WAZIUP Online Course

Developing IoT Solutions with WAZIUP

Step by Step Guide

D-GW-1: Building & Configuring a WAZIUP LoRa Gateway with Raspberry Pi

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ON-LINE ARDUINO SENSORS AND DIY LORA TUTORIAL

WAZIUP Online Course

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For users who want to gain knowledge on IoT in a step-by-step lecture mode, we have defined the following WAZIUP IoT courses:

- **Fundamentals of IoT**
  1. F-IOT-1a: What is IoT
     - Quick Introduction to IoT - [142]
     - IoT and Big Data Platform - [142]
     - How to learn IoT: What Does The Internet Of Things Mean? - YouTube
     - IoT & Big Data: Internet of Things (IoT) - YouTube
     - Geospatial IoT: How To Make Internet Of Things? - YouTube
     - IBM Think Academy - How It Works: Internet of Things? - YouTube
   2. F-IOT-1b: Introduction to Basic Electronics
     - Introduction To Basic Electronics - [142]
     - Introduction To Basic Electronics - Makerspaces
     - Basic Electronics: Instructables
     - Introducing Basic Sensors, part 1 - [142]
     - Introducing physical sensors, part 2 - [142]
   3. F-IOT-2a: Understand
     4. F-IOT-2b: Introduction to Sensors
     5. F-IOT-3: Introduction to WAZIUP
     6. F-IOT-4: WAZIUP Open Project
     7. F-IOT-5: Prototyping and Testing: Getting started with WAZIUP Gateway
       1. D-GW-1: Building & Configuring a WAZIUP LoRa Gateway with Raspberry Pi - WAZIUP
          - Quick overview of WAZIUP Gateway - [142]
          - Installing gateway software on SD card - [142]
          - Connecting to Gateway and Basic Linux Commands - [142]
          - Configuring Gateway and Setting up Internet Access - [142]
       2. D-GW-2: Building an Outdoor Gateway - [142]
       3. D-GW-3: Antenna Tutorial for Gateway - [142]
       7. D-GW-4: Gateway Web Admin Interface - [142]
       8. D-GW-5: Migrating & Using WaziGate distribution - [142]
       1. D-IOT-2: WAZIUP IoT and Gateway Deployment Guidelines - [142]
       2. D-IOT-3: WAZIUP IoT cloud Platform
       3. D-IOT-4: D-CLOUD-1: Introduction to WAZIUP cloud dashboard - [142]
       4. D-IOT-5: Create your app with WAZIUP - [142]
You can use RaspberryPI 1 model B/B+, RaspberryPI 2 model B, RaspberryPI 3 model B/B+ and RaspberryPI Zero (W). The most important useful feature is the Ethernet interface for easy Internet connection. You can add WiFi with a WiFi USB dongle to use access-point features. With the RPI3 & RPI0W, WiFi and Bluetooth are embedded on the board.
The WaziHat PCB

- WAZIUP has a simple RFM95W breakout for the gateway

- The short WAZIHAT version can be used for end-device as well

<table>
<thead>
<tr>
<th>GPIO#</th>
<th>2nd func.</th>
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<td>+3.3 V</td>
<td>1</td>
<td>+5 V</td>
<td>2</td>
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<tr>
<td>2</td>
<td>+5 V</td>
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<td>3</td>
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<td>3</td>
<td>SCL (I2C)</td>
<td>5</td>
<td>GND</td>
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<td>4</td>
<td>GCLK</td>
<td>8</td>
<td>TXD0 (UART)</td>
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<td>11</td>
<td>RXD0 (UART)</td>
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<td>8</td>
<td>GEN4</td>
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<td>SCLK (SPI)</td>
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<td>CE1, N (SPI)</td>
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</tbody>
</table>

DIO0 on GPIO4
RESET on GPIO17
Freely available RFM95W breakout

- Very simple RFM95W breakout

- The zipped Gerber archive can be freely downloaded from https://github.com/CongducPham/LowCostLoRaGw
Put it in a nice case!

Lot's of low-cost Raspberry indoor cases are available on the market. Take the one you like the most! Outdoor usage requires a water-resistant case and some additional precautions beyond the scope of this tutorial, see https://github.com/CongducPham/tutorials/blob/master/Low-cost-LoRa-GW-step-by-step.pdf
Getting the software

https://github.com/CongducPham/LowCostLoRaGw

Get our SD card image

Download our zipped SD card image. The current image has everything you need including:

- support for RPI3B+ as well (including the WiFi)
- remot3.it tools for remote access
- the simple gateway web admin interface for easy configuration and management
- mosquitto-clients package installed to have `mosquitto_pub` and `mosquitto_sub` commands (v1.5)
- Node-Red v0.18.6, Node.js v0.11.1 and npm upgraded with `node-red-contrib-thingspeak42` installed
- a ready-to-use Node-Red flow to show how received data can be uploaded to MQTT brokers and ThingSpeak
- MongoDB v3.0.9

Download the SD card image

http://cpham.perso.univ-pau.fr/LORA/WAZIUP/raspberrypi-jessie-WAZIUP-demo.iso.zip
Flashing the OS

- Use an **8GB** or larger SD card. Some SD cards may not work. This one has been successfully tested. It has to be class 10.
- Use balenaEtcher ([https://www.balena.io/etcher/](https://www.balena.io/etcher/)) to flash the SD card, you do not need to unzip the image. Available on multiple platforms.

Provide Internet to your gateway

- Boot your gateway with the SD card
- Use an Ethernet cable to connect your Raspberry into a DHCP-enabled box/router/network to get an IP address (if you need to know the MAC address then see next slide)
- You can also share your laptop WiFi Internet connection to make your laptop acting as a DHCP server:
  - Example for MacOS users can be found here [https://mycyberuniverse.com/mac-os/connect-to-raspberry-pi-from-a-mac-using-ethernet.html](https://mycyberuniverse.com/mac-os/connect-to-raspberry-pi-from-a-mac-using-ethernet.html)
  - Example for Windows users can be found here [https://electrosome.com/raspberry-pi-ethernet-direct-windows-pc/](https://electrosome.com/raspberry-pi-ethernet-direct-windows-pc/)
  - You can then use Angry IP Scanner ([http://angryip.org/](http://angryip.org/)) available on Windows/Mac/Linux/Android to determine the assigned IP address for the Raspberry if necessary
Gateway access & configuration interfaces

- There are 2 gateway configuration interfaces
  - A web admin interface
  - A command line interface that needs ssh
- The web interface is sufficient for most users
  - Easy basic configuration and easy update
  - Pre-defined cloud configuration
  - dedicated course: D-GW-4 Gateway Web Admin Interface
Need to know the MAC address?

- In some cases, you need to get the MAC address to allow for DHCP server to assign an IP address.
- The gateway is also configured as a WiFi access point with address 192.168.200.1
  - Select the WAZIUP_PI_GW_xxxxxxxxxx WiFi
  - WiFi password is loragateway
- Use a browser and go to [http://192.168.200.1/admin](http://192.168.200.1/admin)
  - Login: admin / password: loragateway
  - Go to **Gateway Configuration/Gateway** & look for MAC address
Update your gateway (1)

- If your gateway is connected to your laptop's Ethernet interface (laptop is sharing its WiFi connection)
  - Use Angry IP Scanner to determine the assigned IP address on Ethernet interface, e.g. 192.168.2.12
  - Use a browser and connect to http://192.168.2.12/admin

- If your gateway is connected to a box/router/network which already assigned an IP address to the gateway (DHCP)
  - Simply connect to the gateway WAZIUP_PI_GW_xxxxxxxxxxxxx WiFi
  - WiFi password is loragateway
  - Use a browser and go to http://192.168.200.1/admin

- Web admin interface login: admin / password: loragateway
1. Full Update
2. Basic Config
3. Update Web Interface

1. Install a new gateway by removing the existing `lora_gateway` folder, all existing configuration files will be overwritten.
   If you install a new gateway with our SD card image, you can use this option.

2. Compile and configure the gateway (to set the gateway id & the WiFi access point SSID).
   This is also required if you install a new gateway using the provided SD card image. It is recommended to run `Basic config` right after Full update or New installation.

3. Update the web admin interface after an update of the distribution to install the last version of the web admin interface.
   It is recommended to run `Update web admin` right after Full update or New installation.
   Then reload the page.

Update web admin
Full update
New installation
Full update
New installation
Basic config
Software version number

Gateway Update

- New installation
- Full update
- Basic config
- Download and install a file
- Update web admin interface

Run Basic config after any update and reboot for new version to be applied.

Install latest version of gateway. erasing all existing configuration file.
Custom SSID will be preserved. May take minutes, wait for finish notification.

Git version: 476. Installed version: 476. Date of current distribution is 2020-01-07 15:50:37.937685972 +0100

- The software version number on github and the installed version number are displayed
- Click on Test Internet to obtain the latest software version number on github
Configuring WAZIUP cloud (1)

- Go to Cloud/Cloud WAZIUP menu
Configuring WAziUP cloud (2)

- Configuring WAziUP cloud

WAziUP cloud defines domains that will be defined as `project_name+'- '+organization_name+service_tree`, e.g. waziup-UPPA-TESTS if:
  - `project_name` is waziup,
  - `organization_name` is UPPA,
  - `service_tree` is –TESTS

The device id will be `organization_name+service_tree+"_Sensor"+device_addr`. For instance, for sensor 2 hosted by UPPA: UPPA-TESTS_Sensor2.

Username and password of the WAziUP account. If username is "guest" then all data will be public.
WAZIUP cloud platform

- dashboard.waziup.io
Quick test

- Enable WAZIUP cloud
- Set organization name to something unique
  - Referred to as organization
- Leave other parameters as default
  - Project name is waziup
  - Service tree is empty
  - Username is guest
- Flash a device with Arduino_LoRa_Simple_temp example
- You should see on WAZIUP dashboard a sensor named
  - organization_Sensor8
  - e.g. UPPA_Sensor8
SSH to the gateway

- You may need an SSH session to perform advanced configuration tasks
- Use `ssh pi@rpi_addr`, where `rpi_addr` is the IP address assigned to the gateway, see [Update your gateway (1)] slide
- Answer 'yes' if it is the first time you connect using SSH
- Password is `loragateway`
- Once logged in, you will see the text command interface
- Select Q and hit RETURN to quit this interface
- You should be in the `lora_gateway` folder

```
pi@raspberrypi:~/lora_gateway $ ./cmd.sh
```

```
0- sudo python start_gw.py +
1- sudo ./lora_gateway --mode 1 +
2- sudo ./lora_gateway --mode 1 | python post_processing_gw.py +
3- ps aux | grep -e start_gw -e lora_gateway -e post_proc -e log_gw +
4- tail --line=25 ../Dropbox/LoRa-test/post-processing.log +
5- tail --line=25 --f ../Dropbox/LoRa-test/post-processing.log +
6- less ../Dropbox/LoRa-test/post-processing.log +
```

```
g- wifi: configure as WiFi client at next reboot +
h- wifi: indicate WiFi SSID and password at next reboot +
i- wifi: configure as WiFi access point at next reboot +
```

```
--------------------------------------------------- * Connectivity *
```

```
g- wifi: configure as WiFi client at next reboot +
h- wifi: indicate WiFi SSID and password at next reboot +
i- wifi: configure as WiFi access point at next reboot +
```

```
-------------------------------------------------- * Filtering msg *
```

```
l- List LoRa reception indications +
m- List radio module reset indications +
n- List boot indications +
o- List post-processing status +
p- List low-level gateway status +
```

```
-------------------------------------------------- * Configuration *
```

```
A- show gateway_conf.json +
B- edit gateway_conf.json +
C- show clouds.json +
D- edit clouds.json +
```

```
---------------------------------------------------------- * ngrok *
```

```
M- get and install ngrok                                             +
N- ngrok authtoken                                                   +
O- ngrok tcp 22                                                      +
```

```
--------------------------------------------------------- * Update *
```

```
U- update to latest version on repository +
V- download and install a file +
W- run a command +
```

```
------------------------------------------------------- * kill *
```

```
K- kill all gateway related processes +
k- kill rfcomm-server process +
R- reboot gateway +
S- shutdown gateway +
```

```
Q- quit +
```

Enter your choice:
Want to know more?

- Additional tutorials
  https://github.com/CongducPham/tutorials

- More detailed gateway tutorial

- Videos
  Build your low-cost LoRa gateway with WAZIUP
  https://www.youtube.com/watch?v=mj8ItKA14PY
  Setting up a LoRa gateway in less than 5mins (live demo)
  https://www.youtube.com/watch?v=CJbUFXLpSok
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Continue with
D-GW-2: Building an Outdoor Gateway
D-GW-4: Gateway Web Admin Interface V1
D-IOT-1: WAZIUP IoT and Gateway Deployment Guidelines