# Environment Monitoring with LoraWAN


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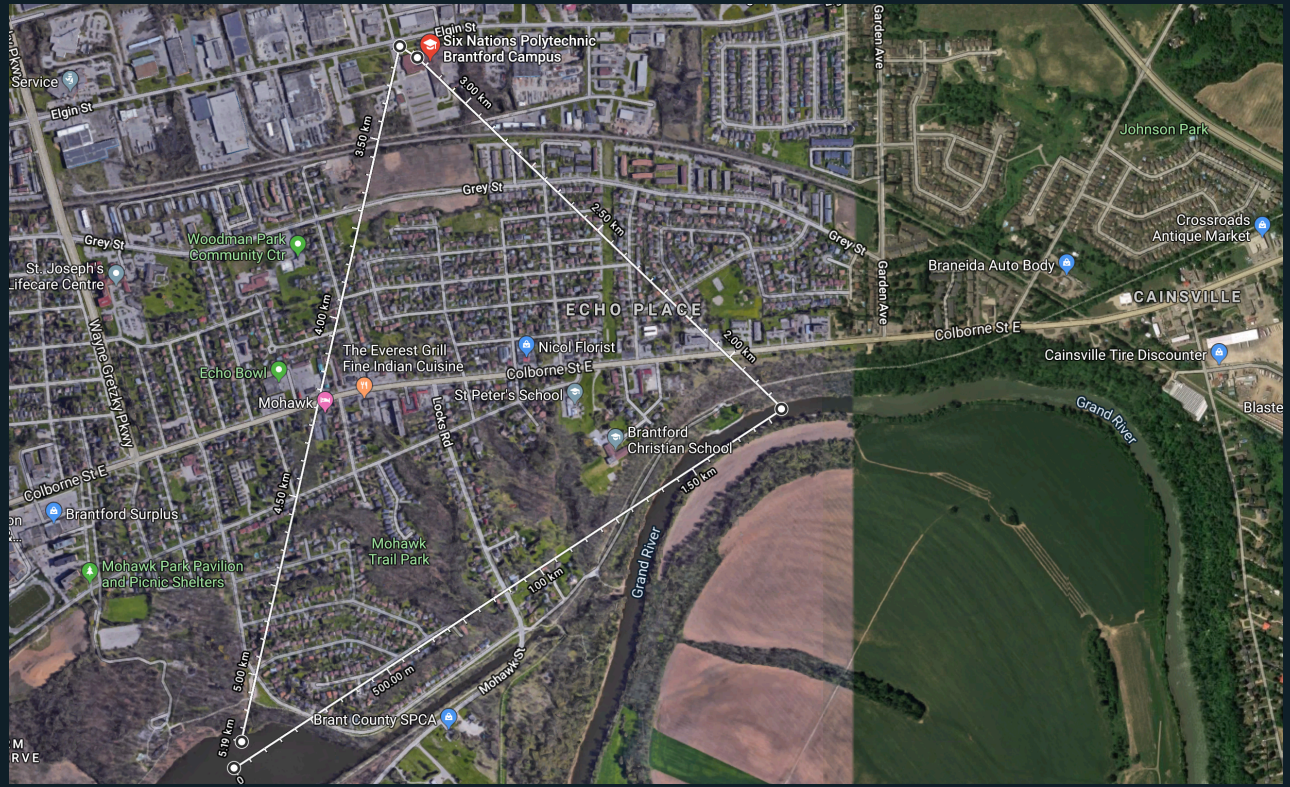
# SNP STEAM ACADEMY

Code and instruction for this class can be found here
https://github.com/markusvankempen/esp8266andDHT11

# Our Goal – Environmental Monitoring

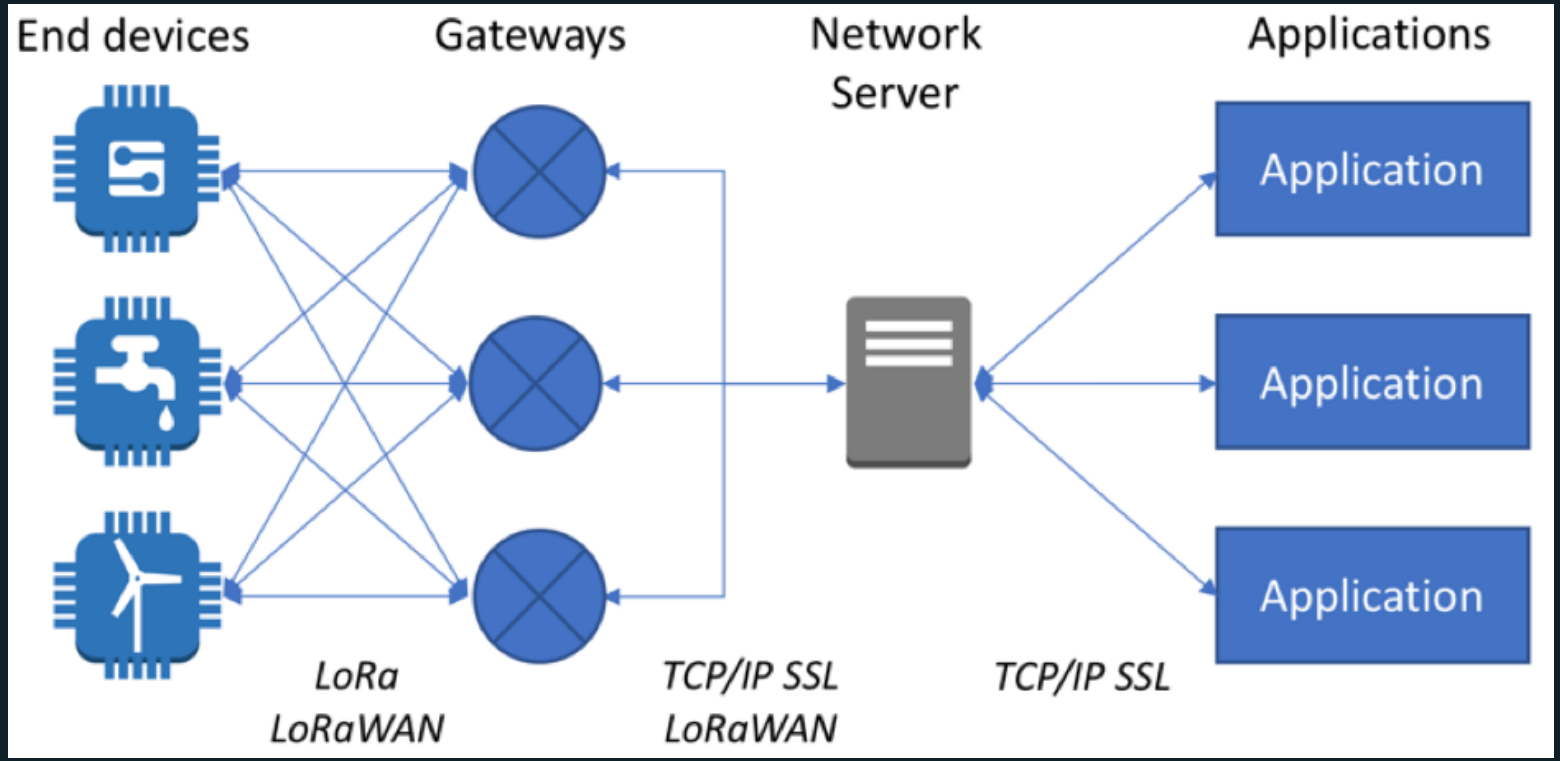


# Why LoraWAN

- 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**<br>Short Range<br>Communication | **Low Power Wide Area**<br>(LPWAN)<br>Internet of Things | **Cellular Network**<br>Traditional<br>M2M |
|---|---|---|---|
| | **40%** | **45%** | **15%** |
| ☺ | Well established standards<br>In building | Low power consumption<br>Low cost<br>Positioning | Existing coverage<br>High data rate |
| ☹ | Battery Live<br>Provisioning<br>Network cost & dependencies | High data rate<br>Emerging standards | Autonomy<br>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

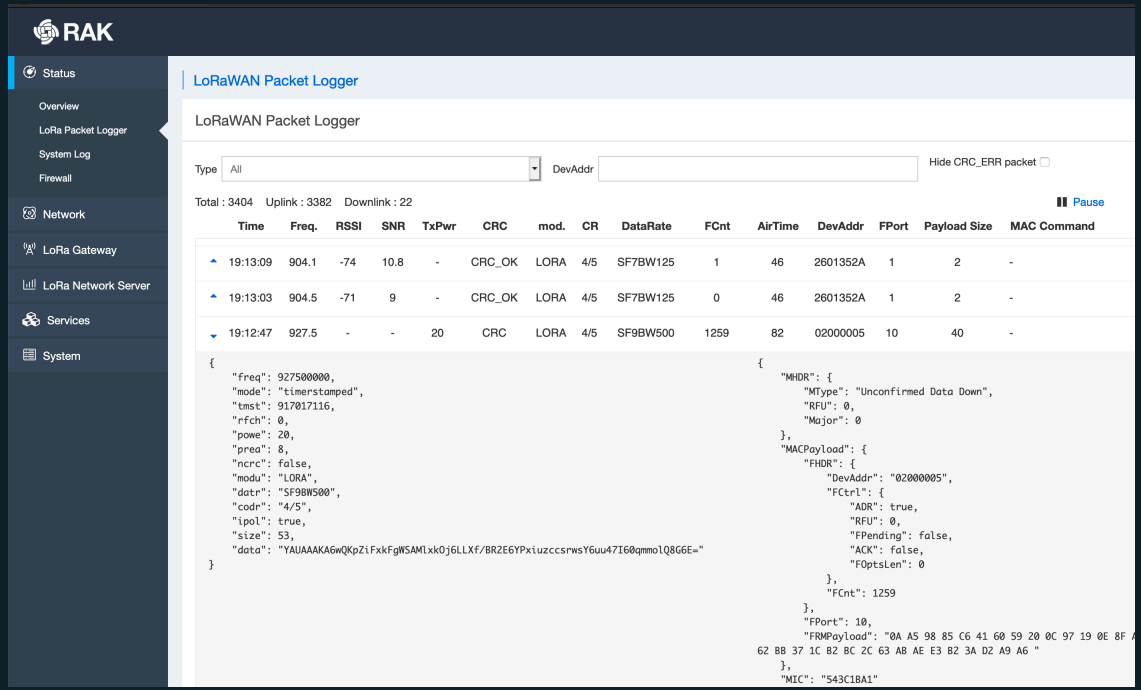
# Lora Gateway & LoraServer

- 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,
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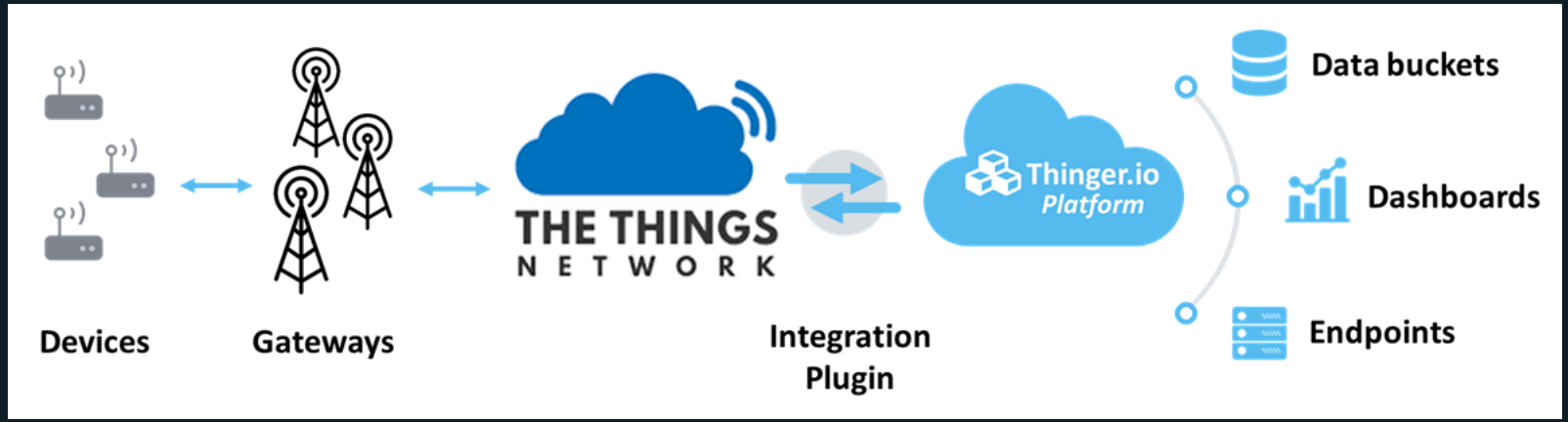
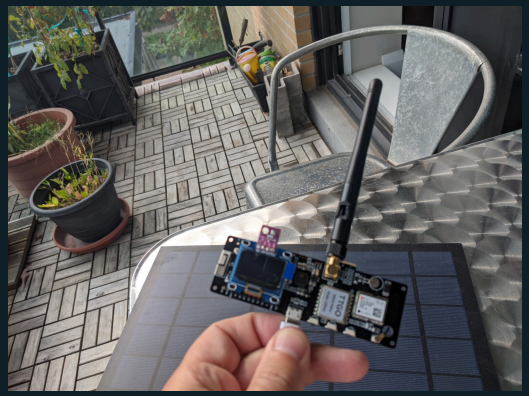
"tmst": 917017116,
"rfch": 0,
"powe": 20,
"prea": 8,
"ncrc": false,
"modu": "LORA",
"datr": "SF9BW500",
"codr": "4/5",
"ipol": true,
"size": 53,
"data": "YAUAAAKA6wQKpZiFxkFgWSAMlxkOj6LLXf/BR2E6YPxiuzccsrwsY6uu47I60qmmolQ8G6E="
}
{
"MHDR": {
"MType": "Unconfirmed Data Down",
"RFU": 0,
"Major": 0
},
"MACPayload": {
"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

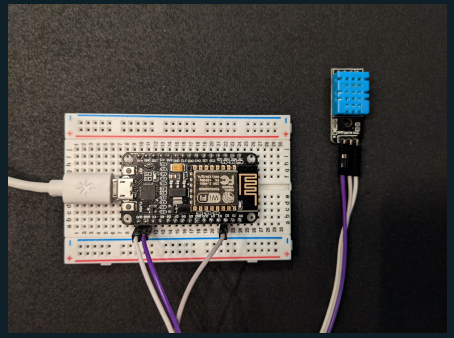
Really good power management … all one … with gps options for tracking

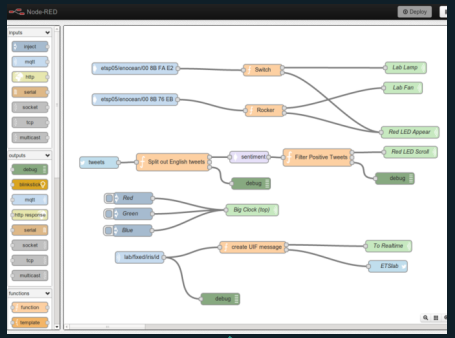
http://www.lilygo.cn/products.aspx?TypeId=50003&FId=t3:50003:3
https://github.com/JoepSchyns/Low_power_TTGO_T-beam
https://github.com/LilyGO/TTGO-T-Beam
https://tinymicros.com/wiki/TTGO_T-Beam

# Today

We will simulate the Lora network using wifi with our esp8266 & DHT1 to send temperature data via mqtt to a server and save the data into a database and than “surf” the data.

# Class Overview





Virtual Server with docker images

52.117.240.201

mosquitto

SQL

Surf

# Chapter One (1)

Arduino IDE setup

Esp8266 and dht11 test program

Some exercises/play

# Arduino IDE setup  - esp8266 board

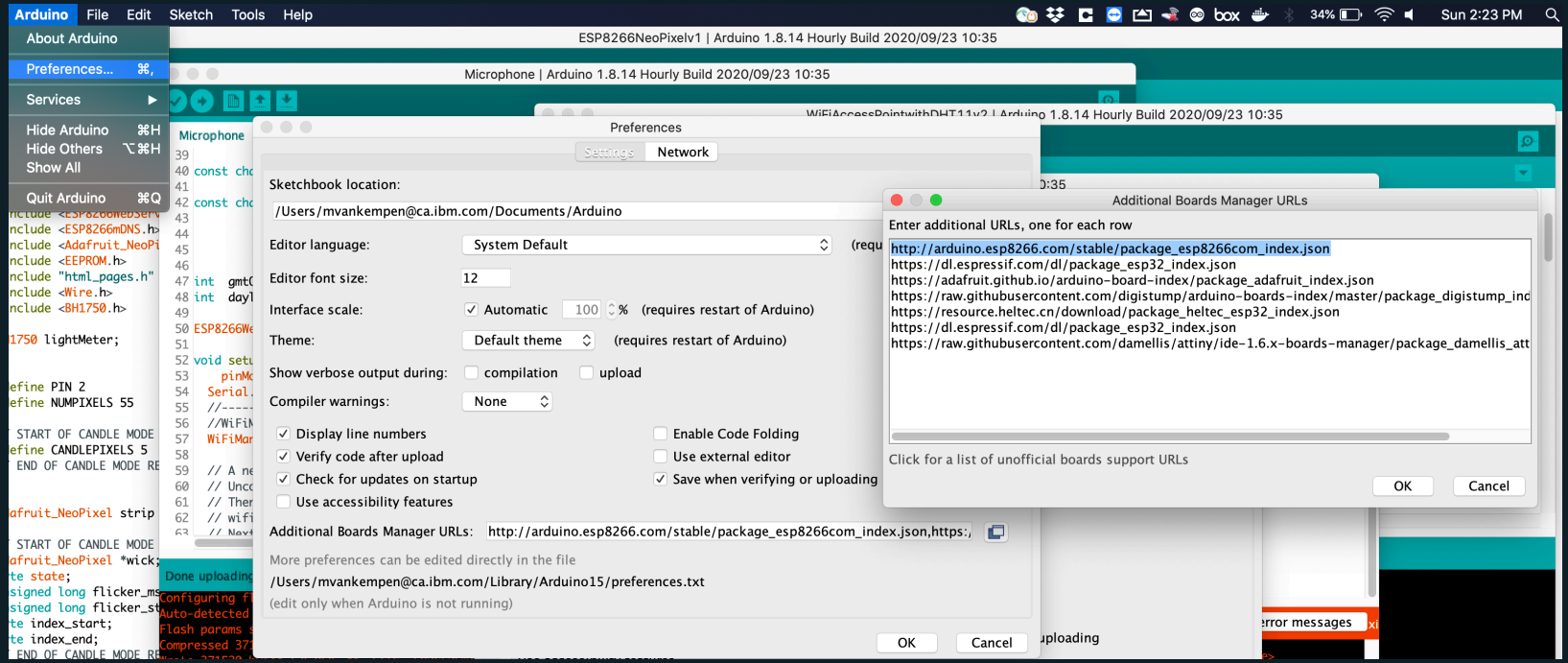
We need to add the esp8266 board and libraries to the IDE

**Instructions**

- Start Arduino and open Preferences window.
- Enter https://arduino.esp8266.com/stable/package_esp8266com_index.json into *Additional Board Manager URLs* field. You can add multiple URLs, separating them with commas.
- Open Boards Manager from Tools > Board menu and find *esp8266* platform.
- Select the version you need from a drop-down box.
- Click *install* button.
- Don’t forget to select your ESP8266 board from Tools > Board menu after installation

More reference
https://arduino-esp8266.readthedocs.io/en/latest/installing.html
https://www.hackster.io/rajthavti/dht11-sensor-interfacing-with-nodemcu-086762

# ESP8266 board import



# Arduino IDE setup  - dht11 library

You should have the **Arduino IDE** software running at this time. Next it's necessary to install our DHT library, which can be done though the Arduino Library Manager:

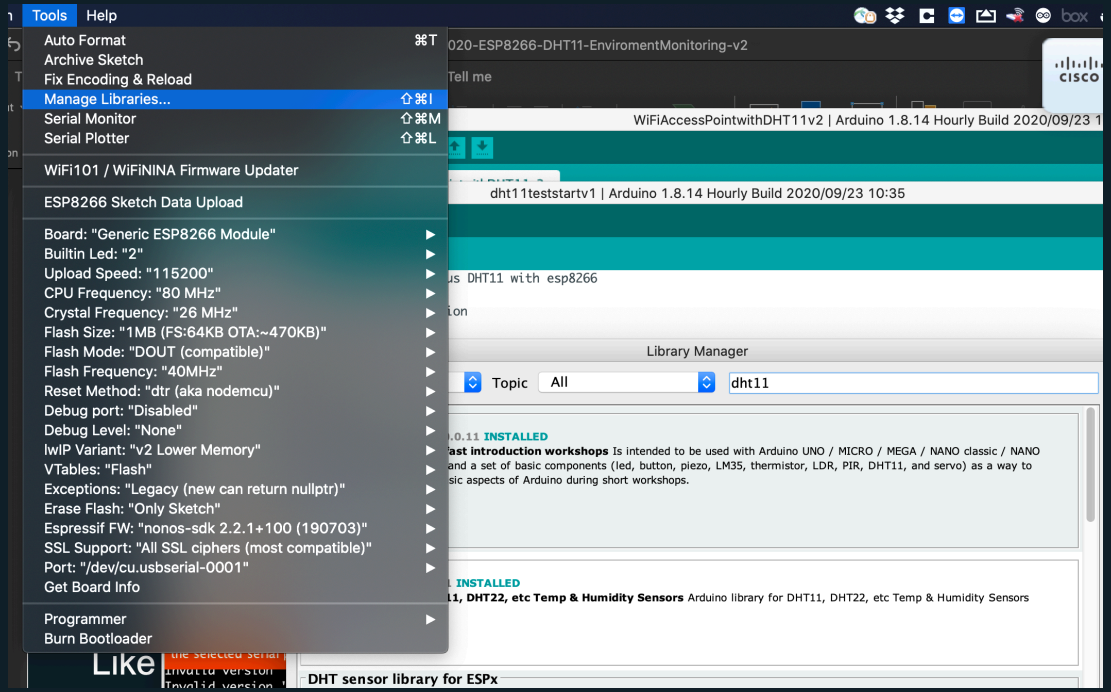
**Sketch→Include Library→Manage Libraries…**

Enter "**dht**" in the search field and look through the list for "**DHT sensor library** by **Adafruit**." Click the "Install" button, or "Update" from an earlier version.

DHT Sensor Library: https://github.com/adafruit/DHT-sensor-library

More reference
https://arduino-esp8266.readthedocs.io/en/latest/installing.html
https://www.hackster.io/rajthavti/dht11-sensor-interfacing-with-nodemcu-086762
https://learn.adafruit.com/dht/downloads?view=all

# Import DHT11 Library



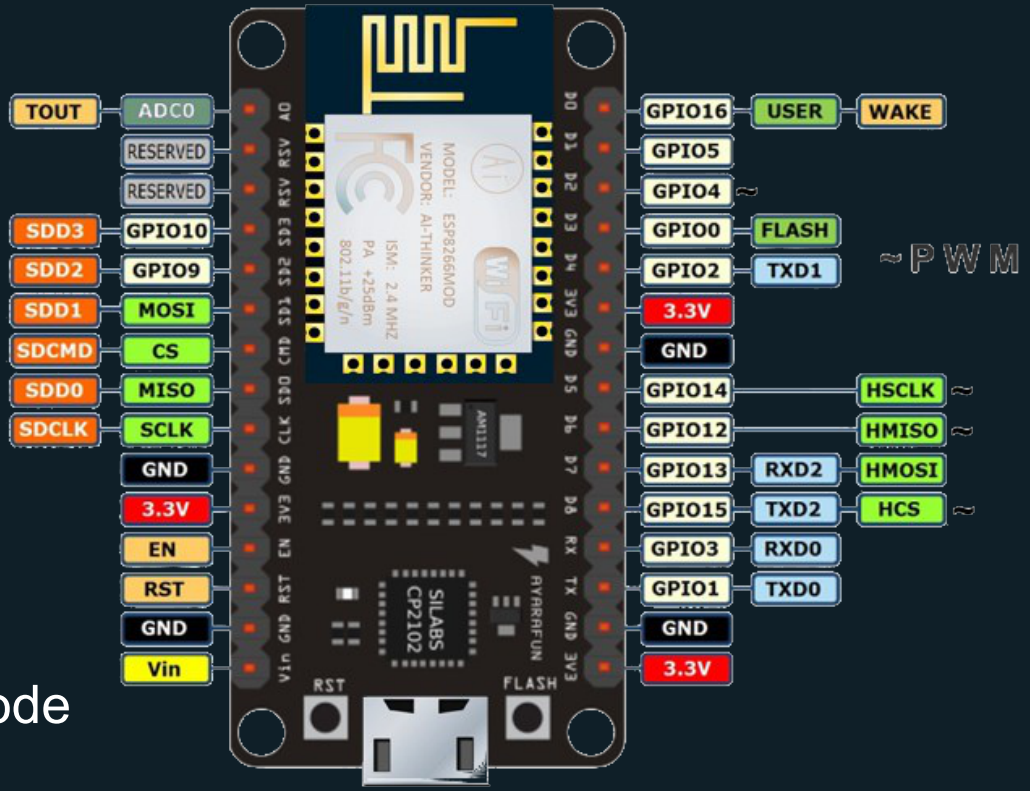
# ESP8266 and DHT11 wiring

PIN on the esp8266

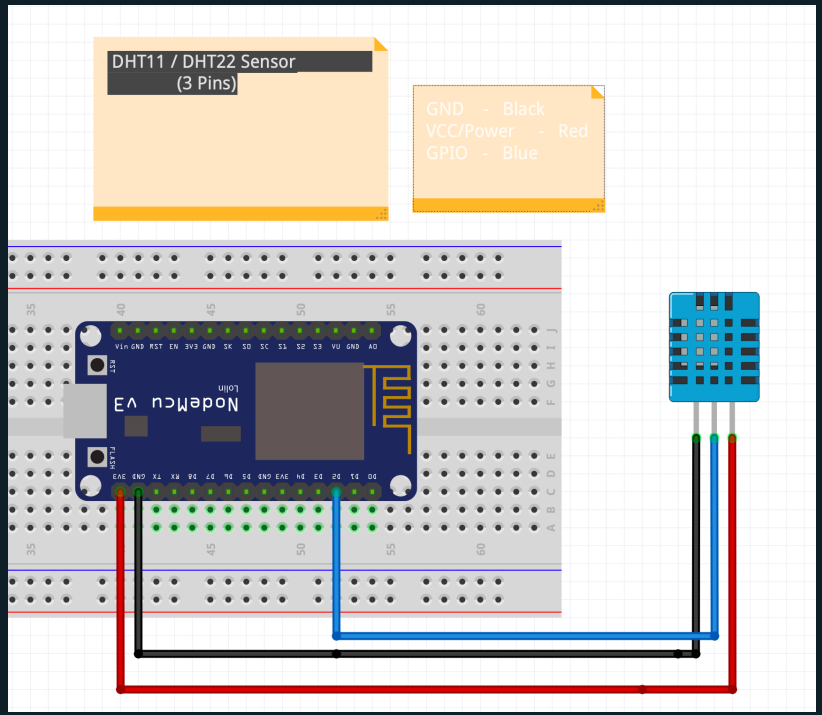
Note we will be using
The GPIO numbers
NOT the PINs

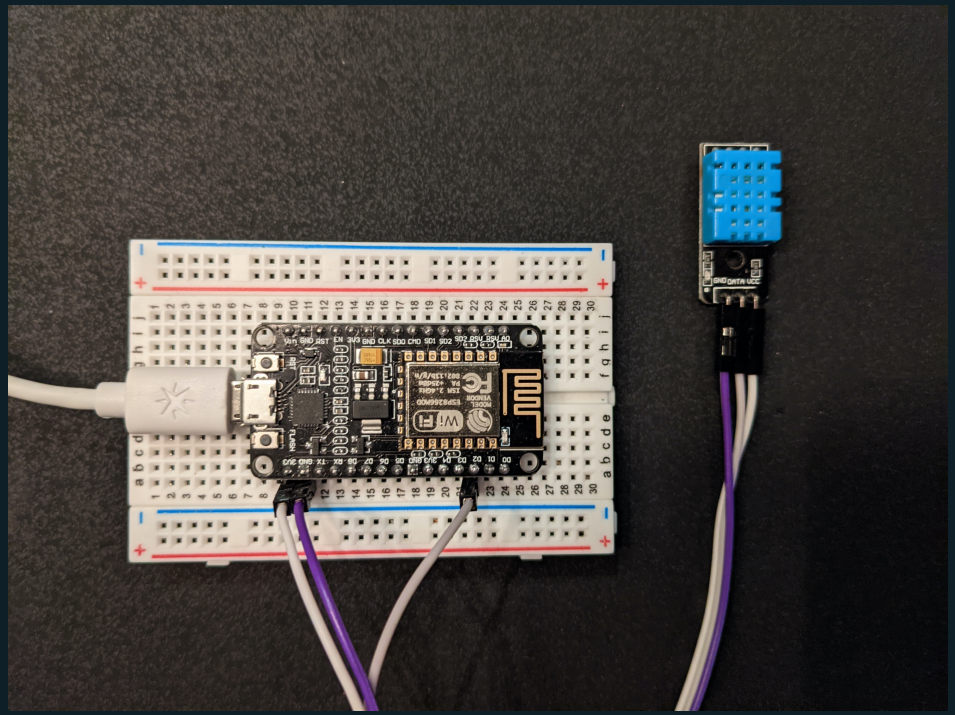
Like Pin D2 = GPIO4

We use number 4 in our code



# ESP8266 & DHT11 Wiring



# Code esp8266-dht11. - Number one

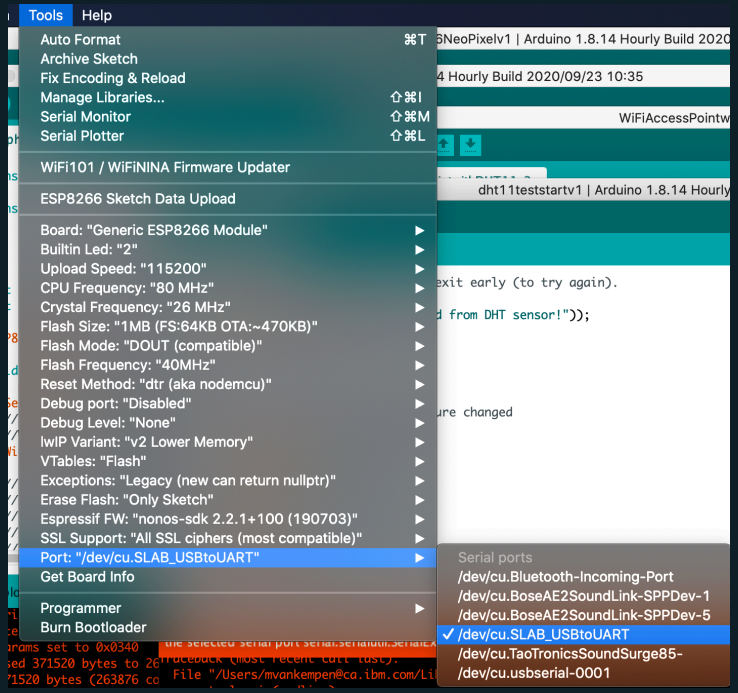
All code and instruction can be found here
https://github.com/markusvankempen/esp8266andDHT11

Here our 1st code to upload to the esp8266 which is connected to DH11

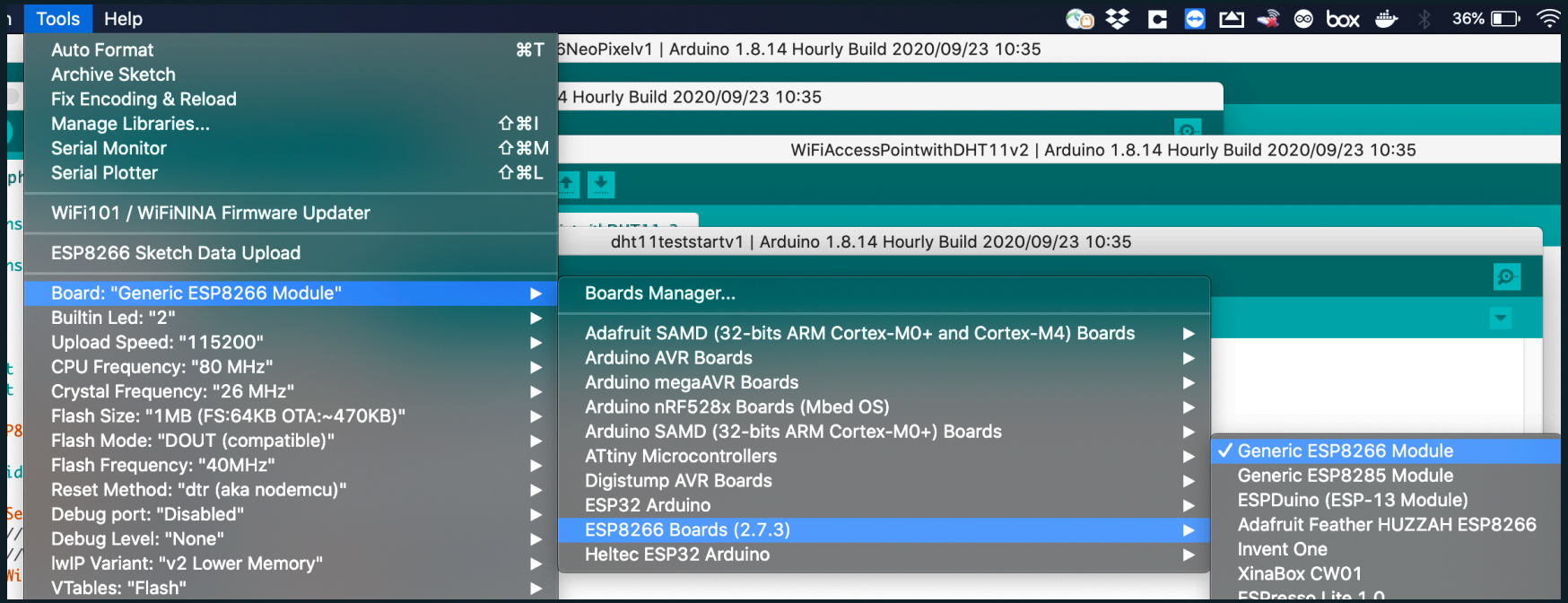
**Note:**

- Make sure u select the right board
- Copy the code into your IDE make sure to select the right serial Port

# Serial Port Selection



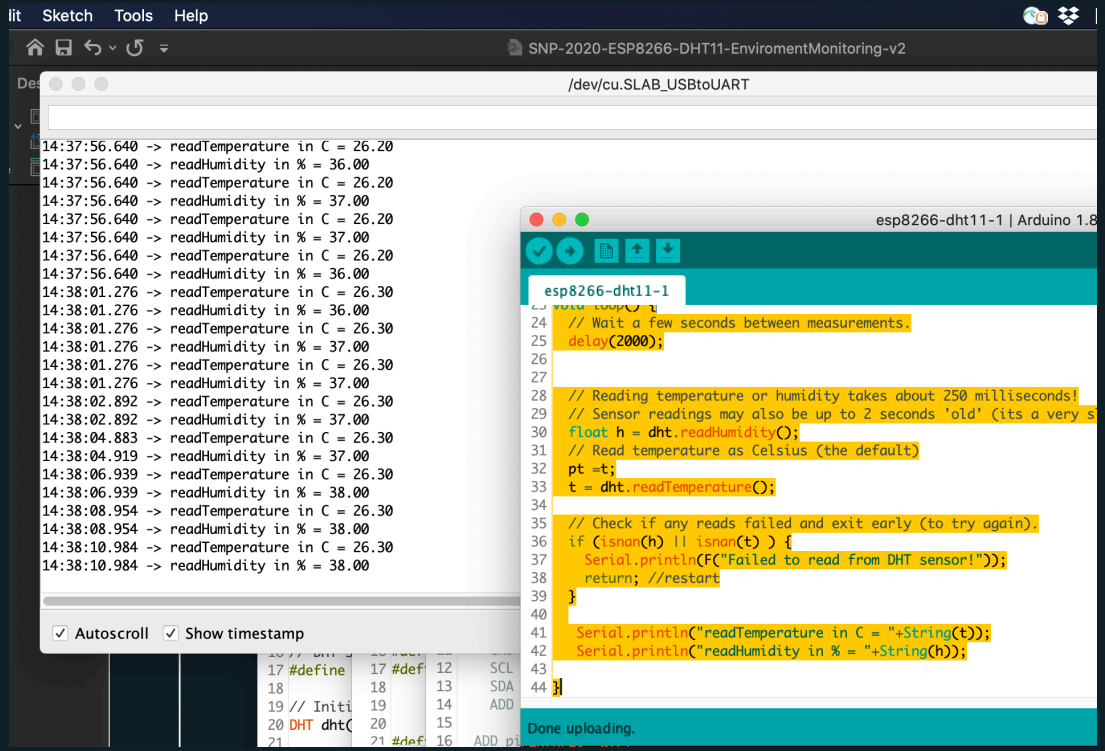
# Board Selection



# Upload the code to esp8266

Code :
https://raw.githubusercontent.com/markusvankempen/esp8266andDHT11/main/code/esp-dht11-1.ino

Once you upload and open the serial terminal / make sure the Baudrate is 115200



# Exercise #1 … display temperature and Humidity in the plotter

https://arduinogetstarted.com/tutorials/arduino-serial-plotter

# Chapter two (2)

Sending data to mqtt broker

Save the Data to an SQL database

Display the data in Realtime and via Historian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