layout support
- CSS Flexbox-like layout support

11.11.5 Styles

- Optimize and simplify styles
- State is saved in the object instead of the style property
- Object size and position can be set in styles too

11.11.6 Events

- Allow adding multiple events to an object
- A `user_data` can be attached to the added events

11.11.7 Driver changes

- `lv_disp_drv_t`, `lv_indev_drv_t`, `lv_fs_drv_t` needs to be `static`
- `...disp_buf...` is renamed to `draw_buf`. See an initialization example here.
- No partial update if two screen sized buffers are set
- `disp_drv->full_refresh = 1` makes always the whole display redraw.
- `hor_res` and `ver_res` need to be set in `disp_drv`
- `indev_read_cb` returns `void`. To indicate that there is more that to read set `data->continue_reading = 1` in the `read_cb`

11.11.8 Other changes

- Remove the copy parameter from create functions
- Simplified File system interface API
- Use a more generic inheritance
- The built-in themes are reworked
- `lv_obj_align` now saved the alignment and realigns the object automatically but can't be used to align to other than the parent
- `lv_obj_align_to` can align to an object but doesn't save the alignment
- `lv_pct(x)` can be used to set the size and position in percentage
- There are many other changes in widgets that are not detailed here. Please refer to the documentation of the widgets.

11.11.9 New release policy

- We will follow Release branches with GitLab flow
- Minor releases are expected in every 3-4 month
- `master` will always contain the latest changes

11.11.10 Migrating from v7 to v8

- First and foremost, create a new `lv_conf.h` based on `lv_conf_template.h`.
- To try the new version it's recommended to use a simulator project and see the examples.
- When migrating your project to v8
  - Update the drivers are described above
  - Update the styles
  - Update the events
  - Use the new layouts instead of `lv_cont` features
  - Use `lv_obj` instead of `lv_page`
  - See the changes in Colors
  - The other parts are mainly minor renames and refactoring. See the functions' documentation for descriptions.

11.12 v7.11.0 (16.03.2021)

11.12.1 New features

- Add better screen orientation management with software rotation support
- Decide text animation's direction based on base_dir (when using LV_USE_BIDI)

11.12.2 Bugfixes

- fix(gauge) fix needle invalidation
- fix(bar) correct symmetric handling for vertical sliders

11.13 v7.10.1 (16.02.2021)

11.13.1 Bugfixes

- fix(draw) overlap outline with background to prevent aliasing artifacts
- fix(indev) clear the indev's `act_obj` in `lv_indev_reset`
- fix(text) fix out of bounds read in `_lv_txt_get_width`
- fix(list) scroll list when button is focused using LV_KEY_NEXT/PREV
- fix(text) improve Arabic contextual analysis by adding hyphen processing and proper handling of lam-alef sequence
- fix(delete) delete animation after the children are deleted
- fix(gauge) consider paddings for needle images

11.14 v7.10.0 (02.02.2021)

11.14.1 New features

- feat(indev) allow input events to be passed to disabled objects
- feat(spinbox) add inline get_step function for MicroPython support

11.14.2 Bugfixes

- fix(btnmatrix) fix lv_btnmatrix_get_active_btn_text() when used in a group

11.15 v7.9.1 (19.01.2021)

11.15.1 Bugfixes

- fix(cpicker) fix division by zero
- fix(dropdown) fix selecting options after the last one
- fix(msgbox) use the animation time provided
- fix(gpu_nxp_pxp) fix incorrect define name
- fix(indev) don't leave edit mode if there is only one object in the group
- fix(draw_rect) fix draw pattern stack-use-after-scope error

11.16 v7.9.0 (05.01.2021)

11.16.1 New features

- feat(chart) add lv_chart_remove_series and lv_chart_hide_series
- feat(img_cache) allow disabling image caching
- calendar: make get_day_of_week() public
- Added support for Zephyr integration

11.16.2 Bugfixes

- fix(draw_rect) free buffer used for arabic processing
- fix(win) arabic process the title of the window
- fix(dropdown) arabic process the option in lv_dropdown_add_option
- fix(textarea) buffer overflow in password mode with UTF-8 characters
- fix(textarea) cursor position after hiding character in password mode
- fix(linemeter) draw critical lines with correct color
- fix(lv_conf_internal) be sure Kconfig defines are always uppercase
- fix(kconfig) handle disable sprintf float correctly.
- fix(layout) stop layout after recursion threshold is reached
- fix(gauge) fix redraw with image needle

11.17 v7.8.1 (15.12.2020)

11.17.1 Bugfixes

- fix(lv_scr_load_anim) fix when multiple screens are loaded at the same time with delay
- fix(page) fix LV_SCROLLBAR_MODE_DRAG

11.18 v7.8.0 (01.12.2020)

11.18.1 New features

- make DMA2D non blocking
- add unscii-16 built-in font
- add KConfig
- add lv_refr_get_fps_avg()

11.18.2 Bugfixes

- fix(btnmatrix) handle arabic texts in button matrices
- fix(indev) disabled object shouldn't absorb clicks but let the parent to be clicked
- fix(arabic) support processing again already processed texts with _lv_txt_ap_proc
- fix(textarea) support Arabic letter connections
- fix(dropdown) support Arabic letter connections
- fix(value_str) support Arabic letter connections in value string property
- fix(indev) in LV_INDEV_TYPE_BUTTON recognize 1 cycle long presses too
- fix(arc) make arc work with encoder
- fix(slider) adjusting the left knob too with encoder
- fix reference to LV_DRAW_BUF_MAX_NUM in lv_mem.c
- fix(polygon draw) join adjacent points if they are on the same coordinate
- fix(linemeter) fix invalidation when setting new value
- fix(table) add missing invalidation when changing cell type
- refactor(roller) rename LV_ROLLER_MODE_INIFINITE -> LV_ROLLER_MODE_INFINITE

11.19 v7.7.2 (17.11.2020)

11.19.1 Bugfixes

- fix(draw_triangle): fix polygon/triangle drawing when the order of points is counter-clockwise
- fix(btnmatrix): fix setting the same map with modified pointers
- fix(arc) fix and improve arc dragging
- label: Repair calculate back `dot` character logical error which cause infinite loop.
- fix(theme_material): remove the bottom border from tabview header
- fix(imgbtn) guess the closest available state with valid src
- fix(spinbox) update cursor position in lv_spinbox_set_step

11.20 v7.7.1 (03.11.2020)

11.20.1 Bugfixes

- Respect btnmatrix's `one_check` in `lv_btnmatrix_set_btn_ctrl`
- Gauge: make the needle images to use the styles from `LV_GAUGE_PART_PART`
- Group: fix in `lv_group_remove_obj` to handle deleting hidden objects correctly

11.21 v7.7.0 (20.10.2020)

11.21.1 New features

- Add PXP GPU support (for NXP MCUs)
- Add VG-Lite GPU support (for NXP MCUs)
- Allow max. 16 cell types for table
- Add `lv_table_set_text_fmt()`
- Use margin on calendar header to set distances and padding to the size of the header
- Add `text_sel_bg` style property

11.21.2 Bugfixes

- Theme update to support text selection background
- Fix imgbtn state change
- Support RTL in table (draw columns right to left)
- Support RTL in pretty layout (draw columns right to left)
- Skip objects in groups if they are in disabled state
- Fix dropdown selection with RTL basedirection
- Fix rectangle border drawing with large width
- Fix `lv_win_clean()`

11.22 v7.6.1 (06.10.2020)

11.22.1 Bugfixes

- Fix BIDI support in dropdown list
- Fix copying base dir in `lv_obj_create`
- Handle sub pixel rendering in font loader
- Fix transitions with style caching
- Fix click focus
- Fix imgbtn image switching with empty style
- Material theme: do not set the text font to allow easy global font change

11.23 v7.6.0 (22.09.2020)

11.23.1 New features

- Check whether any style property has changed on a state change to decide if any redraw is required

11.23.2 Bugfixes

- Fix selection of options with non-ASCII letters in dropdown list
- Fix font loader to support LV_FONT_FMT_TXT_LARGE

11.24 v7.5.0 (15.09.2020)

11.24.1 New features

- Add `clean_dcache_cb` and `lv_disp_clean_dcache` to enable users to use their own cache management function
- Add `gpu_wait_cb` to wait until the GPU is working. It allows to run CPU a wait only when the rendered data is needed.
- Add 10px and 8ox built in fonts

11.24.2 Bugfixes

- Fix unexpected DEFOCUS on lv_page when clicking to bg after the scrollable
- Fix `lv_obj_del` and `lv_obj_clean` if the children list changed during deletion.
- Adjust button matrix button width to include padding when spanning multiple units.
- Add rounding to btnmatrix line height calculation
- Add `decmopr_buf` to GC roots
- Fix division by zero in draw_pattern (lv_draw_rect.c) if the image or letter is not found
- Fix drawing images with 1 px height or width

11.25 v7.4.0 (01.09.2020)

The main new features of v7.4 are run-time font loading, style caching and arc knob with value setting by click.

11.25.1 New features

- Add `lv_font_load()` function - Loads a `lv_font_t` object from a binary font file
- Add `lv_font_free()` function - Frees the memory allocated by the `lv_font_load()` function
- Add style caching to reduce access time of properties with default value
- arc: add set value by click feature
- arc: add `LV_ARC_PART_KNOB` similarly to slider
- send gestures event if the object was dragged. User can check dragging with `lv_indev_is_dragging(lv_indev_act())` in the event function.

11.25.2 Bugfixes

- Fix color bleeding on border drawing
- Fix using 'LV_SCROLLBAR_UNHIDE' after 'LV_SCROLLBAR_ON'
- Fix cropping of last column/row if an image is zoomed
- Fix zooming and rotating mosaic images
- Fix deleting tabview with LEFT/RIGHT tab position
- Fix btnmatrix to not send event when CLICK_TRIG = true and the cursor slid from a pressed button
- Fix roller width if selected text is larger than the normal

11.26 v7.3.1 (18.08.2020)

11.26.1 Bugfixes

- Fix drawing value string twice
- Rename `lv_chart_clear_serie` to `lv_chart_clear_series` and `lv_obj_align_origo` to `lv_obj_align_mid`
- Add linemeter's mirror feature again
- Fix text decor (underline strikethrough) with older versions of font converter
- Fix setting local style property multiple times
- Add missing background drawing and radius handling to image button
- Allow adding extra label to list buttons
- Fix crash if `lv_table_set_col_cnt` is called before `lv_table_set_row_cnt` for the first time
- Fix overflow in large image transformations
- Limit extra button click area of button matrix's buttons. With large paddings it was counter-intuitive. (Gaps are mapped to button when clicked).
- Fix `lv_btnmatrix_set_one_check` not forcing exactly one button to be checked
- Fix color picker invalidation in rectangle mode
- Init disabled days to gray color in calendar

11.27 v7.3.0 (04.08.2020)

11.27.1 New features

- Add `lv_task_get_next`
- Add `lv_event_send_refresh`, `lv_event_send_refresh_recursive` to easily send `LV_EVENT_REFRESH` to object
- Add `lv_tabview_set_tab_name()` function - used to change a tab's name
- Add `LV_THEME_MATERIAL_FLAG_NO_TRANSITION` and `LV_THEME_MATERIAL_FLAG_NO_FOCUS` flags
- Reduce code size by adding: `LV_USE_FONT_COMPRESSED` and `LV_FONT_USE_SUBPX` and applying some optimization
- Add `LV_MEMCPY_MEMSET_STD` to use standard `memcpy` and `memset`

11.27.2 Bugfixes

- Do not print warning for missing glyph if its height OR width is zero.
- Prevent duplicated sending of `LV_EVENT_INSERT` from text area
- Tidy outer edges of cpicker widget.
- Remove duplicated lines from `lv_tabview_add_tab`
- btnmatrix: handle combined states of buttons (e.g. checked + disabled)
- textarea: fix typo in lv_textarea_set_scrollbar_mode
- gauge: fix image needle drawing
- fix using freed memory in _lv_style_list_remove_style

11.28 v7.2.0 (21.07.2020)

11.28.1 New features

- Add screen transitions with `lv_scr_load_anim()`
- Add display background color, wallpaper and opacity. Shown when the screen is transparent. Can be used with `lv_disp_set_bg_opa/color/image()`.
- Add `LV_CALENDAR_WEEK_STARTS_MONDAY`
- Add `lv_chart_set_x_start_point()` function - Set the index of the x-axis start point in the data array
- Add `lv_chart_set_ext_array()` function - Set an external array of data points to use for the chart
- Add `lv_chart_set_point_id()` function - Set an individual point value in the chart series directly based on index
- Add `lv_chart_get_x_start_point()` function - Get the current index of the x-axis start point in the data array

- Add `lv_chart_get_point_id()` function - Get an individual point value in the chart series directly based on index
- Add `ext_buf_assigned` bit field to `lv_chart_series_t` structure - it's true if external buffer is assigned to series
- Add `lv_chart_set_series_axis()` to assign series to primary or secondary axis
- Add `lv_chart_set_y_range()` to allow setting range of secondary y-axis (based on `lv_chart_set_range` but extended with an axis parameter)
- Allow setting different font for the selected text in `lv_roller`
- Add `theme->apply_cb` to replace `theme->apply_xcb` to make it compatible with the MicroPython binding
- Add `lv_theme_set_base()` to allow easy extension of built-in (or any) themes
- Add `lv_obj_align_x()` and `lv_obj_align_y()` functions
- Add `lv_obj_align_origo_x()` and `lv_obj_align_origo_y()` functions

11.28.2 Bugfixes

- `tileview` fix navigation when not screen sized
- Use 14px font by default to for better compatibility with smaller displays
- `linemeter` fix conversation of current value to "level"
- Fix drawing on right border
- Set the cursor image non-clickable by default
- Improve mono theme when used with keyboard or encoder

11.29 v7.1.0 (07.07.2020)

11.29.1 New features

- Add `focus_parent` attribute to `lv_obj`
- Allow using buttons in encoder input device
- Add lv_btnmatrix_set/get_align capability
- DMA2D: Remove dependency on ST CubeMX HAL
- Added `max_used` propriety to `lv_mem_monitor_t` struct
- In `lv_init` test if the strings are UTF-8 encoded.
- Add `user_data` to themes
- Add LV_BIG_ENDIAN_SYSTEM flag to lv_conf.h in order to fix displaying images on big endian systems.
- Add inline function lv_checkbox_get_state(const lv_obj_t * cb) to extend the checkbox functionality.
- Add inline function lv_checkbox_set_state(const lv_obj_t * cb, lv_btn_state_t state) to extend the checkbox functionality.

11.29.2 Bugfixes

- `lv_img` fix invalidation area when angle or zoom changes
- Update the style handling to support Big endian MCUs
- Change some methods to support big endian hardware.
- remove use of c++ keyword 'new' in parameter of function lv_theme_set_base().
- Add LV_BIG_ENDIAN_SYSTEM flag to lv_conf.h in order to fix displaying images on big endian systems.
- Fix inserting chars in text area in big endian hardware.

11.30 v7.0.2 (16.06.2020)

11.30.1 Bugfixes

- `lv_textarea` fix wrong cursor position when clicked after the last character
- Change all text related indices from 16-bit to 32-bit integers throughout whole library. #1545
- Fix gestures
- Do not call `set_px_cb` for transparent pixel
- Fix list button focus in material theme
- Fix crash when a text area is cleared with the backspace of a keyboard
- Add version number to `lv_conf_template.h`
- Add log in true double buffering mode with `set_px_cb`
- `lv_dropdown`: fix missing `LV_EVENT_VALUE_CHANGED` event when used with encoder
- `lv_tileview`: fix if not the {0;0} tile is created first
- `lv_debug`: restructure to allow asserting in from `lv_misc` too
- add assert if `_lv_mem_buf_get()` fails
- `lv_textarea`: fix character delete in password mode
- Update `LV_OPA_MIN` and `LV_OPA_MAX` to widen the opacity processed range
- `lv_btnm` fix sending events for hidden buttons
- `lv_gaguge` make `lv_gauge_set_angle_offset` offset the labels and needles too
- Fix typo in the API `scrllable` -> `scrollable`
- `tabview` by default allow auto expanding the page only to right and bottom (#1573)
- fix crash when drawing gradient to the same color
- chart: fix memory leak
- `img`: improve hit test for transformed images

11.31 v7.0.1 (01.06.2020)

11.31.1 Bugfixes

- Make Micropython working by adding the required variables as GC_ROOT
- Prefix some internal API functions with _ to reduce the API of LVGL
- Fix built-in SimSun CJK font
- Fix UTF-8 encoding when `LV_USE_ARABIC_PERSIAN_CHARS` is enabled
- Fix DMA2D usage when 32 bit images directly blended
- Fix lv_roller in infinite mode when used with encoder
- Add `lv_theme_get_color_secondary()`
- Add `LV_COLOR_MIX_ROUND_OFS` to adjust color mixing to make it compatible with the GPU
- Improve DMA2D blending
- Remove memcpy from `lv_ll` (caused issues with some optimization settings)
- `lv_chart` fix X tick drawing
- Fix vertical dashed line drawing
- Some additional minor fixes and formattings

11.32 v7.0.0 (18.05.2020)

11.32.1 Documentation

The docs for v7 is available at https://docs.lvgl.io/7.11/index.html

11.32.2 Legal changes

The name of the project is changed to LVGL and the new website is on https://lvgl.io

LVGL remains free under the same conditions (MIT license) and a company is created to manage LVGL and offer services.

11.32.3 New drawing system

Complete rework of LVGL's draw engine to use "masks" for more advanced and higher quality graphical effects. A possible use-case of this system is to remove the overflowing content from the rounded edges. It also allows drawing perfectly anti-aliased circles, lines, and arcs. Internally, the drawings happen by defining masks (such as rounded rectangle, line, angle). When something is drawn the currently active masks can make some pixels transparent. For example, rectangle borders are drawn by using 2 rectangle masks: one mask removes the inner part and another the outer part.

The API in this regard remained the same but some new functions were added:

- `lv_img_set_zoom`: set image object's zoom factor
- `lv_img_set_angle`: set image object's angle without using canvas
- `lv_img_set_pivot`: set the pivot point of rotation

The new drawing engine brought new drawing features too. They are highlighted in the "style" section.

11.32.4 New style system

The old style system is replaced with a new more flexible and lightweighted one. It uses an approach similar to CSS: support cascading styles, inheriting properties and local style properties per object. As part of these updates, a lot of objects were reworked and the APIs have been changed.

- more shadows options: *offset* and *spread*
- gradient stop position to shift the gradient area and horizontal gradient
- `LV_BLEND_MODE_NORMAL/ADDITIVE/SUBTRACTIVE` blending modes
- *clip corner*: crop the content on the rounded corners
- *text underline* and *strikethrough*
- dashed vertical and horizontal lines (*dash gap*, *dash_width*)
- *outline*: a border-like part drawn out of the background. Can have spacing to the background.
- *pattern*: display and image in the middle of the background or repeat it
- *value* display a text which is stored in the style. It can be used e.g. as a light-weighted text on buttons too.
- *margin*: similar to *padding* but used to keep space outside the object

Read the Style section of the documentation to learn how the new styles system works.

11.32.5 GPU integration

To better utilize GPUs, from this version GPU usage can be integrated into LVGL. In `lv_conf.h` any supported GPUs can be enabled with a single configuration option.

Right now, only ST's DMA2D (Chrom-ART) is integrated. More will in the upcoming releases.

11.32.6 Renames

The following object types are renamed:

- sw -> switch
- ta -> textarea
- cb -> checkbox
- lmeter -> linemeter
- mbox -> msgbox
- ddlist -> dropdown
- btnm -> btnmatrix
- kb -> keyboard
- preload -> spinner
- lv_objx folder -> lv_widgets
- LV_FIT_FILL -> LV_FIT_PARENT

- LV_FIT_FLOOD -> LV_FLOOD_MAX
- LV_LAYOUT_COL_L/M/R -> LV_LAYOUT_COLUMN_LEFT/MID/RIGHT
- LV_LAYOUT_ROW_T/M/B -> LV_LAYOUT_ROW_TOP/MID/BOTTOM

11.32.7 Reworked and improved object

- `dropdown`: Completely reworked. Now creates a separate list when opened and can be dropped to down/up/left/right.
- `label`: `body_draw` is removed, instead, if its style has a visible background/border/shadow etc it will be drawn. Padding really makes the object larger (not just virtually as before)
- `arc`: can draw background too.
- `btn`: doesn't store styles for each state because it's done naturally in the new style system.
- `calendar`: highlight the pressed datum. The used styles are changed: use `LV_CALENDAR_PART_DATE` normal for normal dates, checked for highlighted, focused for today, pressed for the being pressed. (checked+pressed, focused+pressed also work)
- `chart`: only has `LINE` and `COLUMN` types because with new styles all the others can be described. LV_CHART_PART_SERIES sets the style of the series. bg_opa > 0 draws an area in LINE mode. `LV_CHART_PART_SERIES_BG` also added to set a different style for the series area. Padding in `LV_CHART_PART_BG` makes the series area smaller, and it ensures space for axis labels/numbers.
- `linemeter`, `gauge`: can have background if the related style properties are set. Padding makes the scale/lines smaller. scale_border_width and scale_end_border_width allow to draw an arc on the outer part of the scale lines.
- `gauge`: `lv_gauge_set_needle_img` allows use image as needle
- `canvas`: allow drawing to true color alpha and alpha only canvas, add `lv_canvas_blur_hor/ver` and rename `lv_canvas_rotate` to `lv_canvas_transform`
- `textarea`: If available in the font use bullet (`U+2022`) character in text area password

11.32.8 New object types

- `lv_objmask`: masks can be added to it. The children will be masked accordingly.

11.32.9 Others

- Change the built-in fonts to Montserrat and add built-in fonts from 12 px to 48 px for every 2nd size.
- Add example CJK and Arabic/Persian/Hebrew built-in font
- Add ° and "bullet" to the built-in fonts
- Add Arabic/Persian script support: change the character according to its position in the text.
- Add `playback_time` to animations.
- Add `repeat_count` to animations instead of the current "repeat forever".
- Replace `LV_LAYOUT_PRETTY` with `LV_LAYOUT_PRETTY_TOP/MID/BOTTOM`

11.32.10 Demos

- lv_examples was reworked and new examples and demos were added

11.32.11 New release policy

- Maintain this Changelog for every release
- Save old major version in new branches. E.g. `release/v6`
- Merge new features and fixes directly into `master` and release a patch or minor releases every 2 weeks.

11.32.12 Migrating from v6 to v7

- First and foremost, create a new `lv_conf.h` based on `lv_conf_template.h`.
- To try the new version it suggested using a simulator project and see the examples.
- If you have a running project, the most difficult part of the migration is updating to the new style system. Unfortunately, there is no better way than manually updating to the new format.
- The other parts are mainly minor renames and refactoring as described above.

CHAPTER TWELVE

ROADMAP

12.1 Planned for v9

12.1.1 Naming and API

- [x] `lv_style_set_size()` should have separate width and height parameters
- [ ] `lv_img_set_src()` use "type-aware" parameter. See here
- [x] Reconsider image color formats.
- [ ] More consistent names:`remove/clear/delete/del`, `offset/ofs`, `add/create/register`, `id/idx/index`, `middle/mid/center`, `img/image`, `txt/text`, `opa/opacity/alpha`, `scr/screen`, `disp, display`, `finished/complete/completed/ready`, `buf/buffer`, `..._cb`, angle, rotation`,` zoom, scale`
- [ ] Reconsider the use of `has`, `is`, `enable` "action" keywords
- [x] Update canvas API (https://github.com/lvgl/lvgl/issues/3393)
- [x] `LV_STYLE_PROP_INHERIT` -> `LV_STYLE_PROP_FLAG_INHERITABLE` LINK
- [x] Replace `disp_drv->direct_mode/full_refresh` with enum.
- [x] Consider flat directory structure. E.g. `extra/widgets` to `widgets`
- [ ] Use `uint32_t` and `int32_t` in APIs where possible. Consider hardcoding `lv_coord_t` as `int32_t`.
- [ ] To define a new stdlib API use defines `LV_USE_CUSTO_...` and let the user implement `lv_...` functions somewhere (instead of defining the name of the custom functions)

12.1.2 Architecture

- [x] Consider merging `lv_disp_t`, `lv_disp_t`, `lv_disp_draw_buf_t`, `lv_draw_ctx_t`, and `struct`s from the new driver API (or only some of them)
- [ ] Better way to reset global variables in `lv_deinit()` #3385
- [x] New driver architecture #2720
- [x] `draw_ctx->buffer_convert`? See here. Also remove 16 SWAPPED color format? See here.
- [ ] Reconsider masks. There should be a generic high level mask API whic is independent of the drawing engine.
- [ ] `get_glyph_bitmap` should return an a8 bitmap that can be blended immediately.
- [ ] Reconsider how themes should work. See here.

- [ ] Make LVGL render independent areas in parallel.
- [ ] Introduce a pipeline in renderer to support multi-GPUs/Accelerators, such as 2D-capable-DMAs, 2D GPUs, dedicated processor cores for 2D tasks etc.
- [x] More conscious `<std*.h>` wrapper API
- [x] Drop `lv_mem_buf_get` as tlsf should be fast enough for normal allocations too. Fragmentation is also lower if processes can completely clean up after themselves.
- [ ] `lv_array`: replace linked lists with array where possible (arrays are faster and uses less memory)
- [ ] Reconsider how to handle UTF-8 characters (allow different encoding too) and Bidi. Maybe create an abstraction for typesetting.
- [ ] Generic `lv_date_t` and `lv_time_t`?
- [x] More color formats: 24 bit, ARGB1555, ARGB4444 etc
- [ ] Unified caching #3116 #3415
- [ ] Make layouts with an `lv_layout_dsc_t` instead of registering an ID+callback. See here
- [ ] Condider using `lv_color32_t` on APIs to support e.g. alpha gradient.

12.1.3 Styles

- [ ] Make `style_bg_img` support `9patch` images
- [ ] non-uniform scale of images: scale width and height differently
- [ ] Scroll anim settings should come from styles to allow customization

12.1.4 Widgets

- [ ] `lv_img`: Reconsider image sizing models (when the image size is not content): center, top-left, zoom, tile, other?
- [ ] `lv_tabview` Replace button matrix with real buttons for more flexibility
- [ ] `lv_label` reconsider label long modes. (support min/max-width/height too) #3420
- [ ] Improve `lv_label_align_t` #1656
- [ ] Disabled widgets should absorb indev actions without sending events. #3860

12.1.5 Drawing and rendering

- [ ] Automatically recalculate the layout if a coordinte is get with `lv_obj_get_width/height/x/y/etc`

12.1.6 Animations

- [ ] Consider `anim` events to replace many callbacks with one
- [ ] `lv_anim_time_to_speed` should work differently to remove `style_anim_speed`. E.g. on large values of anim time store the speed. Besides all widgets should use the `style_anim` property. `anim` should clamp the time if it's calculated from speed, e.g `lv_clamp(200, t, 2000)`. (maybe `a->min_time/max_time`).
- [ ] Use dedicated `lv_anim_custom_exec_cb_t`. See here.

12.2 Planned in general

12.2.1 CI

- [ ] Plaform independent bechmarking # 3443
- [ ] Run static analyzer
- [ ] Release script
- [ ] Unit test for all widgets #2337
- [ ] CI test for flash/RAM usage #3127

12.2.2 Architecture

- [ ] C++ binding: https://github.com/lvgl/lv_binding_cpp
- [ ] Markup language #2428

12.2.3 Styles

- [ ] Hover
- [ ] Global states in selectors. E.g. `LV_STATE_PRESSED | SMALL_SCREEN` like media quarry in CSS

12.2.4 Drawing and rendering

- [ ] Different radius on each corner #2800
- [ ] gradient to border/outline/shadow
- [ ] multiple shadow/border
- [ ] perspective
- [ ] text shadow
- [ ] innter shadow
- [ ] ARGB image stroke/grow on the alpha map
- [ ] real time blur
- [ ] gradient with alpha

12.2.5 Others

- [ ] More grid features. E.g. repeat(auto-fill, minmax(px, 1fr))
- [ ] Named grid cells to allow updating layouts without touching the children (like CSS `grid-template-areas`)
- [ ] Scene support. See this comment
- [ ] Circle layout. #2871
- [ ] Variable binding. I.e create properties which can be bound to objects and those obejcts are notified on value change. Maybe based on `lv_msg`?
- [ ] Consider stagger animations.
- [ ] Universal scale widget/support (see here)

12.3 Ideas

- Consider direct binary font format support
- Improve groups. Discussion. Reconsider focusing logic. Allow having no widget selected (on web it's possible). Keep editing state in `lv_obj_t` (See here). Support slider left knob focusing (see here)
- lv_mem_alloc_aligned(size, align)
- Speed up font decompression
- Support larger images: add support for large image #1892
- Functional programming support, pure view? See here
- Style components. See this comment
- SVG support: integrate an SVG render library
- Support dot_begin and dot_middle long modes for labels
- Allow matrix input for image transformation?
- Radial/skew/conic gradient
- Somehow let children inherit the parent's state
- text on path

INDEX