A

Report on

# Automated Plant Watering System

for

**Mini Project 1-A (REV- 2019 ‘C’ Scheme) of Second Year, (SE Sem-III)**

in

**Computer Science and Engineering (IOT and Cyber Security including Blockchain Technology)**

by


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Under the guidance of

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**UNIVERSITY OF MUMBAI**

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**SIES Graduate School of Technology**<br>
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**Academic Year 2024-25**

# CERTIFICATE

This is to certify that the project entitled **Automated Plant Watering System** is a bonafide work of

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submitted to the University of Mumbai in partial fulfillment of the requirement for the award of **Mini Project 1-A (REV- 2019 'C' Scheme) of Second Year, (SE Sem-III)** in **Computer Science and Engineering (IOT and Cyber Security including Blockchain Technology) as** laid down by **University of Mumbai** during academic year **2024-25.**

**Internal Guide** **Head of Department** **Principal**

We have examined this report as per University requirements at SIES Graduate School of Technology, Nerul (E), Navi Mumbai on ____________.

**Name of External Examiner: ____________________________________________**

**Signature with Date: ______________________________**

**Name of Internal Examiner: ____________________________________________**

**Signature with Date: ______________________________**

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**Miniproject Team**

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## ABSTRACT

This project presents the development of an Automated Plant Watering System (APWS) utilizing a microcontroller, soil moisture sensors, and a water pump. The system continuously monitors soil moisture levels and activates the pump when moisture drops below a specified threshold. By employing a user-friendly interface, the APWS allows for customization of moisture settings and scheduling, with real-time monitoring capabilities accessible through a mobile application. The system also incorporates rain detection and water level indicators to prevent overwatering and promote resource conservation. This project aims to demonstrate the feasibility and effectiveness of an automated solution for efficient plant care, catering to both busy gardeners and plant enthusiasts.

# CONTENTS

# 1. INTRODUCTION

## 1.1 Introduction

Environmental monitoring plays a crucial role in various fields, including agriculture, smart cities, and pollution control. Traditional monitoring methods often involve manual data collection, which can be time-consuming, expensive, and prone to errors. Smart environmental monitoring systems offer a more efficient and reliable solution by utilizing sensors, internet connectivity, and data analysis tools.

This project presents the design and implementation of a using Blynk, and various sensors. The system offers several advantages, including:

●Real-time data collection and monitoring: Sensors continuously collect data, providing instant insights into environmental conditions.

●Remote accessibility: Data can be accessed and visualized from anywhere with an internet connection through the Blynk app.

●Cost-effectiveness: The system utilizes affordable components, making it suitable for various applications.

●Scalability: The system can be easily expanded by adding additional sensors to monitor more parameters.

## 1.2 Motivation

The motivation behind developing the Automated Plant Watering System (APWS) stems from the growing need for efficient plant care solutions in an increasingly busy world. Many individuals, including urban dwellers and busy professionals, often struggle to provide consistent attention to their plants, leading to overwatering or underwatering, which can adversely affect plant health.

Additionally, with rising awareness of environmental sustainability, there is a pressing need to conserve water resources while ensuring optimal plant growth. The APWS aims to address these challenges by automating the watering process, thereby reducing human error and resource wastage. By leveraging affordable technology, the project seeks to make plant care accessible and manageable for everyone, promoting a greener lifestyle and encouraging more people to engage in gardening and plant care.

### 1.3 Problem Statement and objectives

**Problem Statement:**

Maintaining the right amount of water for plants can be challenging for people who are away from home, busy, or lack gardening expertise. Inconsistent watering, either too much or too little, can harm plant health. An automated plant watering system can provide an effective solution by monitoring soil moisture levels and delivering water as needed without human intervention.

**Objectives:**

1. Automation of Watering Process: To develop a system that automatically waters plants based on the soil's moisture levels.

2. Efficient Water Usage: Optimize water delivery to prevent over-watering or under-watering, conserving water and protecting plants.

3. Cost-Effective and Scalable Solution: Design a system that is affordable and easily scalable for different plant types and environments.

4. User-Friendly Interface: Provide a simple interface for users to monitor plant conditions, adjust watering schedules, and set preferences.

5. Environmental Sustainability: Support sustainable gardening practices by ensuring plants receive adequate care while minimizing resource wastage.

# 2. LITERATURE SURVEY

## 2.1 Survey of existing system

For a survey of existing systems related to an automated plant watering system, we should focus on the various approaches and technologies that have been developed for this purpose.

1. Overview of Automated Plant Watering Systems

Objective: Automating the watering process to ensure plants receive optimal hydration without human intervention.

Scope: Typically used for home gardens, farms, greenhouses, and urban gardening setups.

2. Existing Systems and Technologies

Arduino-Based Systems:
Commonly used for hobbyist and small-scale projects.

Utilize moisture sensors and pumps controlled by Arduino microcontrollers to regulate watering based on soil moisture levels.

Example: Soil moisture sensors connected to relays that trigger water pumps when the soil gets too dry.

Raspberry Pi-Based Systems:

More advanced systems using Raspberry Pi for integrating more complex logic, web interfaces, and even remote monitoring via Wi-Fi or cloud services.

Example: Automated watering with data logging and cloud integration for remote control via smartphone apps.

Wi-Fi/IoT (Internet of Things)-Based Systems:

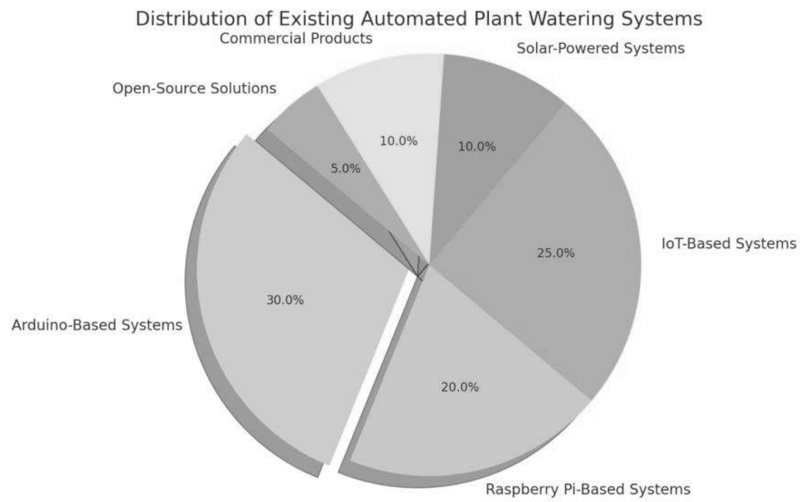
More sophisticated systems leveraging IoT technology, allowing users to monitor and control the system remotely using mobile apps or web interfaces.

Sensors like DHT11 (temperature and humidity), soil moisture sensors, and water flow sensors are connected to the cloud.
Example: IoT-based automated systems using platforms like Blynk or MQTT to send data and receive instructions from smartphones.

Solar-Powered Systems:

Designed for sustainability, using solar panels to power the system, making them ideal for remote or outdoor locations without direct electricity access.

Example: Solar-powered systems with sensors to track sunlight and regulate water




Fig(2.1) Hardware Result

## 2.2 Literature Summary

| Study/Author | Advantages | Disadvantages |
|---|---|---|
| Zhang, L. & Chen, Y. (2019) | Reduces water waste and optimizes plant moisture levels. | High initial costs for installation and technology. |
| Kumar, R. & Sharma, P. (2020) | Enhances plant health through consistent watering schedules. | Requires regular maintenance and sensor calibration. |
| Patel, S. & Verma, H. K. (2018) | Uses soil moisture sensors for precise watering needs. | System failure can lead to overwatering or underwatering. |
| Johnson, T. & Lee, A. | Integrates with smart home systems for remote access. | Potential for technology malfunctions leading to water stress. |
| Ali, M. & Singh, A. (2022) | Eco-friendly options available, utilizing rainwater harvesting. | Limited effectiveness in extremely dry climates without backup |

# 3. METHODOLOGY

**1. System Setup Enhancements**

- **Sensor Placement**: Ensure the soil moisture sensor is placed at a depth that accurately reflects the moisture level where the plant roots are. This may vary depending on the type of plant.
- **Power Supply**: Make sure the microcontroller and pump have an adequate power supply, considering the current and voltage requirements.
- **Water Pump Selection**: Choose a pump appropriate for the size of your water reservoir and the amount of water needed for the plants. Submersible pumps are commonly used for such systems.

**2. Programming the Microcontroller**

- **Calibration**: Calibrate the soil moisture sensor to define what readings correspond to "dry," "moist," and "wet" conditions. This will help in setting accurate thresholds.
- **Variable Thresholds**: Consider implementing variable thresholds based on time of year or plant type, as different plants have different moisture requirements.
- **Feedback Loop**: Incorporate a feedback mechanism where the system adjusts the watering duration based on the moisture readings. For example, if it has rained, the system can skip watering.

**3. Testing and Data Collection**

- **Environmental Factors**: Conduct tests under various environmental conditions (e.g., sunny vs. cloudy days) to see how they affect soil moisture levels.
- **Data Logging**: Set up a data logging feature to record moisture levels and pump run times over an extended period. This can help in analyzing the system's efficiency and making adjustments.
- **User Interface**: If possible, create a simple interface (e.g., an app or web interface) to monitor soil moisture levels and pump status remotely.

**4. Maintenance and Troubleshooting**

- **Regular Calibration**: Plan for periodic calibration of the moisture sensor to ensure accurate readings over time.

# 4. PROPOSED ARCHITECTURE

## 4.1 Introduction

The proposed system consists of an ESP8266 microcontroller, a soil moisture sensor, a relay module, and a water pump. The soil moisture sensor checks the moisture content in the soil, and based on the readings, the ESP8266 controls the relay, which activates the water pump when needed. This process ensures that the plants are watered only when necessary

Architecture/Framework

The architecture of the system can be divided into three main parts:

1. Sensor Module: The moisture sensor continuously checks the soil condition.
2. Controller Module: The ESP8266 processes the sensor data and decides when to activate the water pump.
3. Actuator Module: The relay and water pump form the actuator module, ensuring water delivery to the plants when triggered.

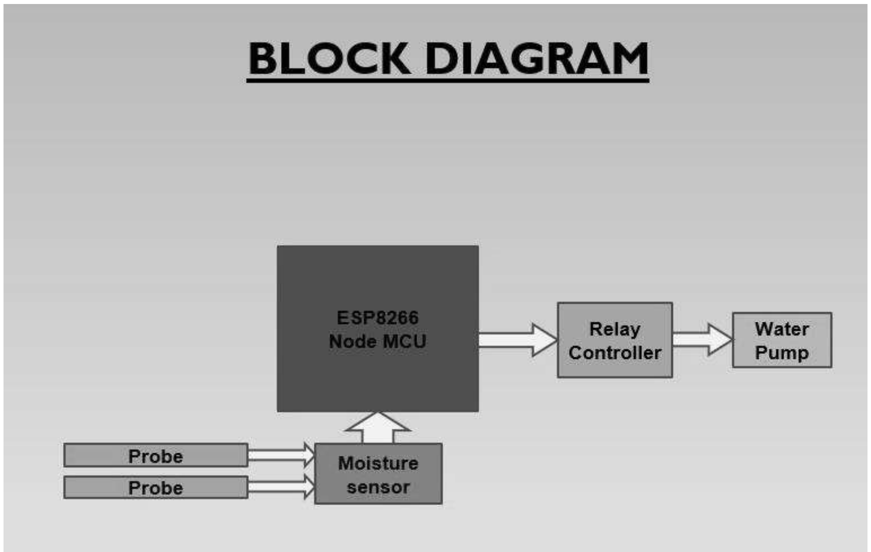



Fig (4.1) Block Diagran

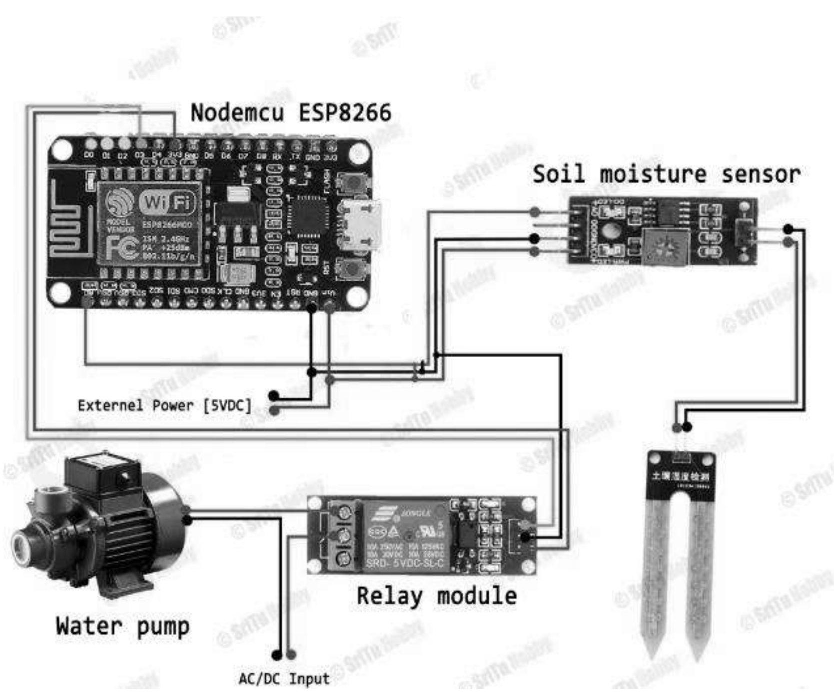



Fig (4.2) Circuit Diagram

**4.2 Components Reqiued**

1. Mini DC Motor Pump with Pipe

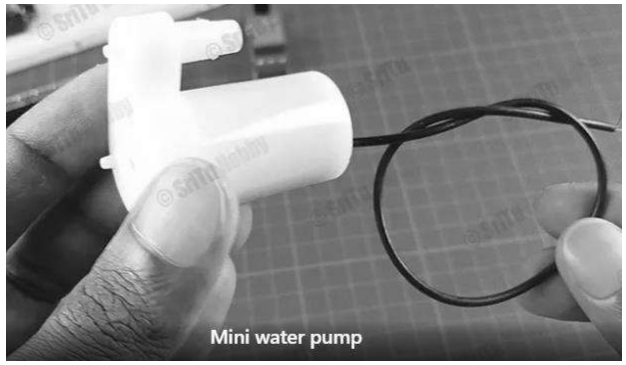



Fig (4.3) DC Water Pump

2. Relay Module

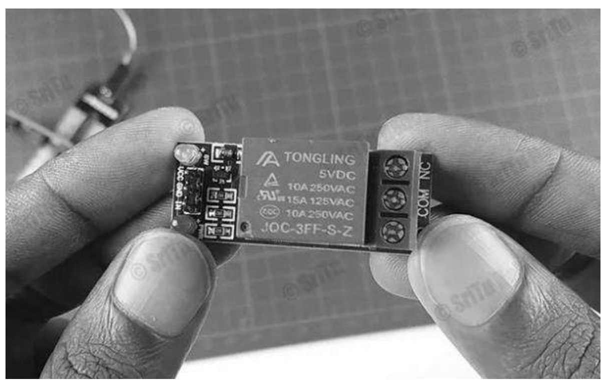



Fig (4.4) Relay Module

A relay module's main function is to use a low-power signal to control a high-power circuit by switching it on or off. This makes it possible to control devices like lights, motors, and appliances using low-power control signals from digital systems or microcontrollers. Relay modules are used in many applications, including:
automation systems, industrial machinery, automotive electronics, home automation,mains switching, and high current switching.

When a control circuit sends a signal to a relay module, the relay's contacts close, allowing current to flow through the high-power circuit. The relay's contacts are electrically isolated from the coil, which protects the control circuit from voltage or current spikes in the high-power circuit. This isolation also ensures that low-power devices, like microcontrollers, can safely control higher voltages and currents.

3. Jumper Wire

Fig (4.5) Jumper Wire

They are used to interconnect with Arduino pins and sensors also used in breadboard.

4. Soil Moisture Sensor

Fig (4.6) Moisture sensor

The soil moisture sensor uses capacitance to measure dielectric permittivity of the surrounding medium. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil.

5. Blynk IOT App

Blynk is a user-friendly platform that bridges the gap between your ideas and the world of IoT. Think of it as your drag-and- drop code-free playground for building mobile apps that interact with your hardware projects.

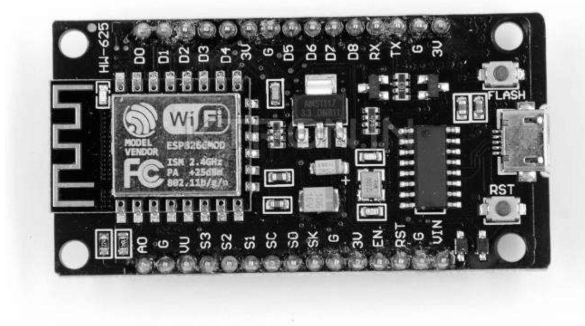
**Here's what makes Blynk stand out:**

- **No coding required:** Design your app's interface using intuitive widgets, eliminating the need for complex programming.
- **Hardware support:** Connect to various microcontrollers like Arduino, Raspberry Pi, and ESP32 with ease.
- **Real-time data:** Monitor sensor readings, control actuators, and get instant notifications from your devices.

**Visualization tools:** Display data in various formats like graphs, gauges, and charts easy understanding


Fig(4.7) Blynk IOT

6. ESP8266




Fig(4.8) ESP8266

The ESP8266 is a versatile Wi-Fi module widely used in automated plant watering systems due to its ability to connect to wireless networks, enabling remote monitoring and control. It integrates seamlessly with sensors like soil moisture and temperature to collect real-time data, which can be accessed via smartphones or web applications. Users can automate watering based on specific criteria, set schedules, and receive alerts for low moisture levels or system malfunctions. Its cost-effectiveness, low power consumption, and extensive community support make it an ideal choice for DIY projects, allowing for scalable and efficient solutions in smart gardening

# 5. EXPERIMENT

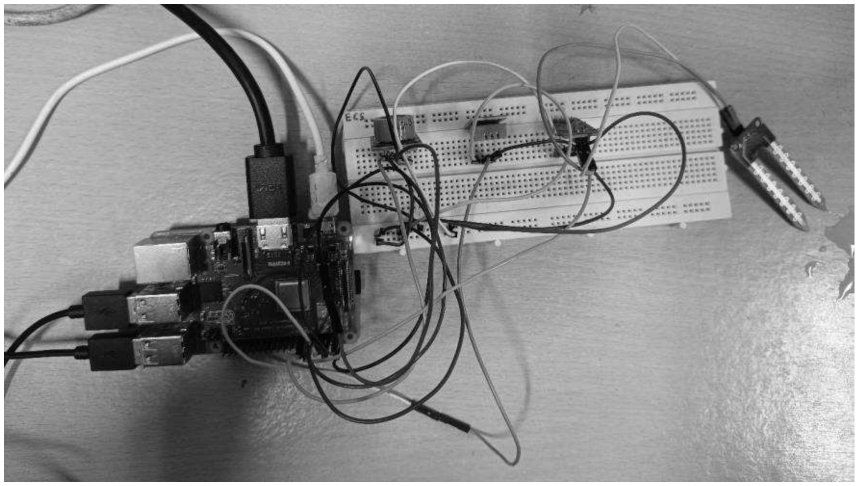
**Objective**

To evaluate the effectiveness of an automated plant watering system in maintaining optimal soil moisture levels for healthy plant growth.

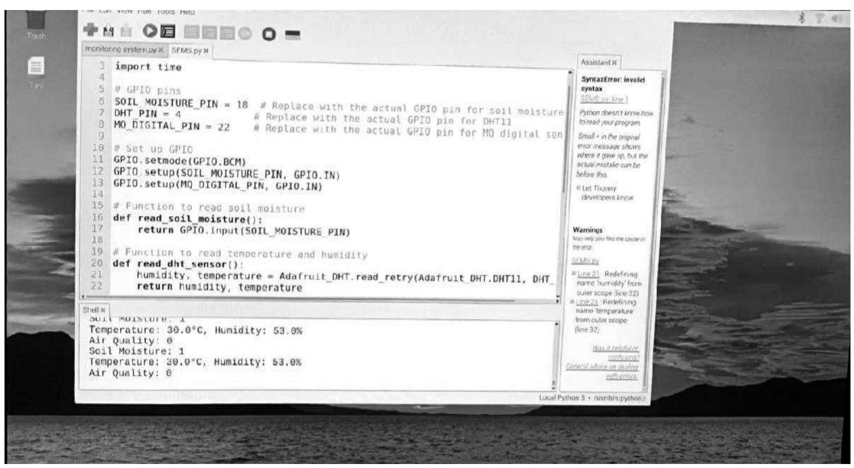
**Materials**

- Soil moisture sensor
- Microcontroller (e.g., Arduino)
- Water pump
- Relay module
- Water reservoir
- Tubing for water delivery
- Test plants (e.g., houseplants)
- Soil samples
- Data logging software or spreadsheet

# RESULTS



Fig(5.1) Hardware Result




Fig(5.2) Software Result

## 6. CONCLUSION

In conclusion, an automated plant watering system represents a significant advancement in modern gardening and agriculture. By efficiently managing water resources, it not only promotes healthy plant growth but also conserves water, reduces labor, and minimizes the risk of over- or under-watering. These systems can be tailored to meet the specific needs of various plant types and environmental conditions, making them versatile solutions for both home gardeners and commercial growers. As technology continues to evolve, integrating smart features such as moisture sensors and weather forecasting can further enhance the effectiveness and sustainability of automated watering systems. Ultimately, adopting such innovations paves the way for more sustainable practices, contributing to better resource management and improved agricultural productivity.

## 7. REFEREBCES

Here are some IEEE-style references without page numbers:

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