Evaluation of LoRa and LoRaWAN with the Arduino boards and gateway

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Outline

Background

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- There are many protocols for IoT, but the most popular are Zigbee, Z-Wave, Bluetooth, Wi-Fi, and LoRaWAN.
- LoRaWAN is a low-power wide-area network (LPWAN) protocol based on the LoRa technology.

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- LoRa is ideal for applications that transmit small chunks of data with low bit rates.

LoRa bandwidth vs range

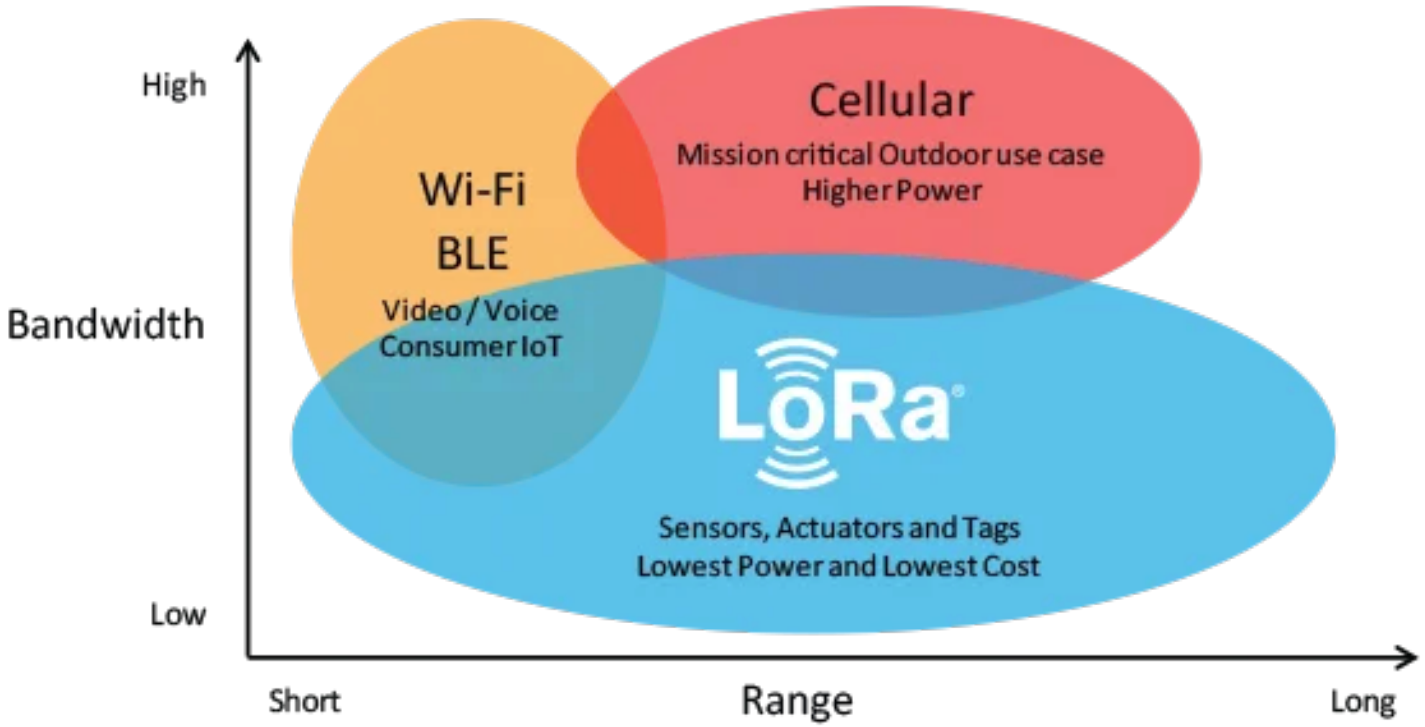

Figure: LoRa bandwidth vs range

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- LoRaWAN is optimized for low power consumption and supports large networks with millions of devices.

LoRaWAN stack

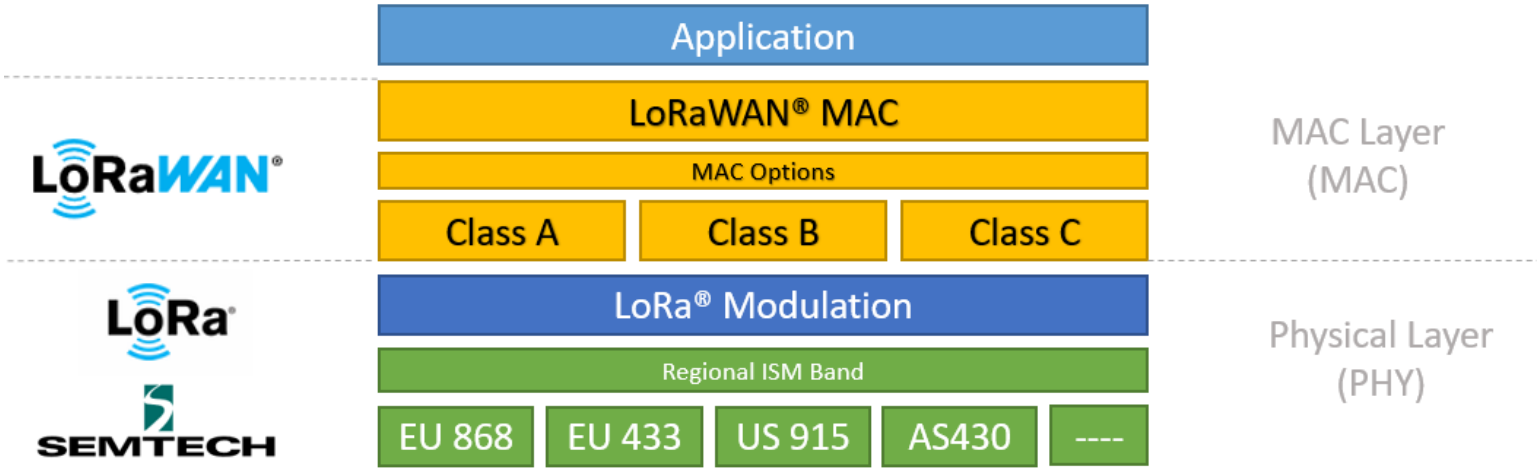
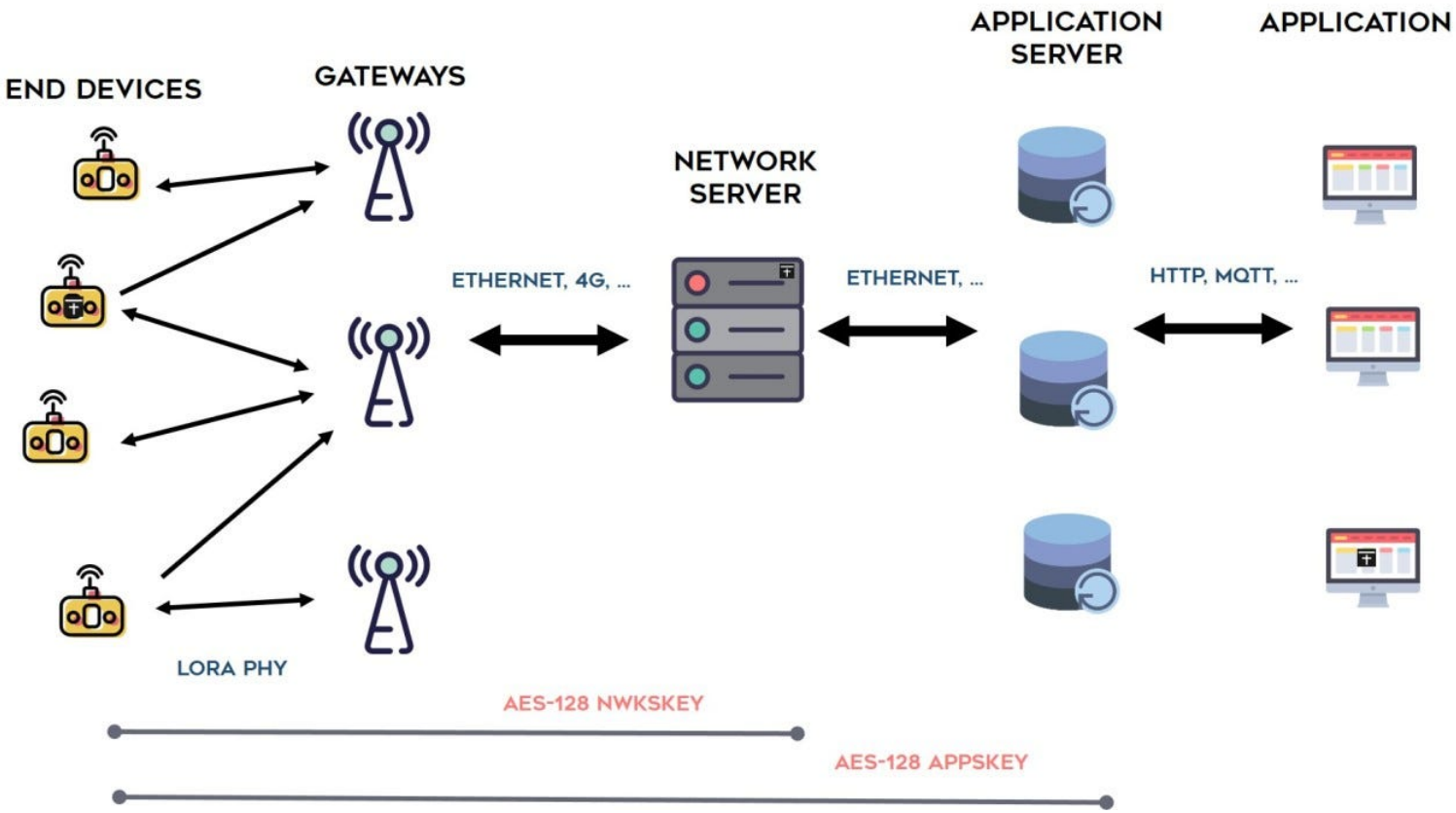


Figure: LoRaWAN protocol stack

LoRaWAN architecture



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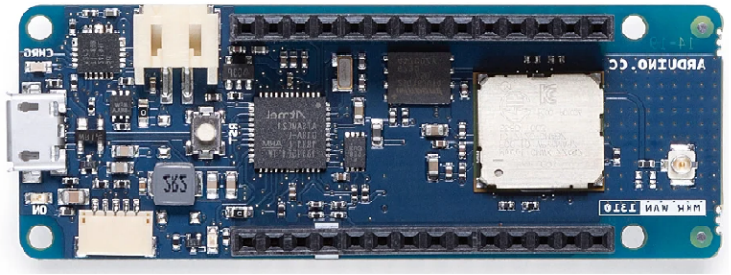
- Arduino offers two LoRaWAN gateway built by RAKwireless: one for indoor and one for outdoor use.

Boards

Figure: Arduino MKR WAN 1300



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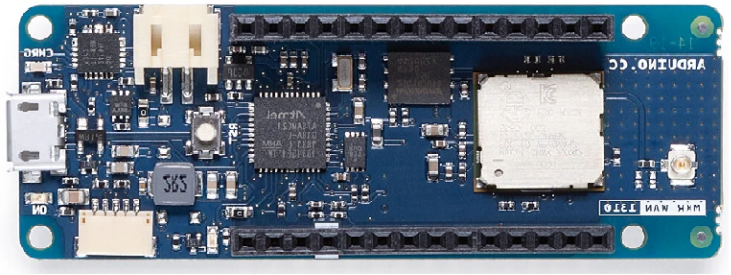

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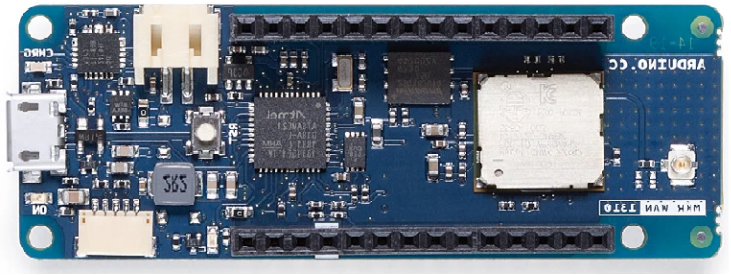

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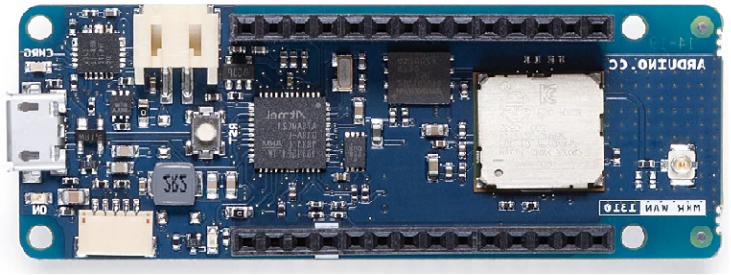

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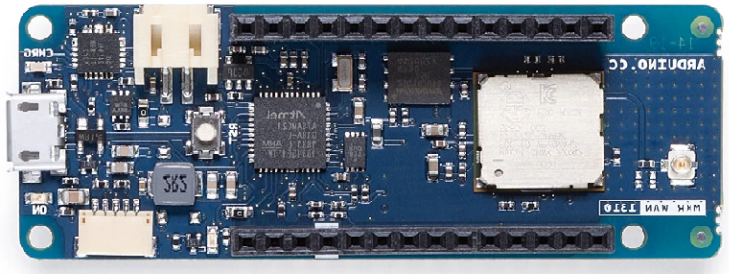

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- The 1310 now also supports OTA (Over-The-Air) updates and data logging.
- The price is 50€.

Gateway

Figure: WisGate Edge Lite 2
LoRaWAN indoor gateway

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- It is not suitable for applications that require high reliability because there is no acknowledgment mechanism.
- It is not suitable for applications that require high security because the data is not encrypted.
- You can build your own protocol on top of LoRa.

LoRa Gossiping

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- The board with the blue LED sends a message.
- The boards with the white LED forward the message.
- If the message was already forwarded, the board with the white LED does not forward it again.

LoRa Gossiping

▸ Video of the LoRa gossiping

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- By LoRaWAN specifications, the end devices can only communicate with the gateway.
- To build a multi-hop network, you need to use LoRa. But you will lose the acknowledgment mechanism and the security.

LoRaWAN Multihop

In literature, there are some proposals to build a multi-hop network with LoRaWAN or a hybrid network with LoRa and LoRaWAN. But they are not official or widely used.

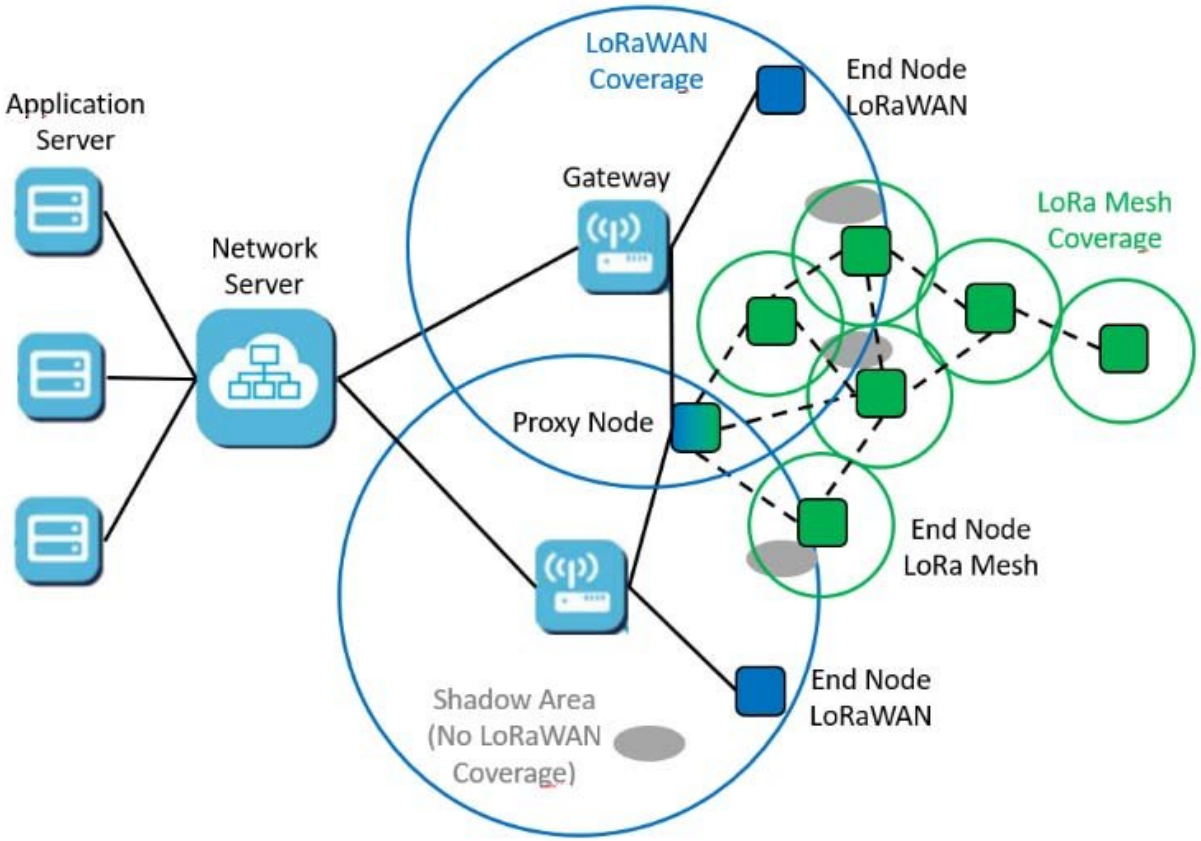

Figure: LoRaWAN hybrid network

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- The gateway will send the data to a MQTT broker.
- The data will be extracted from the MQTT broker, decoded from base64, and sent to ThingsBoard and IoTPanels for the visualization. This is done with a GO script.

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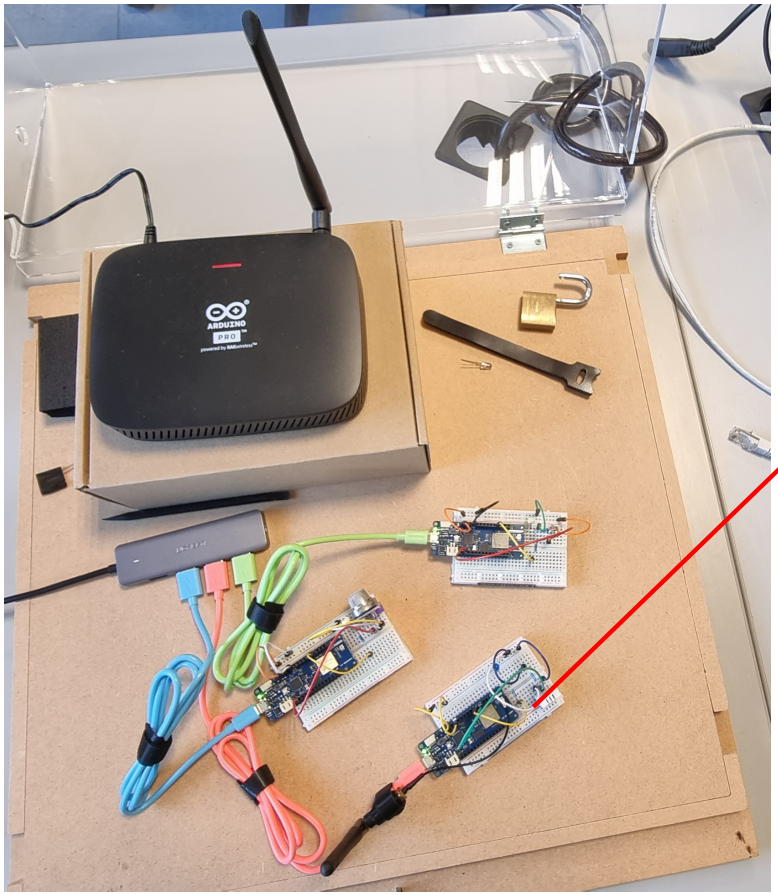

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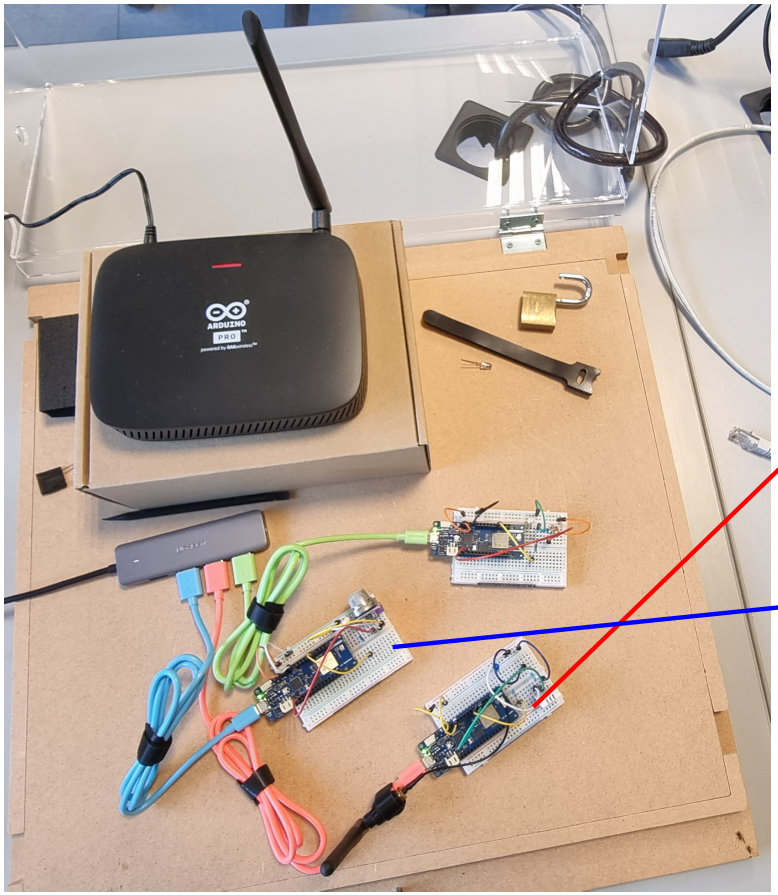

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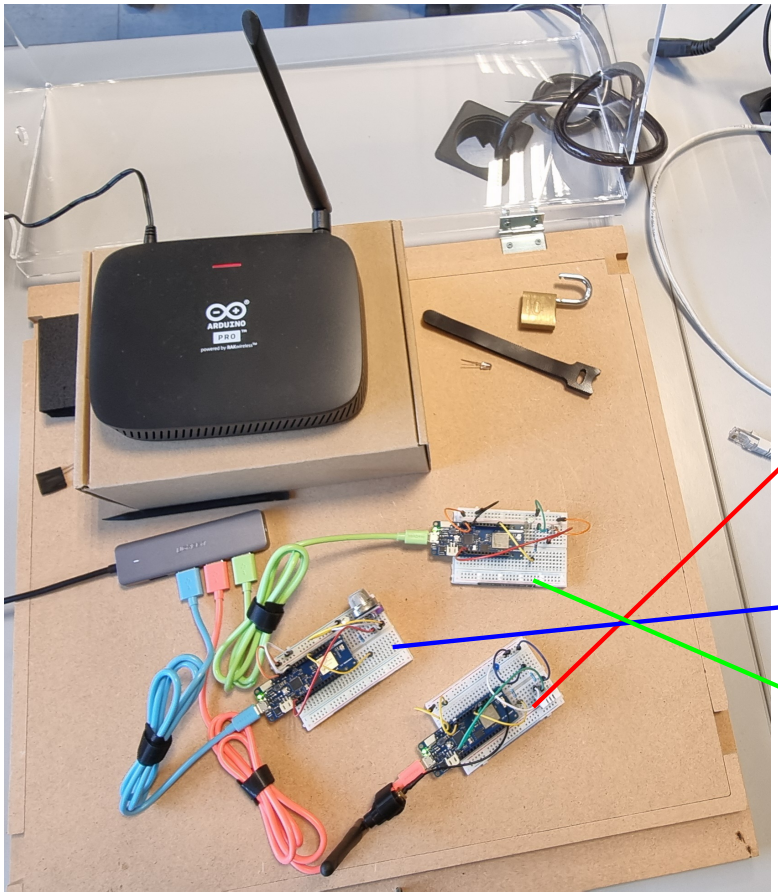

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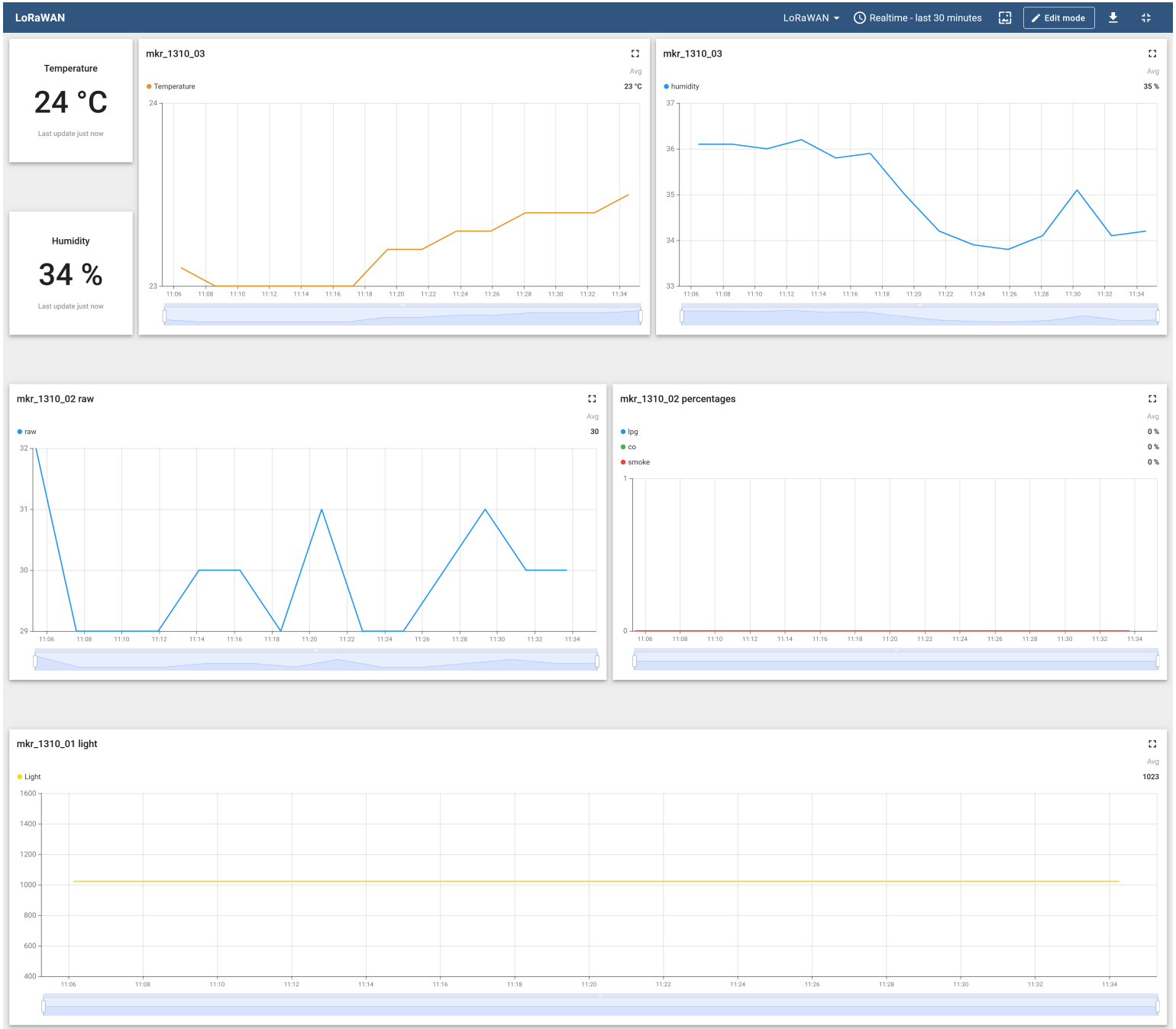
LoRaWAN Project – ThingsBoard



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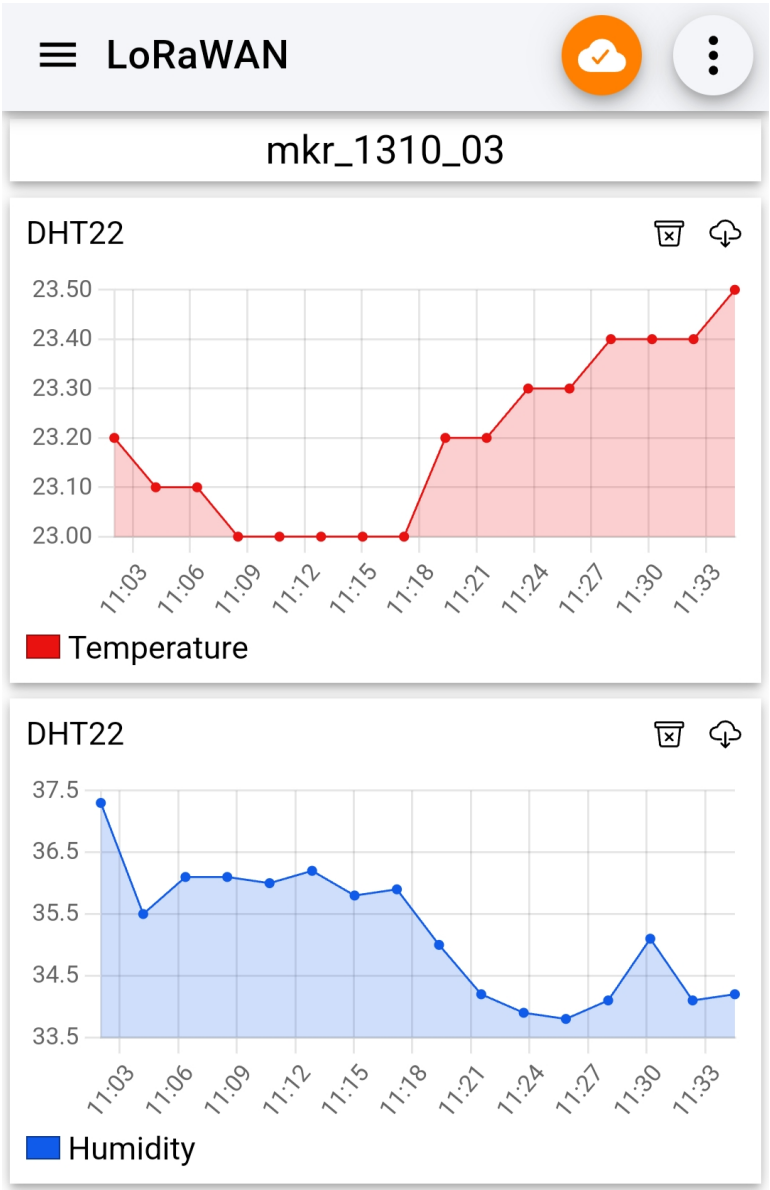

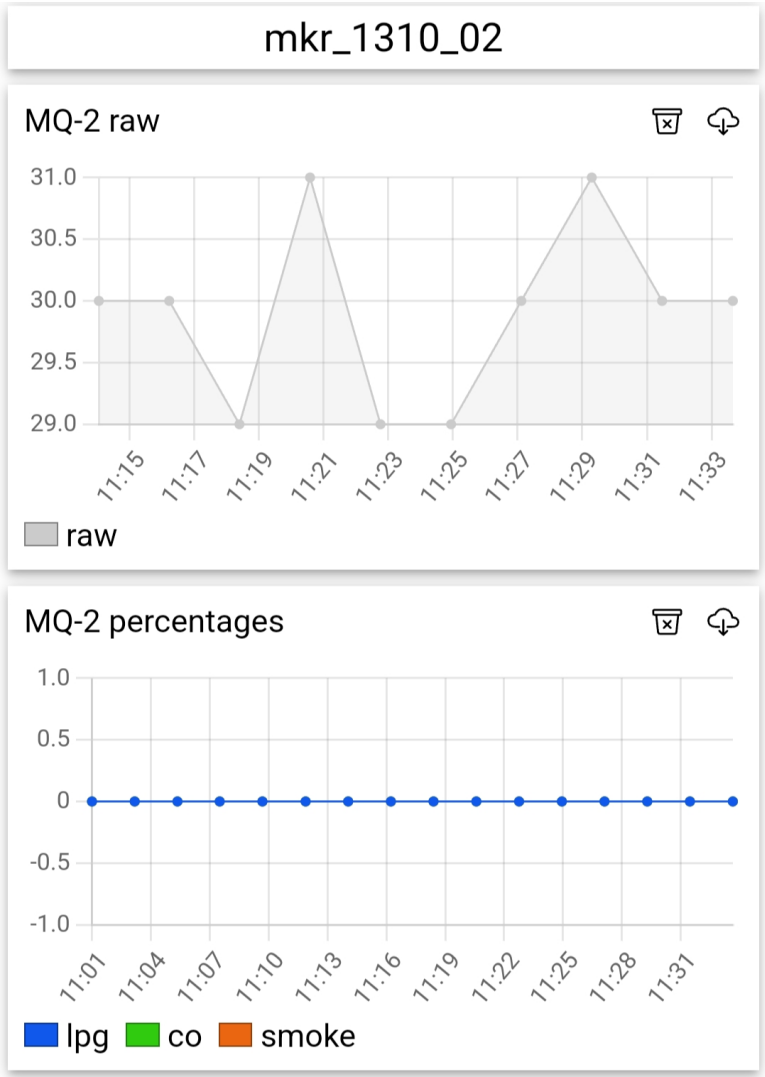

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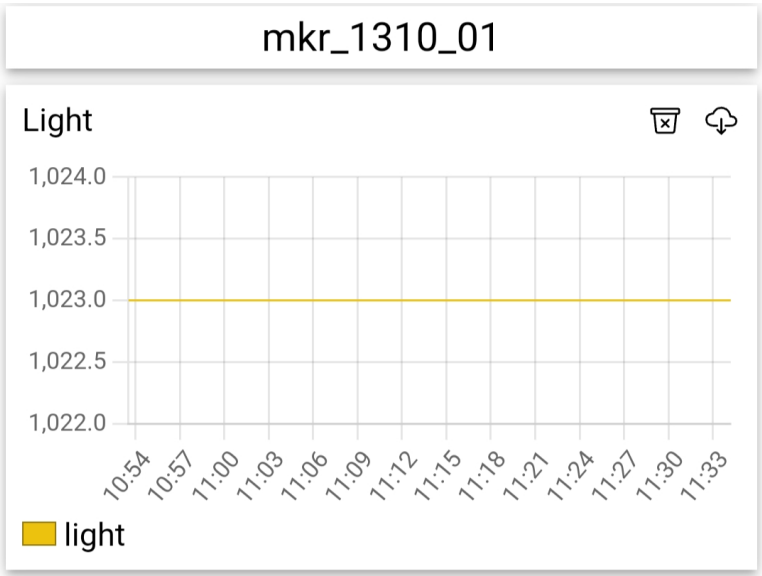

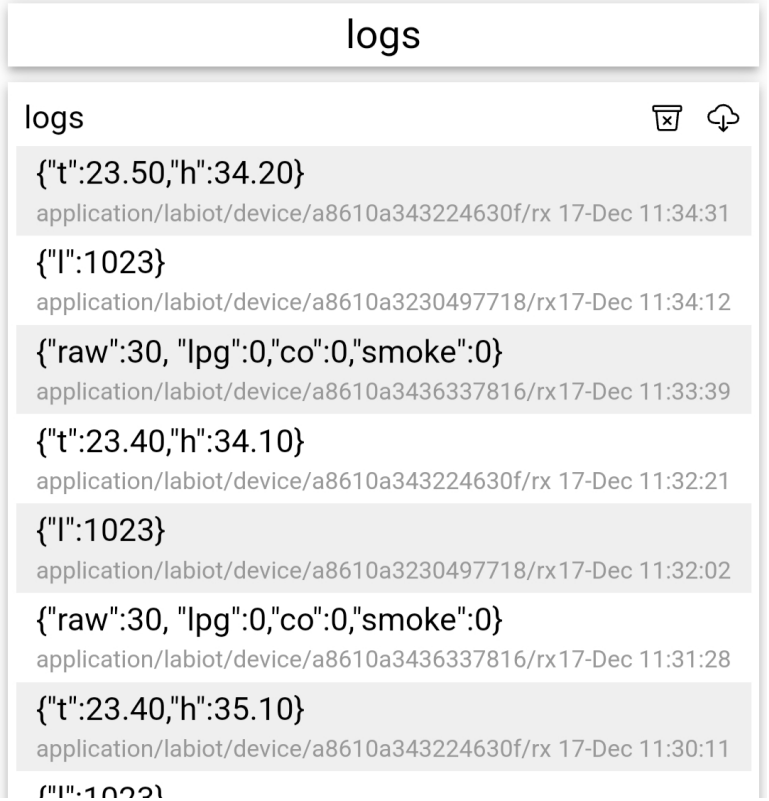

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- You can not use use both LoRa and LoRaWAN at the same time because their configuration conflicts.

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- Overall, the main issue is the missing of a detailed documentation by Arduino and RAKwireless. There is also a very poor community support because the gateway is not widely used.

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- The tested transmission range indoor was not very good.

References


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