Environment Monitoring with LoraWAN

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SNP STEAM ACADEMY

https://www.snpolytechnic.com/steam-academy

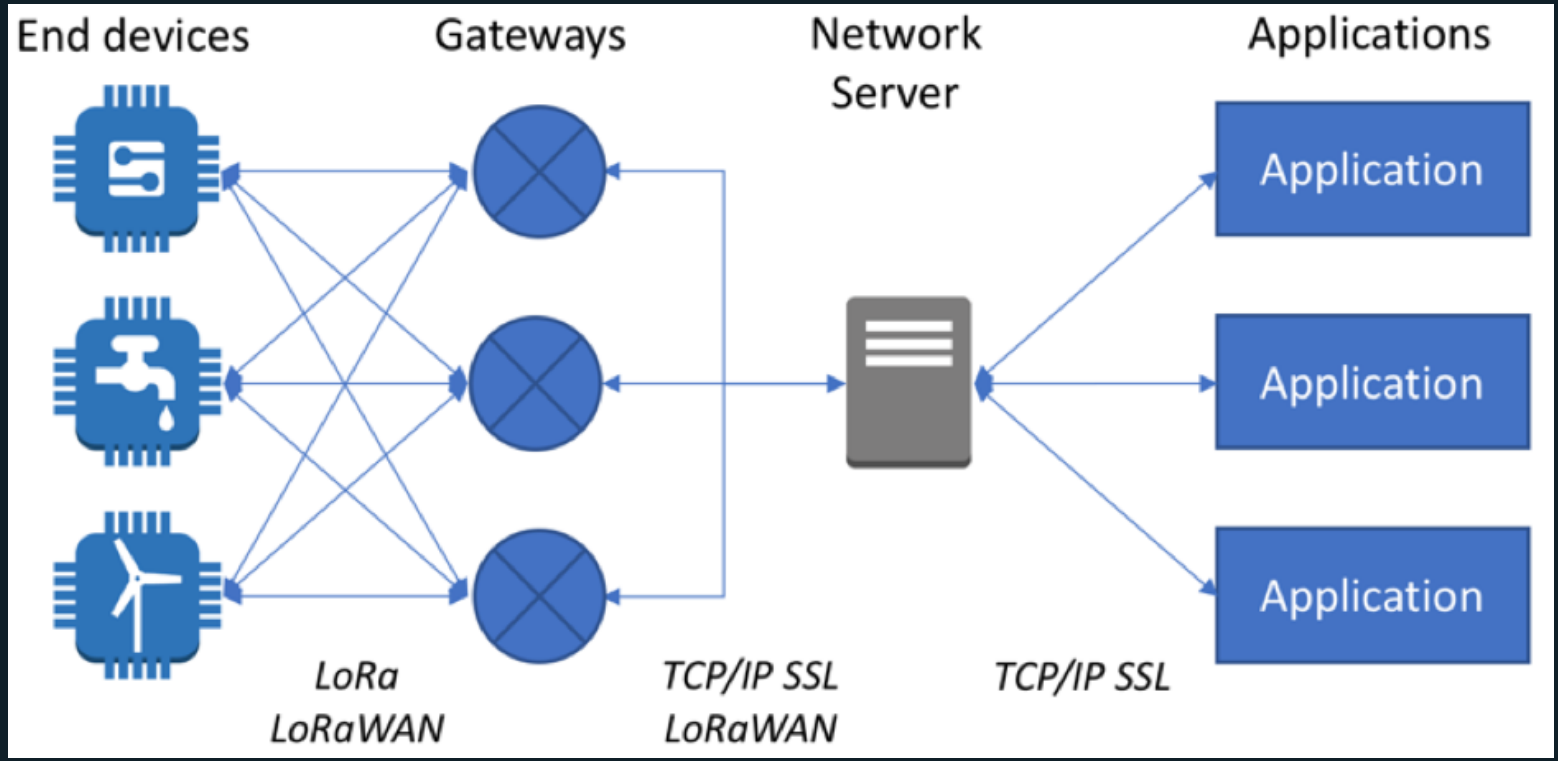
https://github.com/SixNationsPolytechnic

Why LoraWAN

- It’s free - not Telco costs
- LORA = LongRange 10km and LowPower (LPWan)
- Lot of use case example and support available

- More infos
- https://www.semtech.com/lora/why-lora
- https://os.mbed.com/docs/mbed-os/v5.15/tutorials/LoRa-tutorial.html

	Local Area Network Short Range Communication	**Low Power Wide Area** (LPWAN) Internet of Things	**Cellular Network** Traditional M2M
	40%	**45%**	**15%**
☺	Well established standards In building	Low power consumption Low cost Positioning	Existing coverage High data rate
☹	Battery Live Provisioning Network cost & dependencies	High data rate Emerging standards	Autonomy Total cost of ownership
	Bluetooth 4.0 · ZigBee · Wi Fi	LoRa	GSM · 3G+ / H+ · 4G


End devices
Gateways
Network Server
Applications
Application
Application
Application
LoRa
LoRaWAN
TCP/IP SSL
LoRaWAN
TCP/IP SSL

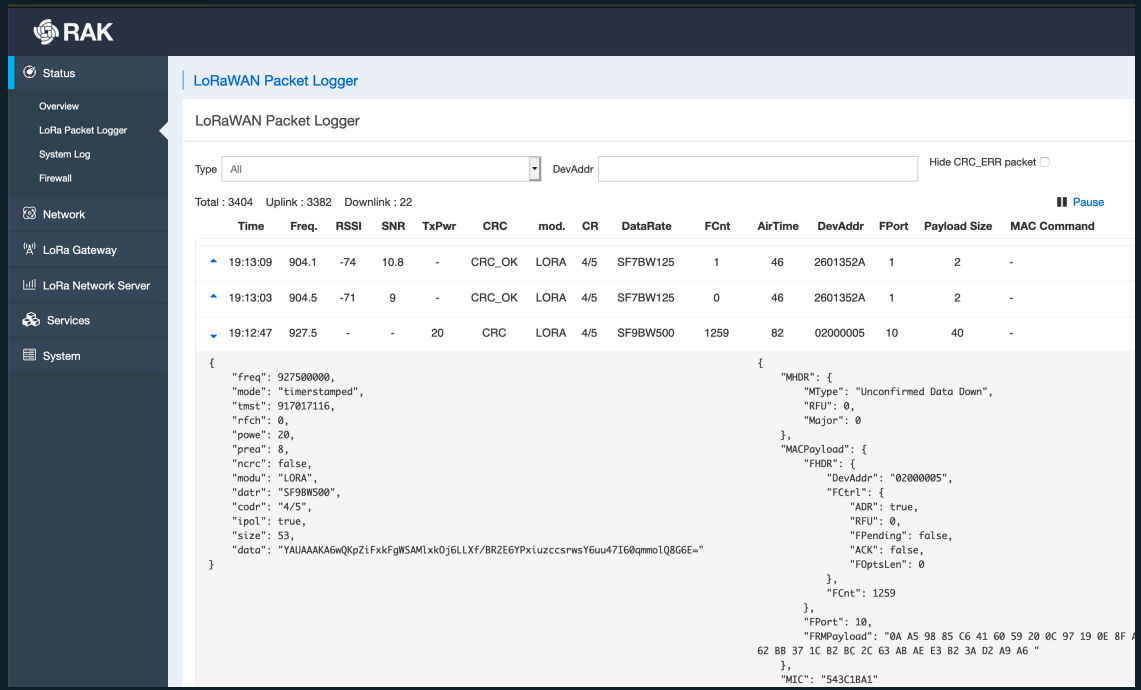
Lora Gateway & LoraServer

- Has Wifi/lora/GPS/LTE
- Power via POE

- More infos here
- https://www.rakwireless.com/en-us/products/lpwan-gateways-and-concentrators/rak7249

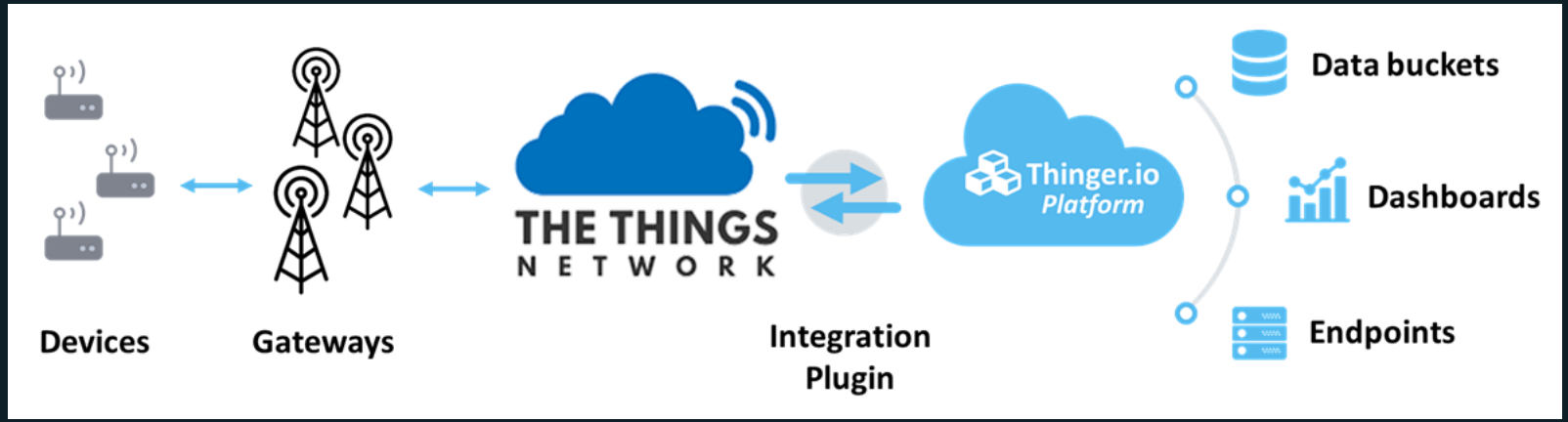
- So far tested Gateway setup with different lora Nodes connection to TTN and MQTT

- ToDo’s
  - Test LTE setup
  - Need Solar Kit
  - https://store.rakwireless.com/products/solar-kit?variant=31385712885805

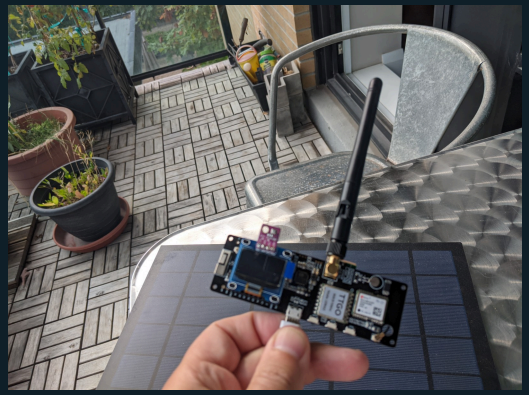

RAK
Status
Overview
LoRa Packet Logger
System Log
Firewall
Network
LoRa Gateway
LoRa Network Server
Services
System
LoRaWAN Packet Logger
LoRaWAN Packet Logger
Type All
DevAddr
Hide CRC_ERR packet
Total : 3404 Uplink : 3382 Downlink : 22
Pause
Time Freq. RSSI SNR TxPwr CRC mod. CR DataRate FCnt AirTime DevAddr FPort Payload Size MAC Command
19:13:09 904.1 -74 10.8 - CRC_OK LORA 4/5 SF7BW125 1 46 2601352A 1 2 -
19:13:03 904.5 -71 9 - CRC_OK LORA 4/5 SF7BW125 0 46 2601352A 1 2 -
19:12:47 927.5 - - 20 CRC LORA 4/5 SF9BW500 1259 82 02000005 10 40 -
{
"freq": 927500000,
"mode": "timerstamped",
"tmst": 917017116,
"rfch": 0,
"powe": 20,
"prea": 8,
"ncrc": false,
"modu": "LORA",
"datr": "SF9BW500",
"codr": "4/5",
"ipol": true,
"size": 53,
"data": "YAUAAAKA6wQKpZiFxkFgWSAMlxkOj6LLXf/BR2E6YPxiuzccsrwsY6uu47I60qmmolQ8G6E="
}
{
"MHDR": {
"MType": "Unconfirmed Data Down",
"RFU": 0,
"Major": 0
},
"MACPayload": {
"FHDR": {
"DevAddr": "02000005",
"FCtrl": {
"ADR": true,
"RFU": 0,
"FPending": false,
"ACK": false,
"FOptsLen": 0
},
"FCnt": 1259
},
"FPort": 10,
"FRMPayload": "0A A5 98 85 C6 41 60 59 20 0C 97 19 0E 8F A
62 BB 37 1C B2 BC 2C 63 AB AE E3 B2 3A D2 A9 A6 "
},
"MIC": "543C1BA1"

What is TTN / TheThingsNetwork - https://www.thethingsnetwork.org/

We can use this as a cloud provider or we can use the GW lora server or we can forward the data via mqtt …lots of options



Lora Nodes – I test several with batteries and solar panel – TTGO -T-Beam

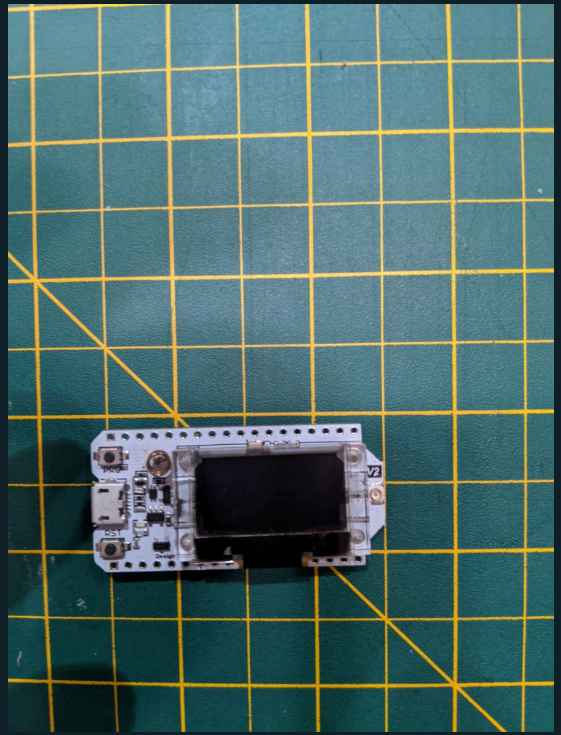


TTGO … had lots of software support Arduino based and wifi support
Pro

Really good power management … all one … with gps options for tracking

http://www.lilygo.cn/products.aspx?TypeId=50003&FId=t3:50003:3
https://github.com/JoepSchyns/Low_power_TTGO_T-beam
https://github.com/LilyGO/TTGO-T-Beam
https://tinymicros.com/wiki/TTGO_T-Beam

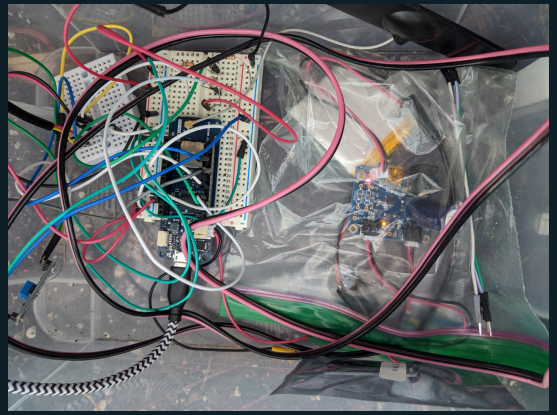
HelTec

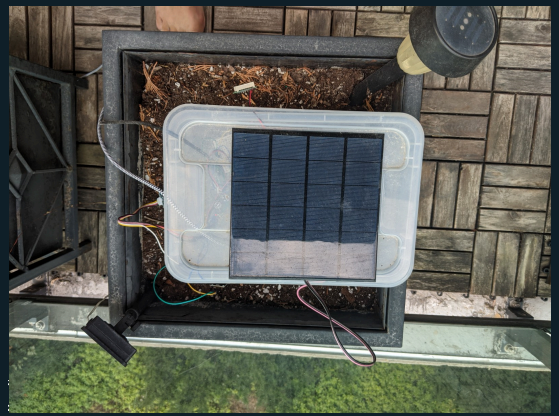


Like TTGO
https://heltec.org/project/wifi-kit-32/

https://heltec-automation-docs.readthedocs.io/en/latest/

MKR1310 Lora





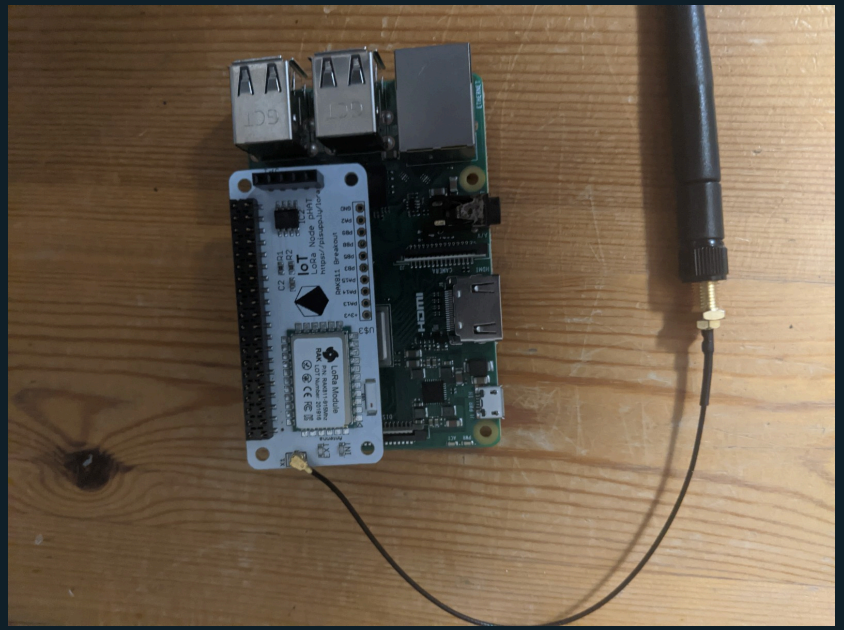
Official Arduino Lora Board
Also good power management and Flash?

https://store.arduino.cc/usa/mkr-wan-1310

Pros
- Lots of Library
- Good Power management

Cons
- Is C/Arduino

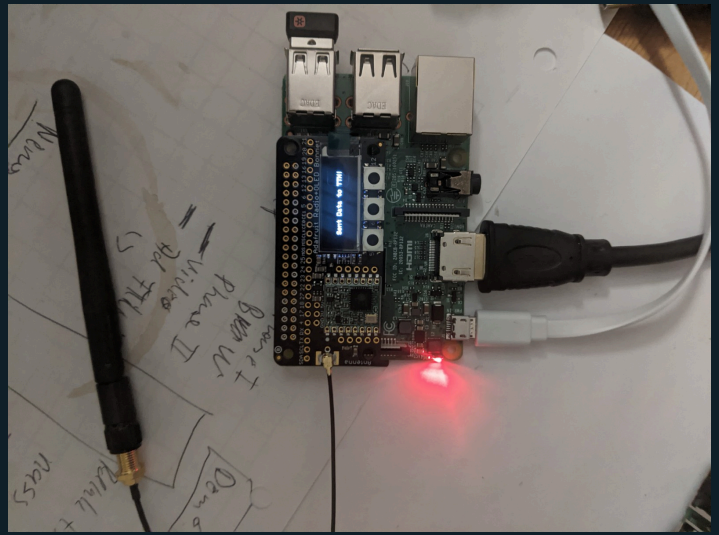
Raspberry PI Lora Hat
https://learn.pi-supply.com/make/getting-started-with-the-microbit-lora-node/



Pros
- Pi has lots of support
- Python Library

Cons
- Power consumption

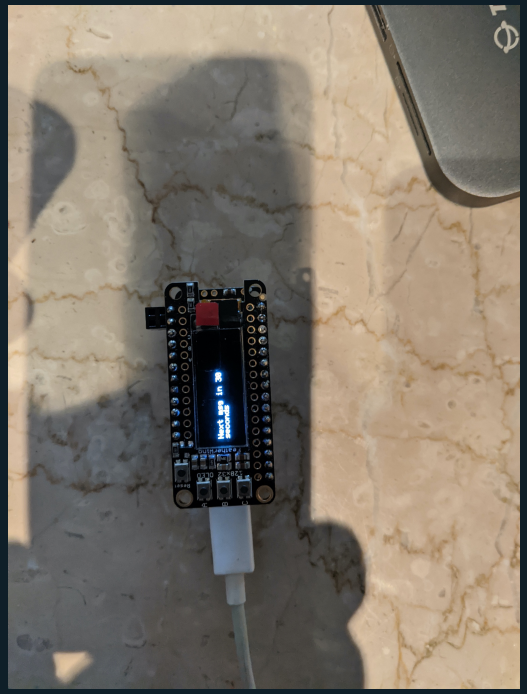
Pi Lora Bonnet from adafruit
https://www.adafruit.com/product/4074



Pros
Pi has lots of support
Python Library

Cons
Power consumption
Does not support all Lora Features

Adafruit feather

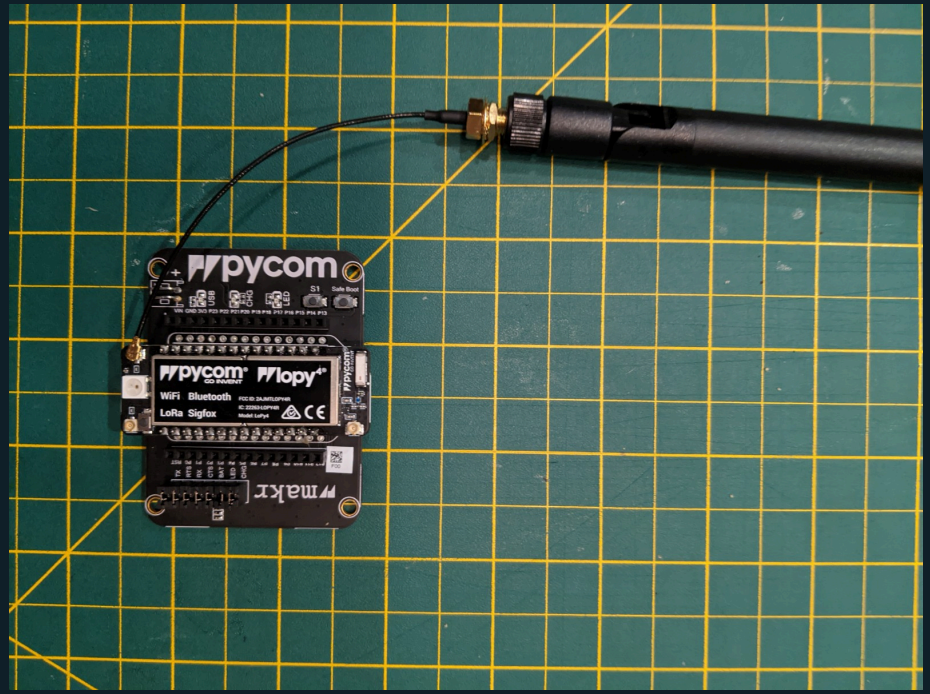


Pros
- Arduino based

Cons
- Powermanagement
- Does not support all lora features

- https://tum-gis-sensor-nodes.readthedocs.io/en/late

Pycom – lopy4 … by far the best
https://pycom.io/



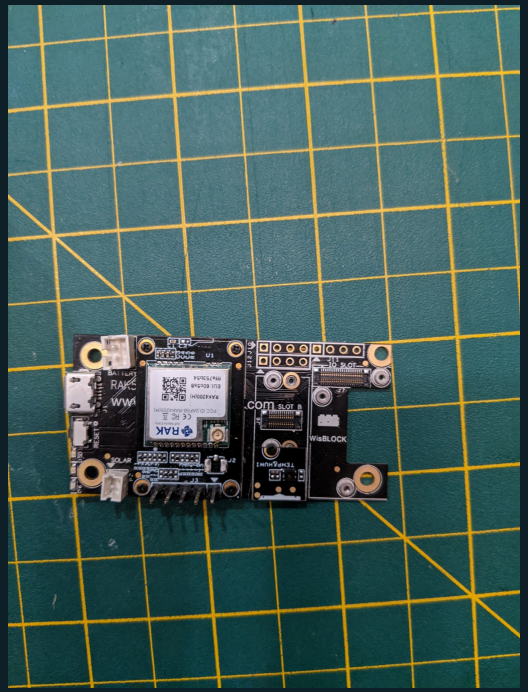
Pros

- Python Based
- Cloud Code IDE
- Big Flash and SD card support
- Wifi/BLE and Lora
- Good power management
- They have IP67 cases

Cons

-

RAKWis node



Pros
Has sensors on board

Cons
Can not be programmed

IDEs

Most have a plugin for VS/Atom etc

Arduino Has a Cloud IDE and PlugIns as well as the standalone IDE

PyCom Has plugin and Cloud coding good for OTA

I really like https://platformio.org/

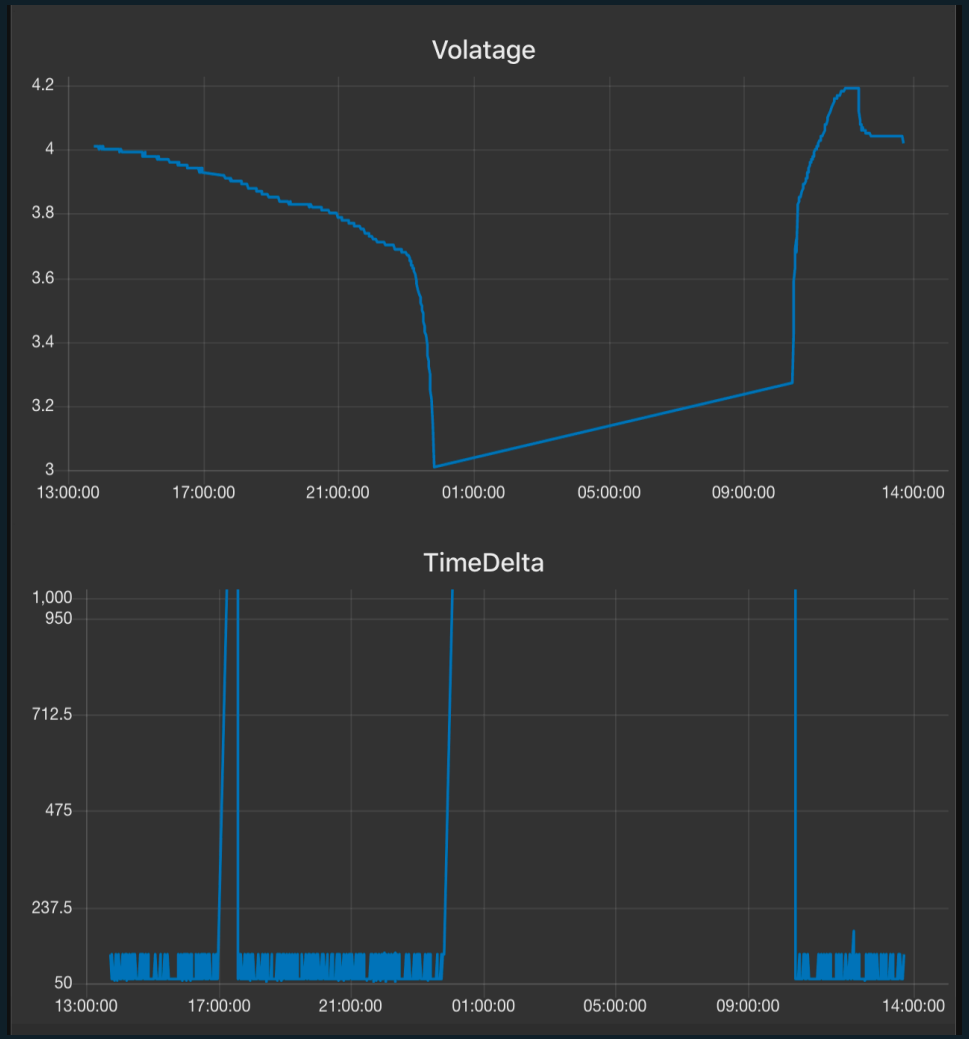
https://www.instructables.com/Develop-ESP32-With-PlatformIO-IDE/

Batteries which for the LoraNode which can be charged via Solar need solar chargers and maybe boosters

Batteries

- Boosters / Voltage regulators
- Solar chargers
- 3v3 vs 5 V
- Battery Amperage e.g 2400 -3200 mah
- Weather/Clouds winter we should be able to work for 3+ days without sun

voltage graph

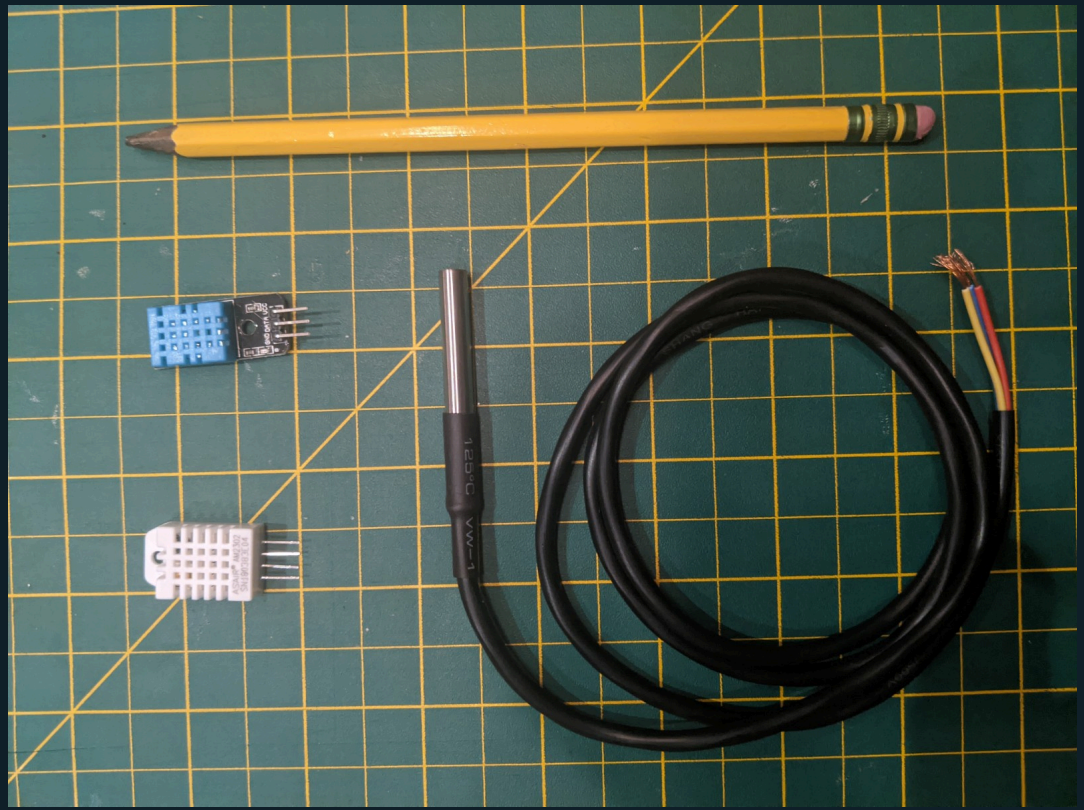


Todo: Think about Waterproofed casing! IP67

Alternative Case,Solar and 18650 Batteries

Sensor to Start with DHT22 and Waterproof 1Wire Temperature sensor

BME280 ,
1 Wire, Dallas
DHT22/11
Light Sensor
GAS Sensor



Sensor stuff to think about

- Corrosion
- Ambient vs outside

Recommendation

Cost ?

Support

TTGO T-Beam BLE,Wifi Lora, MKR1310 (Lora)

PI Head , PYCOM Wifi,BLE,Lora mesh support

OTA – update …

Send only message when there is a Change

Send a heartbeat every hour

Ali shopping list – will create one in and sen via email

10 X MKR1310
5 X TTGO T-Beam
OLED 128x64 I2C
Pycom Sense
Solar Panels
10 x 18650 2400maH
Cheap RC LiPos
BME280,DHt22,GAS Sensor , Light ,1 Wire
Lora HAT for PI
Maybe SolarLight/Casewith Movement detection
Solar Kit for Gateway

Next Steps … Task … Help

- Nathan -> Order ESP8266 weather station and send to studens
- Markus -> Ali shipping List

- Markus -> setup mqtt and datawarehouse infrastructure so we can capture the students weather infos

- Markus -> share mqtt code for esp

- Nathan -> send out teaching schedule

END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