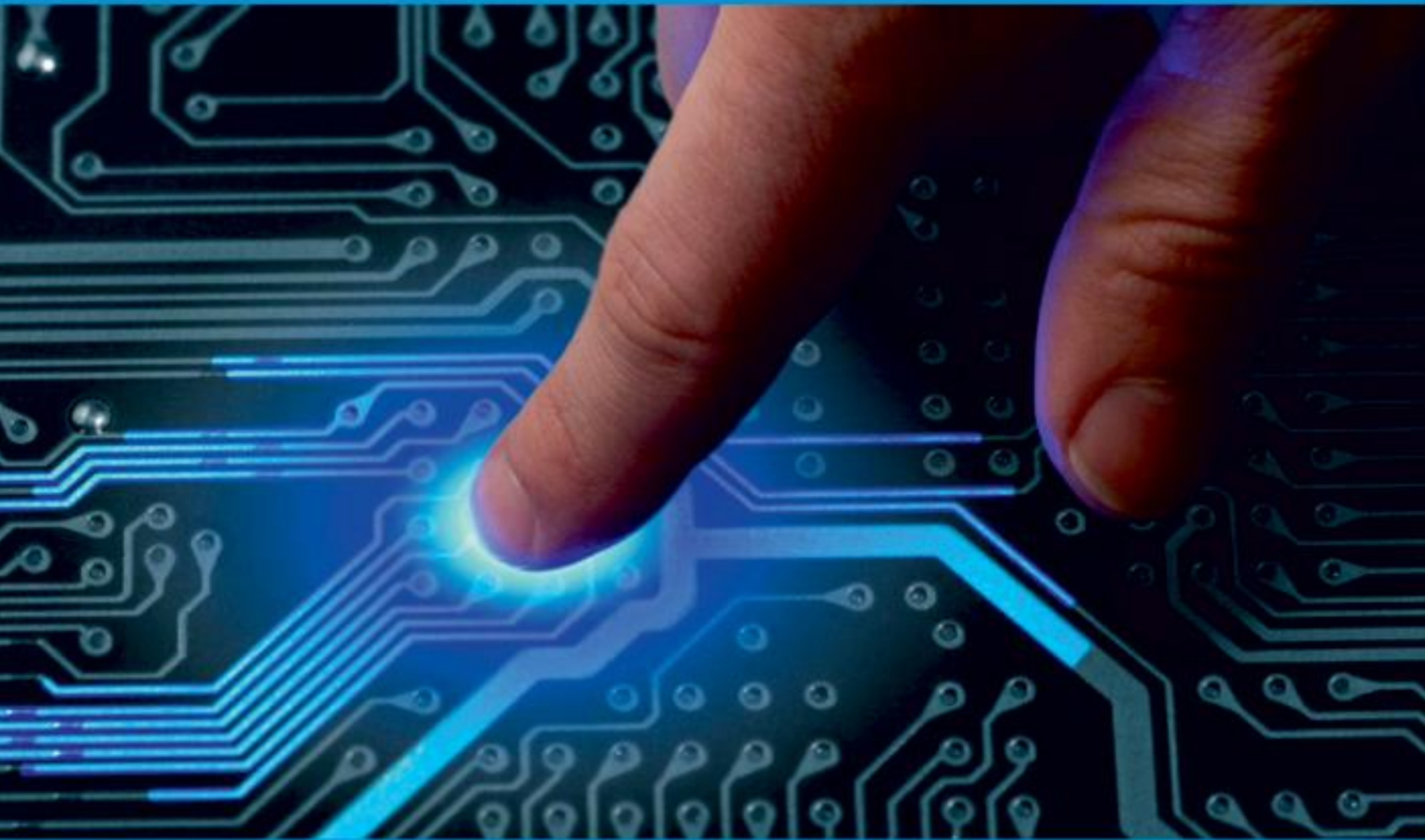
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 4, April 2024

Impact Factor: 8.379

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204312 |

Automatic Irrigation and Fertilization to The Root Zone of Plants.

[1]Roshan A Avadan, [2]Bharat L Gawade, [3]Abhishek D Kole, [4]Prof. S .T Matale

Final Year Engineering Students, Department of Electronics and Telecommunication Engineering, Sant Gajanan Maharaj College of Engineering, Mahagaon Maharashtra, India. [1,2,3]

Assistant Professor, Department of Electronics and Telecommunication Engineering, Sant Gajanan Maharaj College of Engineering, Mahagaon Maharashtra, India. [4]

ABSTRACT: One of the biggest consumers of water resources is the agricultural industry. Water is a valuable resource that must be protected with the most recent technological advancements. By replacing manual labor and static farming practices with intelligent, dynamic systems, modern technologies and digital tools can increase productivity while requiring less human oversight. This proposed outline of the agronomic models that ought to be incorporated into an intelligent system that schedules fertilization and irrigation in accordance with the needs of the plants and uses automatic watering to monitor and maintain the appropriate level of soil moisture using the smart sensors and Internet of Things [IoT]. This study presents a cutting-edge drip system for precision irrigation and fertilization, the efficiency of subsurface drip irrigation [SDI] could be similar to drip irrigation but it uses less water. The device initiates the watering function to allow water to be drained to the root zone using pipework if the soil moisture value is found to be within the predetermined range.

KEYWORDS: IOT (Internet of Things), precision irrigation, fertilization, root zone, subsystem drip irrigation**.**

I. INTRODUCTION

As the world transitions to new practices and technologies, it is essential to aim for an increase in agriculture. Numerous researchers are employed in the field of agriculture. In the twenty-first century, agriculture has a number of difficulties in producing enough food and fiber to support a growing population. Food, energy, and water security are essential for a long-term, sustainable economy. The agricultural industry uses a lot of water, and 70% of groundwater and river water is used for irrigation[1]. The information about the numerous environmental elements is provided by the collected data. Crop output can be increased, but not entirely by monitoring environmental conditions. Numerous additional factors also contribute to a greater degree of productivity decline.Hence automation must be implemented in irrigating fields to overcome these problems [2].

According to the ASAE (American Society of Agricultural Engineers) Standards, subsurface drip irrigation, or SDI, is "the application of water below the soil surface though emitters with discharge rates generally in the same range as drip irrigation".So, apart from the particulars mentioned above, an SDI unit is just a network of drip irrigation buried to a given depth.Although subsurface drip irrigation (SDI) uses less water than drip irrigation, its efficiency may be comparable. In terms of surface irrigation, it could result in water savings of up to 25% to 50% [3].

II. LITERATURE SURVEY

A review of the literature is crucial for identifying the unique approach. Comprehending the analysis conducted by multiple writers on the suggested subject and outlining the approach, along with its advantages and disadvantages, is beneficial.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204312 |

Table No.1- Literature Survey

Ref.	Findings
[1]	-This article elaborates the potential of solar fertigation systems to improve sustainability, efficiency, and productivity in agriculture while also reducing environmental impacts. -The authors propose an integrated approach combining IoT (Internet of Things) For smart Irrigation in agriculture.
[2]	-The authors present an automated Irrigation control system specifically designed for greenhouse crop production. -IoT-based irrigation systems use soil moisture sensors to measure the moisture content in the soil. These sensors provide real-time data, helping the system determine when and how much water is needed.
[3]	-This article provides a comprehensive overview of SDI technology, its management practices, benefits, and challenges involved in agricultural water management. -The authors propose Subsurface drip irrigation (SDI) it is an advanced method of irrigation in which water is delivered directly to the root zone of plants through a network of buried pipes and emitters. -Researchers often investigate the management of nutrients in SDI systems, ensuring that fertilizers are effectively delivered to the root zone while minimizing nutrient loss.
[4]	-This review paper summarizes the current state of the art in automatic Irrigation in precision agriculture. -It discusses various approaches, technologies, and challenges involved in achieving optimal Irrigation practices.
[5]	-The study emphasized how real-time data transfer made possible by 5G connectivity improves precision agriculture decision-making's responsiveness and speed. -The purpose of this study was to highlight the use of WSN and IoT in agriculture and to provide a comprehensive analysis of sensor and IoT data analytics for agricultural applications.
[6]	-In order to maximize system efficiency and lifetime, the study emphasized the significance of choosing the appropriate installation depth depending on soil type, crop characteristics, and local environmental circumstances.
[7]	-This paper uses ARM7 (LPC2148), Raspberry-pi and zigbee modules. -The paper shows two primary sections: the field area, which has the ARM7, zigbee, and sensors, and the control section, which has the raspberry pi and the zigbee components.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204312 |

III. BLOCK DIAGRAM

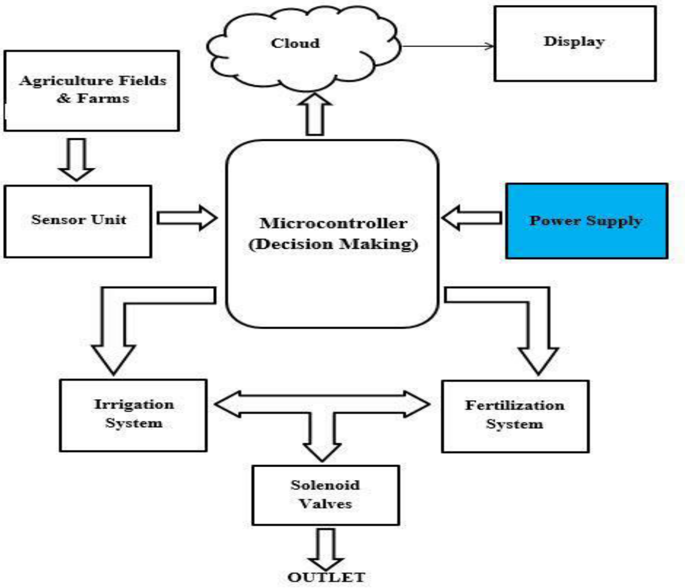


Fig No.1 Block Diagram

I. CIRCUIT DIAGRAM

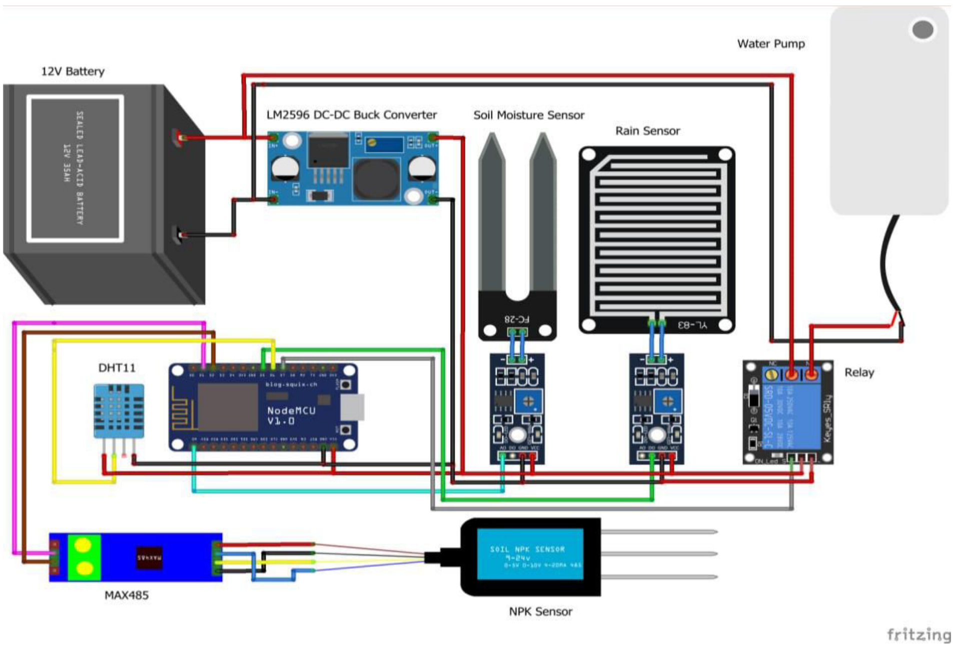


Fig No.2 Circuit Diagram

Fig No.2 shows the designing, building, and debugging electrical and electronic systems. All of the hardware components, including the ESP8266, soil moisture sensor, relay, and numerous other devices, are shown in the circuit diagram above. The circuit diagram shows how the parts are put together on the PCB board. It displays the circuit's parts and their connections in addition to the information or current flowing through the circuit.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204312 |

The hardware specifications for the implementation are provided in the ensuing section.

a) **ESP8266 Microcontroller:**

The ESP8266 microcontroller chip is a popular and affordable microcontroller chip with built-in Wi-Fi capabilities, which makes it perfect for Internet of Things applications. It allows for quick prototyping and provides a wealth of support resources because to its compatibility with Arduino and vast developer community.

b) **Soil moisture sensor**:

A soil moisture sensor is a tool used to gauge the soil's moisture content. Usually, two or more probes are put into the soil, and the electrical resistance between the probes is used to calculate the moisture content. In order to improve irrigation schedules and avoid overwatering or underwatering of plants, soil moisture sensors are widely employed in gardening and agriculture.

c) **DHT11 sensor:**

Accurate temperature measurements between 0°C and 50°C and humidity readings between 20% and 90% are provided by the DHT11 sensor. The DHT11 sensor is frequently used in applications including weather stations, environmental monitoring, and home automation systems because of its user-friendly interface and reasonable cost.

d) **Watering pump:**

For all of your water pumping needs, the R385 Diaphragm Mini Water Pump 12VDC is the ideal choice. This pump operates on 12V DC and provides dependable performance, guaranteeing a constant water flow.A premium diaphragm pump made for effective water pumping is the R385 Diaphragm Mini Water Pump 12VDC.

e) **NPK sensor:**

A tool called an NPK sensor is used to gauge the concentrations of potassium (K), phosphorus (P), and nitrogen (N) in soil and other media. These sensors measure the amounts of these vital nutrients using a variety of methods, including spectroscopy, electrochemical analysis, and ion-selective electrodes.

f) **Rain drop sensor:**

An electrical device called a raindrop sensor is used to identify raindrops or other water droplets. Usually made up of two conductive electrodes, it measures how the conductivity varies in the presence of water and outputs a signal.

The following section gives the datails regarding software used for the implementation.

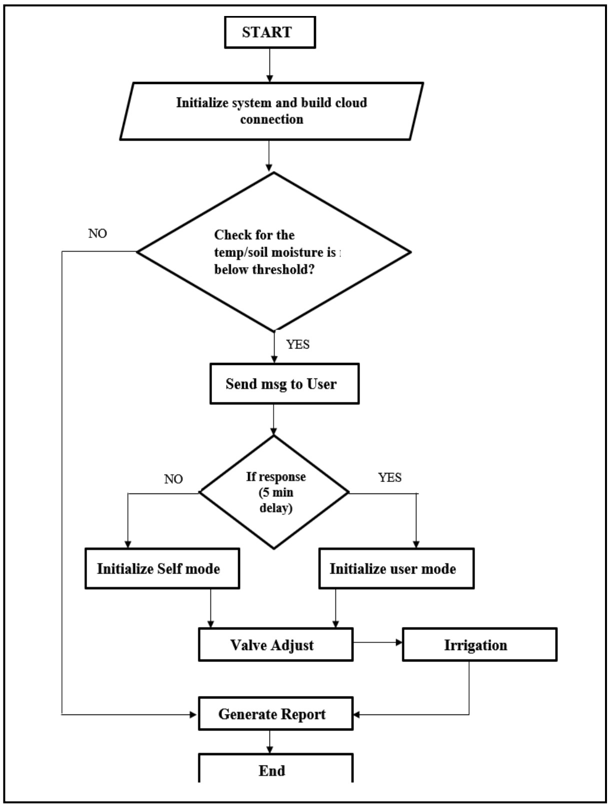
For app developers, Kodular offers a vast array of capabilities and components, ranging from more sophisticated features like camera integration, database connectivity, and social media integration to user interface elements like buttons, labels, and text boxes. In addition, the platform comes with a companion app that lets users test their apps in real time on their devices—all without requiring an emulator or a physical device. App developers can choose from a range of revenue streams offered by Kodular, such as in-app purchases, in-app advertising, and subscriptions. Additionally, the platform offers data tracking and analytical tools that let developers keep an eye on how well their apps are performing and decide what needs to be updated or improved.

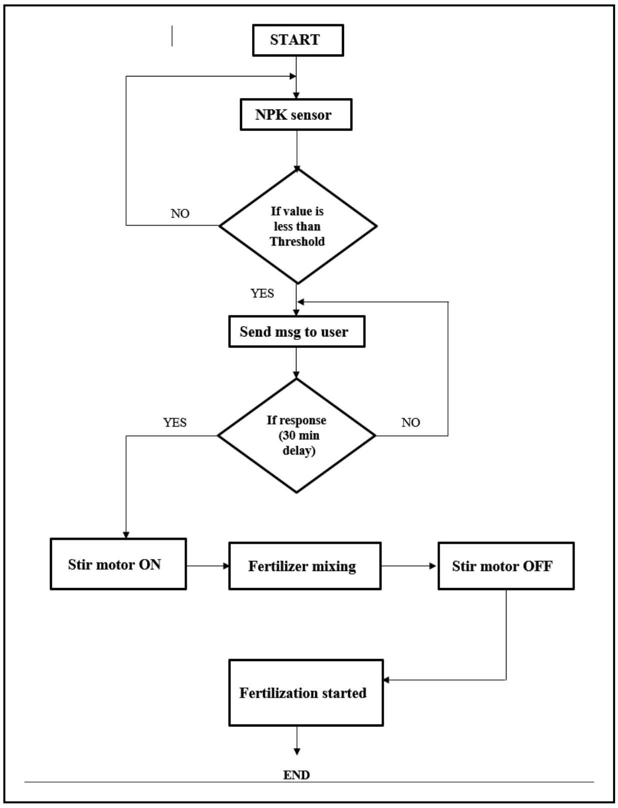
| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204312 |

II. **FLOW CHART**





IV. RESULTS

Soil moisture, nutrient levels, and possibly weather conditions are monitored by sensors placed in the soil.Data from these sensors is transmitted to a ESP8266 controller for analysis.The controller processes this data to determine the precise irrigation and fertilization requirements for plant's root zone.Based on the analysis, the controller sends signals to motors connected to pipes, regulating the flow of water and fertilizers.
Feedback mechanisms is employed to continuously monitor soil conditions and adjust irrigation and fertilization parameters in real-time.This automated system ensures that plants receive optimal hydration and nutrient levels, promoting healthy growth while conserving resources.

a) Irrigation system :

The fig no.5 shows the actual irrigation system at the time of demonstration, if the threadshold value of soil moisture sensor becomes >50 the subsurface irrigation system starts.Their are two containers which provides irrigation and fertilization to the field. The pipelines are buried inside the soil to ensure minimal use of water and nutrients.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |
|| Volume 12, Issue 4, April 2024 ||
| DOI: 10.15680/IJIRCCE.2024.1204312 |

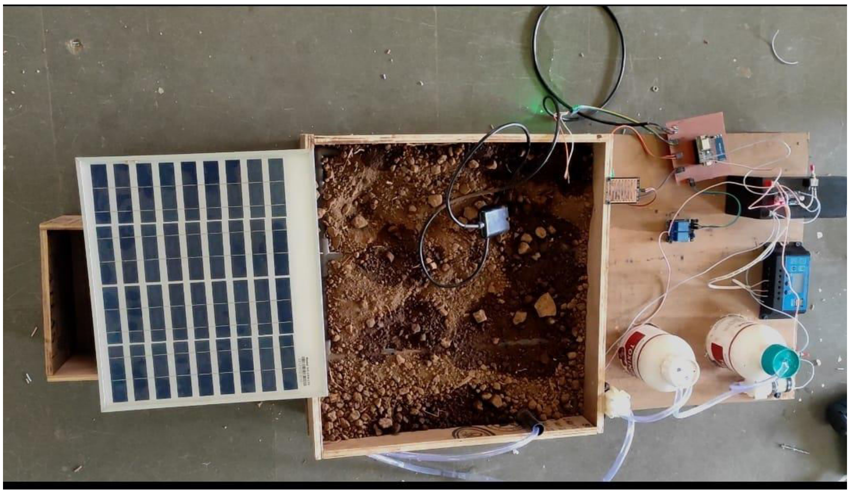


Fig No.5 Demonstration of irrigation system

b) Application for displaying values:

The fig no.6 and 7 shows the values detected by the moisture, NPK, and temperature sensor and shows whether the rain is detected or not. If rain is detected the moisture level will increase above 50 and then irrigation system will stop.

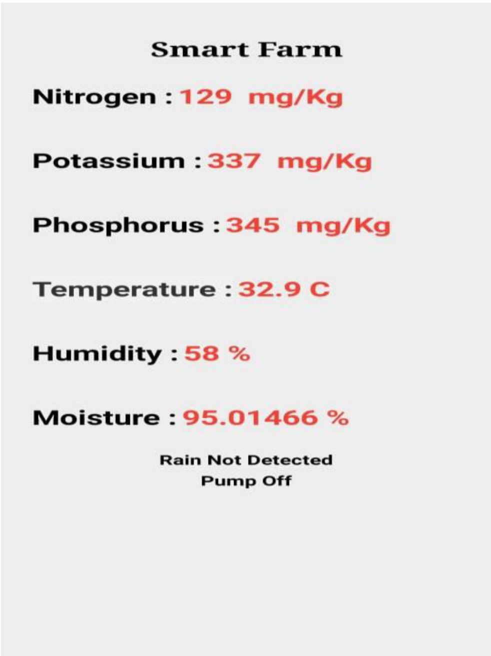


Fig No.6 Pump OFF status

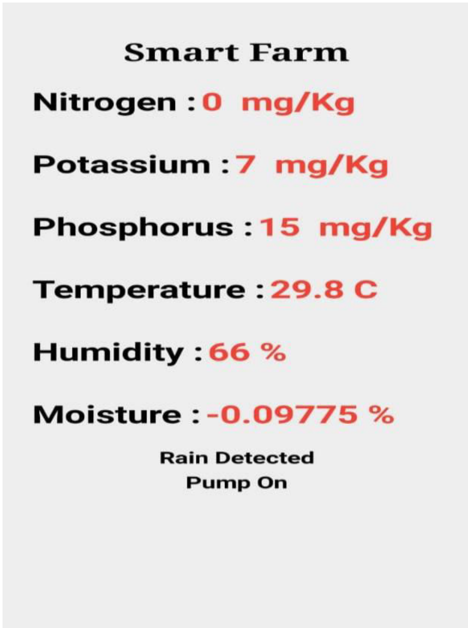


Fig No.7 Pump ON status

c) Fertilization system:

The fig no.8 shows the implementation of fertilization, the first container contains fertilizer and second contains water. If fertilization is required then fertilizer is added into the water manually and then it is distributed to the field.

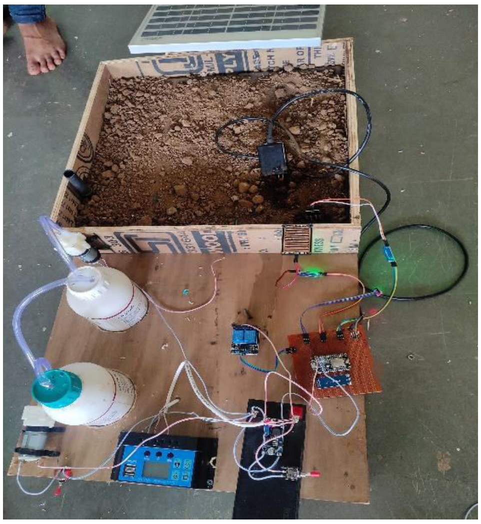


Fig No.8 Demonstration of fertilization system

Emitters along the drip lines discharge water and nutrients in exact amounts that reach the plant's root zone. By reducing weed growth and minimizing water loss through evaporation, the subsurface placement of drip lines improves plant health and efficiency.The solar panel acts as an energy source to the overall system.

V. CONCLUSION

This automated irrigation and fertigation system successfully implements irrigation and fertigation automation, leading to the conclusion that it is a useful system. The irrigation automation operates in accordance with the constant monitoring of the sensor threshold values. The message is sent in response to irrigation demand, causing the irrigation to begin or stop right away. We also receive continual sensor status updates via the Kodular platform. Finally, we may access and operate the electrical and water flow control system remotely with the help of this technology.

VI. ACKNOWLEDGEMENT

We wish to express our deep, sincere gratitude to our guide Prof. S. T. Matale for their excellent guidance, encouragement, support, and insightful comments throughout the period of our bachelor's degree. Whatever knowledge and experience we have gained during ours study here; we owe it to him. He has been our pillar of strength during times of downfalls.
Our work could not have been completed without the support of our collage, other teaching as well as non- teaching staff members of the electronics and telecommunication engineering department. We are also thankful To SGM Education Group and Research Centre Mahagaon, for giving us the opportunity to carry out our project work.

REFERENCES

1. Uzair Ahmad , Arturo Alvino and Stefano Marino "Solar Fertigation: A Sustainable and Smart IoT-Based Irrigation and Fertilization System for Efficient Water and Nutrient Management". Published: 23 April 2022 https://doi.org/10.3390/agronomy12051012.
2. P. Suganya, Aditya Subramanian, Yagneshwaran. B, "Automatic Irrigation System using IoT", International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395-0056 Volume: 04 Issue: 10 | Oct -2018 www.irjet.net p-ISSN: 2395-0072.
3. Leonor Rodríguez Sinobas and María Gil Rodríguez, "A Review of Subsurface Drip Irrigation and Its Management", Research Group "Hydraulic of Irrigation" Technical University of Madrid, Spain 01 September 2020.
4. Mani Bansal, Abhay Pandey, Mandvi Singh, Nivesh Sharma, Raj Kumar Goel Institute of Technology Ghaziabad, India "Automatic Watering Of Plants" Volume 10, Issue 5 May 2022 | ISSN: 2320-2882.
5. C. Murugamani, S. Shitharth, S. Hemalatha, "Machine Learning Technique for Precision Agriculture Applications in 5G-Based Internet of Things" Volume 2022, Article ID 6534238 ,Published 7 June 2022.
6. Shaolei Guo "Subsurface Drip Lateral Line Depths to Protect against Root Intrusion", Key Laboratory of Water

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204312 |

Cycle and Related Land Surface Processes, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China Published: 31 October 2019. https://doi.org/10.3390/w11112285.

7. Gourav Bankar "AUTOMATED IRRIGATION AND FERTIGATION SYSTEM", International Journal of Electrical and Electronics Research ISSN 2348-6988 (online) Vol. 4, Issue 2, pp: (193-197), Month: April - June 2016.