Gate and Garage Project

Step-by-step instructions · Heltec WiFi LoRa 32 V3 · Mighty Mule gate and Genie 3055 garage opener

Contents

1. How the system works
2. Parts list
3. Set up the computer
4. Erase a board (factory reset)
5. Test a board's screen
6. Program the four boards
7. Solder the pin headers
8. Test on the breadboard
9. Install at the gate
10. Install in the garage
11. Set up the phones
12. Everyday use
13. Power, solar and outages
14. Troubleshooting

1. How the system works

Board	Program	Where it lives	What it does
1. Gate receiver	gate_receiver	Mighty Mule control box	Presses the gate's CYCL input with a relay; runs the 15-second gate light; reports open/closed
2. Handheld remote	gate_remote	With you or in the car	Press PRG to open/close the gate over LoRa
3. Gate bridge	gate_bridge	In the house, on WiFi	Phone page http://gate.local; ntfy alerts and commands; passes commands to the gate over LoRa
4. Garage controller	garage_controller	Next to the Genie opener	Phone page http://garage.local; ntfy commands; "left open" reminder (WiFi only, no LoRa)

Your magnetometer keeps opening the gate as it does today. Commands are signed with a secret key, so nobody else's radio can open the gate.

2. Parts list

Part	For	What to look for
4 × Heltec WiFi LoRa 32 V3 + antennas	All	Antenna screwed on before use
USB-C data cable	Programming	Must carry data, not charge only
2-channel relay module	Gate	Works with 3.3 V logic
1-channel relay module	Garage	Pins DC+, DC−, IN; trigger jumper on H
12 V to 5 V USB-C converter	Gate	DC-DC step-down with USB-C output
Magnetic reed switches (normally open)	Gate, garage (optional)	Wired door/window contact; overhead-door type for the garage
12 V DC LED light (<1 A)	Gate light	Outdoor rated
Inline blade fuse holder + 2 A fuse	Gate light	Fit close to battery +
18 AWG outdoor wire; bell wire	Gate; garage	2-conductor
Breadboard kit	Testing	Male-female jumpers, LEDs, 330 Ω resistors
Soldering iron + solder	Headers	30–60 W, 0.8 mm rosin-core solder
3.7 V LiPo, 1.25 mm JST (optional)	Remote	Check + and − match the board before plugging in

3. Set up the computer (once)

3.1 Install Arduino IDE

1. Download Arduino IDE 2.x from arduino.cc/en/software and install it.

3.2 Install the USB driver (Windows)

1. Plug in a board. Open Device Manager (right-click Start).
2. If you see **CP2102 USB to UART Bridge Controller** with a yellow warning, the driver is missing.
3. Go to silabs.com/developers/usb-to-uart-bridge-vcp-drivers → Downloads → **CP210x Universal Windows Driver**.
4. Right-click the zip → Extract All. In the folder, right-click **silabser.inf** → (Show more options) → Install.
5. Unplug and replug the board. It should appear under Ports (COM & LPT) as **Silicon Labs CP210x USB to UART Bridge (COMx)**.

3.3 Install the ESP32 board package

1. File → Preferences → Additional boards manager URLs: `https://espressif.github.io/arduino-esp32/package_esp32_index.json`
2. Tools → Board → Boards Manager → search **esp32** → install **esp32 by Espressif Systems** (takes several minutes).

3.4 Install the libraries

1. Tools → Manage Libraries → search **RadioLib** (by Jan Gromes). In the version dropdown, choose **7.1.2** (or another 7.0–7.2), then Install.
2. Search **SSD1306** → install **ESP8266 and ESP32 OLED driver for SSD1306 displays** (ThingPulse).

> **Important:** RadioLib 7.7 and newer (including 7.8.1) changed how the radio starts and will not compile with these programs. Ignore any "update available" prompt for RadioLib.

3.5 Select the board and port (every time you plug in a board)

1. Click the board dropdown at the top → **Select other board and port...**
2. Type **heltec** in the search box → tick **Heltec WiFi LoRa 32(V3)**.
3. Under PORTS tick the board's COM port → OK.

4. Erase a board (factory reset)

1. File → New Sketch (leave the blank code as is).
2. Tools → **Erase All Flash Before Sketch Upload** → Enabled.
3. Upload. In the output, look for **"Flash memory erased successfully"**.
4. Set Erase All Flash back to **Disabled**.

A blank screen afterwards is normal. Erasing also clears the remote's counter: if you erase one gate board, erase and reprogram all three gate boards.

5. Test a board's screen

1. Open **OLED_Test.ino**, check board and port, Upload.
2. The screen shows "OLED works!" with a count going up each second.
3. If the text is upside down, add or remove `display.flipScreenVertically();` right after `display.init();`.

6. Program the four boards

How to load a program

1. File → Open → pick the .ino inside its folder (or File → New Sketch, click in the code, Ctrl+A, then Ctrl+V to paste).
2. Change the settings listed below. Change only the text between quote marks; keep the quotes and the semicolon.
3. Select board and port (3.5), then click Upload. Success ends with **"Hash of data verified"** and **"Hard resetting via RTS pin..."**.

Line numbers: File → Preferences → tick "Show line numbers". The SECRET_KEY is case sensitive and must be identical in all three gate programs.

6.1 gate_receiver (board 1)

Line	Setting	Set to
24	SECRET_KEY	Your phrase (same in all three gate programs)
29	HAVE_REED_SWITCH	false until the gate reed switch is installed, then true
30	LIGHT_ON_SECONDS	15 (light time after the gate closes)
31	REED_CLOSED_LEVEL	LOW; change to HIGH if the light comes on when the gate opens
35	HEARTBEAT_MIN	30 (how often it checks in with the bridge)
36	HAVE_BATTERY_SENSE	true once the 2-resistor battery divider is fitted
38	BATT_DIVIDER	Adjust until the battery reading matches a multimeter
44	RELAY_ON	HIGH; change to LOW if the relays work backwards

Check: Serial Monitor at 115200, press RST → **"Gate receiver ready"**. Its screen stays dark on purpose (saves the gate battery).

6.2 gate_remote (board 2)

Line	Setting	Set to
14	SECRET_KEY	Same phrase
114	flipScreenVertically	Add // at the start if the text is upside down

Check: the screen shows **Gate Remote / Ready**. Press PRG → "Gate OK".

6.3 gate_bridge (board 3)

Line	Setting	Set to
31	SECRET_KEY	Same phrase
32	WIFI_SSID	Your WiFi name (2.4 GHz)
33	WIFI_PASS	Your WiFi password
34	NTFY_TOPIC	Long random topic, e.g. gate-7fk29xq4mz81
35	PIN	Your 4-digit PIN
37	GARAGE_URL	http://garage.local, or the garage controller's address
39	FLIP_SCREEN	false if the text is upside down
43	LOW_BATT_V	12.0 ("Gate battery low" below this)
44	GATE_OFFLINE_MIN	75 (minutes before "Gate receiver not responding")
45	WATCH_GARAGE	true (alert if the garage controller goes offline)
46	NIGHT_CHECK_HOUR	22 = 10 PM; -1 = off
47	NIGHT_AUTO_CLOSE	true = close the gate at the night check instead of alerting

Check: the screen shows **Gate Bridge**, its address (e.g. 192.168.1.45) and **Ready**. The gate page at http://gate.local now also has a Garage section.

6.4 garage_controller (board 4)

Line	Setting	Set to
25	WIFI_SSID	Your WiFi name
26	WIFI_PASS	Your WiFi password
27	NTFY_TOPIC	The SAME topic as the gate bridge
28	PIN	Your PIN
30	FLIP_SCREEN	false if the text is upside down
35	HAVE_GARAGE_REED	true once the door reed switch is installed
36	CLOSED_LEVEL	LOW; change to HIGH if open/closed are reversed
37	RELAY_ON	HIGH; change to LOW if the relay works backwards
39	LEFT_OPEN_MIN	Minutes before the "left open" alert (0 = off)
40	REMIND_EVERY_MIN	How often to repeat the reminder
41	NIGHT_CHECK_HOUR	22 = 10 PM; -1 = off
42	NIGHT_AUTO_CLOSE	true = close the door at the night check instead of alerting

No SECRET_KEY here: this board does not use LoRa. Check: the screen shows **Garage Controller**, its address and **Ready**.

7. Solder the pin headers

Only the **gate receiver** and **garage controller** need headers (they connect to wires). The bridge and remote don't.

1. Push the two long pin strips into the breadboard, long ends down, spaced to match the board's two rows of holes.
2. Lay the Heltec on top so the short ends poke up through its holes. Unplug USB.
3. Heat the iron to about 350 °C / 660 °F. Solder one pin at each end first.
4. Solder each remaining pin: touch the iron to pin and pad 1–2 s, feed solder until a small shiny cone forms.
5. Check that no solder joins two neighbouring pins. Keep the iron away from the screen and antenna cable.

Pin names: **GPIO 5, 6, 7** are the pins with **5, 6, 7** printed beside them, not the 5th or 7th pin counted along the row.

8. Test on the breadboard

1. Relay wiring: **DC+ (VCC)** → **5V**, **DC− (GND)** → **GND**, **IN** → **GPIO 7** (2-channel: IN1 → GPIO 7, IN2 → GPIO 6). Trigger jumper on **H**.
2. Test load: 3V3 → relay COM; relay NO → 330 Ω resistor → LED long leg; LED short leg → GND.
3. Press Open on the phone page: the relay clicks and the LED lights for half a second.
4. Reed test without a switch: set HAVE_REED_SWITCH to true, upload, touch a wire between GPIO 5 and GND → phone gets "Gate closed"; remove it → "Gate opened".

9. Install at the gate

See page 1 of **Gate_and_Garage_Wiring.pdf**.

1. Turn the opener off with its rocker switch.
2. Measure AUX PWR with a multimeter: it should read 12–14 V. If not, feed the converter from the battery through a 2 A fuse instead.
3. Converter input → AUX PWR + and −, alongside the existing red and yellow magnetometer wires. Converter USB-C → gate receiver.

4. Relay 1 COM → **CYCL**; relay 1 NO → the empty **COM** terminal. Do not move the black (COM) or blue (EXIT) wires.
5. Gate light: battery + → 2 A fuse → relay 2 COM; relay 2 NO → light +; light − → battery −.
6. Reed switch on the gate post, magnet on the gate (within about 1/2 inch when closed), wired to GPIO 5 and GND. Set HAVE_REED_SWITCH to true and upload.
7. Mount the Heltec in the open area on the right of the box or in a small weatherproof box beside it, antenna pointing up. Turn the opener back on.

10. Install in the garage

See page 2 of the wiring PDF (use the garage controller in place of the bridge).

1. Quick test first: with the opener plugged in, briefly touch a wire across the two wall-button terminals. The door should move.
2. Unplug the opener. Relay DC+ → 5V, DC− → GND, IN → GPIO 7.
3. Relay COM and NO → the two wall-button terminals (same screws as the existing wall button; either way round). Use bell wire.
4. Optional door reed switch on the frame, magnet on the door → GPIO 5 and GND; set HAVE_GARAGE_REED to true.
5. Power the controller from a USB charger. Plug the opener back in and test.

11. Set up the phones (iPhone or Android)

Home-screen buttons (home WiFi)

1. On home WiFi, open **http://gate.local** and **http://garage.local** (or the address on each board's screen).
2. iPhone (Safari): Share → Add to Home Screen → tap **Add** at the top right. Android (Chrome): ⋮ → Add to Home screen → Add.

Alerts and control from anywhere (ntfy)

1. Install the free **ntfy** app (App Store / Google Play). Tap + and subscribe to your topic (server ntfy.sh).
2. To send commands, open **https://ntfy.sh/<your topic>** in the browser and type a command. Add this page to the home screen as "Gate away".

> The topic name works like a password: keep it long and random, and use a PIN you don't use elsewhere.

12. Everyday use

To	At home (web page)	Anywhere (ntfy)
Open / close gate	Open gate / Close gate	`open 4821` / `close 4821`
Open gate for a time	Open 5 / 15 / 30 min	`open 4821 15` (1–240 min)
Gate status	Shown at the top	`status`
Open / close garage	Open garage / Close garage	`garage open 4821` / `garage close 4821`
Garage status	Shown at the top	`garage status`

- Handheld remote: press PRG. Pressing while the gate moves stops it (Mighty Mule CYCL behaviour).
- Timed open: a Close, a remote press, or the gate closing cancels the timer. Needs the reed switch.
- Open does nothing if already open; Close does nothing if already closed (needs the reed switches).
- ntfy commands take up to 10 s (gate) or 15 s (garage). Web buttons act at once.
- Alerts: Gate opened/closed (and by whom); Garage opened/closed; Garage left open after 10 min, then every 30 min; night check at 10 PM; gate battery low; gate receiver or garage controller not responding.
- Battery sense (gate receiver): gate battery + → 100 kΩ → GPIO 4; GPIO 4 → 22 kΩ → GND. Then set HAVE_BATTERY_SENSE to true.
- Close remotely only when you know the way is clear. Consider a photo beam on the Mighty Mule SAFE terminal.

13. Power, solar and outages

- The gate receiver adds about 5–6 Wh a day to the gate battery. A Mighty Mule solar panel in good sun usually covers it.
- Check the battery in the morning for the first weeks: 12.6 V or more is healthy; sliding toward 12.2 V means the panel isn't keeping up (aim it south, keep it clean and unshaded, or fit a 20 W panel).
- Power outage: the gate, gate receiver, magnetometer and a battery-powered remote keep working. The bridge, garage controller, WiFi and internet stop until power returns (a UPS keeps them running). Everything restarts by itself.

14. Troubleshooting

Problem	Fix
"NO PORTS DISCOVERED"	Use a data USB-C cable; install the CP210x driver (3.2)
Board missing from the list	Install esp32 by Espressif (3.3); restart Arduino IDE; type "heltec" in the search box
"Missing FQBN"	No board selected: do 3.5
"RadioLib.h: No such file"	Install RadioLib (3.4)
"no matching function for call to SX1262::begin"	RadioLib too new: install 7.1.2
"SECRET_KEY was not declared"	The SECRET_KEY line was damaged: `const char SECRET_KEY[] = "your-phrase";`
"'isplay' was not declared"	A typo: the d of display is missing
Upload won't start	Hold PRG, tap RST, release PRG, Upload again; set Upload Speed to 115200
Remote shows "No reply"	Receiver powered? Antennas on? SECRET_KEY identical in all programs? Boards at least 1 m apart
Remote screen blank	gate_remote not uploaded yet
Fast-blinking white LED on receiver	Radio failed to start: check board is V3; read the number in Serial Monitor
Slow blinking white LED	The blink test program is still loaded: upload the real program
Page says "Bridge not reachable" / "not available"	Phone on home WiFi? Board screen shows Ready? Address changed → use gate.local / garage.local or the new address; reserve the address in your router (DHCP reservation)
Home-screen icon missing	Swipe through pages or search; repeat Add to Home Screen and tap Add
"Timed open needs the reed switch"	Normal until the gate reed switch is installed and HAVE_REED_SWITCH is true
Relay works backwards	Set the trigger jumper to H, or change RELAY_ON to LOW
Text upside down	Change FLIP_SCREEN, or add/remove the flipScreenVertically line