SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR.

Introduction to IoT

TEACHER'S ASSESSMENT

(6TH SEM-A/B, SESSION 2024-25, ECT 359-4)

"IoT-Based Plant Watering system using Esp32"

Submitted By

Meehush Bokare (Roll No.-42, Sec B)
Onkar Pathak (Roll No.-50, Sec A)
Priyansh Nigam (Roll No.-52, Sec A)

Department of Electronics and Communication Engineering

1. Introduction:

In recent years, the demand for sustainable living and smart home solutions has led to the innovation of automated systems in agriculture and gardening. One significant advancement is the automation of plant irrigation systems using Internet of Things (IoT) technologies. Proper and timely watering is crucial for healthy plant growth. However, many individuals either forget to water their plants or overwater them, both of which can negatively impact plant health.
To address this issue, this project focuses on developing an automated plant watering system using the ESP32 microcontroller and the updated Blynk IoT platform. The system monitors real-time soil moisture levels, automates watering based on a predefined threshold, and provides fertilizer suggestions by detecting prolonged dry conditions in combination with plant type.

Objectives:

- To monitor soil moisture levels using a sensor.
- To control a water pump automatically based on soil dryness.
- To allow remote monitoring and manual control through the Blynk app.
- To enhance plant care by recommending fertilizers based on moisture patterns and plant type.

Problem Statement: Many people either overwater or underwater their plants due to inconsistent schedules or lack of knowledge about plant care. Manual watering also becomes inefficient in modern urban lifestyles. Thus, a smart, responsive, and plant-specific watering system is required.

2. Existing Approaches or algorithm:

Several types of irrigation systems have been implemented with varying levels of automation and intelligence:

- **Timer-Based Irrigation Systems:** These systems operate on a fixed schedule, watering plants at regular intervals regardless of soil condition. Though simple to implement, they lack responsiveness to the actual moisture needs of the plant.

- **Threshold-Based Irrigation Systems:** These involve the use of soil moisture sensors to determine when to water plants. When the moisture level drops below a set threshold, the system triggers irrigation. This method is more efficient than timer-based approaches.

- **IoT-Based Systems:** IoT-integrated systems, such as those using platforms like Blynk or ThingSpeak, provide remote access and real-time feedback.

They often include dashboards and manual override features for enhanced user control.

- **Machine Learning/AI Systems:** Advanced systems incorporate environmental data (humidity, temperature, weather forecasts) and apply machine learning to predict irrigation needs. While effective, these are complex and resource-heavy, making them unsuitable for small-scale applications.

Our project adopts a hybrid approach, using a threshold algorithm enhanced with IoT capabilities and additional logic for fertilizer recommendations based on plant-specific trends.

3. Implemented approach or Algorithm :

Our solution uses a threshold-based algorithm implemented on an ESP32 microcontroller. The algorithm continuously monitors the analog signal from the soil moisture sensor. When the sensor reading falls below a user-defined threshold, the ESP32 activates a water pump through a relay module. Additionally, the system logs repeated instances of dryness, and if such events persist, it checks the user-defined plant type and suggests suitable fertilizers via the Blynk interface.

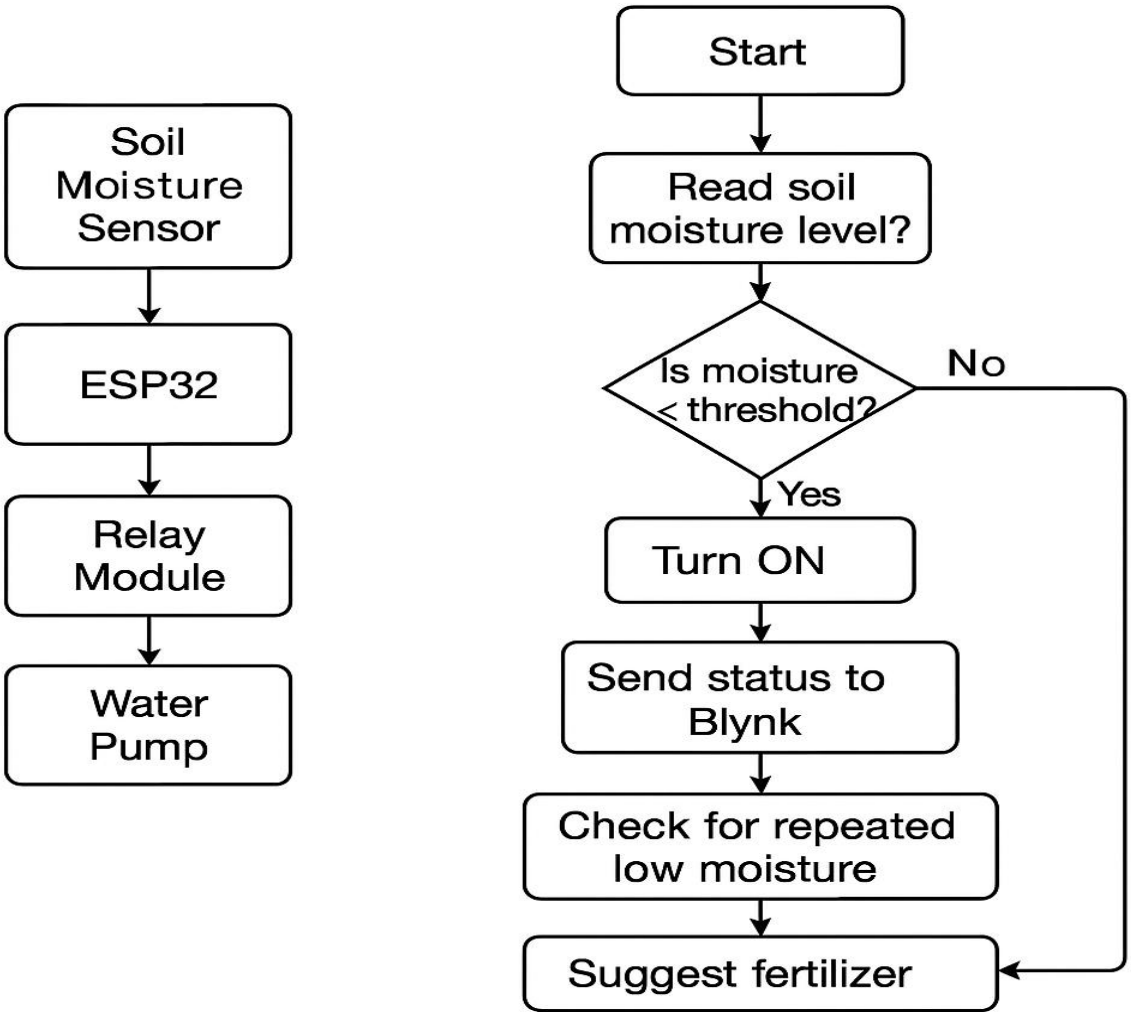
Justification for Selection:

- Simple and efficient.
- Easy to implement on low-power microcontrollers like ESP32.
- Lightweight rule-based logic avoids computational overhead.
- Blynk app provides excellent integration for real-time updates and manual control**.**

Explanation of How This Algorithm Works:

1. The ESP32 reads analog data from the soil moisture sensor.
2. It compares the value to a preset threshold:
    - If below the threshold: the user gets notification to activate the pump.
    - If above: the pump remains off (should be off).
3. The moisture value and pump status are sent to the Blynk app.
4. The user selects the plant type via the app.
5. If low moisture is repeatedly detected over time:
    - A fertilizer recommendation tailored to the plant type is sent to the user.

FLOW CHART:



4. Results :

The system was deployed and tested under controlled conditions with various plant types and soil compositions. The following outcomes were observed:

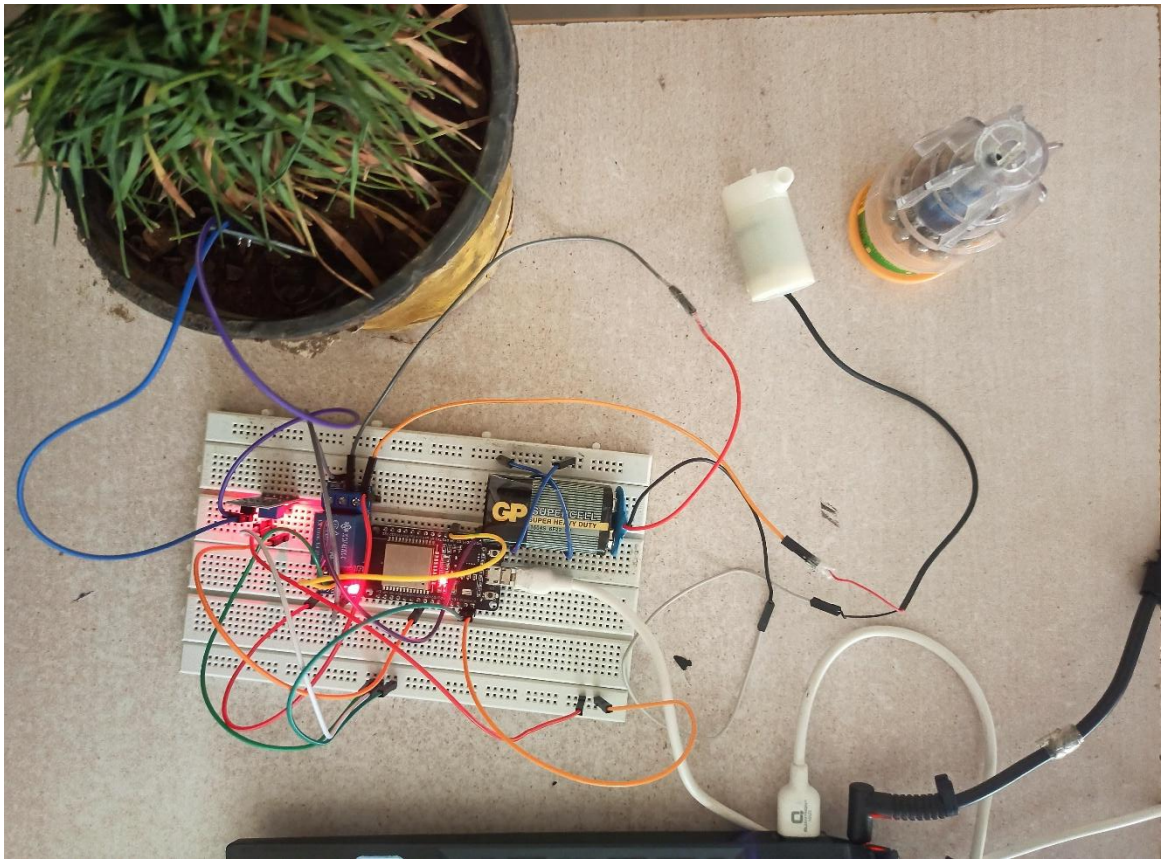
- **Accurate Moisture Monitoring:**
  - The capacitive soil moisture sensor provided consistent readings.
  - Real-time data helped maintain optimal soil hydration levels.

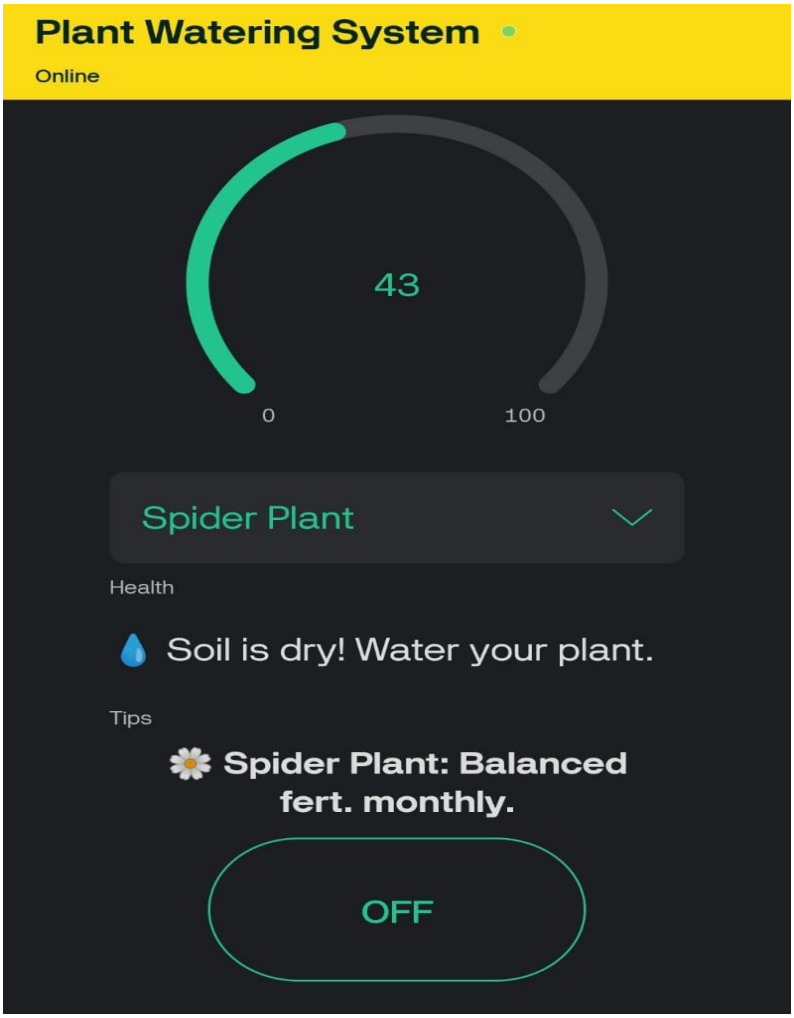
- **Automated Pump Control:**
  - The pump operated only when necessary, ensuring water efficiency.
  - The system responded within milliseconds to changes in sensor data.

- **User Interface via Blynk:**
  - Live readings were displayed on the dashboard.
  - The user could override the pump manually.
  - Plant types (flowering, leafy, succulents, etc.) could be selected.

- **Intelligent Fertilizer Suggestions:**
  - Flowering plants were recommended phosphorus-rich fertilizers.
  - Leafy plants were advised nitrogen-based fertilizers.
  - Succulents received minimal watering advice without fertilizer prompts.

- **System Responsiveness and Efficiency:**
  - Quick response time to both moisture changes and Blynk commands.
  - Minimal water usage with maximized plant health.





5. Conclusion:

The smart irrigation system developed using ESP32 and Blynk offers a compact, cost-effective, and intelligent solution for automated plant care. It supports both automation and user interaction, enhancing gardening efficiency and plant health.

Key Advantages:

- Automates irrigation based on real-time soil data.
- Reduces water wastage through efficient use.
- Offers flexibility with remote control and feedback.
- Improves plant care by suggesting fertilizers when necessary.

Future Scope:

- Addition of multiple moisture sensors for zone-based irrigation.
- Use of Wi-Fi + LoRa for large-area coverage.
- Integration with weather APIs to optimize irrigation.
- Notifications for critical soil conditions or sensor failures.

This system serves as a scalable model for integrating IoT into smart agriculture and can be adapted to commercial greenhouse setups, urban gardens, and even community farming projects.

6. References:

- https://blynk.io
- https://www.espressif.com/en/products/socs/esp32
- https://www.botanicare.com/hydro-101/npk-a-simple-guide
- https://www.youtube.com/watch?v=WLCR0r7rYi8