An Najah National University

Faculty Of Engineering And Information Technology

Computer Engineering Department

Auto-Farm

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Acknowledgements

“

First, Thank for Dr. Mohannad AL-Jabi, who helped us when we needed him, give us useful advice to complete the project in the best way ,

thank the Department of Computer Engineering, whose doors were open to students.

Finally, we do not forget our parents who helped us get here to complete our educational journey.

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Disclaimer

Students from An-Najah National University's Faculty of Engineering's Computer Engineering Department wrote this study. It may have grammatical and content mistakes because it has not been amended or corrected, save from editorial adjustments, as a consequence of the assessment. The opinions expressed in it, along with any conclusions and advice, are all purely the students'. An-Najah National University disclaims all liability and responsibility for the results of using this study for purposes other than those for which it was commissioned.

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Chapter 1

Abstract

Plants are one of the most important foundations of life, and certainly agricultural crops are consumed in every home, and the population is increasing, so surely there must be an increase and attention to agriculture, and with the progress of science and technology, why not make this technology help us in developing and improving agriculture?
Therefore, we decided to create a new system aimed at increasing production and taking care of it from a distance, without the need for anyone to come and take care of this crop in terms of examining the soil, moisture and irrigation, so the plant is irrigated in appropriate quantities, and certainly in terms of security such as fire, in the event of its occurrence, identifying it and preventing it, certainly this system It will facilitate agricultural matters and can be used at home for its simplicity, and it will save people the effort of irrigation and interest in the crop, and it will provide security and protection from a distance
We will design a farm using several plants, and we will use several sensors to do all the required tasks, such as a sensor for measuring humidity to control irrigation, a sensor for sensing fire or sensing heat to control water sprinklers to extinguish fire and prevent its spread, and it will be designed in a modern way and add additional features to achieve an ideal environment for crop growth
There is such a project, but we will try to implement it in a distinctive way and add additional features.

locally there is no similar project but globally there are similar projects but they don't have a system to call the water truck for water supply, in addition to the process of adding fertilizer automatically.

Chapter 2

Introduction

Background

Plants are an essential element for food, the environment and their beauty in general, so it is our duty to take care of them and create systems that help us with that from a distance, and monitor their conditions.

Problem Statement

The main problem is that the farmer does not have time at all times to go to the farm and check the conditions, and the automatic system solves this problem.

Purpose

This system will provide an easy solution for farmers to take care of their farms from a distance, and certainly provide protection for them and organize operations in terms of irrigation, checking humidity, rain times, and when anyone passes in front of the farm gate and others.

Objectives & Scope

Since this is a model project, you can use the mobile application and web to have a look to all the dashboard content that was read from the communication between the hardware components and cloud .

The system can do following :

1. Read the values of soil moisture , temperature , humidity , water level percentage , light intensity, notify the user when it starts raining ,and notify the owner if someone is has walked by the door it will give the motion when detected and when it ended in sec, fire alarm and water to stop it.
2. Control water pump , garage door ,Lights ..
3. All the hardware components can be controlled automatically .
4. Send a message to the owner in some situations like having someone in the farm.
5. Lights turn on automatically if it becomes night

Report Organization

- In the next chapter **(Constraints & Earlier Coursework)** , we will discuss what diffi- culties we faced in our project and how we were able to overcome them, in addition to the courses that helped us in this project.
- In the fourth chapter **(Literature Review)** , we will review some of the works and projects similar to ours and how our project differs from these projects.
- In the fifth chapter **(Methodology)** , we will discuss in detail the system process and what hardware components we used , how we connect these components and how it works, in addition to how we make communication between components and the application that control the system.
- The sixth chapter **(Results & Discussion)** is talk about the project results and what is the expected from project.
- In the final chapter **(Conclusion)** , we will briefly discuss the most important things that went through the project and what we learned from it, in addition to some recommendations that may be developed to be implemented in the future.

Chapter 3

Constraints & Earlier Coursework

Constraints & Limitations

On our way to accomplish this project, we faced many difficulties
The most important of these constraints are the following :

- Several sensors performed poorly because they provided inaccurate data.
- selecting the project's requirements and creating a scenario that the project will use.

  • Since we had to wait days for the merchants to have what we needed in stock, several parts took longer than anticipated to come from the supplier.

  • The project's weight; we had a tough time finding a spot to work on it because the design was cumbersome and difficult to move.

  • The high cost of some equipment, as we frequently had to purchase it rather than waiting to purchase it at a fair price.

- • We had problem working at university because of the internet that was used in ESP.

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Standards

We used some common ready-made techniques in our project to make the work easier :

- After connecting the boards, we upload the code using the Arduino IDE, a compiler.
- We use Serial Communication between ESP and Arduino.
- We use Arduino IoT Cloud = mobile application to control the system, and web view .

Earlier Coursework

There are many courses in the of Computer Engineering Department that we benefited from in our project
some examples :

- Microcontroller projects , Digital lab , PIC Lab, and CPU lab which helped us understand how to connect the components .
- Online videos.

Chapter 4

Literature Review

Auto-Farm is a new system that attempts to keep the owner in touch with his garden constantly and carry out necessary duties without requiring personal attendance. It's not the first project aimed at controlling home gardens remotely, are many projects similar to it that have been developed previously :

1. **Smart Indoor Farming System** :
   This project is being carried out as a capstone project at An-Najah National University. It includes a number of sensors, including those for temperature, soil moisture, fan, and light intensity.

2. **Smart Garden Monitoring and Control System with Sensor Technology** (Conference: 2021
   This project, which is part of the 3rd International Conference on Signal Processing and Communication (ICPSC), also includes temperature and humidity sensors, soil moisture sensors, a driver, a DC motor, and a fan.

In our project we explored the obstacles and problems that were in the previous projects and tried to improve them.

Chapter 5

Methodology

In this chapter we will discuss in detail the system process and what hardware components we used, how we connect these components , to how we make communication between components and the application that control the system.

Hardware Components

In this section we are going to show how the hardware components .

ESP32 Microcontroller

The ESP32 line of low-cost, low-power system on a chip microcontrollers includes built-in antenna switches, RF baluns, power amplifiers, low-noise receive amplifiers, and power-management modules. It also includes integrated Wi-Fi and dual-mode Bluetooth.

We choose ESP32 in our system because it has a built-in Wi-Fi module so it can be controlled from any place in the world and send the data to the cloud.

But we faced problem in using it at university because of the internet.

Figure 5.1: ESP32 Microcontroller

Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

We used it because it contain enough Pins for all sensors that we used in our project, and easy to connect and deal with it.

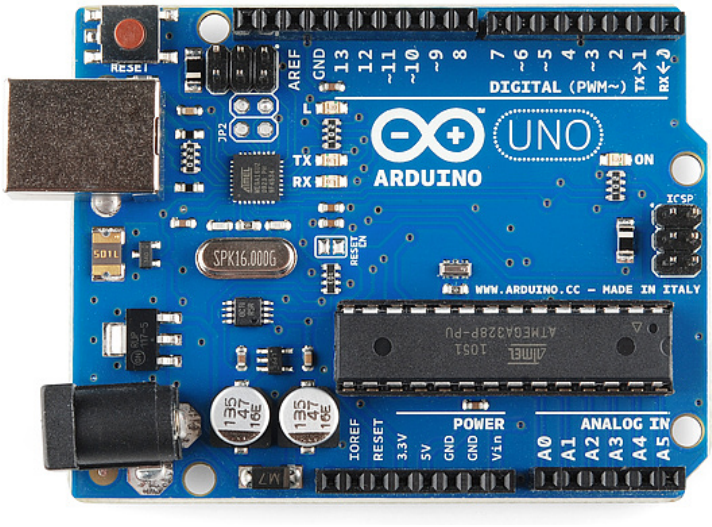


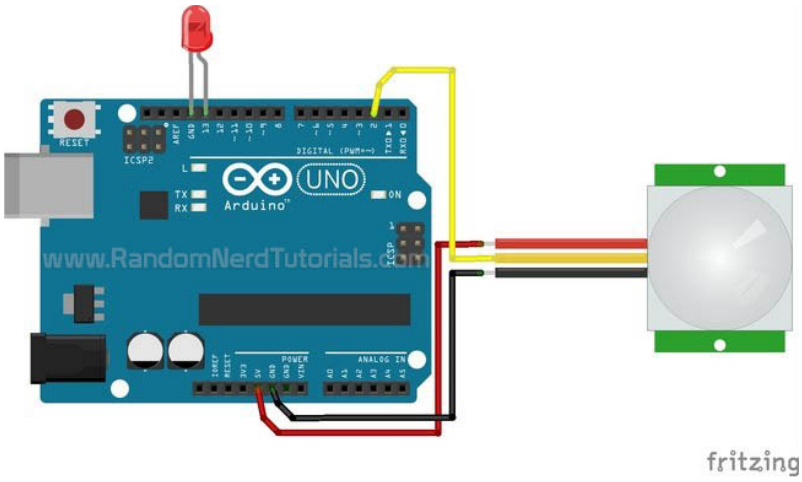
Figure . Arduino

HC-SR501 PIR Motion Sensor Driver Module

The HC-SR501 auto-senses light in various applications (in house, basement, outdoor, warehouse, garage, etc,)

It used to notify if anyone cross the garage door

Figure 5.2: HC-SR501 PIR Motion Sensor



DHT Sensor

DHT sensor is basically used for measuring the temperature & humidity.

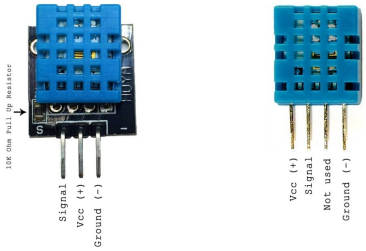


Figure 5.3: DHT11 Sensor

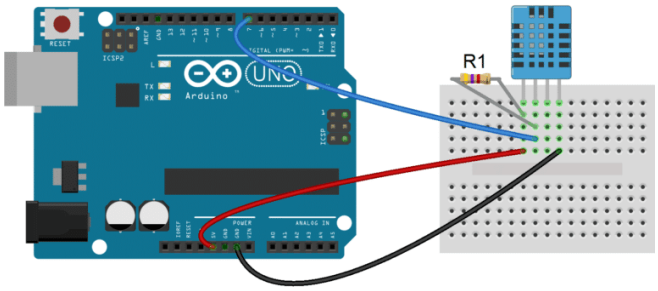


Figure 5.4.: DHT11 Sensor Connection

Raindrop Sensor

Raindrop sensor is basically a board on which nickel is coated in the form of lines.

Figure 5.5: Raindrop Sensor

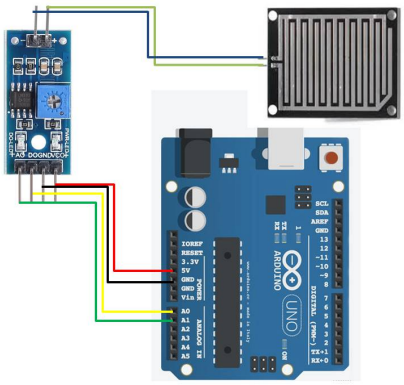


Figure 5.6: Raindrop Sensor Connection

Soil Moisture Sensor

Soil Moisture sensor measures the volumetric content of water inside the soil and gives us the moisture level as output.

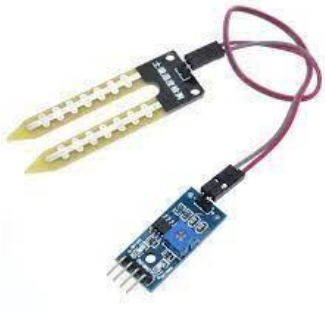


Figure 5.7: Soil Moisture Sensor

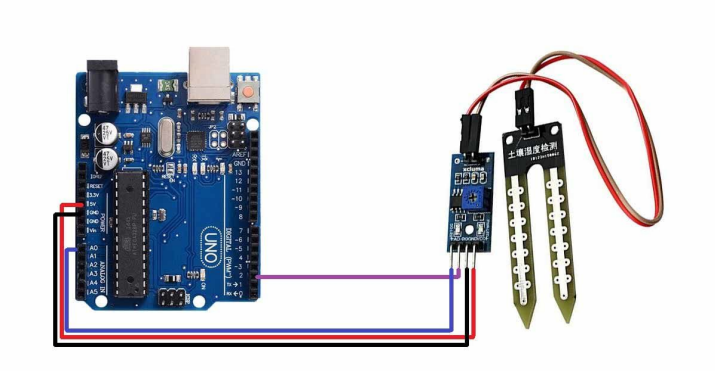


Figure 5.8: Soil Moisture Connection

LDR Sensor

LDR sensor is used to measure the light on the planets .

Figure 5.9: LDR Sensor

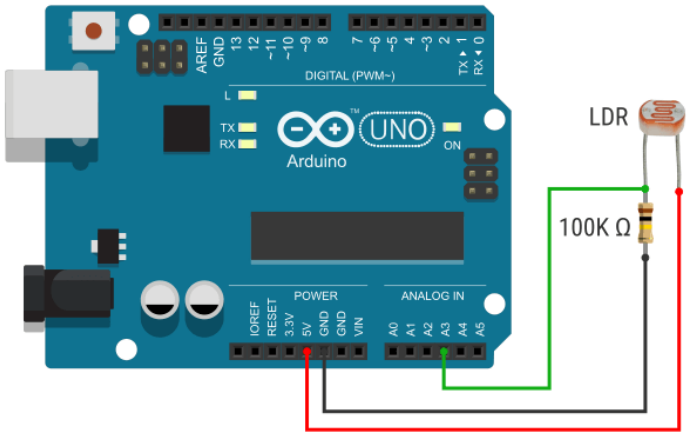


Figure : LDR Sensor connection

Water Pump

Our system contains a water tank and inside it there is a water pump also with a water level sensor. 1. First Water pump simply pulls the water from the water tank and water the plants using the plastic tube.

2. Our System got fire detection Sensor, and we used the pump to stop and detected fire.

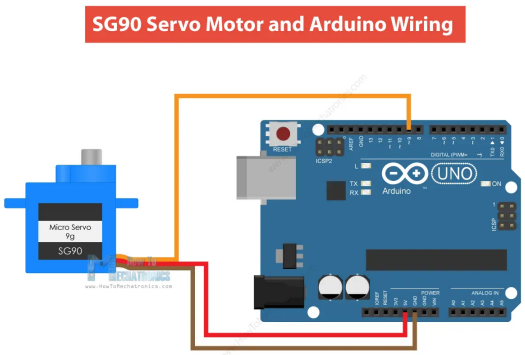
Figure 5.10: Mini Water Pump

Servo Motor

A servo motor is a type of motor that can rotate with great precision.

Our system use servo motor for opening and closing the garage door .

Figure 5.11: Servo Motor



Water Level Sensor

The water level sensor is a device that measures the liquid level in a fixed container that is too high or too low.

Figure 5.13: Water level sensor

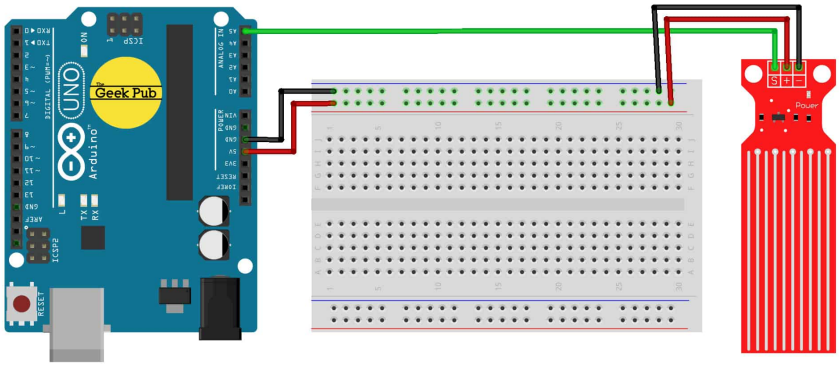
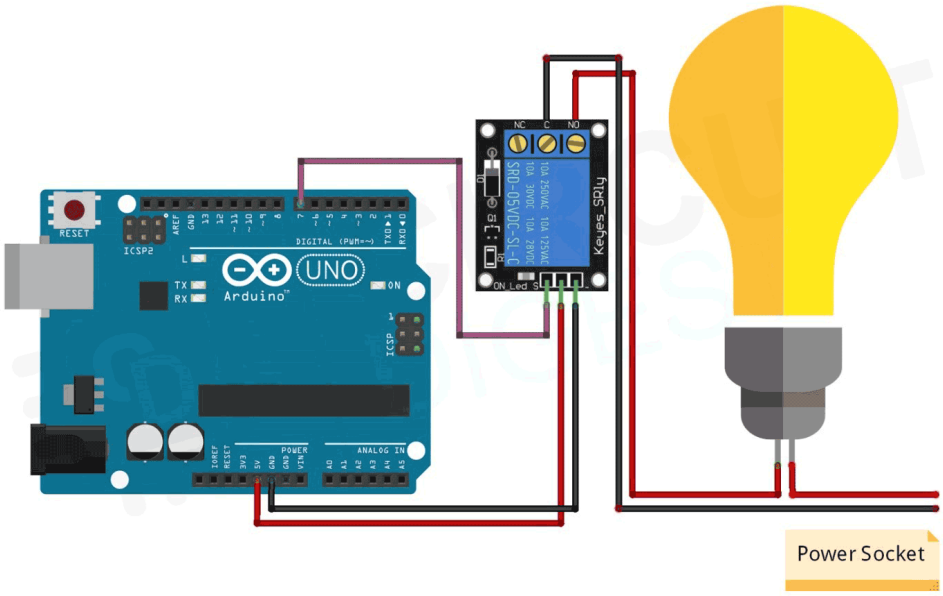


Figure 5.14: Water level sensor connection

Light Bulb

Used to be light when it is night.



- **Flame Sensor fire detection module**

Figure: Fire sensor

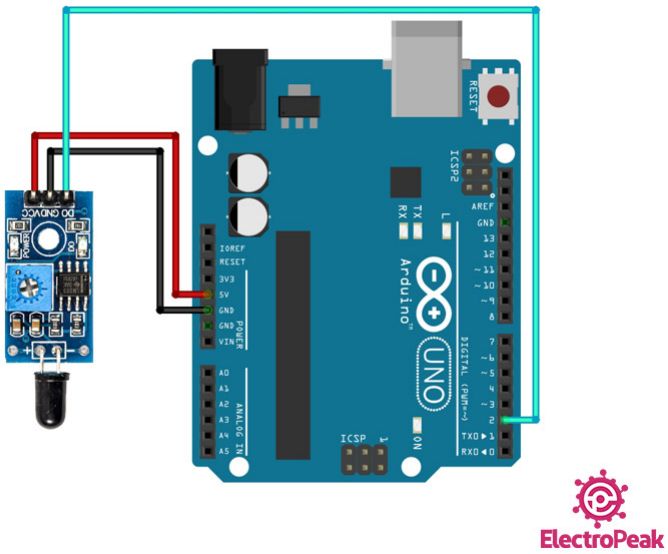


Figure: Fire sensor connection

- KY-022 INFRARED SENSOR

It will control the garage door using the remote.

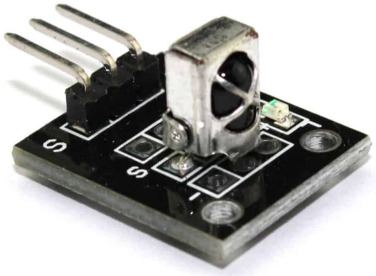


Figure: IR Sensor

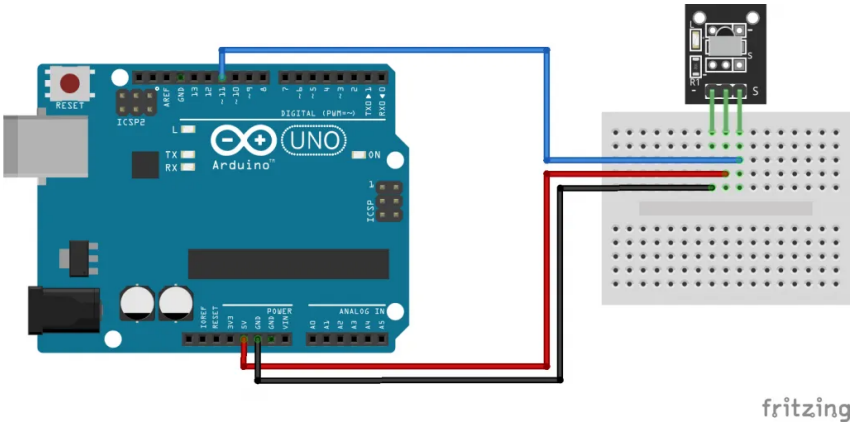


Figure: IR connection

- **Relay**

  It takes a signal from Arduino and connect the electrical circuit, we Used Relay to turn on the light and the water bump.

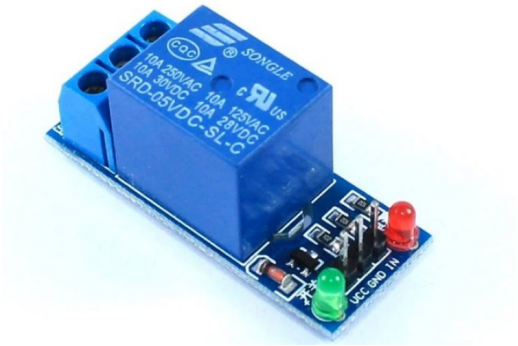


Figure: Relay

System Design

Basically Auto-Farm

This system is designed to make it easier for the farm owner to take care of it and monitor its condition remotely.

In the beginning, we cared about safety, by notifying the owner in the event of anyone entering from the gate of the farm,

and setting a sensor in the event of a fire, which will activate the withdrawal of water from the tank that is certainly

separate from the irrigation tank, and spray the entire area with water.

Certainly, we examine the moisture and temperature of the soil in particular, and in the event of a shortage in it, the

withdrawal of water from the other tank will be activated, and the crops will be irrigated.

When night falls, the farm will be light automatically.

Of course, we will check the rain conditions, as if it rains, the system will stop irrigation

- Water Level Sensor.
- Soil Moisture Sensor.
- Raindrop Sensor.
- LDR Sensor.
- DHT Sensor
- Water Pump.
- Servo Motor (used for garage).
- Light Bulbs.
- IR Sensor
- Relay
- Flame Detection Sensor

. HC-SR501 PIR Motion Sensor Module

And all sensors are connected on the Arduino and we take all the reads to ESP, and we can control them manually , and the reads will be shown to the user via the mobile application and WebSite.

Software

Our system can easily be controlled from a web and mobile application.The application is user friendly and easy to use.

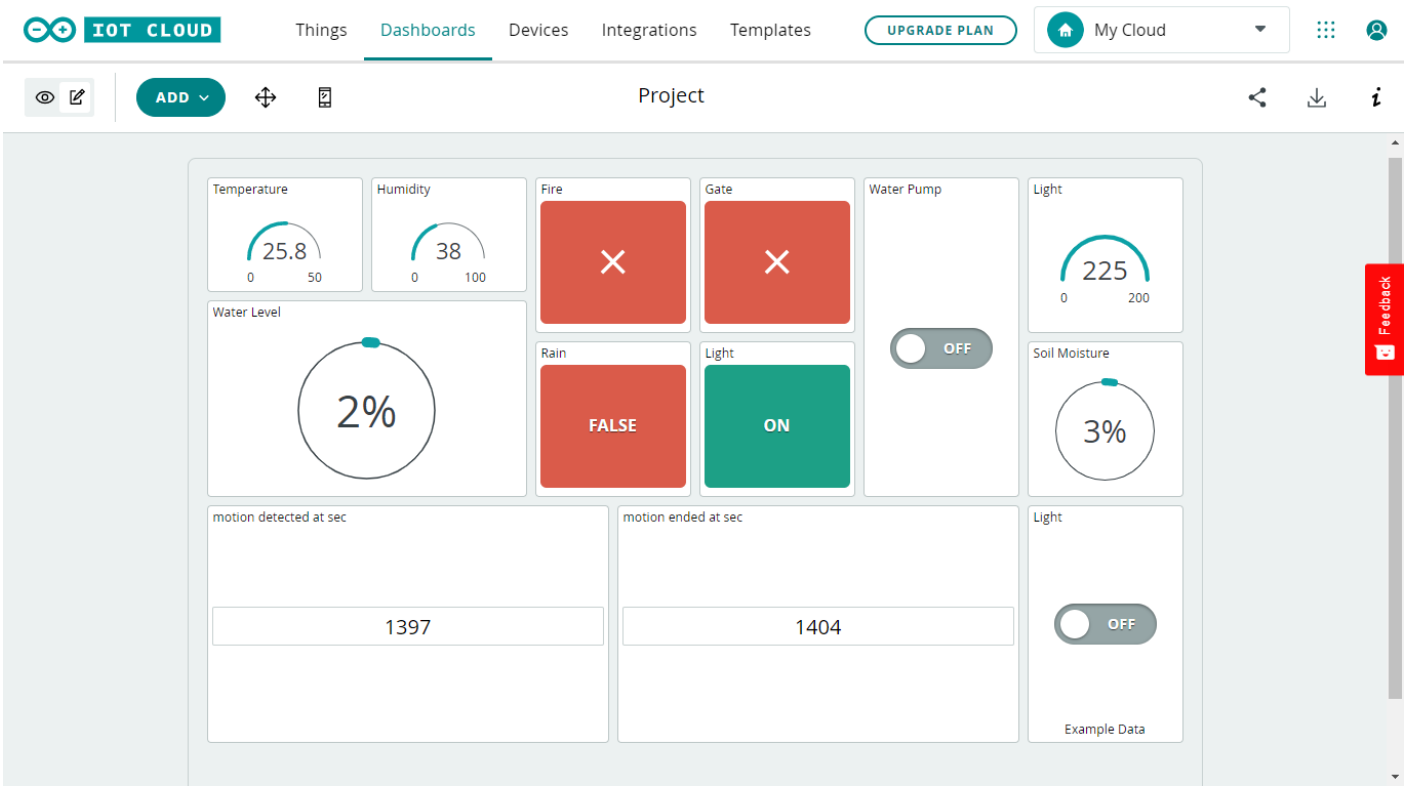
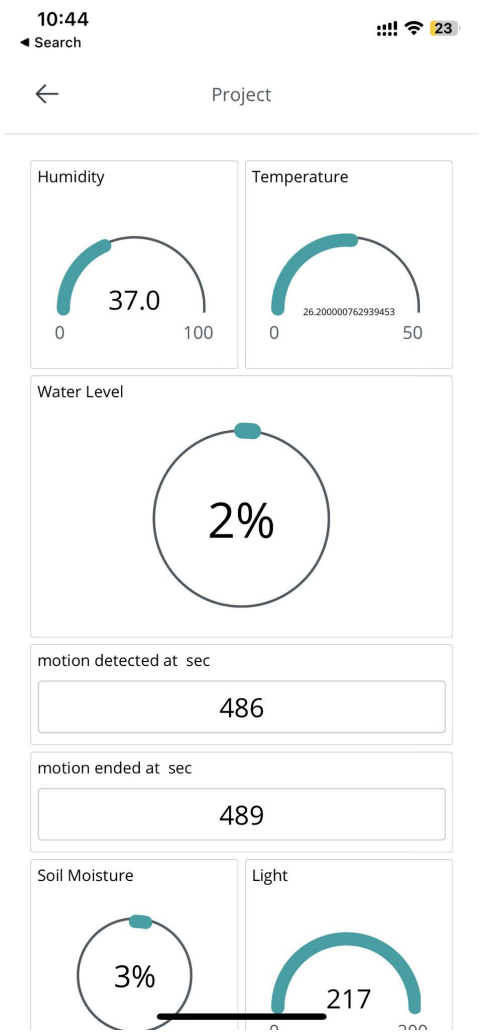
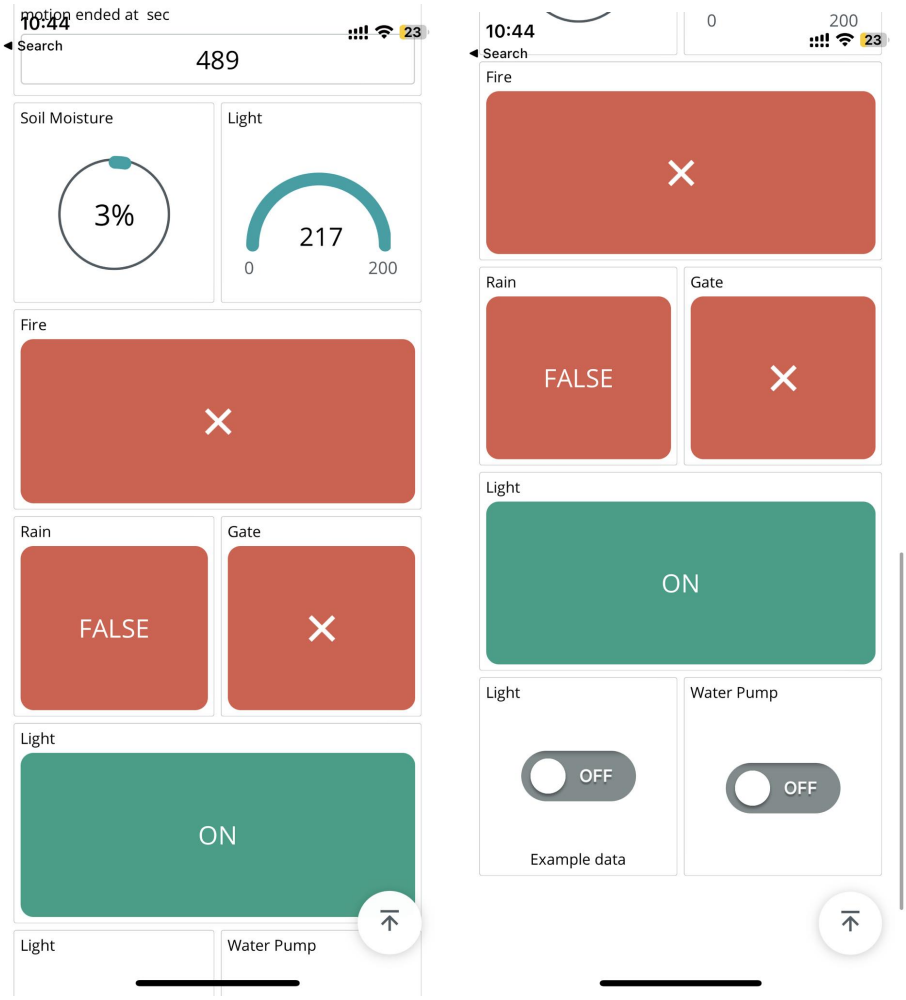


Figure 5.20: Web View


10:44
Search
23
Project
Humidity
37.0
0
100
Temperature
26.200000762939453
0
50
Water Level
2%
motion detected at sec
486
motion ended at sec
489
Soil Moisture
3%
Light
217

(a) label 1



(b) label 2

(c) label 3

Figure 5.21: Mobile View

Communication between ESP and Arduino

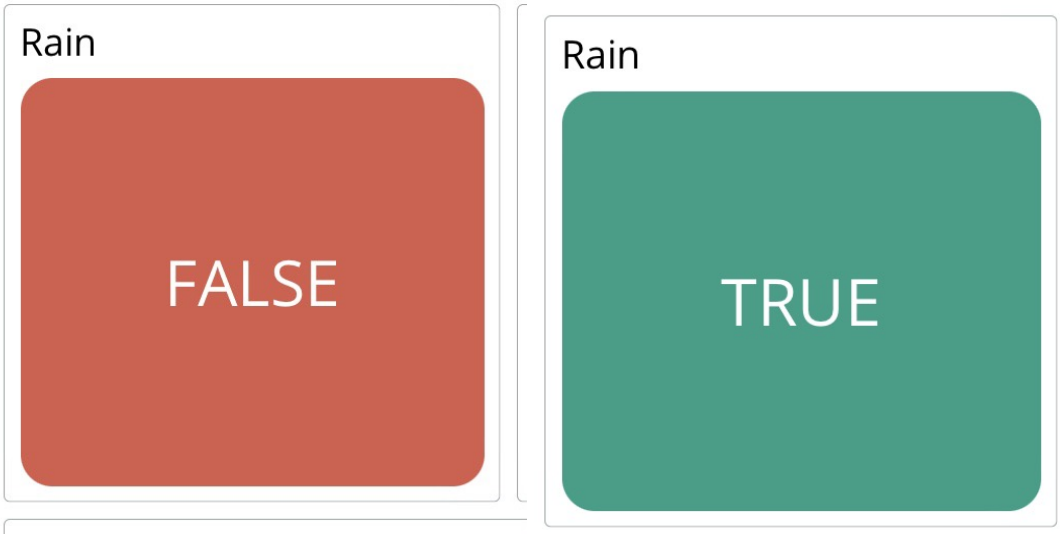
We have serial communication Rx for ESP to Tx for Arduino
Tx for ESP to Rx for Arduino
Data will be received by ESP in this way , then the we will control the data that we got from ESP and show the data in the application .

```
Data1 = 2
Data2 = notraining
Data3 = closed
Data4 = 228
Data5 = nofire
Data6 = 3
Data7 = 24.80
Data8 = 41.00
Data9 = 38
Data10 = 44
Data11 = light
=====================================================
Data1 = 2
Data2 = notraining
Data3 = closed
Data4 = 233
Data5 = nofire
Data6 = 3
Data7 = 24.80
```

Newline 9600 baud SEND

Raining Process

We add a rain sensor that reading and notify if there is rain or not, Notification is appear in the application like this :



(a) Not Raining (b) Raining

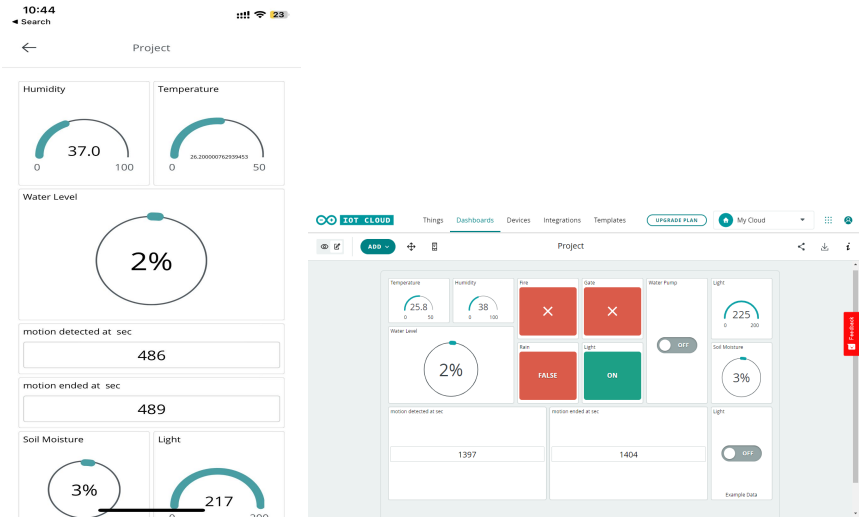
Figure 5.26: Rain Status in Application

Chapter 6

Results & Discussion

In this chapter we will talk about the project results and what is the expected from project.The final produced project is a smart auto farm

As a result, we made a web/mobile application that show all sensors values like temperature, humidity, water level, rain status, soil moisture, and motion detection, fire detection , light intensity , in addition to control components like water pump, lights, garden gate.



(a) Mobile View (b) Web View

Figure 6.1: Application View

Chapter 7

Conclusion

Summary

In the end, We have created a system to take care of the farm automatically in many respects and safely, and I expect that we have succeeded in that and in achieving the expected results from this project

What did we learn ?

Of course, we learned many important things in this project, the most important of which is how to deal with the different sensors and read and follow the instructions to avoid burning or experimenting with any of the pieces.
And we learned on Arduino, how to connect the pieces using it, and how to write the control codes.
We learned to take the data from the sensors and use them for the mobile application and the web, and help us to automatically control the system

Recommendation

To improve our system maybe we can add a raspberry pi , maybe to see if the plants are still alive- Or useful-.
We suggest also to add a camera and using AI algorithm to do more jobs.

Future Work

We hope we can add more functionalities to this project, Perhaps creating a complete environmental agricultural system that helps encourage agriculture and raise the level of crops, due to its ease of use and its many advantages.

Chapter 8

References

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