FACULTÉ DES SCIENCES ET TECHNOLOGIES | Université de Lille

Strawberry Greenhouse Monitoring System

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CHAPTER 1

Project Baground

Introduction

The world's climate is changing rapidly, and this will continue to do so in the future which means new risks for food and agriculture.

https://th.bing.com/th/id/OIP.sA2Y7f1OFhWEEG5DrdPpIgAAAA?rs=1&pid=ImgDetMain
https://agrointel.ro/wp-content/uploads/2022/08/seceta-agricultura-porumb.jpg

IoT in Agriculture

In the agricultural world, IOT solutions take the form of sensors connected to the Internet to collect environmental and mechanical measurements.

https://s3-us-west-2.amazonaws.com/aa.techdemand.io/wp-content/uploads/2022/02/14184734/IoT-in-Agriculture-1024x631.jpg

Benefits of IOT in Agriculture

- Increase productivity and the quality of the product.
- Increases profits / incomes and reduces significantly the costs
- Having access promptly to exact accurate data helps in increasing the efficiency level in the use of water , pesticides, and fertilizers amounts managements.

Project’s idea

1. Temperature Control
   - Maintaining optimal temperature for growth (15-25°C)
2. Humidity Management
   - Need for high humidity (60-80%) for optimal growth
3. Light Requirements
   - Sufficient light intensity and duration (10-14 hours daily)
4. Pest and Disease Control
   - Monitoring and managing common pests (e.g., spider mites)
5. Nutrient Supply
   - Ensuring balanced nutrient supply through soil or hydroponics
6. Watering Systems
   - Efficient irrigation systems (drip irrigation, hydroponics)

CHAPTER 2

Hardware Component

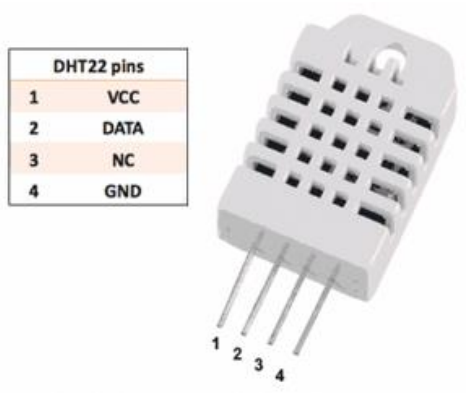
Hardware Components

Our prject depends on IOT technology using ESP32 as a microcontroller and a set of sensors.

ESP 32 [1]

It is a microcontroller board That receives inputs from many sensors and turn it into outputs to control a system.

DHT 22 [2]



It mesures temperature and humidity.

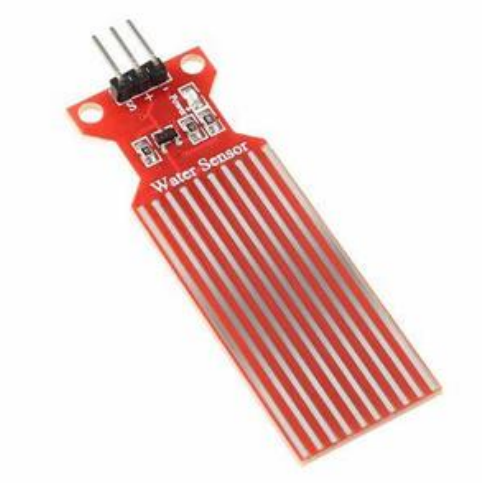
SoiL Moisture Sensor [3]

It mesures the scale of the water in the soil

[1] https://www.orient.lv/wp-content/uploads/2020/11/v_nodemcu_esp_wroom32_bt_wifi-600x600.jpg
[2] http://akademia.nettigo.pl/dht22/
[3] https://th.bing.com/th/id/OIP.gjFeVvS2yNaeRqQbCzaVpgHaHa?w=600&h=600&rs=1&pid=ImgDetMain

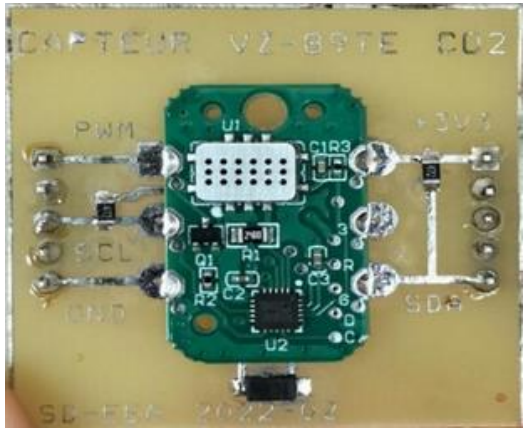
Hardware Components

Water Level Sensor [1]



It measures the water level

Carbone Dioxyde Sensor



It mesures the amount of CO2 in the desired area.

Light Sensor

It is used to detect the light radiation

[1] https://th.bing.com/th/id/OIP._IW9W86BkuvLh5mhcAAHBQAAAA?rs=1&pid=ImgDetMain

CHAPTER 3

Design & Fabrication

KiCad Overwiew

An open-source software suite for electronic design automation (EDA).

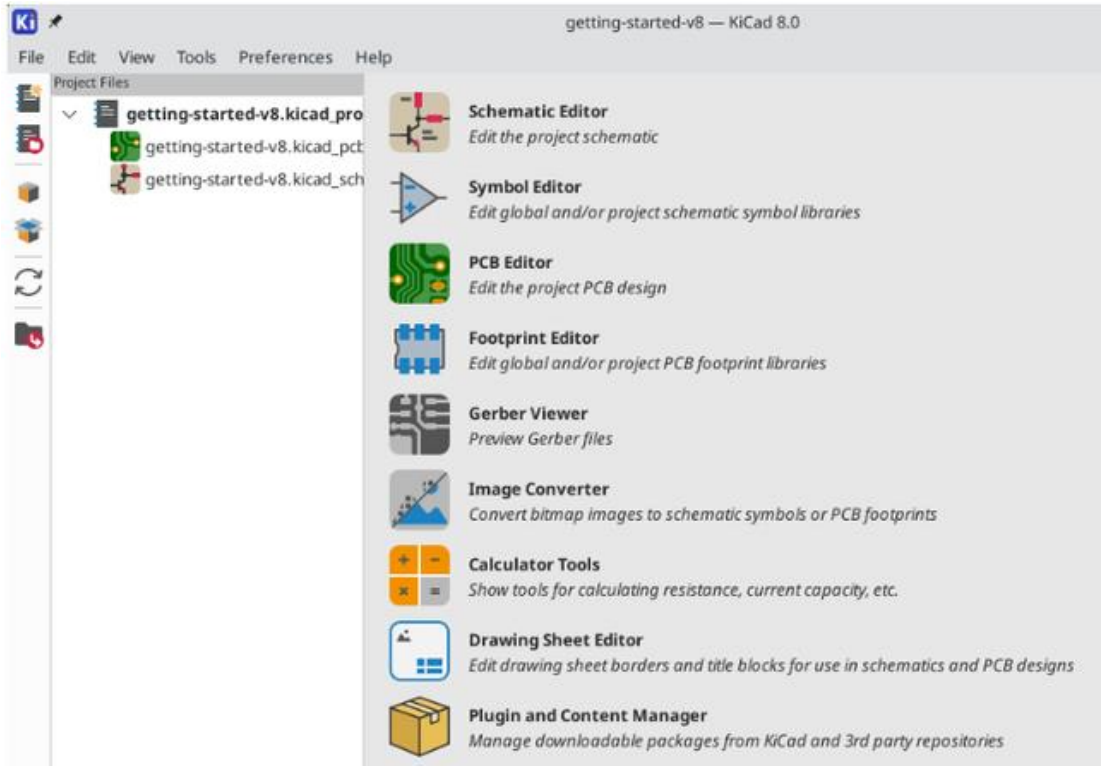
Key Features:

Schematic Capture: Create and edit electronic circuit diagrams.

PCB Editor: Design and layout printed circuit boards (PCBs) with multiple layers.

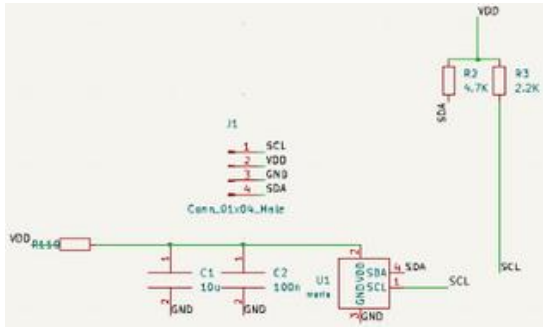
3D Viewer: Visualize PCB designs in 3D for better understanding and error checking.

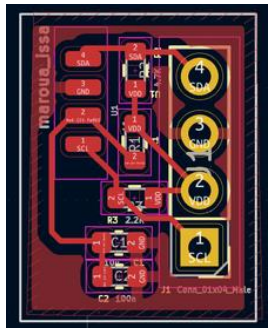
Component Libraries: Extensive libraries for components, footprints, and symbols.



Light Sensor design and Fabrication

Using KiCad to do design the PCB to put the sensor



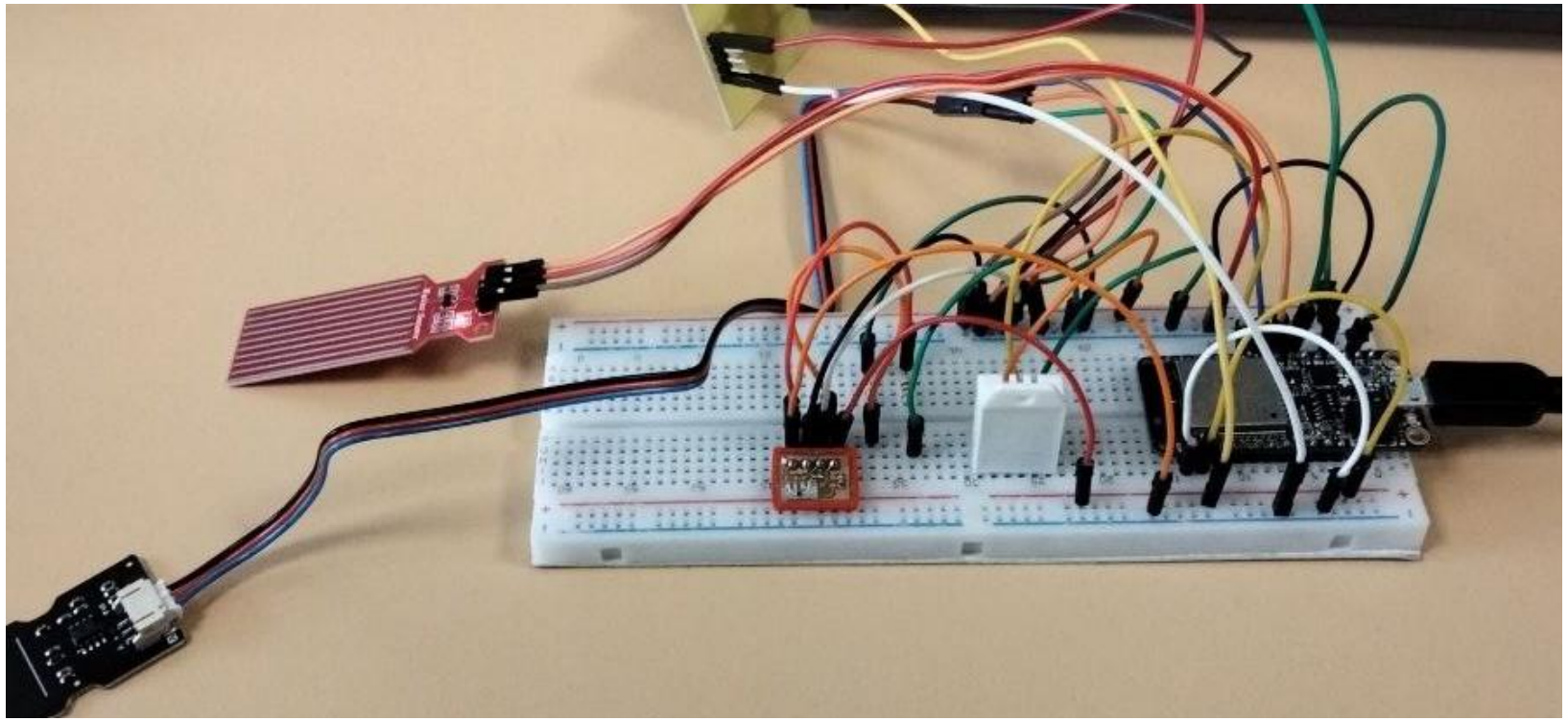


Fabrication of the PCB using PhotoLaser machine

https://fr.rs-online.com/web/p/capteurs-de-couleurs-et-lumieres/1226791

Wiring

Using breadboard to connect all the sensors to ESP32



Programmation

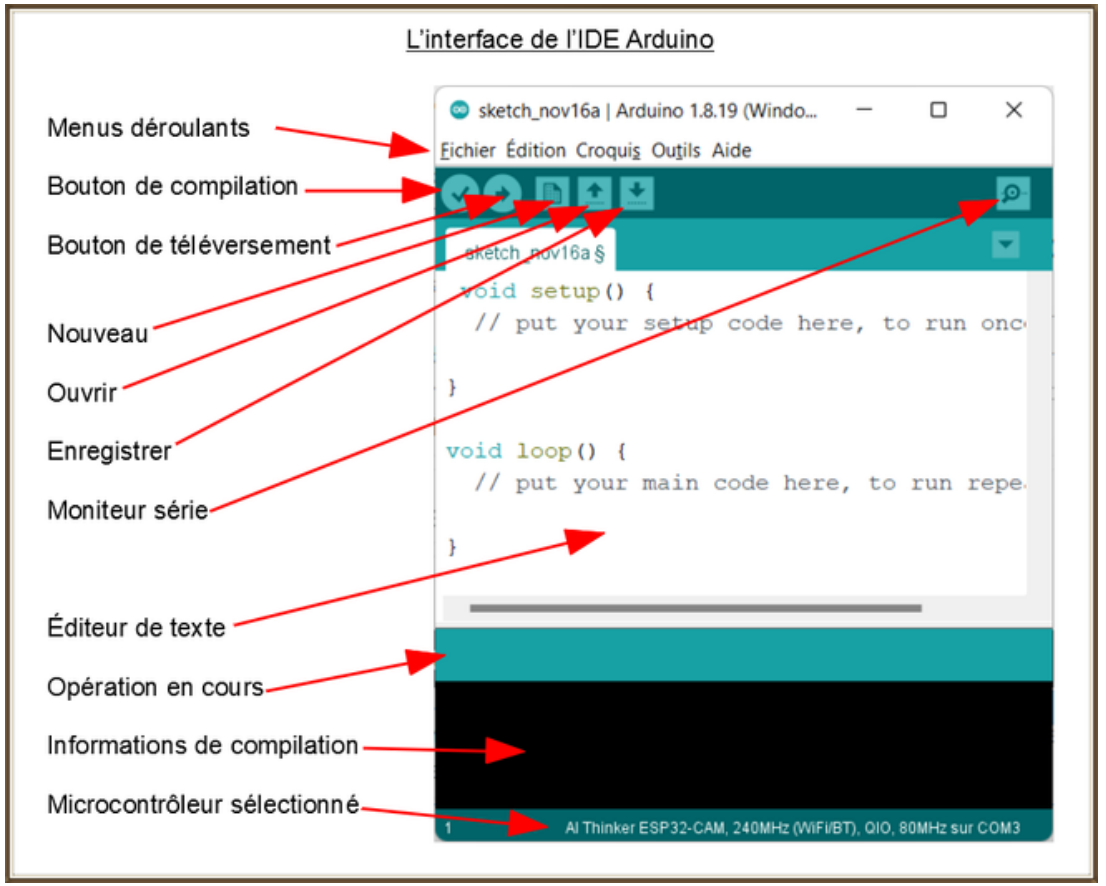
Arduino IDE

- Libraries definitions
- WiFi and ThingsBoard Configuration
- Pin Definitions
- Setup Function:

Initializes serial communication; Sets up sensors; Connects to WiFi and ThingsBoard.

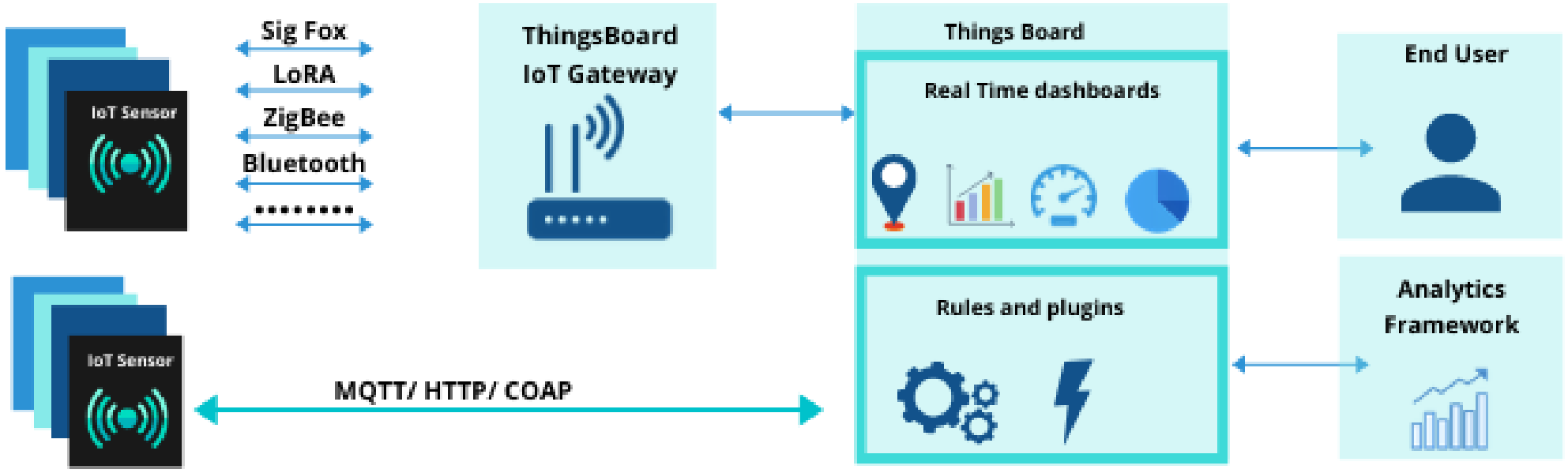
- Loop Function:

Reads sensor data:Temperature and humidity from DHT22; CO2 levels, water level, light intensity, and soil moisture.



Connection with Thingsboard

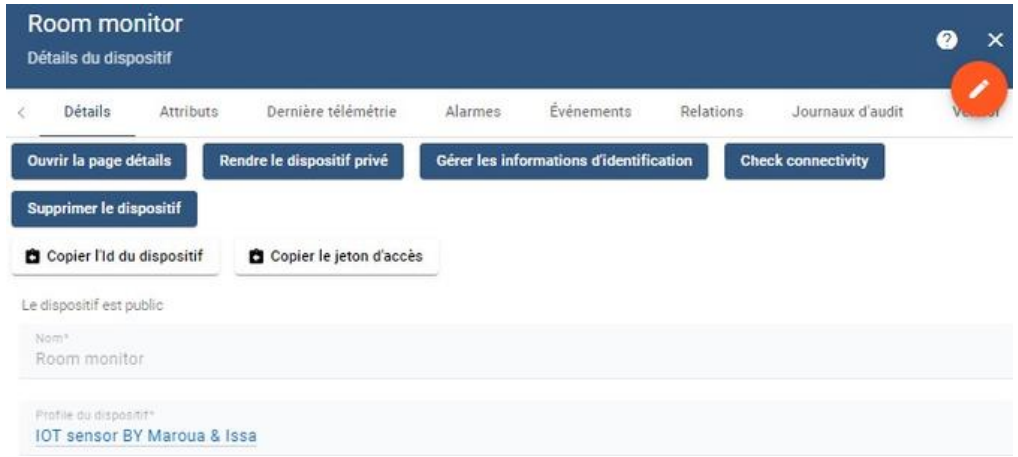
Thingsboard principles



https://thingsboard.io/

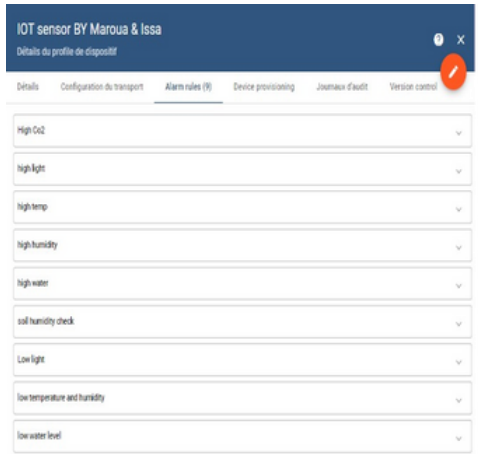
Device definition

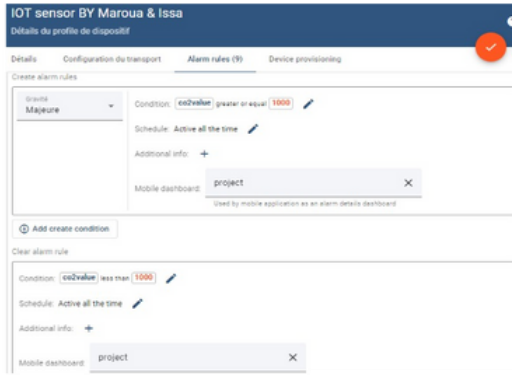
We create a device which will be associated to the hardware to show the sensors result



Alarms setup

In the alarm rules, we use the device profil and write the conditions that must be respected





User dashboard

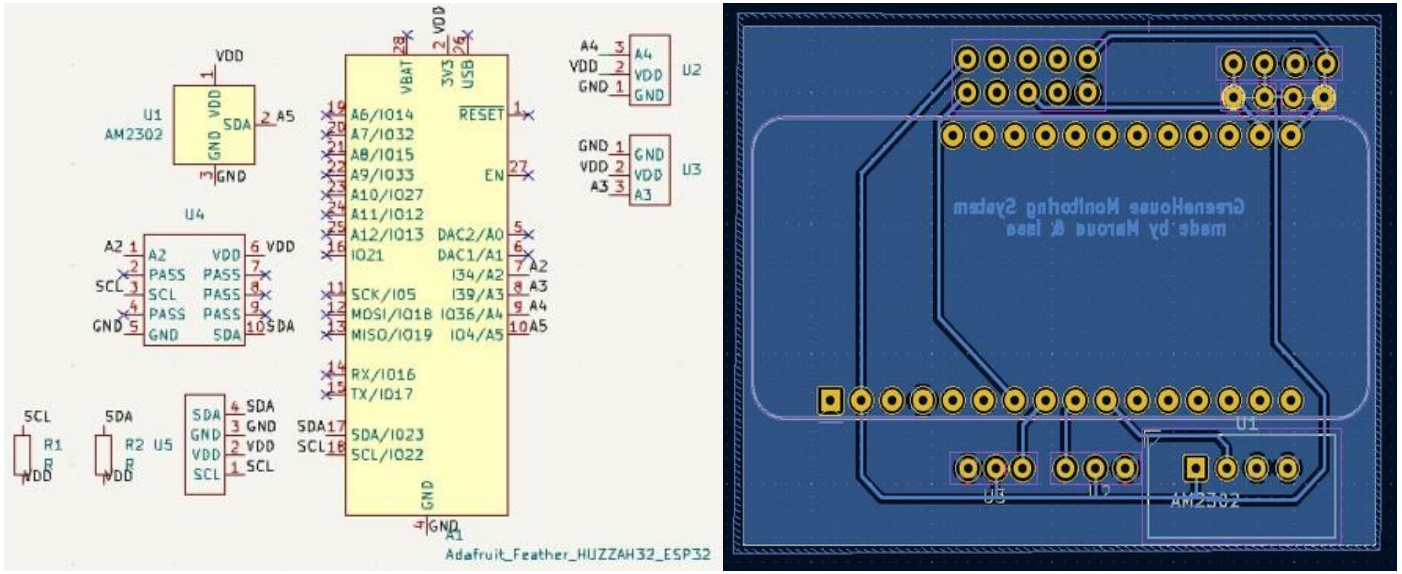
Real time data widgets

Heure de création	Source	Type	Gravité
2024-05-01 16:34:07	ISSA TEST	low water level	Critique
2024-05-01 16:25:08	ISSA TEST	high light	Critique
2024-05-01 16:19:16	ISSA TEST	high temp	Critique
2024-05-01 13:15:44	ISSA TEST	high humidity	Critique
2024-05-01 13:06:08	ISSA TEST	High Co2	Majeure

Alarms widget

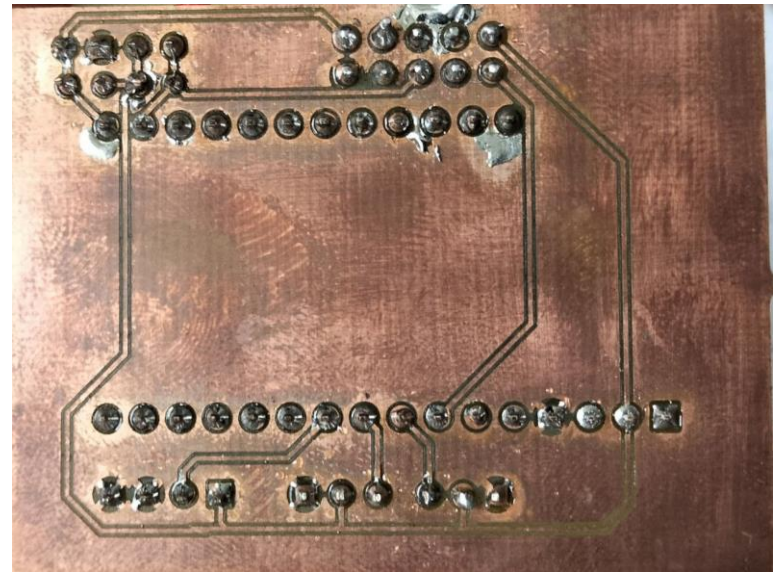
The PCB of the project

From Design to Fabrication



51 cm

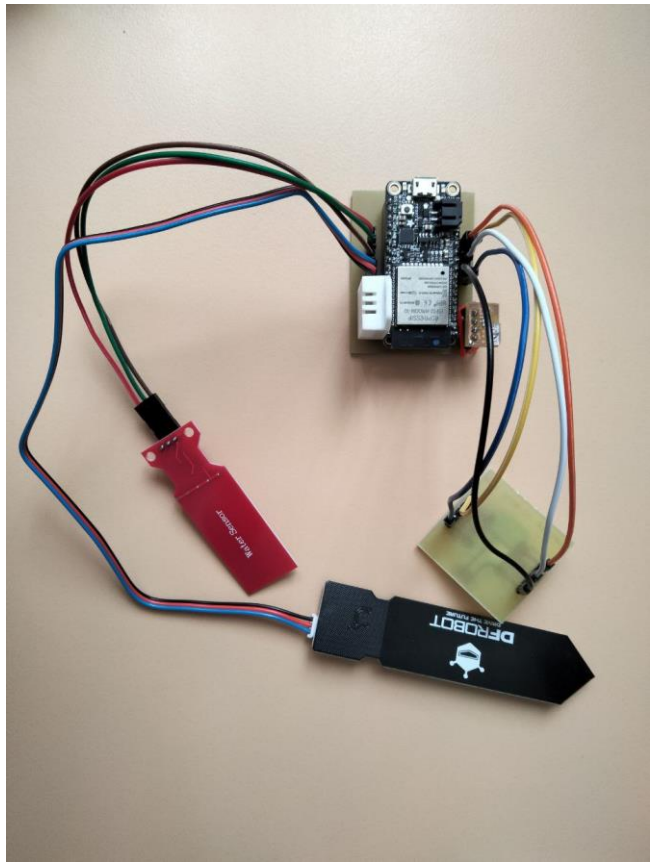
39 cm



Electronic schematic and PCB design

Fabricated PCB

Final Project



Conclusion and Perspectibves

With IOT SYSTEM WE CAN:

- SAVE THE WORLD
- INCREASE PRODUCTION PERFORMANCE
- HAVE A REAL TIME CONTROL