SMART IRRIGATION SYSTEM

A MINI-PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

ABSTRACT

The statistical evidence reveals that Indian population has taken the shape of the highest amount of bell-shaped curve. With the world population set to reach 8 billion by 2025 and the number constantly increasing, food security issues ought to be on 'the agenda' of country governments for the near future. By then, perhaps 25-30 years, if a population continues to grow, a serious food shortage will ensue, thereby drawing attention to the critical need for agriculture. The farmers of our time are certainly not an exception in suffering from highly uneven rainfall and water scarcity thus the rational use of irrigation water is a must. The present paper is sharing a concept that will help farmers to save lots of time, money, and energy. Manual irrigation methods are labor-consuming and require a big deal of labor force. When compared to the manual irrigation technology, the automated irrigation systems do not require the presence of humans that much. The system features the sensors which do the determination of the temperature or humidity changes. When these environmental factors are changed, the sensors send a signal to a microcontroller that commences irrigation. This technology system guarantees that there is no water wastage and it is released on demand only. This helps to safeguard the environment by ensuring that there is no overuse of water.

Through this implementation, farmers will be able to fulfill their irrigation requirements with considerable and sustained efficiency for the purpose of environmentally secure farming practice and food supply security.

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First, we thank the almighty god for the successful completion of the project. Our sincere thanks to our Chairman **Mr. S. Meganathan, B.E., F.I.E**., for his sincere endeavor in educating us in his premier institution. We would like to express our deep gratitude to our beloved Chairperson **Dr. Thangam Meganathan, Ph.D.,** for her enthusiastic motivation which inspired us a lot in completing this project and Vice Chairman **Mr. Abhay Shankar Meganathan, B.E., M.S.,** for providing us with the requisite infrastructure. We also express our sincere gratitude to our college Principal**, Dr. S.N. Murugesan M.E., PhD.,** and **Dr. P. KUMAR M.E., Ph.D.,** Head of the Department of Computer Science and Engineering and our project guide **Mrs. ANITHA ASHISHDEEP B.E. M.Tech,** for his encouragement and guiding us throughout the project and to our parents, friends, all faculty members and supporting staffs for their direct and indirect involvement in successful completion of the project for their encouragement and support.

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TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

In agriculture, providing a great plant health and effective water management means the future of eco-friendly food production. How ever due to the fact that the world population seems to be in a continuous increase, there are needs to come up with innovative solutions to sustain agriculture while at the same time conserving the available resources. The most widely used traditional irrigation techniques are usually based on human monitoring and have a low efficiency level, which result in water wastage and even crop damage. Also, apart from the challenges associated with human surveillance of vast agricultural spaces, it is time-consuming. Traditional irrigation is mostly operated on the feedback of subjective monitoring, and is usually prone to inefficiencies, which eventually results in water wastage and possible crop loss. Similarly, the vastness of farm areas prevents the use of human eyes as good as this. These issues are targeted through the development of a Smart Irrigation System which is a IOT technology based.

This system is a solution that eliminates labor by automating irrigation activities and abilities for monitoring in real-time. The Smart Irrigation System through sensors that measure soil moisture, temperature and humidity can precisely determine the plants' water needs and create a schedule that adjusts irrigation to match the plant's requirements. By using sensors that monitor the soil moisture, temperature and humidity the Smart Irrigation System is able to precisely determine the water requirements of plants and adjust irrigation periods accordingly. Automating the watering process greatly reduces the amount of water used and guarantees the plants will receive the appropriate amount of water at the appropriate times, resulting in healthy growth and maximum yields. The automatic way of irrigation prevents water wastage and also control the amount of water that the plant gets at the correct time, resulting in healthier growth of plants and satisfactory yields. Moreover, the solution facilitates smart irrigation with remote monitoring and control, which allows farmers to supervise irrigation from wherever by using a mobile application. Thus, it increases efficiency and allows swift action, which ultimately boosts the overall farm management effectiveness. As a result, system features remote monitoring and control facility that helps farmers to observe and manage irrigation activities from anywhere through the mobile application. The remote mastering offers a lot of efficiency, and timely intervention is facilitated as the issues are addressed, thus ensuring farm management is safe way.

Briefly, the Smart Irrigation System presents the total body of solution that helps to enhance plant health and sustain water usage in agriculture. By taking advantage of the great potential of the Internet of Things (IoT) technology, this system performs its role in cementing sustainable agriculture, resource conservation, and agricultural productivity which are the goals for the whole world.

CHAPTER 2
LITERATURE SURVEY

In GSM Based Automated Irrigation Control using Rain gun Irrigation System. R. Suresh, S. Gopinath, K. Govindaraju, T. Devika, N. Suthanthira Vanitha [1] mentioned about using automatic microcontroller-based rain gun irrigation system in which the irrigation will take place only when there will be intense requirement of water that save a large quantity of water. This system brings a change to management of field resources where they developed a software stack called Android is used for mobile devices that include an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Mobile phones have almost become an integral part of us serving multiple needs of humans. This application makes use of the GPRS feature of mobile phone as a solution for irrigation control system. This system covered lower range of agriculture land and not economically affordable. The System Supports large Amount of water in the land and uses GSM to send message and an android app is been used they have used a methodology to overcome under irrigation, over irrigation that causes leaching and loss of nutrient content of soil they have also promised that Microcontroller used can increase System Life and lower the power Consumption. There system is just limited to the automation of irrigation system and lacks in extra ordinary features. In GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile Pavithra D. S, M. S. Srinath.[2] States features of their system.

In Irrigation Control System Using Android and GSM for Efficient Use of Water and Power – Laxmi Shabadi, Nandini Patil, Nikita. M, Shruti. J, Smitha. P & Swati. C [3]

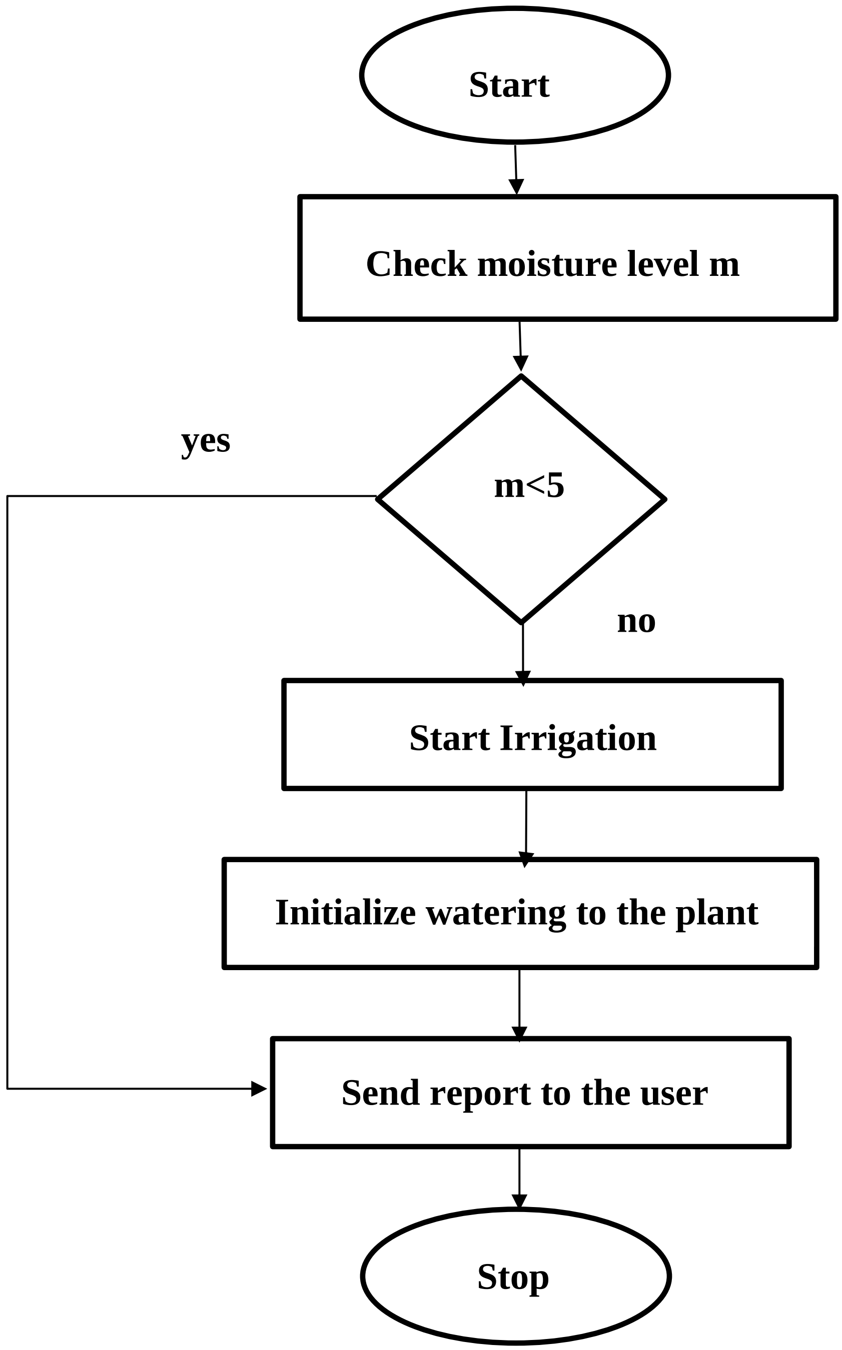
Automated irrigation system uses valves to turn motor ON and OFF. These valves may be easily automated by using controllers. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and off. In addition, farmers using automation equipment are able to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day, which will improve crop performance by ensuring adequate water and nutrients when needed. Those valves may be easily automated by using controllers. Automating farm or nursery irrigation allows farmers to apply the right amount of water at the right time, regardless of the availability of labor to turn valves on and of fIt only allows the user to monitor and maintain the moisture level remotely irrespective of time. From the point of view of working at remote place the developed microcontroller-based irrigation system can work constantly for indefinite time period, even in certain abnormal circumstances. If the plants get water at the proper time then it helps to increase the production from 25 to 30 % [5] Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network Yunseop (James) Kim, Member, IEEE, Robert G. Evans, and William M. Iversen [6] The setup of technical system describe in this paper is broad based and is relatively one of the efficient system that has developed windows application to monitor the field. Field is equipped with wireless communication sensors that avails better facilitated sensor communication and covers wider field area. Detailed description on site field sensors and Internet technology is described briefly. The statistical data provided is measured to be efficient and used for research work. Microcontroller Based Automatic Plant Irrigation System* Venkata Naga Rohit Gunturi [7] The main aim of this paper is to provide automatic irrigation to the plants which helps in saving money and water. A wireless application of drip irrigation automation supported by soil moisture sensors [8].

2.1 EXISTING SYSTEM

Manual irrigation is the process of supplying water directly to crops and plants by using human labor for physical application of water using technologies like bucket irrigation, watering cans, flooding, and furrow. These approaches are easy to implement, and the necessary tools used are relatively less expensive and are affordable by the small-scale farmers and growers. They have a high level control of the water delivery, which could be helpful both for the particular plant and for the small plot in the garden. However, the process of manual irrigation is to a large extent labor intensive and requires more time to undertake when compared to the usage of other methods for large areas. Flood and furrow irrigation is not efficient as they lead to a waste of water and can cause soil erosion whereas bucket and watering can methods are labor – intensive and can only be used when farming a small area. Even with these disadvantages, manual irrigation is a potential substitute where mechanized systems cannot be applied due to cost or accessibility.

CHAPTER 3

PROJECT DESCRIPTION



5.1. CONTROLLING MODULE

The control center is the brain of the smart irrigation system. It provides real-time monitoring and manual control through an user interface (UI). This component boasts a dashboard that shows the present level of moisture in the soil and a button that, upon being clicked, initiates the irrigation system.

5.2. SENSING MODULE

Sensing unit involves soil moisture sensor strategically located in the field. These sensors constantly monitor the water level of the soil and send live data to the processing unit every time. Sensors to be used as accurate and reliable, they make sure that the system has timely information on the soil conditions.

5.3. PROCESSING MODULE

The processing unit, comprising the ESP32 microcontroller, is the component which manages data processing and decision-making. It gets data from the sensing unit and processes it to obtain the soil's moisture percentage. The actuating unit is sent signals from the processed data and this unit finally controls the water flow. ESP32 is selected for its high processing power and integrated Wi-Fi that will provide a connection and remote monitoring possibility

5.4. ACTUATING MODULE

The actuating unit operates water supply system in accordance with the command of the processing unit. It consists of a solenoid valve or a pump, which are used to control the water supply to the plants. When the control button on the dashboard is clicked or if the system identifies low soil moisture, the actuating unit switch follows up the water supply to balance the soil moisture.

3.1 PROPOSED SYSTEM

The smart irrigation system that we offer is able to manage the water usage and make sure the soil moisture is good for high plant growth. The system is characterized by an intelligent user interface (UI) that is designed with the help of artificial intelligence to offer real time monitoring and control of the irrigation process. The features of the project are as follows:

1. **Real-time Soil Moisture Monitoring:** The dashboard displays current data on the soil moisture and sends it to the sensors located in the field. It becomes easy for the user to do the right thing because one does not grow plants by just playing guesswork.
2. **Moisture Content Indicator:** The level of moisture represented as a percentage will let you know in a clear and immediate way on what condition the soil is at. It is not limited to 'audio' only, however, also includes visual aids (like color coding). g. Sending a flowchart (soil moisture from green for optimal, to yellow for very dry, to red for very dry) is recommendable for readability to improve.
3. **Water Supply Control Button**: The dashboard is designed with a prominent push button usage allowing for access to the water supply system. By pressing that button, users activate the flow of water directly to the plants. This feature helps in attaining flexibility and enables immediate response to the different soil moisture content fluctuations.
4. **Automated Watering**: Hence, the system can be programmed to water set amount of water based on moisture were detected. Once soil moisture reaches a certain lower level; irrigation process can be started automatically. Plants will get water as long as it is needed whether the owners are there or not.

3.2 REQUIREMENTS

3.2.1 HARDWARE REQUIREMENTS

Sensor	:	Moisture Sensor
Microprocessor	:	ESP 32
Actuator	:	Water motor

Fig 3.2.1.a(Moisture Sensor, ESP 32, Water motor)

3.2.2 SOFTWARE REQUIREMENTS

Operating System	:	WINDOWS 10
Front – End	:	Blynk
Back - End	:	Python
IDE	:	Arduino IDE

3.3 ARCHITECTURE DIAGRAM

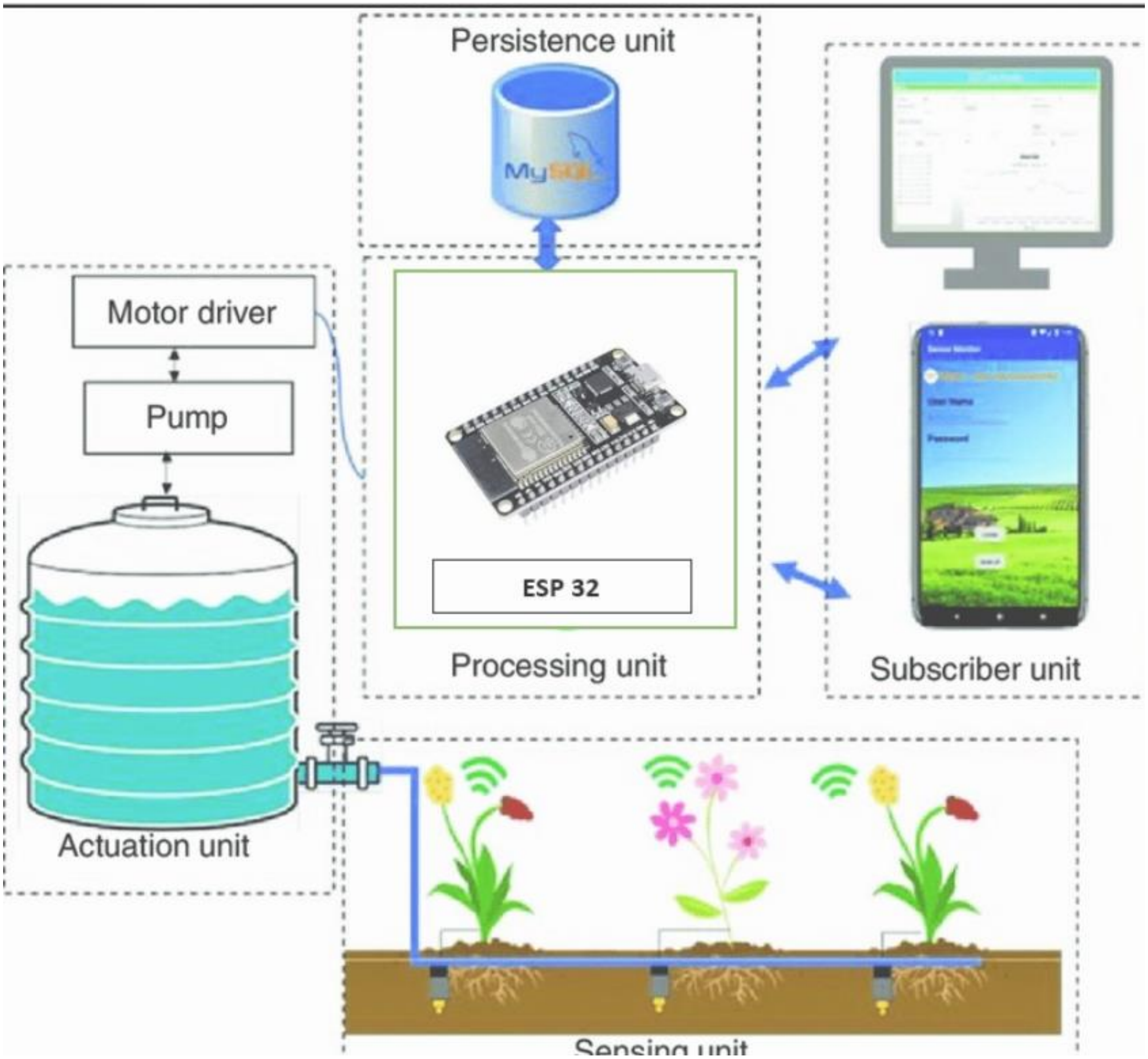


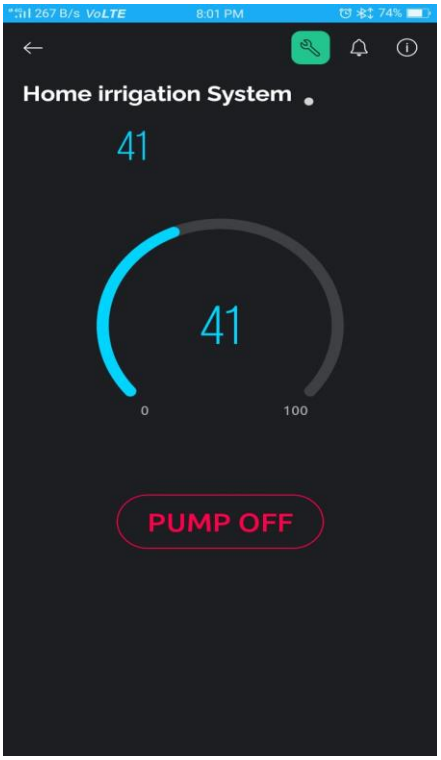
Fig 3.3.1System Architecture diagram

This system architecture is designed to enable optimal water usage and promote ideal soil moisture levels for plants for successful growth by using real-time monitoring and control. The system integrates four key components: the control, operating, sensory, and active element. This cutting-edge technology provides two models of control, i.e. automated and manual operation of the irrigation process, creating a flexible and efficient environment. The control part is equipped with a user interface which is very intuitive providing information in real-time about the level of the soil moisture and to allow you to control the irrigation process manually. Users can access the UI via the web or mobile app of the modular link. This aspect facilitates convenience and simplicity for users.

ESP32 Microcontroller: The microcontroller is an ESP32 microcontroller that is one of the most powerful, and what makes it outstanding is its integrated Wi-Fi. The ESP32 receives data coming from the sensor, takes the processing, and makes a decision accordingly to what is its predefined threshold. Processing unit is configured with the threshold value and the type of event to be detected. (i.e 5%).This particular threshold is measured by the soil moisture content which falls below it automatically triggers the actuating unit for these types of events. The sensing unit comprises of soil moisture sensors located at multiple depths in the soil. This set of sensors read the soil moisture data and transmit it to the processing system instantaneously. They ensure an accuracy and a dependability of measurements that allows the system work flawlessly.

The system is established to keep a constant soil moisture of 5% below the total moisture in the soil. At points the moisture content go down to 50% the ESP32 microcontroller automatically run the actuating system, opening valves or switching on the pumps that can the water plants. This brings about watering immediately as and when necessary, thus ensuring that there is no need for manual intervention.

3.4 OUTPUT



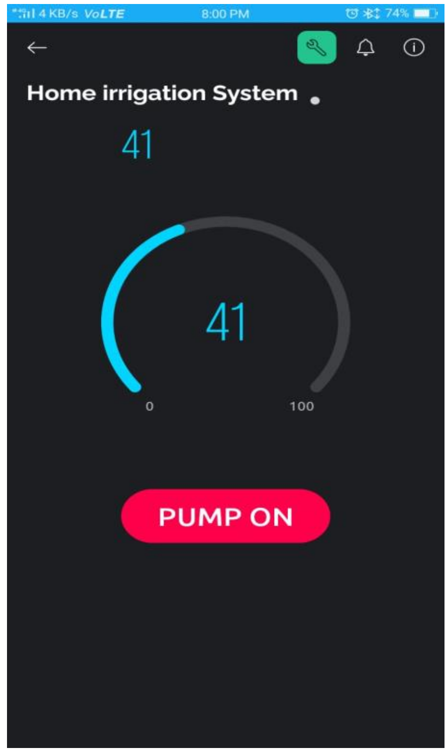


Fig 3.4.1 Moisture level indicator and water controller

(The user can automate the water supply based on the moisture levels)

The threshold value is set and the processing unit is configured. (E.g 5%). At this particular level of soil moisture content, the ESP32 switches on the actuator and starts the water flow. The moisture level will be shown in real time during water supply.

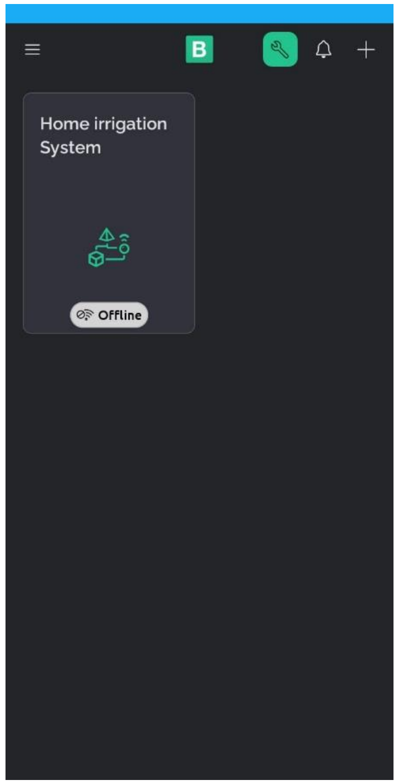


Fig 3.4.2 When system is in offline

(When the system is not connected to the Wi-Fi)

CONNECTIONS:

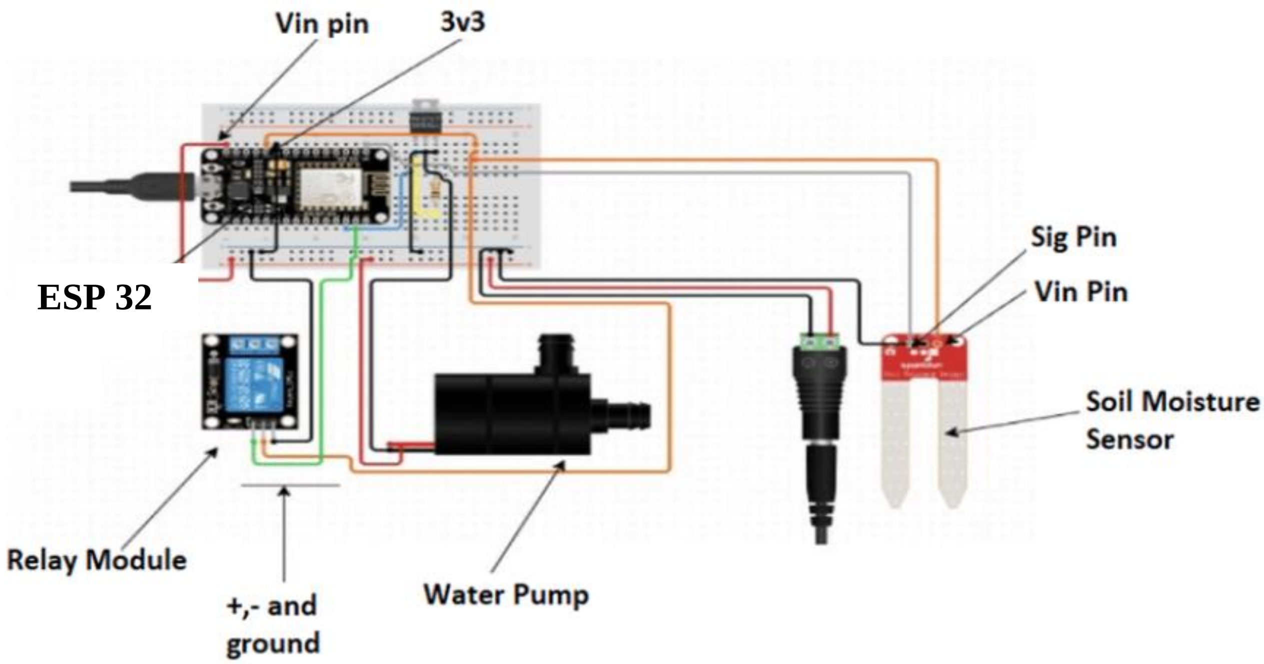


Fig 3.4.3 Circuit Diagram

CHAPTER 4
CONCLUSION AND FUTURE WORK

By using our IoT-based smart irrigation system that has real-time monitoring, automated control and user-friendly interface the water management is taken to a higher level. It maintains the optimal soil moisture, encourages healthier plant growth, and saves water at the same time. An automated watering system equipped with manual override provides both flexibility and convenience living it as a modern tool for sustainability and efficiency. The project is a shining example of the possibilities stemming from IoT technology in relation to improving resource management and crop health.

Future enhancement of this project is to control the water supply depends upon the plant type. To implement this, a camera sensor should be mounted in the agricultural area, these camera captures the pictures of plant in agricultural land and send these pictures to the backend, where a deep learning model is trained to identify the plants based on these images. Once the image is identified the water will supply to the plants based on the program written in the IDE.

APPENDIX I

```
#define BLYNK_TEMPLATE_ID "TMPL34XSjYwwq"
#define BLYNK_TEMPLATE_NAME "Plant  Watering System"
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
#define sensor 34
#define motor 25
BlynkTimer timer;
char auth[] = "mvuDzwA4oCWLnd5LEAu9SXNQX4e_vwKj";
char ssid[] = "santhosh";
char pass[] = "password illa";
void setup() {
  Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
  pinMode(motor, OUTPUT);
  Serial.begin(9600);
  pinMode(2, OUTPUT);
  digitalWrite(motor, HIGH);
}
void soilMoisture() {
  int value = analogRead(sensor);
  value = map(value, 0, 4095, 0, 100);
  value = (value - 100) * -1;
  Blynk.virtualWrite(V0, value);
  Serial.println(value);
  if (value < 5) {
    digitalWrite(motor, LOW);
```

```
    delay(800);
    digitalWrite(motor, HIGH);
 }
}
BLYNK_WRITE(V1) {
  bool Relay = param.asInt();
  if (Relay == 1) {
    digitalWrite(motor, LOW);
  } else {
    digitalWrite(motor, HIGH);
  }
}
void loop() {
  soilMoisture();
  Blynk.run();
  digitalWrite(2, LOW);
  delay(400);
  digitalWrite(2, HIGH);
}
```

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