ELECROW

LoRaWan Gateway Module

Based on ESP32 with 1.8" LCD Datasheet

V1.0

Table of Contents

1 Product Overview

1.1 Product Overview

The Lora Basic Gateway Module is a high-performance single-channel LoRa gateway module, featuring an integrated design that combines the ESP32 WROOM 32UE microcontroller with the RA-01H LoRa module. It is equipped with versatile network connectivity options.

The module is powered via a TYPE-C USB interface and is equipped with the LAN8720A Ethernet PHY chip, supporting 10/100Mbps RMII interface for high-speed wired network connections. Additionally, it leverages the built-in Wi-Fi functionality of the ESP32 to support wireless network access. The module also features an SMA antenna interface, enabling long-range LoRa communication with extensive coverage.

Moreover, the Lora Basic Gateway Module is equipped with a 1.8-inch touch display screen, which can display key information in real-time, such as the gateway's network connection status and IP address. This feature facilitates convenient monitoring and management for users.

The Lora Basic Gateway Module can seamlessly integrate with LoRa node modules and development boards to build a LoRaWAN IoT network. It is widely applicable in fields such as smart home automation, industrial automation, and agricultural monitoring, providing an efficient and reliable communication solution for IoT applications.

1.2 Main Features

- **Main Controller**: Utilizes the ESP32-WROOM-32UE-N4 as the primary controller, featuring an integrated Xtensa dual-core 32-bit LX6 microprocessor, capable of supporting clock frequencies up to 240 MHz.
- **Radio Module**: Integrates the RA-01H module, supporting the 803 MHz - 930 MHz frequency band and compatible with various modulation schemes such as FSK, GFSK, MSK, and LoRa, making it suitable for diverse wireless communication scenarios.
- **Onboard Display**: Equipped with a 1.8-inch 128×160 SPI-TFT-LCD screen, driven by the ST7735S chip, enabling intuitive user interface display.
- **Ethernet Interface**: Features a 10/100 Mbps RJ45 Ethernet port, providing stable wired network connectivity.
- **Compatibility**: Compatible with Arduino and MicroPython, allowing users to develop custom applications and functionalities as needed.
- **Enclosure Design**: Adopts a sleek acrylic protective casing, with a compact and portable form factor for easy carrying and use.
- **Backend Connectivity**: Supports connection to The Things Network (TTN) backend, facilitating gateway setup and data transmission monitoring.
- **Antenna Configuration**: Includes external SMA 2.4 GHz WiFi antenna and 868 MHz/915 MHz LoRa antennas, ensuring robust wireless communication performance.

- **Power Supply**: Supports 5V-USB power input for convenient usage.

1.3 Application Scenarios

- Smart Home
- Industrial Automation
- Healthcare
- Consumer Electronics
- Smart Agriculture
- Automatic Meter Reading
- Home and Building Automation
- Security Systems
- Remote Irrigation Systems

2 Product Dimension Diagram

Figure 1:Dimension Diagram

3 Product Appearance Diagram

Figure 2:Appearance Diagram

4 System Architecture Diagram

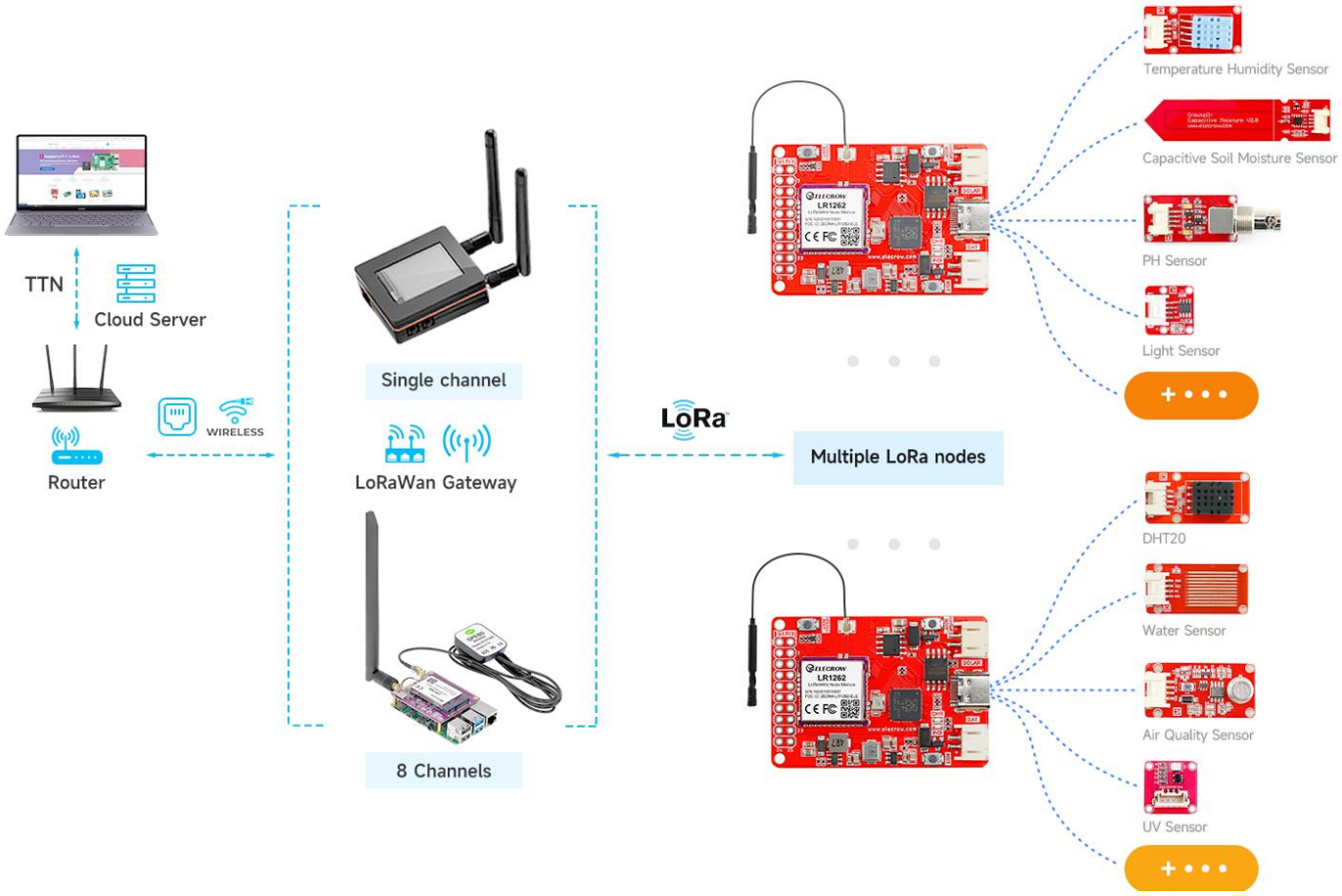

Figure 3:System Architecture Diagram

5 System Block Diagram

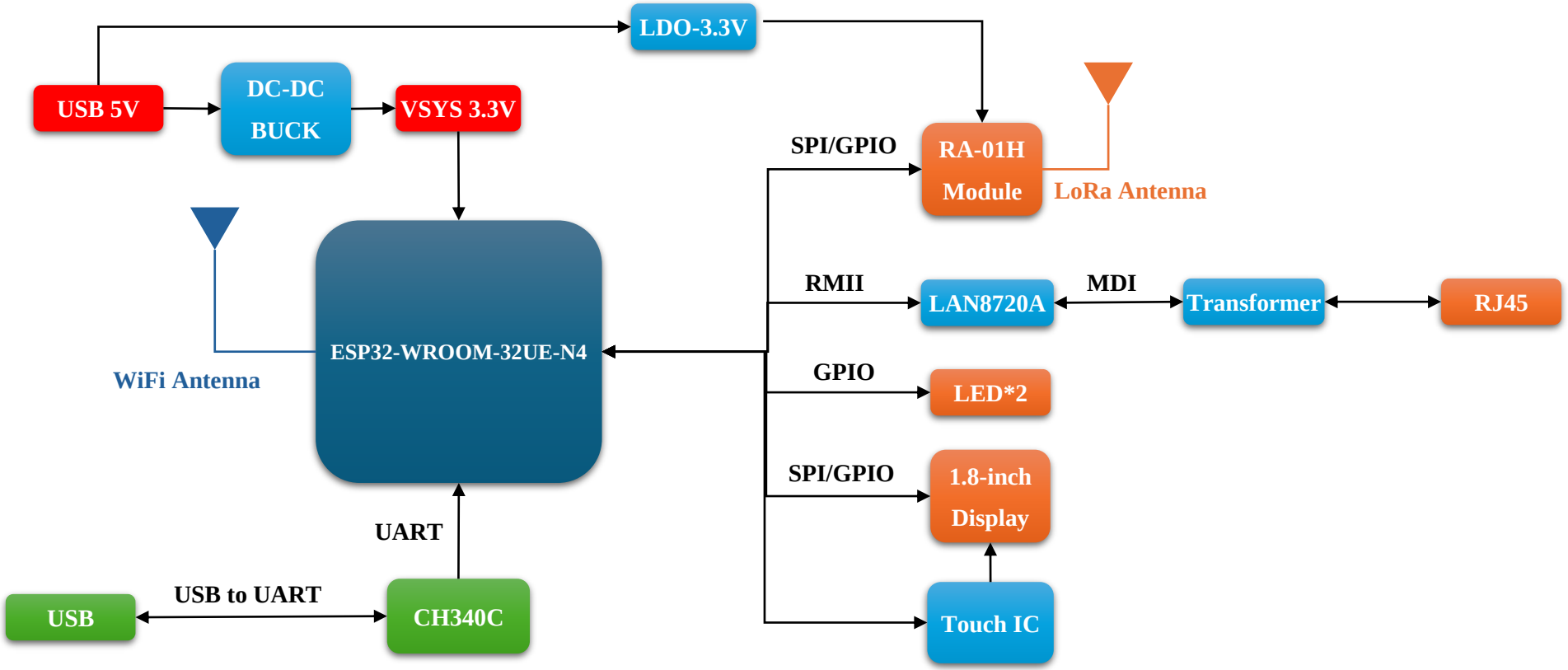

Figure 4:Gateway System Block Diagram

6 Hardware Overview

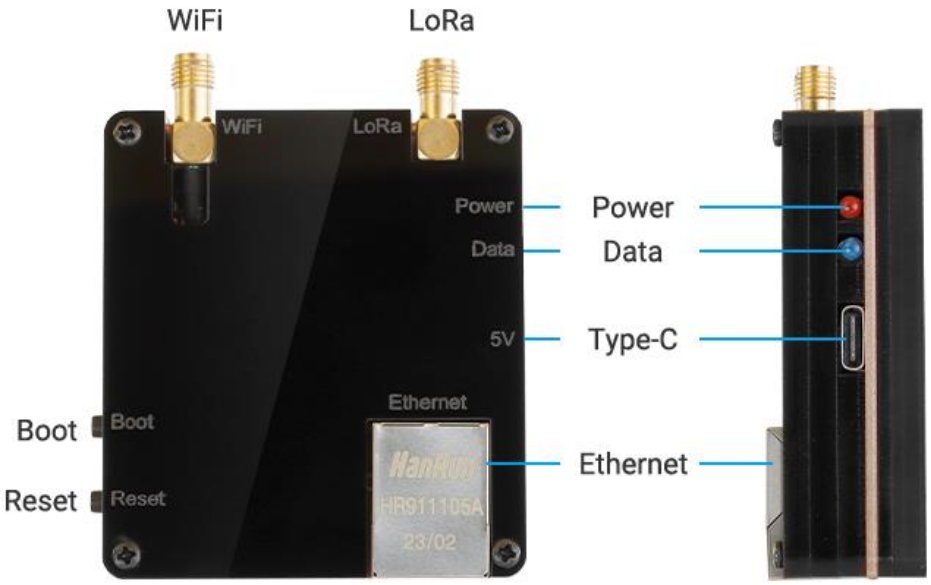

Figure 5:Port Schematic Diagram

6.1 Port Functions

No.	Name	Silkscreen	Pin	Main Control Signal	Function
1	Ethernet Interface	Ethernet	ETH_MDC RMII_TXD1 RMII_TX_EN RMII_TXD0 ETH_MDIO RMII_CLK RMII_CRS_DV RMII_RXD1 RMII_RXD0 RMII_REF_CLK	IO23 IO22 IO21 IO19 IO18 IO17 IO27 IO26 IO25 IO39	Supports 10M/100M RJ45 Ethernet port. Upon wired connection, the device can successfully connect to the network. It supports single-channel data transmission and reception, enabling data exchange with nodes and communication with network servers via Wi-Fi or Ethernet.
2	BOOT (Upgrade Button)	BOOT	IO0	GPIO0	BOOT (Upgrade Button): Used for firmware upgrade. It allows modification or replacement of the underlying software to add new functionalities to the

					hardware.
3	RESET (Reset Button)	RESET	/	EN	RESET (Reset Button): Pressing this button resets the system.
4	SMA Lora 天线接口	LORA	/	/	Connects to an 868 MHz/915 MHz LoRa antenna.
5	SMA WIFI 天线接口	WIFI	/	/	Connects to a 2.4 GHz Wi-Fi antenna.
6	DATA TX/RX LED	DATA	DATA	IO5	Blue data indicator LED that blinks during data transmission and reception, and is off by default.
7	PWR LED	POWER	/	/	ed power indicator LED that remains on when powered and turns off when power is disconnected.
8	Type-C	USB-C	DP DN USB_DP USN_DN	ESP32_RXD0 ESP32_TXD0	Provides power to the gateway module and serves as the communication interface between the PC and the ESP32.
9	RA-01H Module	/	RA_NSS MOSI MISO SCK RA_BUSY RA_RST RA_DIO1	IO14 IO32 IO35 IO33 IO34 IO12 IO13	LoRa transceiver module.
10	1.8 -inch LCD	/	LCD_CS SCK MOSI LCD_DC LCD_RST LCD_BLK XP_CS PEN MISO	IO2 IO33 IO32 IO4 EN IO16 IO15 IO36 IO35	Provides display and touch functionality.

			XP YP XN YN		

6.2 Pin Definitions

No.	ESP32 Pin	Module Pin	Description
1	GND1	GND	Ground
2	MCU_3V3	3V3	Power supply pin
3	IO0	IO0	High level: Chip enabled; Low level: Chip disabled;
4	SEN_VP	NC	
5	SEN_VN	PEN	Used for the LCD to detect touch events
6	IO34	RA_BUSY	Busy signal pin of the RF module
7	IO35	MISO	SPI data output
8	IO32	MOSI	SPI data input
9	IO33	SCK	SPI clock input
10	IO25	RMII_RXD0	RMII receive data pin 0, which is used to receive data in Ethernet communication.
11	IO26	RMII_RXD1	RMII receive data pin 1, which is used to receive data in Ethernet communication.
12	IO27	RMII_CRS_DV	RMII carrier detection, which is used to detect whether there is data transmission in the network and whether the data is valid.
13	IO14	RA_NSS	Chip select input pin of the RF module
14	IO12	RA_RST	Reset pin of the RF module
15	GND2	GND	Ground
16	IO13	RA_DIO1	Digital input/output pin of the RF module
17	NC	NC	
18	NC	NC	
19	NC	NC	
20	NC	NC	
21	NC	NC	
22	NC	NC	

23	IO15	XP_CS	Chip select input
24	IO2	LCD_CS	Serial data input
25	IO0	IO0	Used to control the boot button
26	IO4	LCD_DC	Used to control the data transmission of the LCD
27	IO16	LCD_BLK	Used to control the backlight switch of the LCD
28	IO17	RMII_CLK	The clock signal pin of the Reduced Media Independent Interface (RMII), which provides clock synchronization for Ethernet communication.
29	IO5	DATA	Connected to the blue data indicator light, which flashes when sending and receiving data
30	IO18	ETH_MDIO	Ethernet management data input/output pin, which is used for the transmission of management data with the Ethernet PHY chip.
31	IO19	RMII_TXD0	RMII transmit data pin 0, which is used to transmit data in Ethernet communication.
32	NC	NC	
33	IO21	RMII_TX_EN	RMII transmit enable pin, which is used to control the transmission of data.
34	RXD0	ESP32_RXD0	USB receive data pin, which is used to receive data
35	TXD0	ESP32_TXD0	USB transmit data pin, which is used to transmit data
36	IO22	RMII_TXD1	RMII transmit data pin 1, which is used to transmit data in Ethernet communication.
37	IO23	ETH_MDC	Ethernet management data clock pin, which provides a clock signal for the transmission of Ethernet management data.
38	GND3	GND	Ground
39	GND39-47	GND	Ground

7 Technical Specifications

No.	Item Group	Item	Parameters
1	MCU	Module	ESP32-WROOM-32UE-N4
2		Processor	Built-in ESP32-D0WD-V3 chip, Xtensa® dual-core 32-bit LX6 microprocessor, supporting a clock frequency of up to 240 MHz
3		FLASH	4 MB (Quad SPI)
4		SRAM	520KB
5	Wi-Fi Features	WiFi	Supports 2.4 GHz Wi-Fi (802.11b/g/n), with a maximum data rate of up to 150 Mbps
6		Bluetooth Protocol	Supports Bluetooth V4.2 BR/EDR and Bluetooth Low Energy (BLE)
7		Communication Distance	20m
8	Electrical Characteristics	Module	RA-01H
9		RF chip	SX1276
10		Number of Signal Channels	Single channel
11		Frequency Band	803-930MHz
12		Modulation Mode	Supports FSK, GFSK, MSK, GMSK, LoRa™ and OOK modes
13		Communication Distance	In blocked state: up to 1 km @868Mhz (EU) In unobstructed state: up to 1.8 km @915Mhz (US)
14		Receive Sensitivity	-148dBm(MAX)
15		Transmission Power	+20dBm(MAX)
16		LoRa Antenna	868Mhz(EU)/ 915Mhz(US) antenna
17		Lorawan Protocol	Supports Lorawan 1.0.3
18	Electrical Characteristics	Operating Voltage	DC 5V/1A
19	Mechanical Characteristics	Operating Temperature	-20-~70℃
20		Dimensions	65*58*21.8mm

21		Weight	92.4g (excluding antenna)
22		Color	Black
23		Enclosure Material	Acrylic panel (smooth surface)
24	Others	Antenna Interface	LoRa® antenna: 868 MHz/915 MHz LoRa antenna
25			Wi-Fi antenna: External 2.4G WIFI antenna
26		Antenna Interface	Power indicator light
27			Data sending and receiving indicator light

8 Specifications of 1.8-inch LCD

No.	Item	Specification	Unit
1	Screen Size	1.8	Inch
2	Driver IC	ST7735S	
3	Resolution	128RGB*160	Pixel
4	Viewing Angle Direction	12 o'clock	
5	Contrast Ratio	300	CR
6	Backlight	2 CHIP-WHITE LED	
7	Brightness	180	Cd/m^2
8	Active Display Area	28.03 (W)*35.04 (H)	mm
9	Outline Dimension	34.00(W)*45.83(H)*3.65max(T)	mm
10	Pixel Size	0.219(W)*0.219(H)	mm
11	Pins	14-Pins for display + 4-Pins for touch	
12	Interface	4-wire SPI	

9 Electrical Characteristics

LoRa® RF Parameters

No.	Item	Specification
1	Operating Frequency Band	803~930 MHz
2	Transmission Power	+20dBm(MAX)
3	Receive Sensitivity	-148dBm(MAX)
4	Transmit Current	105mA@20dbm,3.3V
5	Receive Current	12.15mA
6	Standby Current	1.6mA

Wi - Fi RF Parameters

No.	Item	Specification
1	Wireless Standard	IEEE 802.11b/g/n
2	Center Frequency Range of Operating Channel	2412 ~ 2484 MHz
3	Transmission Power	19.5dBm（Typical Value）
4	Receive Sensitivity	-88.0dBm（Typical Value）

Total Power Consumption: DC 5V/1A

No.	Status	Condition	Power Consumption
1	Normal Operation	WiFi Mode	0.6W
2		NET Mode	0.625W
3	Standby	-	0.5W

10 Environmental Characteristics

10.1 Normal Operating Conditions

No.	Item	Minimum Value	Typical Value	Maximum Value	Unit
1	Operating voltage	3.6	5	5.5	V
2	Operating Temperature	-40	-	85	℃

10.2 Extreme Conditions

No.	Item	Minimum Value	Maximum Value	Unit
1	Supply voltage	3.6	5.5	V
2	Storage Temperature	-40	+105	℃

11 Related Documents and Resources

- Lora Basic Gateway Module Product Link
- Multiple LoRa nodes
- Datasheets for Various Gateway Chips

12 Revision History

Date	Version	Release Notes
2025/4/15	V1.0	Initial release