Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology, Baramati
Department of Electronics and Telecommunication Engineering (AY 2022-23)

A PROJECT PRESENTATION
on

Use of Digital Technology For Micro Irrigation System To Improve Water Efficiency Of Irrigation Sector (Using IOT, ML and Cloud Computing) Group No. 25

Presented by

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Abstract

- India is an agricultural country and the majority of its population depends on it. Owing to global warming and the gradual depletion of natural resources, water resources should be used efficiently and precisely for farming.
- This project proposes to automate the tedious process by proposing an Internet Of Things based system for automatic smart drip irrigation and to decide whether to turn on or off the watering of the crop.
- Initialize by sensing the moisture values using sensors. The system will send those values to the cloud platform via IoT technology, which will be processed there
- The Machine Learning model on the cloud platform will decide the switching of the motor.
- and finally the decision will be sent back to the microcontroller to either turn on or off the motor
- This provides an efficient and long-term solution to this irrigation problem.

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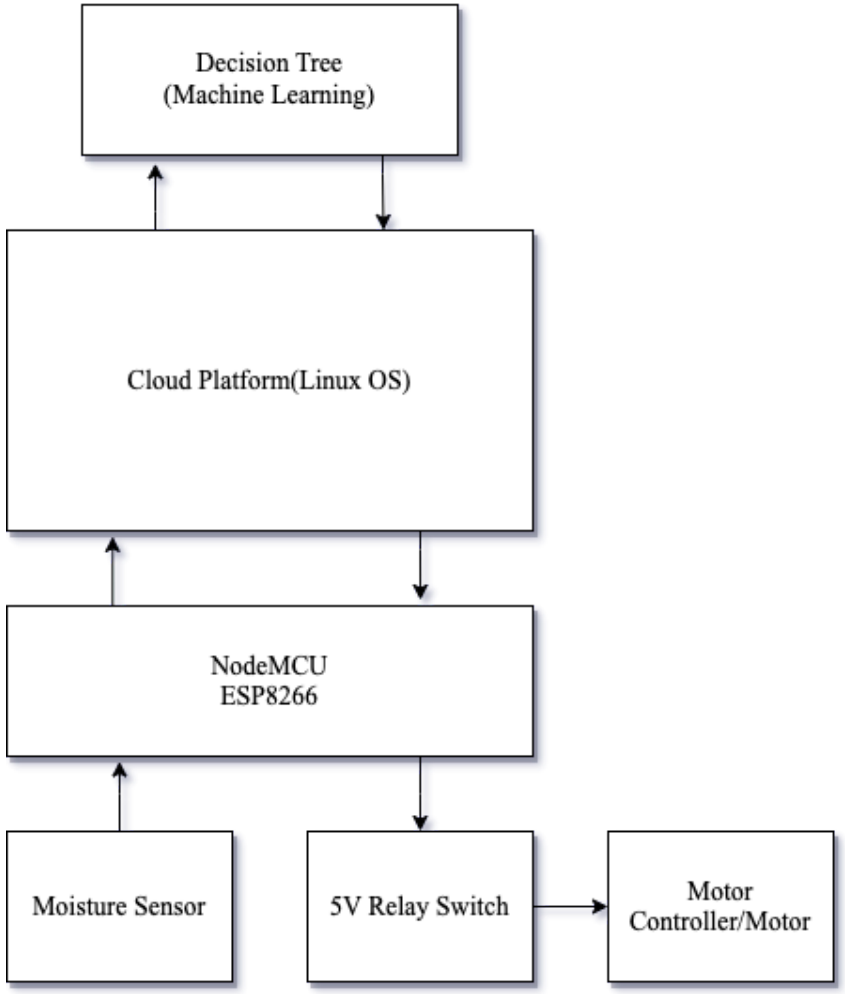
INTRODUCTION

- Traditionally, drip irrigation farming has been performed manually, which requires the farmer to be physically present in the field. In agriculture, the major problem faced by Indian farmers is water scarcity, which is becoming a critical issue. In addition, there are quite a few areas in our country that also face drought. To improve the usage of water, an accurate amount of water required by a particular crop must be provided only at the time it needs.
- This project proposes a “Automated Drip Irrigation System using ML, IoT and Cloud Computing”. Our Sensors will detect the moisture values from the soil and send them to the cloud platform using a NodeMCU ESP8266 microcontroller (which will be responsible for all the communication and controlling actions) unit and from the cloud where we will run our Machine Learning algorithms to train our model and send the instructions back to the microcontroller and switching unit, which will be responsible for the switching of the watering motor as per the soil condition.

INTRODUCTION

Sensing the Moisture:

- Sensing the moisture values using FC-28 Hygrometer Moisture Sensor.
- Sending those values to the cloud platform using IoT via NodeMCU ESP8266
- Performing Machine Learning operation on that using Decision Tree model and creating output.
- Sending back decision to the microcontroller to either turn On or Off the motor in accordance with soil condition.



Aim

The Aim of this project is create a IoT, Cloud Computing based solution which should be able to not just monitor but also make decisions depending upon the sensed soil condition, To ultimately improve soil irrigation efficiency.

Objectives

- To create an advanced system that will sense the moisture level from soil and send it to the cloud platform.
- Design an effective Machine Learning model which should be able to make decision in terms of turning on or off the motor depending upon the soil conditions.
- Create an interactive IoT environment which should be able to communicate between hardware and cloud based software components
- Also, Create a web based control panel to control the switching action manually

Motivation

- Micro-irrigation systems are designed to deliver water directly to the roots of plants using low-pressure, low-volume irrigation methods

- These systems are highly efficient, and have been shown to significantly reduce water use in agricultural and landscaping applications.

- Despite the many advantages of micro-irrigation systems, there is still room for improvement in terms of automation and smartness

- The micro-irrigation system is efficient but lacks in terms of deciding the right amount of water or when to start and stop watering, making it completely manual, labor-based, and unsupervised.

Problem Statement

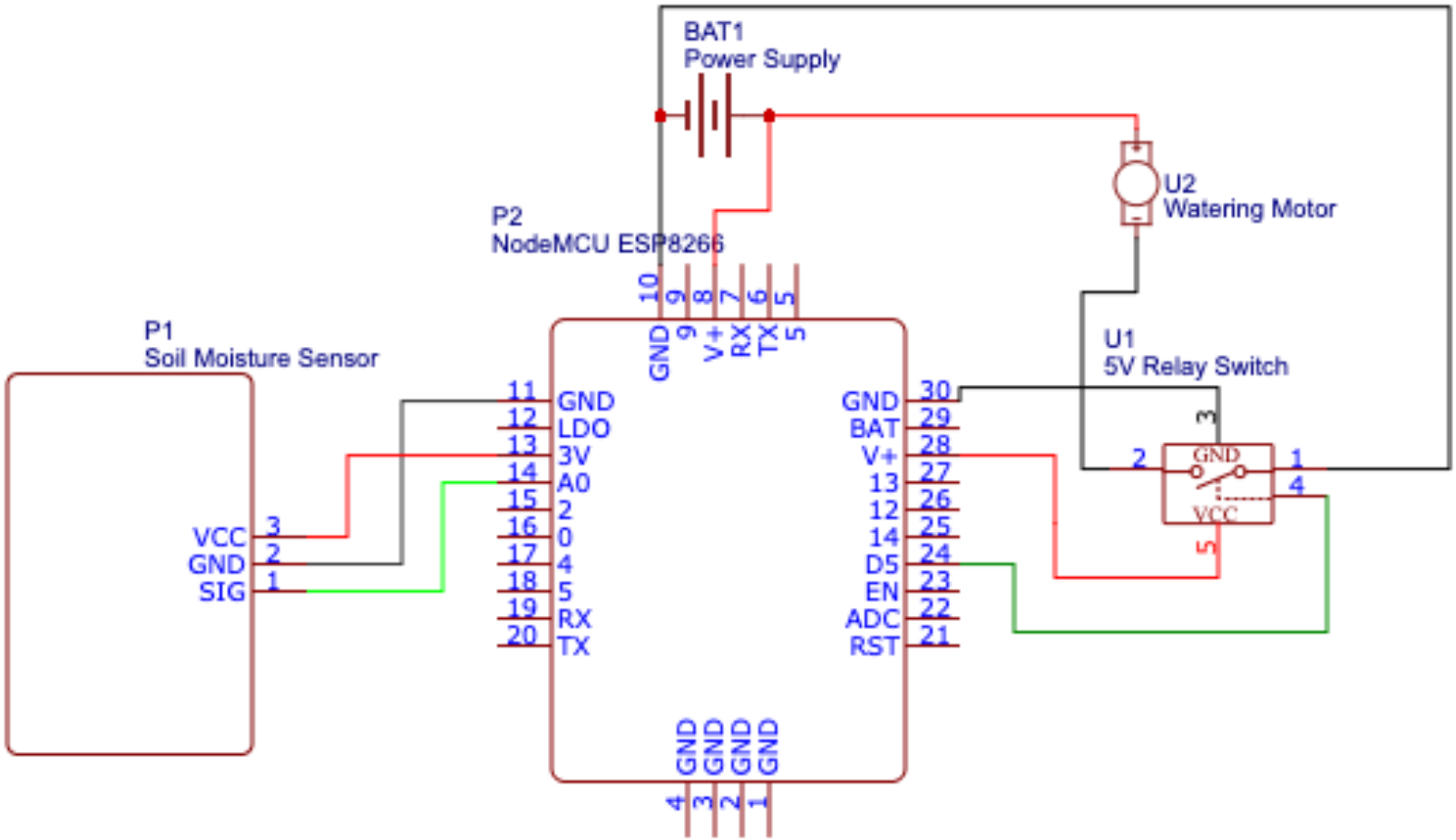
“Due to unsupervised use of the water in the irrigation not only the crops suffer from excess watering but also water sources undergo depletion nevertheless water gets wasted which may leads to the scarcity of water after a period of time. We are in need of a solution which can not only monitor and supervise the soil contents but also could suggest us when to stop and start the watering.”

Literature Survey

Sr. No	Research Paper Title and Publication Details	Authors	Methodology	Results/Conclusion & Discussion
1	*"Crop Water Requirement Prediction in Automated Drip Irrigation System using ML and IoT ,"* 2021 International Conference on Nascent Technologies in Engineering (ICNTE 2021)	Shilpa Chandra, Samiksha Bhilare, Mugdha Asgekar and Ramya R. B	Use of Arduino nano as micro controller with moisture sensor to sense the moisture and humidity values and send those values to the local computer using serial communication which will run machine learning algorithms.	It is observed that as the soil moisture increases the soil becomes more and more wet, Also very wet soil mostly lies between range of 28-42°C.
2	*"Automated Irrigation System-IoT Based Approach,"* 2018 3rd International Conference On Internet of Things: Smart Innovation and Usages (IoT-SIU), Bhimtal, 2018	D. Mishra, A. Khan, R. Tiwari and S. Upadhay	the author approached the IOT based path for automating the irrigation in the agriculture.	The IOT based approach was successfully able to automate the irrigational devices.
3	*"Practical machine learning based on cloud computing resources,"* AIP Conference Proceedings 2123, 020050 (2019)	Agavanakis, Kyriakos & Karpetas, George & Taylor, Michael & Pappa, Evangelia	the author stated the different ways and methods of implementing machine learning algorithms on cloud computing services.	As end result the proposed machine learning algorithms were successfully implemented on the cloud platform.

4	*"Machine Learning based soil moisture prediction for Internet of Things based Smart Irrigation System,"* 2019 5th International Conference on Signal Processing, Computing and Control (ISPCC), Solan, India, 2019	Singh, D. Sharma, A. Goap, S. Sehgal, A. K. Shukla and S. Kumar,	Use of Arduino nano as micro controller with moisture sensor to sense the moisture and humidity values and send those values using IOT.	Based on the moisture values the system is generating appropriate responses.
5	*"Smart drip irrigation system for sustainable agriculture,"* 2016 IEEE Technological Innovations in ICT for Agriculture and Rural Development (TIAR), Chennai, 2016	G. Kavianand, V. M. Nivas, R. Kiruthika and S. Lalitha	Use of microcontroller for controlling the drip watering system.	The microcontroller controls water flow of the drip system depending upon the moisture values.
6	*"Affordable Smart Farming Using IoT and Machine Learning,"* 2018 Second International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2018,	R. Varghese and S. Sharma,	Use of Arduino microcontroller using sensors for sensing the moisture values and taking decisions using Machine Learning.	The Machine Learning algorithm suggests the best frequency at which the watering should be done.
7	*"Internet of Things and Nodemcu A review of use of Nodemcu ESP8266 in IoT products"*	Parihar, Yogendra Singh.	Use of NodeMCU ESP8266 for connection with the cloud platform.	Using the inbuilt WiFi of the ESP8266 the microcontroller is able to establish an connection with cloud platform.

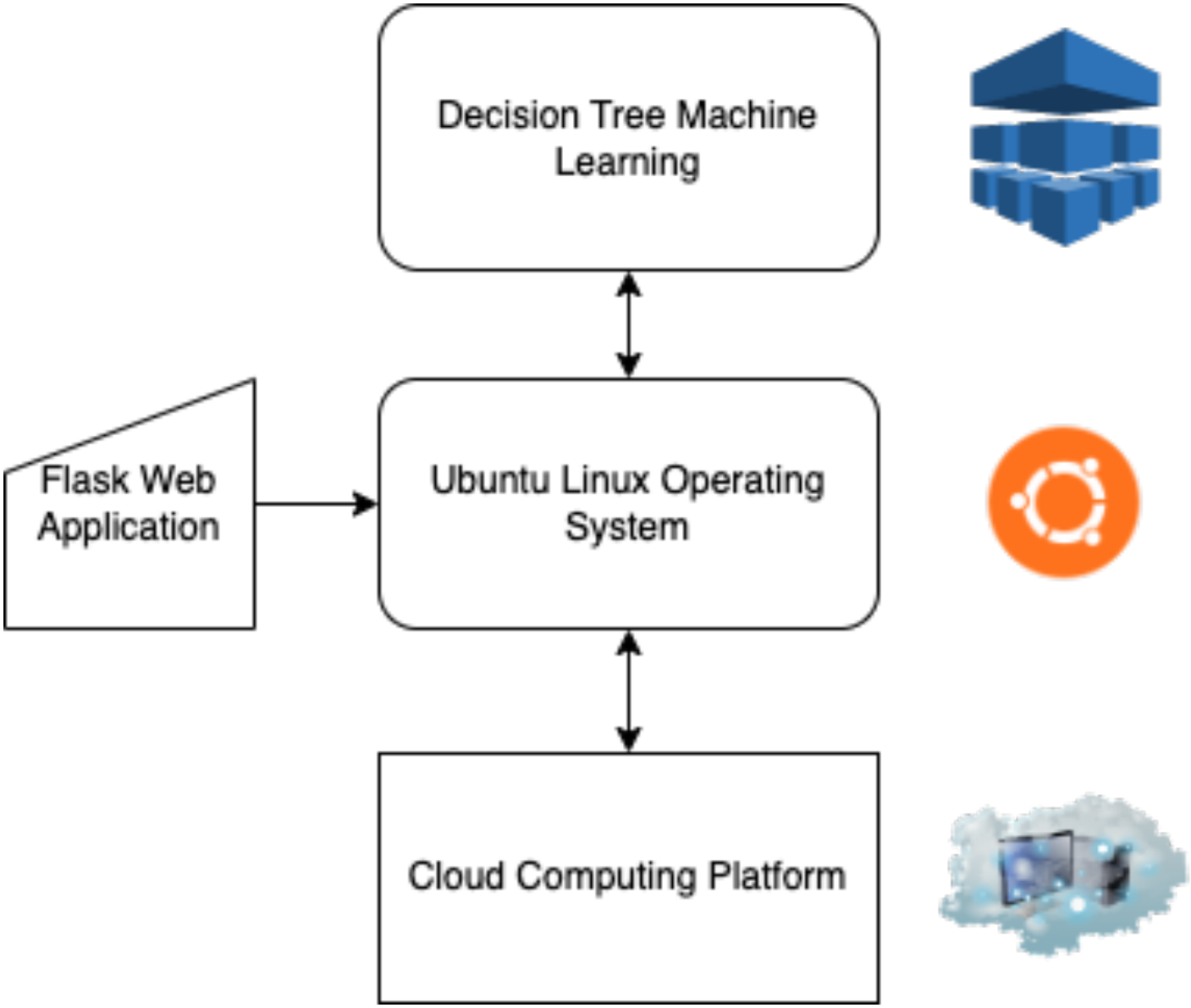
Hardware Implementation Diagram



Hardware Description

- The system consists of NodeMCU ESP8266 microcontroller, FC-28 Hygrometer Moisture Sensor, 5V Relay Switch, Power Supply etc.
- The power supply provides necessary power supply to our system, basically to the NodeMCU ESP8266 microcontroller.
- The FC-28 Moisture Sensor module is attached with the NodeMCU ESP8266 Microcontroller.
- It senses the moisture values of the soil where it is installed and send those values to the cloud platform using NodeMCU microcontroller.
- The sensed value is fed to the Machine Learning algorithm for making decision.
- And then the decision is sent back to the NodeMCU microcontroller to implement it on the 5V relay switch.

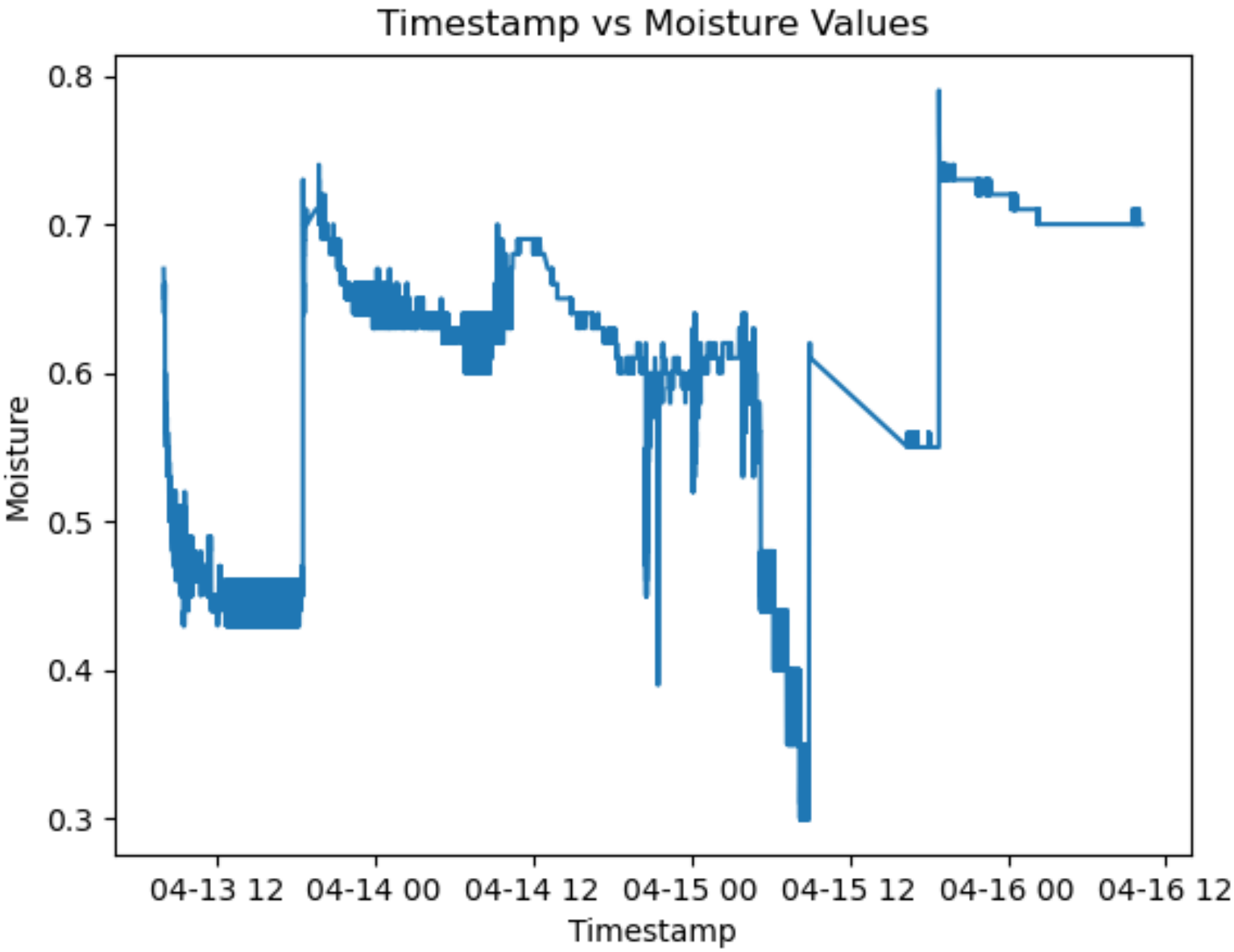
Software Implementation Diagram



Real Time Data Collection

From 2023-04-13 08:00:35 to 2023-04-16 10:11:08. A total of 104731 moisture values were recorded and used to train the decision-tree ML algorithm.

Experimental Data Collection Diagram

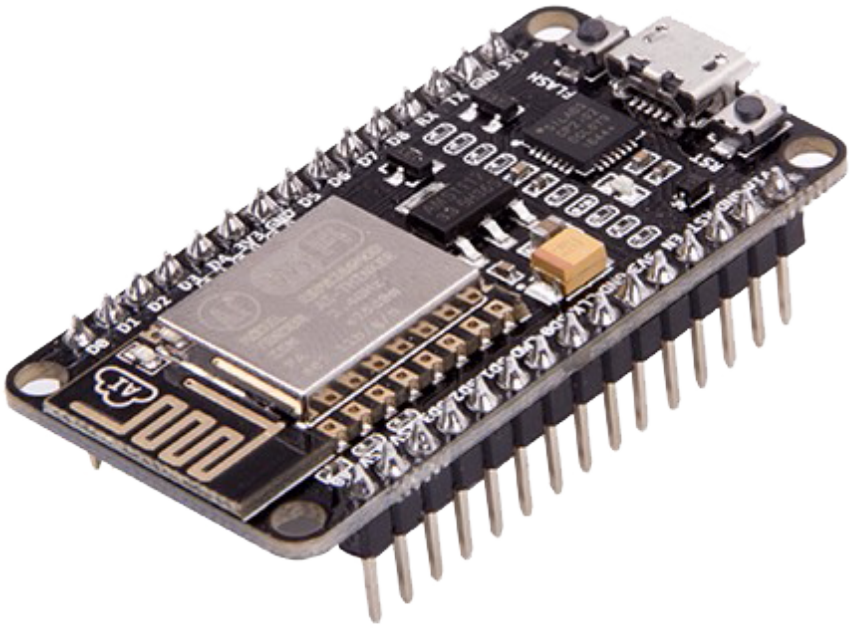


Algorithms/ Methodology

- Step 1 : Power up the system and connect the Wi-Fi network
- Step 2 : Sense the soil moisture values using soil moisture sensor.
- Step 3 : Send those values to the cloud using NodeMCU ESP8266 microcontroller.
- Step 4 : On cloud the Machine Learning model will make the decision depending on the condition sensed.
- Step 5 : The decision will be sent back to the NodeMCU microcontroller from cloud.
- Step 6 : Upon successfully receiving the decision it will be implemented on the 5V relay Switching circuit.
- Step 7 : If operation has to made manual we can given input on the project website.
- Step 8 : And from the inputed value the switching will be done

Components Used

- NodeMCU ESP8266
- FC-28 Hygrometer Soil Moisture Sensor.
- 5V Relay Circuit

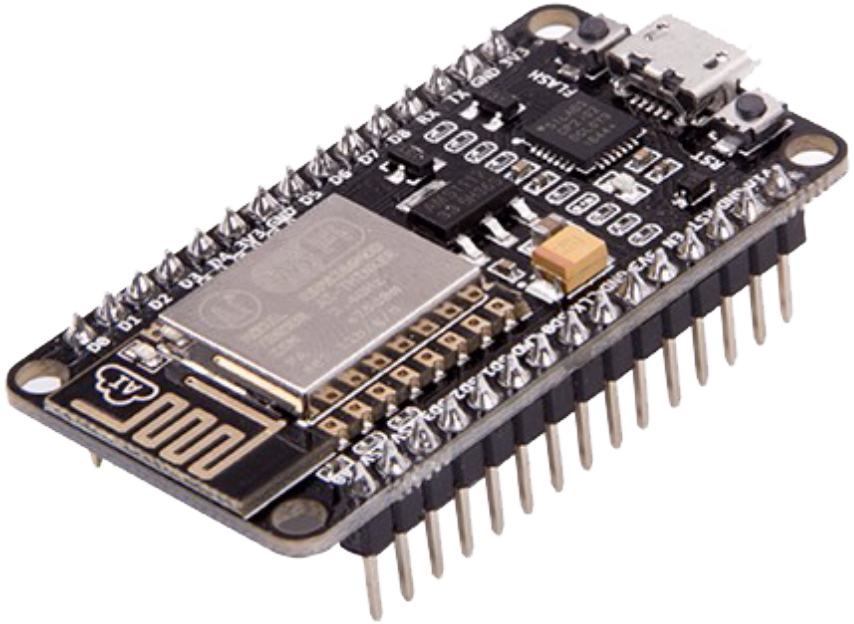


Components Used

- **NodeMCU ESP8266**

- This is Wi-Fi in built micro controller.

- The IoT device is built with NodeMCU ESP8266 with Soil Moisture sensor.



- Microcontroller : ESP-8266 32-bit

- Clock Speed : 80 MHz

- USB Connector : Micro USB

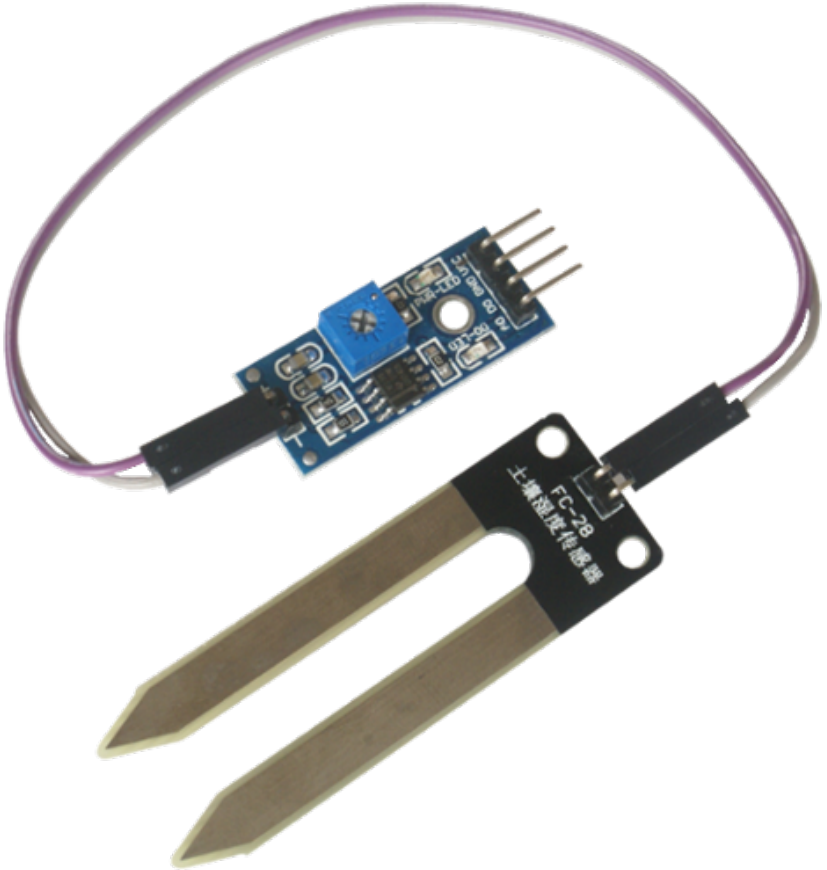
- Operating Voltage : 3.3V

Components Using

- **FC-28 Hygrometer Moisture Sensor**

FC-28 Hygrometer Moisture sensor is a microcontroller compatible moisture sensor.

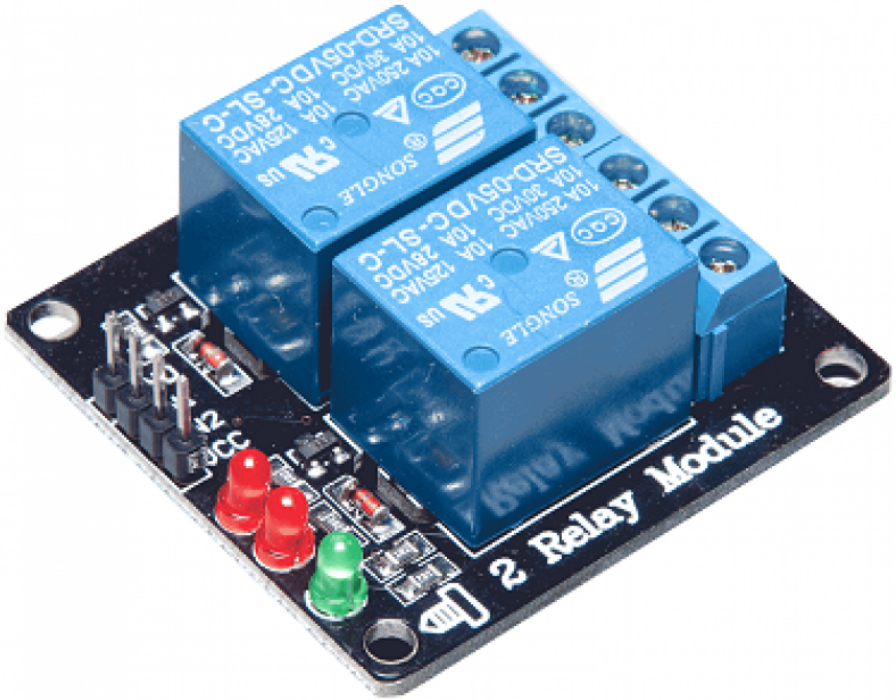
It works on a principle of resistance experienced for transmission of current between the two terminals to calculate moisture level.



Components Used

- **5V Relay Switch**

5V Relay switch is a relay based switch used for switching operation of the circuits having higher voltages of AC supply switches
It is a microcontroller compatible device used in many IoT projects and applications.

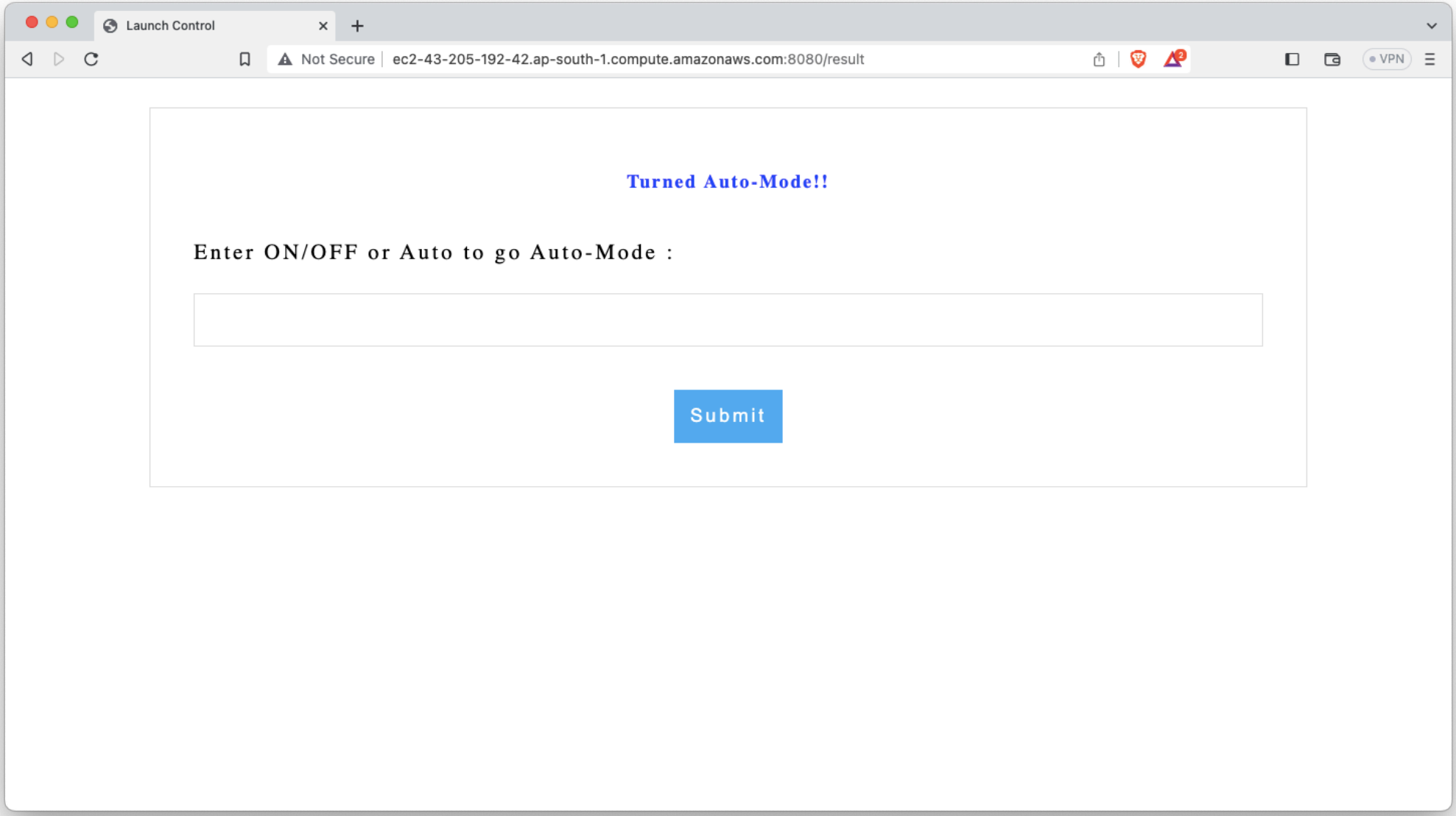


Advantages

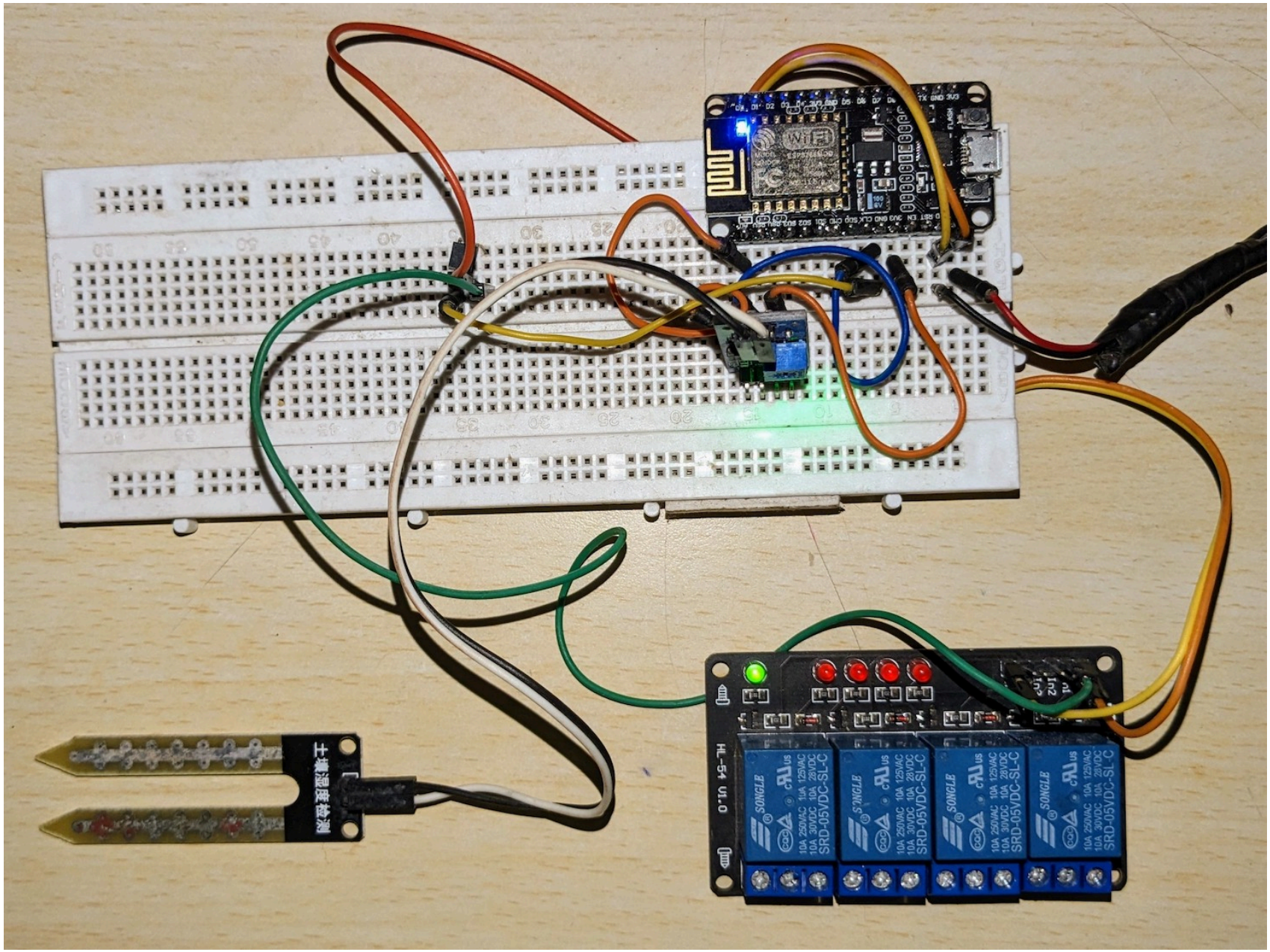
- Improves Water Efficiency .
- Brings automation in the irrigation field.
- Reduces labour work.
- Can be controlled manually from remote location.
- Monitoring of the soil as well crop.
- Efficient use of electric power.

Final Software Implementation Result

Project Web Address : http://ec2-43-205-192-42.ap-south-1.compute.amazonaws.com/



Final Hardware Implementation Results



Expected Outcome

- This project ensures overall monitoring and controlling of the soil moisture and irrigation system.

- It sensed the moisture values from the soil and send them to the cloud using Wi-Fi network

- The cloud platform equipped with MQTT, HTTP, etc. services will receive those values and fed them to the Machine Learning model for generating output.
- The machine learning model is trained using moisture values collected earlier using an experiment.
- The experiment hold the 0.5 value as a threshold for differentiating the soil moisture from dry to wet.

- Upon successfully making the decision its sent back to the microcontroller for switching of the relay switch.

- And in the NodeMCU ESP8266 microcontroller will switch the switching circuit in accordance with the input.

Future Scope

- This work can be extended in the future with more interactive Machine as well as Deep learning model to correctly predict the actual amount of required by the particular crop and timing.
- This work can also be implemented in the small as well large farms.
- This system will not just only be able to provide water but also can be used to provide fertilisers to the crop
- The real time monitoring can be extended with surveillance CCTV cameras.
- In future work, we are looking forward to make farming and irrigation completely automated and labour free.

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Thank you !!!