Solution

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Modification History

	Date	Author
1.0	09/06/2022	Maxime Drelon
1.1	10/06/2022	Maxime Drelon
2.0	17/07/2022	Maxime Drelon

Software

Name	Description	Link	Price
Visual Studio Code	IDE	https://code.visualstudio.com/	Free
PlatformIO	Framework	https://platformio.org/	Free
Eclipse Mosquitto	MQTT Broker	https://mosquitto.org/	Free
Autodesk Fusion 360	3D Modeling	https://www.autodesk.fr/products/fusion-360	Free

Prusa Slicer	Slicer	https://www.prusa3d.com/page/prusaslicer_424/	Free
InfluxDb	Software	https://www.influxdata.com/	Free
Telegraf	Software	https://www.influxdata.com/time-series-platform/telegraf/	Free
Docker	Software	https://www.docker.com/	Free
			0$

Hardware

Name	Description	Link	Price
DHT11	Air Temperature, Humidity	https://www.amazon.fr/	7$
Capacitive soil moisture sensor v1.2	Soil Moisture	https://www.amazon.fr/	5$
GL5539	Photo Resistor	https://www.amazon.fr/	5$
Arduino nano RP2040 connect	Controller	https://store.arduino.cc/	25$
PETG	3D Printing Filament	https://www.prusa3d.com/category/prusament-petg/	30$
MK3S+	3D printer	https://www.prusa3d.com/product/original-prusa-i3-mk3s-kit-3/	700$
			772$

💽 Data Collection

The data will be read and sent from the following sensors every 15min:

- DHT11
- CSMS v1.2
- GL5539

These sensors will provide us with data of the environment where the module was setup, we will measure the following data:

- Air

    - Temperature (in degress C)
    - Humidity (%)
- Soil
    - Humidity (%)
- Brightness (0 → 1000)

The data will then be sent via MQTT which is a lighter and faster protocole than standard http request and allows us to publish data to topics instead of routes, so that we can listen to theses topics from different sources if need be.

The controller will publish to the following topics:

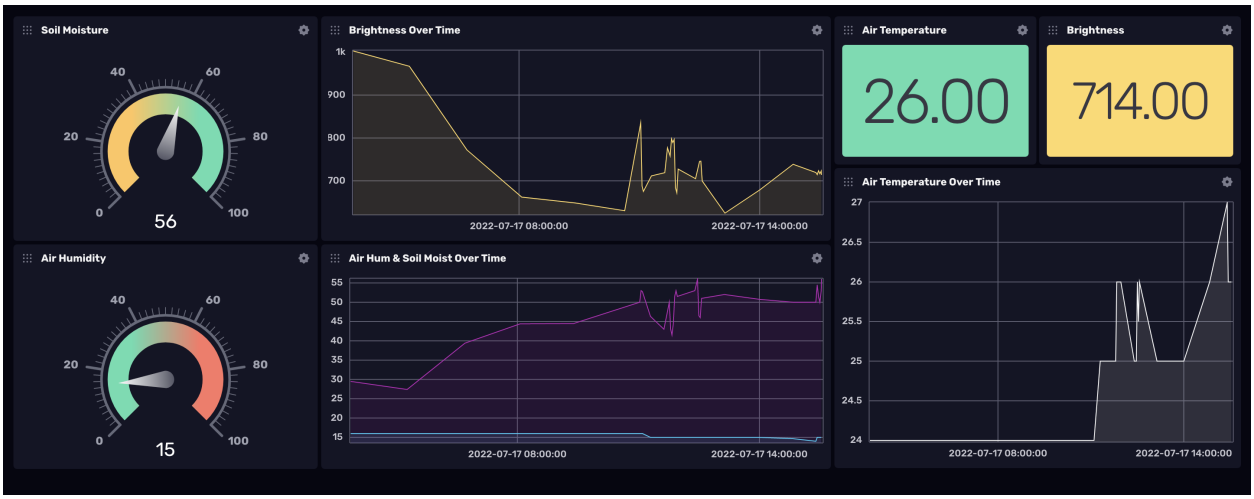
- sensors/greentech/v1/deviceName/airTemperature
- sensors/greentech/v1/deviceName/airHumidity
- sensors/greentech/v1/deviceName/soilMoisture
- sensors/greentech/v1/deviceName/brightness

The device name will change to differentiate each module and compare data bewteen them.

To save the data we will be using influxDB a time series database, and to listen to our topics we will be using the telegraf plugin of influxdb.

Telegraf will subscribe to our previously defined topics and store the data everytime the data is sent.

InfluxDB will then provide us a customizable dashboard to preview our data:



This data can be fetched outside of influxdb for other use using the influxdb client available in multiple languages.

🔧 Maintainability & Resilience

Our modules will be designed with high maintainability in mind, each sensor will be “plug & play” meaning they are easily swappable by the end user.

The main circuit board will have a port dedicated for each of these modules requiring zero to little experience.

3D model of the module casing will be available to reprint if needed.

Circuit Schematics & Maintenance Documentation will aslo be publicaly available.

Each component of a module will be sold by us if replacement was ever needed.

Critical sensors will be protected by the casing designed to be weatherproof and withstand the harshest conditions

Exposed sensors will all be picked for their weatherproof rated and tested

🔋 Power

This project being remote we will power it using solar power and storing energy in lithium cells.

To save on power consumption we will only measure data on given intervals then go into a “Deep Sleep” mode which will reduce our power consumption to nearly 0.

To determine the required power will need to calculate it based on the power consumption of each sensor and the controller, based on the operating time and solar exposure of the region it will be deployed.

Power Comsumptiono formula:
(Uptime) x (Days Running) x (Total Module Wattage) / 1000.

Solar Cell Power:
solarCellPower = Power (Wc) / area (m^2) × 1000