PLANT WATERING SYSTEM USING ESP32

A PROJECT REPORT
submitted by

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BONAFIDE CERTIFICATE

Certified that this project report titled "PLANT WATERING SYSTEM USING ESP32" is the bonafide work of SAI PRASAD R (210701220) PURUSHOTHAMAN M (210701199)" who carried out the work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ABSTRACT

This paper presents the design and implementation of an IoT-based automated plant watering system utilizing the ESP32 microcontroller. The system aims to optimize water usage and ensure the health of plants through precise and timely watering. By integrating soil moisture sensors, the ESP32 continuously monitors soil moisture levels and activates a water pump when the moisture falls below a predefined threshold. The system is equipped with Wi-Fi capabilities, allowing real-time monitoring and control via a mobile application or web interface. Users can receive notification.. The proposed solution offers a cost-effective, scalable, and user-friendly approach to plant care, reducing manual intervention and enhancing plant growth. This paper discusses the hardware and software components, system architecture, and performance evaluation of the implemented prototype. Initial results demonstrate the system's reliability and efficiency in maintaining optimal soil moisture levels, showcasing its potential for domestic gardens, greenhouses, and agricultural applications.

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CHAPTER 1

INTRODUCTION

Internet of Things represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. Internet of Things is very quickly becoming a reality. We can see the proof of it around us. Our devices are getting smarter each day from smartphones to smart TV to smart car to Smart kitchen. Everything is now getting connected to Internet. Internet of Things (IoT) describes a network of physical objects that connect to each other through the internet. Objects, or ‘things can transfer information wirelessly without requiring human interaction. A ‘thing’ can be any object that can be assigned an IP address and provided with the ability to transfer data over a network. A Thing, in the Internet of Things, can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an IP address and provided with the ability to transfer data over a network. These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include smart thermostat systems and washer/dryers that utilize WiFi for remote monitoring. In this project, we will learn about the IoT Based Smart Agriculture & Automatic Irrigation System with ESP32. Agriculture plays a vital role in the development of agricultural countries. Some issues concerning agriculture have been always hindering the development of the country. Consequently, the only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Hence the method is making agriculture smart using automation and IoT technologies. The Internet of Things (IoT) enables various applications of crop growth monitoring and selection, automatic irrigation decision support, etc. We proposed the ESP32 IoT Automatic irrigation system to modernize and improve the productivity of the crop.

1.2 Objectives

• **Modernization of Traditional Agriculture Methods:** To explore how IoT technologies can be integrated into agriculture to modernize and improve traditional farming methods.

• **Enhancing Crop Productivity:** To develop an automatic irrigation system that optimizes water usage and enhances crop productivity by providing the right amount of water at the right time.

• **Real-time Monitoring and Decision Support:** To enable real-time monitoring of crop growth and environmental conditions (such as soil moisture, temperature, and humidity) using IoT sensors, providing farmers with valuable data for decision-making.

• **Remote Accessibility and Control**: To enable remote monitoring and control of the irrigation system via the internet, allowing farmers to manage irrigation schedules and monitor crop conditions from anywhere, using smartphones or computers.

CHAPTER 2

LITERATURE REVIEW

1 Automated Plant Watering System. Abhishek Gupta[1] et al. explain that the system consists of a soil moisture sensor, a water pump, and a microcontroller that controls the watering process. The article also discusses the advantages of using an automated system over manual watering, such as improved plant growth and reduced water waste. Overall, the article presents a useful solution for individuals who want to maintain healthy plants while minimizing their water usage.

2 Automated Plant Watering System. K.Ajay Reddy[2] et al. This project provides a user friendly, reliable and automated water pumping system at fields. Now a day's technology is running with time, it completely occupied the life style of human beings. Even though there is such an importance for technology in our routine life there are even people whose life styles are very far to this well-known term technology. So it is our responsibility to design few reliable systems which can be even efficiently used by them. This basic idea gave birth to the project Node MCU based water pump controller at fields using Relay switches. The project mainly aims in designing water management system using soil moisture

3 Smart Garden Monitoring System Using IoT. T.Thamaraimanalan[3] et al. They explain that the system collects data on parameters such as temperature, humidity, soil moisture, and light intensity using sensors and sends the data to a cloud-based server for storage and analysis. The article also describes how the system can be accessed remotely through a mobile application. The authors highlight the benefits of such a system, including improved plant growth and reduced water usage, as well as potential applications for large-scale farming. Overall, the article provides a useful resource for individuals interested in implementing an IoT- based garden monitoring system.

4 Embedded Based Green House Monitoring system using Microcontroller. Arul Jai Singh [4] et al. presents a system designed to monitor and control the environmental parameters of a greenhouse using an embedded system based on a PIC microcontroller. The authors, Arul Jai Singh, Raviram, and Shanthosh Kumar, explain that the system measures parameters such as temperature, humidity, and light intensity using sensors and adjusts them to maintain optimal conditions for plant growth. The article also describes the implementation of a web-based interface for remote monitoring and control of the system. The authors highlight the benefits of the system, including increased yield and reduced energy consumption, as well as potential applications in commercial agriculture. Overall, the article provides a useful resource for individuals interested in implementing an embedded-based greenhouse monitoring system for optimal plant growth.

2.1 Existing System

An existing irrigation system can be upgraded to a smart system by first gathering information about the current system, such as contacting local utility services to determine any critical underground piping, digging around irrigation heads to map out existing irrigation points, turning on the current system to check for any issues, and analyzing the property's unique water and irrigation system requirements. A professional irrigation company can then perform an irrigation audit, recommend maintenance systems, and upgrade the existing hardware if necessary before installing the smart controller, smart irrigation heads, and sensors.

2.2 Proposed System

A proposed system for a smart irrigation system would involve the installation of a smart controller, specialized smart irrigation heads and attachments, and various sensors around the property. The smart controller, connected to Wi-Fi, would collect data related to water consumption. This data would be used to calculate the exact amount of water the land needs and adjust water requirements accordingly. The system would also monitor and water usage to automatically adjust irrigation schedules.

2.2.1Advantages of the proposed system

- **Non-intrusive Monitoring:** The proposed system eliminates the need for elderly individuals to wear additional devices, providing a non-intrusive and unobtrusive solution for fall detection.

- **Passive Monitoring: By** integrating sensors into the environment, the system passively monitors movement patterns, enhancing user comfort and acceptance, particularly for individuals with sensory or cognitive impairments.

- **Real-time Alerts:** The system offers real-time alerts to caregivers via the Blynk enabling prompt assistance in the event of a fall without requiring the elderly individual to trigger an alarm manually.

- **Continuous Monitoring:** Unlike wearable device-based systems that rely on consistent device wear, the proposed system provides continuous monitoring, ensuring comprehensive fall detection coverage throughout the home environment.

CHAPTER 3

SYSTEM DESIGN

3.1 Development Environment

3.1.1 Hardware Requirements

1. ESP32 Board

2. Soil Moisture Sensor-Capacitive Soil Moisture Sensor V1.2 3.DHT11

3. Relay Module- 5V Relay Module

4. DC Motor Pump- 5V Water Pump

5. Bread Board and Jumper cables

Moisture Sensor Module

The soil wetness device is a kind of device generally used to find the hydrodynamic percentage of water in the soil. Gravimetric measuring of soil wetness must be extracted, dried, and sample weighted. These sensors approximate the volumetric water content indirectly by the use of other soil laws, such as the dielectric constant, electrical resistance, or alternatively, relationship to neutrons.

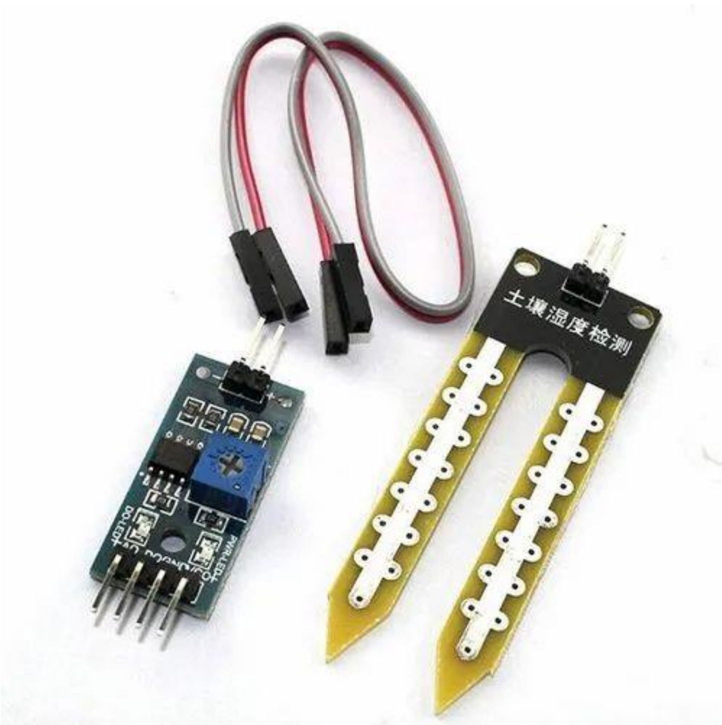


Fig.3.1 Moisture Sensor

ESP32 WiFi Development Board

A low-cost microcontroller with built-in Wi-Fi capability. This will act as the main controller and handle data processing and communication.

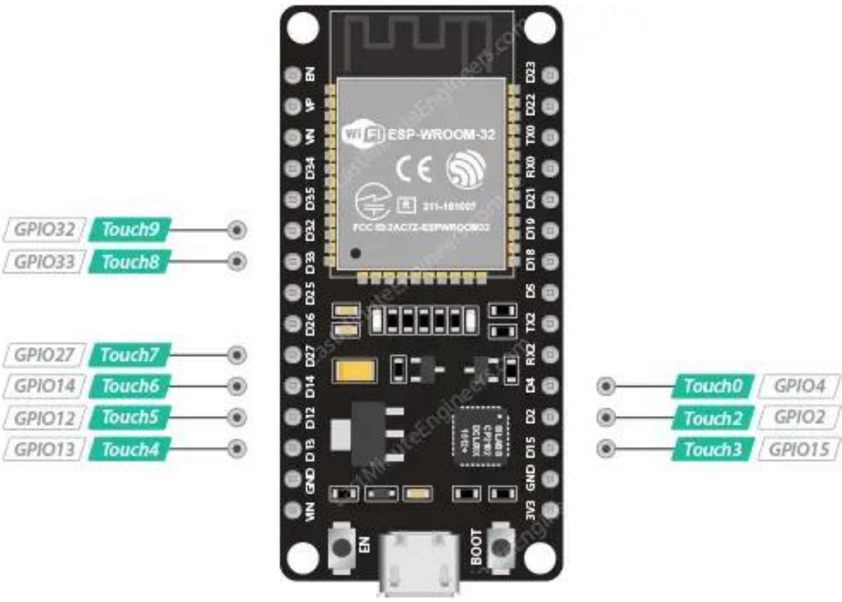


Fig.3.2 ESP32 Module

Submersible motor

The power source for these small, lightweight submersible pump motor ranges from 2.5 to 6V. It uses just 220 mA of electricity and has a maximum flow rate of 120 liters per hour. All that is required is to connect a tube pipe to the motor output, submerge it, and then power it. Never allow the motor to submerge underwater.

Fig.3.3 Submersbile Motor

Relay module

A power relay component is an electronic switch that can handle on an electromagnet . The electromagnet is switched on by a divide small power signal that is sent by a microcontroller. Once it started, the electromagnet stated to either open or close an electrical circuit

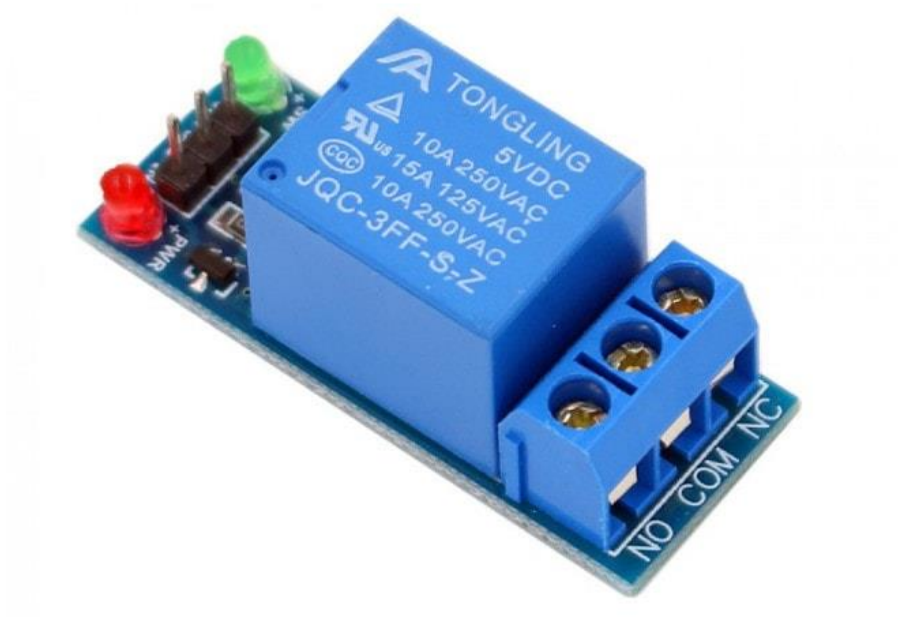


Fig.3.4 Relay

Jumper Wires

Male-to-male and male-to-female jumper wires are needed for making connections between the ESP32, MPU6050, and the breadboard.

BreadBoard

A breadboard is used for prototyping and making temporary connections between the components without soldering.

USB Cable

A USB cable (Micro-USB to USB) is required to power the ESP32 and upload the code from the computer.

3.3V Power Supply

The ESP32 development board and the MPU6050 sensor module require a stable 3.3V power supply for operation.

3.1.1Software Requirements

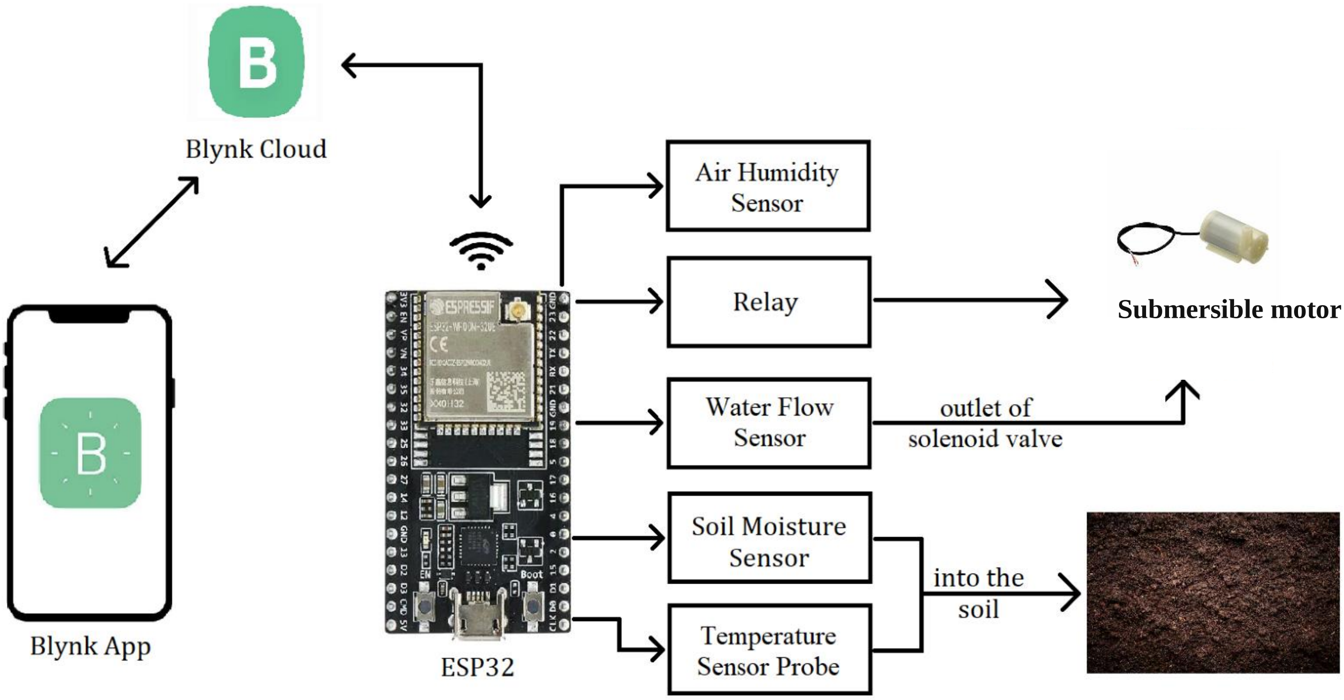
- **Arduino IDE:** Used for programming the ESP32 with firmware code.

- **Blynk App:** Download and install the Blynk app on your smartphone. Blynk provides both Android and iOS versions, so choose the appropriate one for your device.
- **Blynk Library for Arduino**: Install the Blynk library in the Arduino IDE. This library allows communication between the ESP32 board and the Blynk app.

  You can install the Blynk library through the Arduino Library Manager.

CHAPTER 4

PROJECT DESCRIPTION



The Physical Description of project can be represented by the above Fig 5. All Sensors are connected to the ESP32 and DC Pump and Relay module is connected to Power Supply. Here we use the power supply as Battery. The Output can be shown in Blynk App. This app is used to Monitor and Control our Hardware project and Display the parameters in Web Dashboard of Blynk App. The circuit Diagram can be shown in below Figure:6 The connections of circuit are explain below. In ESP32 we use D3, D2,D5 and A0 along with VCC and GND Pins.DTH11 Sensor consist of Three pins the data pin is connected to D3 of MCU and Supply and Ground pin is connected to VCC and GND respectively. Soil moisture sensor signal pin is connected to A0 and remaining two pins one is connected to supply and another is ground. LED positive is connected to D2 whereas negative is grounded. Relay Module data pin is connected to the D5 and Supply and Ground is connected to VCC and GND Respectively. DC Pump) Relay Module is connected to the Battery. DC pump Operates based on the Relay and Battery. When we give Power Supply to ESP32 5V or 9V then the user program in flash memory is enables and display the outputs. According to the displayed information we overcome the Soil Moisture related problems then we improve the Soil Moisture by giving the proper water supply to plant through motor. Then Automatically the we improve plant growth and also reduce the wastage of water. When moisture level is high then the motor is in OFF position.

4.1 SYSTEM ARCHITECTURE

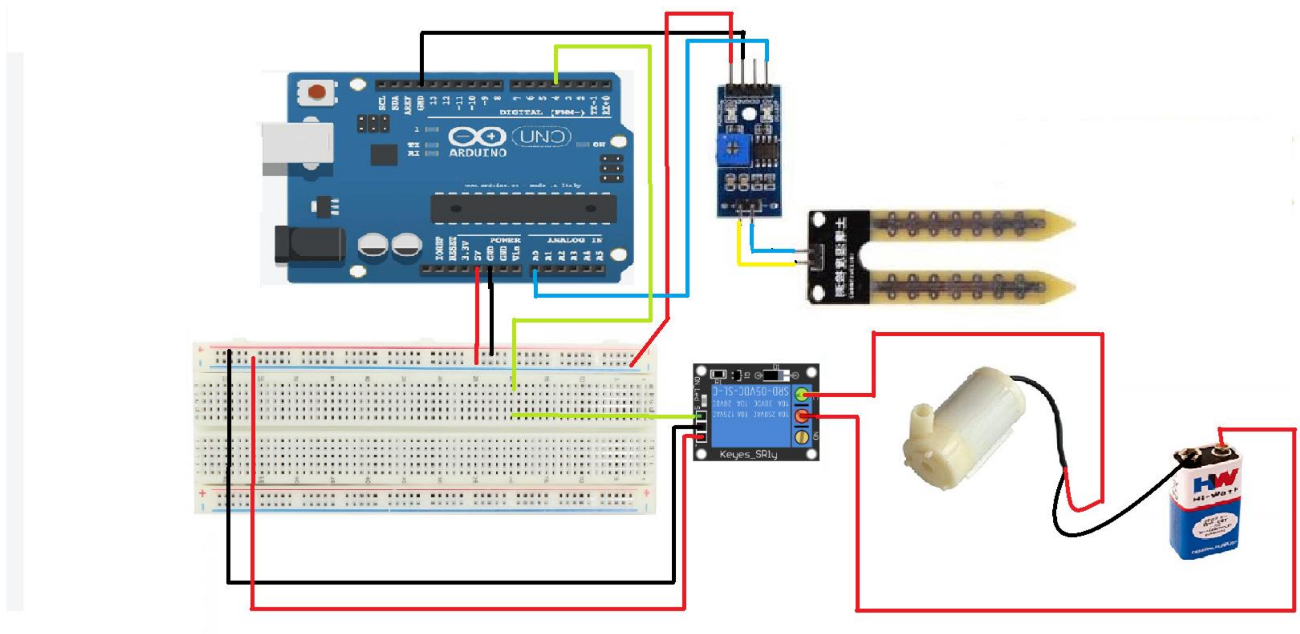


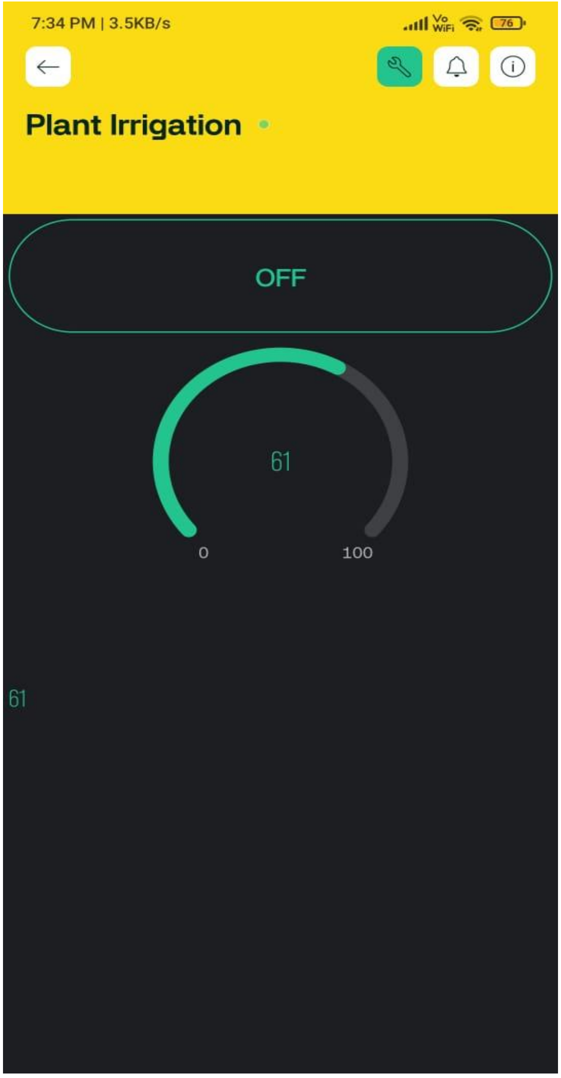
Fig 4.1 System Architecture

4.2 METHODOLOGY

We will use Capacitive Soil Moisture Sensor to measure moisture content present in the soil. Using a 5V Power relay we will control the Water Pump. Whenever the sensor detects a low quantity of moisture in the soil, the motor turns on automatically. Hence, will automatically irrigate the field. Once the soil becomes wet, the motor turns off. You can monitor all this happening remotely via Blynk app online from any part of the world.

CHAPTER 5

RESULTS AND DISCUSSION



The above picture shows the real time results on Blynk App web dashboard Screen.it displays the Exact Temperature, Humidity and Soil Moisture Readings. The Blynk application is connected to Wi- Fi. Through this Wi-Fi the App can shows the Readings in any Android Device

Fig -5.1: Interface of Blynk Application

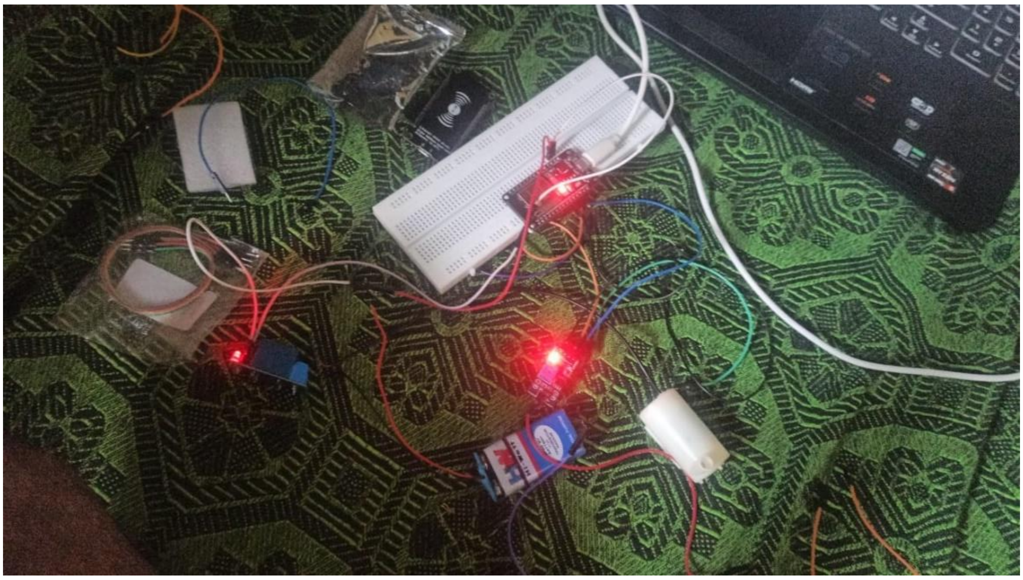


Fig -5.2: Working Model.

CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 Conclusion

In this project, we implemented an automatic irrigation facility which one can easily control from their home by using a simple online application. Labor work would be eliminated and we would get accurate results. The proposed system can reduce the efforts of farmers and provides a high yield. It also conserves water for irrigation by locating the sensor at the right position above the soil level. This work has shown that plants can still sustain at low moisture level more than one parameter has made this system an efficient one for managing the field.

6.2 Future Work

The Future Scope of this Project never be ended Because in today fast World every person will Require a helping hand to take care of plant and Plant health status. This is Further used for large Scale of Agriculture Purpose to increase the Crop Rate and help farmers to reduce man power. Machine results and sensing provide accurate results which will help optimize production. With IOT the Plant Monitoring system can be made portable. Plant Monitoring system can be set up in extreme climatic conditions as the automated system will continuously make alterations such that suitable conditions for the plants are sustained.

APPENDIX

SOFTWARE INSTALLATION

Arduino IDE

We need to first install the Arduino IDE, then install the required modules for ESP32. After running the code successfully, mount it.

Sample code

```
#define BLYNK_TEMPLATE_ID "TMPL34XSjYwwq"
#define BLYNK_TEMPLATE_NAME "Plant  Watering System"

#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>

#define sensor 34
#define motor 25
#define bulb 14


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);
  pinMode(bulb, OUTPUT);
  pinMode(2, OUTPUT);
  digitalWrite(motor, HIGH);
  digitalWrite(bulb, HIGH);
}

void soilMoisture() {
  int value = analogRead(sensor);
  value = map(value, 0, 4095, 0, 100);
```

```
  value = (value - 100) * -1;
  Blynk.virtualWrite(V0, 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);
  }
}

BLYNK_WRITE(V2) {
  bool Relay = param.asInt();
  if (Relay == 1) {
    digitalWrite(bulb, LOW);
  } else {
    digitalWrite(bulb, HIGH);
  }}

void loop() {
  soilMoisture();
  Blynk.run();
  digitalWrite(2, LOW);
  delay(400);
  digitalWrite(2, HIGH);}
```

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