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Automatic Plant Watering System

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Abstract

Monitoring and caring for plants can be a challenging and time-consuming process due to traditional methods lacking automation, which results in inefficient water usage and inconsistent care routines, ultimately affecting plant growth and health. Manual watering often leads to over or under-watering, exacerbating these issues and making plant care labour- intensive and less effective. The project proposes a automatic plant watering sys-tem utilizing IoT technology, including sensors and automated watering mechanisms, to provide a user-friendly platform for plant care. This system collects real-time data on soil moisture, temperature, and humidity, and automates watering through a water pump controlled by a relay. By ensuring optimal water usage and consistent care, this solution aims to promote healthier plant growth and simplify plant management for individuals. Additionally, the system can be integrated with mobile applications to offer remote monitoring and control, providing users with real-time notifications and insights into their plant's needs. This innovative approach not only enhances the efficiency of plant care but also makes it more accessible to a broader audience, including those with limited gardening experience.

Keywords: Automatic Plant Watering System, IoT-based, Real-time Monitoring, Soil Moisture Sensors, Nodemcu Microcontroller, Blynk App, Water Conservation, Precision Agriculture.

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1. Introduction

The automatic plant watering system is an innovative, user-friendly platform that utilizes IoT technology to provide optimal care for plants. The system collects real-time data on soil moisture, temperature and humidity and automates watering through a water pump controlled by a relay. This solution aims to promote healthier plant growth, simplify plant management and make a plant care more accessible to a broader audience.

Monitoring and caring for plants can be complex and time-consuming, especially for individuals who lack experience or knowledge in horticulture. Ensuring plants receive the right amount of water, maintaining optimal soil moisture levels, and monitoring environmental conditions are crucial for plant health and growth. Traditional methods of plant care often result in inconsistent and inefficient water usage, which can lead to either overwatering or under watering. Additionally, manual monitoring requires significant time and effort, which many individuals and challenging to manage on a regular basis. The lack of automated solutions that simplify these tasks further exacerbates the problem. The project aims to address these issues by developing a Automatic Plant Watering System, an IoT-based solution that automates plant care, making it more efficient and accessible for everyone.

2. Related Works

The Automatic Plant Watering System with Blynk App requires hardware and software development. The hardware development involves integrating sensors for soil moisture, as well as a Nodemcu microcontroller and programming it to read sensor data, control the watering system and communicate with the Blynk App. Additionally, designing and developing for an automated watering system requires water pump, valves and irrigation tubes. Software development entails designing and developing the Blynk App for real-time monitoring, as well as developing APIs for communication between the microcontroller and Blynk App based on the sensor data.

3. Methodology

Data collection is a continuous process that ensures the system has accurate and up-to-date information about the plant and environmental conditions. The sensors collect real-time data on soil moisture, temperature, and humidity.This data is transmitted to the NodeMCU microcontroller, which processes and sends it to the Blynk app for remote monitoring. The system can store historical data to help users track trends and make informed decisions about plant care.

Integrating sensors into the system involves both hardware and software components. The hardware integration ensures that sensors are properly connected to the NodeMCU micro-controller and can reliably transmit data. The software integration involves programming the microcontroller to read data from the sensors, process it, and send it to the Blynk app. Key steps include: Wiring Sensors:- Connecting soil moisture, temperature, and humidity sensors to the appropriate pins on the NodeMCU. Programming the NodeMCU:- Writing code to read sensor data, process it, and control the waterpump based on predefined conditions. Connecting to Blynk:- Configuring the NodeMCU to send data to the Blynk app, allowing users to monitor and control the system remotely.

The software development process involves creating a program that runs on the NodeMCU. The Blynk App is connected to the microcontroller, such as NodeMCU or ESP8266, through the Blynk library, enabling communication between the app and the hardware. Next, the sensor data from the soil moisture, temperature, and humidity sensors is read and sent to the Blynk App through the microcontroller. The app then processes the data and sends commands back to the microcontroller to control the watering system. Additionally, APIs are integrated to enable features such as scheduling, notifications, and data analytics. The Blynk App is also customized to provide a user-friendly interface for users to monitor and control their plant watering system remotely. Finally, testing and debugging are performed to ensure seamless integration and functionality of the entire system..

3.1 Automatic Plant Watering System Architecture

The automatic plant watering system employs a multi-stage architecture that starts with continuous soil moisture monitoring using sensors. This data is processed in real-time using advanced algorithms to accurately identify the need for watering. Upon detection, the system automatically activates the watering system and adjusts the watering schedule. These adjustments are disseminated to the user through a mobile app or web interface, ensuring a coordinated and efficient watering process. Simultaneously, soil moisture levels and real-time updates are provided through a website. Throughout this process, the system logs and stores data, including soil moisture levels, timestamps, and watering schedules. This data logging is crucial for post-watering analysis, system improvement, and plant health

management strategies.

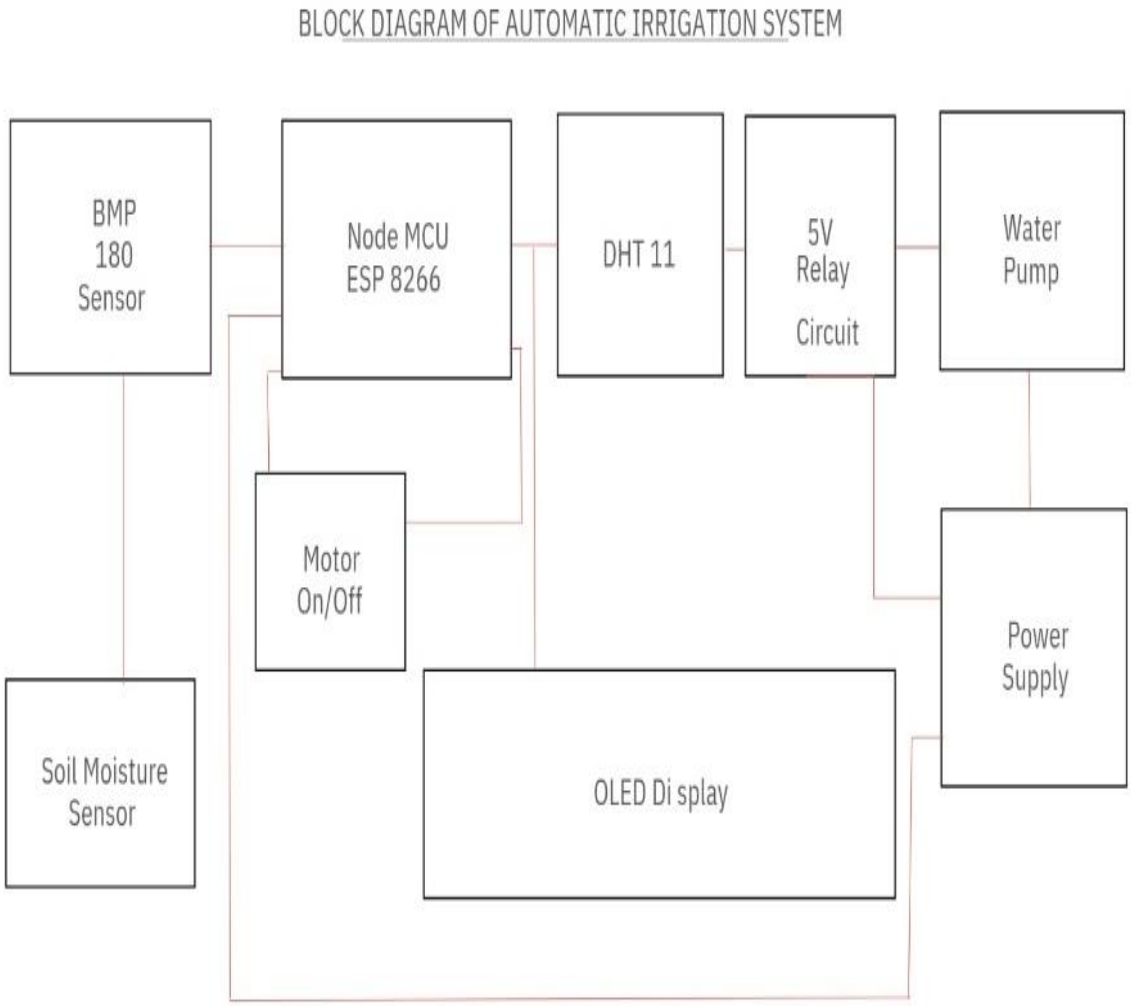

Figure 1: System Design

3.2 Implementation

3.2.1 Tools And Technologies Used

Category	Tools & Technologies
Programming Language	Python, Type script, Java script
Sensors	Soil moisture Sensor
IDEs	PyCharm, Vs Code
Watering Control Libraries	Advanced algorithms for soil moisture

4. Result and Discussion

The evaluation of the proposed automatic plant watering system focuses on its accuracy in maintaining optimal soil moisture levels using sensor data. The results demonstrate the system's capability to accurately detect soil moisture levels and its potential to improve plant health and water conservation.

The system is working effectively and reliably, fulfilling its intended purpose of automating plant irrigation based on real-time soil moisture levels. It accurately detects when the soils dry and activates the water pump accordingly, ensuring plants receive the right amount of water without user intervention. The Blynk app provides a smooth and user-friendly interface for monitoring moisture levels and controlling the system remotely. Users receive live updates and can manually operate the pump if needed. Overall, the system demonstrates good performance, efficiency, and responsiveness, making it a practical and convenient solution for plant care.

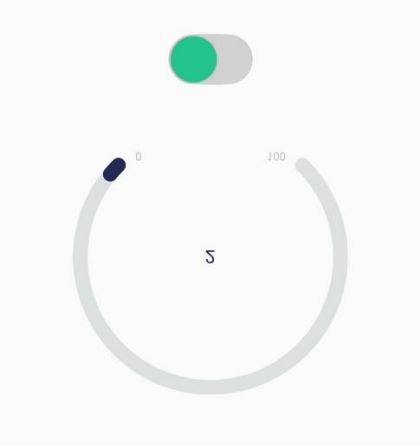

Figure 2: Initial Reading

Figure 3: Final Reading (watering system activated)

The automated irrigation system is programmed to initiate watering when soil moisture levels fall below 30% and cease watering when levels exceed 30%, ensuring optimal water conservation and plant hydration.

5. Performance Analysis

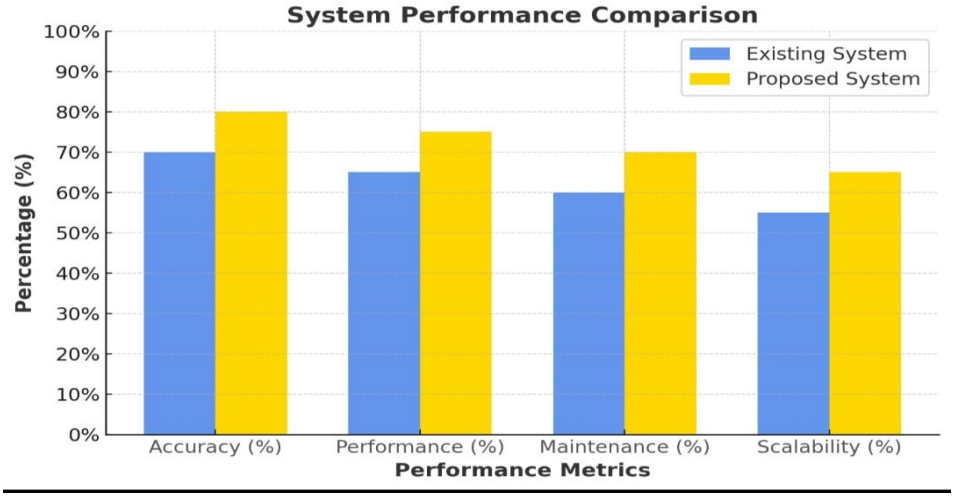

Figure 4: System Performance Comparison

The proposed system demonstrates enhanced capabilities with notable scores of 80% in Accuracy, 75% in Performance, 65% in Scalability, and 70% in Maintainability. These metrics highlight its potential to outperform the existing system, which achieves 70% in Accuracy, 65% in Performance, 60% in Scalability, and 55% in Maintainability. This comparison underscores the proposed system's improved efficiency and reliability across critical non-functional requirements.

6. Conclusions

The project aims to assist plant enthusiasts and gardeners who may lack access to advanced plant monitoring tools in monitoring and maintaining their plants' health. Smart computer programs are utilized to analyse sensor data and provide real-time insights into plant conditions. These insights are tailored to users' specific needs, helping to ensure optimal plant care. The approach differs from others by incorporating a method that allows the computer program to operate faster and more accurately, even with limited data. This method enables real-time monitoring and reliable alerts. Ultimately, the project focuses on making it easier for everyone to maintain healthy plants, regardless of their technical expertise or resources

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