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Plant Monitoring System Using IoT

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Abstract- Using NodeMCU (ESP8266), this study suggests an Internet of Things-based smart plant monitoring and automated irrigation system. A soil moisture sensor and DHT11 sensor are used to monitor environmental factors and soil moisture. To guarantee effective irrigation, a relay-controlled water pump is immediately turned on based on current soil moisture levels. For real-time monitoring, data visualization, and smartphone-based remote control, sensor data is sent to the Blynk IoT platform. The method promotes healthy plant development, avoids water waste, and requires less manual intervention. It is appropriate for home gardens and small-scale agricultural uses because to its affordable and scalable design.

Keywords: Blynk Platform, Soil Moisture Sensor, NodeMCU (ESP8266), Internet of Things (IoT), Smart Irrigation, and Automated Plant Monitoring.

I. Introduction

Smart systems that combine sensors, microcontrollers, and cloud platforms for remote control and real-time monitoring have been made possible by the Internet of Things (IoT). IoT-based plant monitoring systems enhance irrigation effectiveness, minimize manual labor, and maximize water use in home gardening and agribusiness.

An Internet of Things-based plant monitoring and automatic irrigation system utilizing NodeMCU (ESP8266) is presented in this study. The device sends data to a cloud platform for real-time viewing while continuously monitoring soil moisture, temperature, and humidity.

A relay-driven water pump automatically regulates irrigation based on soil moisture levels.

For home gardens and small-scale agricultural applications, the suggested system provides an affordable, scalable, and user-friendly alternative.

II. Ease of Use

The suggested system is easy to use and requires no technical knowledge. A straightforward mobile application provides access to real-time sensor data and irrigation administration, making it simple to monitor and operate from any place. Because there is less need for human interaction thanks to the automated irrigation mechanism, the system is practical for daily use.

A. Selecting a System Framework

The four primary modules of the suggested Internet of Things-based plant monitoring system are sensing, processing, communication, and actuation. The NodeMCU (ESP8266) microcontroller receives real-time environmental data from soil moisture, temperature, and humidity sensors. The Blynk platform uses Wi-Fi to send the processed data to the cloud for real-time monitoring and viewing. The system regulates a relay module to automatically turn on or off the water pump based on predetermined soil moisture limits. This closed-loop system guarantees effective irrigation, less water waste, and little human involvement.

III. Prepare Your System Before Implementation

The hardware and software components needed for the project must be carefully planned before the plant monitoring system is put into operation. Reliable performance and seamless integration are guaranteed by proper system preparation. Sensors, microcontrollers, communication modules, and power supply units are examples of hardware components. Programming tools, libraries, and cloud platforms for remote monitoring and data visualization are all part of the software ecosystem.

A. Abbreviations and Acronyms

Measured in degrees Celsius (°C), temperature is a significant environmental factor that influences plant growth. The Celsius scale gives a clear picture of the atmospheric conditions around the facility and is commonly used in environmental monitoring systems. Measuring temperature accurately helps assess plant health and comprehend climate factors.

B. Units

The International System of Units (SI) is followed in the measurements made by the plant monitoring system. The **percentage (%)** of soil moisture is shown. **Degrees Celsius (°C)** are used to express temperature. **Relative humidity (%RH)** is used to measure humidity. **Volts (V)** are used to quantify electrical voltage. **Amperes (A)** are used to measure current. Accurate system analysis and consistent sensor data interpretation are guaranteed by the use of standard units. Particularly with plant monitoring systems that run on batteries or solar power, monitoring current usage aids in assessing power efficiency, identifying issues, and guaranteeing steady system performance.

C. Equations

Moisture threshold detection is the primary equation utilized in the plant monitoring system. If the moisture value is less than the threshold value. Water Pump = NO in that case; otherwise, Water Pump = OFF. When soil moisture levels drop too low, the device can automatically irrigate plants thanks to this reasoning. Using a moisture threshold condition, the plant monitoring system operates on an automatic decision-making premise. A soil moisture sensor is used to detect soil moisture continuously. The measured value is then compared to a predetermined threshold.

D. Some Common Mistakes

The following are some typical errors that could impair system performance:

- The soil moisture sensor was positioned incorrectly.
- Inadequate sensor calibration. Cloud communication is failing due to poor Wi-Fi connectivity.
- Inaccurate threshold values result in needless irrigation.
- The system is operating unsteadily due to a poor power supply.
- Microcontroller firmware programming errors.
- Preventing these errors guarantees dependable system operation. Inadequate control over the power supply.
- The microcontroller (such as the Arduino Uno or NodeMCU) may restart often if weak batteries or unpredictable voltage are used.
- Wiring connections that are loose.
- Inaccurate or erratic readings could be caused by loose or improper connections between sensors and controller boards.

IV. Using The Template

To confirm the accuracy of sensor readings and irrigation control, the system was tested in various environmental settings. Real-time sensor data was successfully sent to the Blynk cloud platform by the NodeMCU. In addition to displaying the data, the mobile application enabled remote irrigation pump control. Future changes, like adding more sensors or incorporating cutting-edge data processing methods, are also made possible by the system architecture. The entire setup was created by integrating all hardware components once the plant monitoring system was designed. The circuit design dictated how the sensors, microcontroller, relay module, and water pump were connected.

A. Authors and Affiliations

This project was created by a small group of students under the direction of a faculty advisor. Each person took on a separate role; some coded, tested, or authored the documentation, while others managed the hardware. It's not merely a formality to include the writers and their affiliations. It maintains transparency and offers credit where credit is due. We listed names along with each person's department and school in the standard academic order. This makes it easier for future references or assessments because anyone looking at the project later will know exactly who performed what.

1. When a project has a larger team, we divide up the work according to each person's strengths. Everything goes more smoothly when people work together.

2. When there are only a few people, everyone contributes to various activities, such as coding, circuit design, reviewing outcomes, and so forth.

a) Selection: We choose team members according to their aptitudes and areas of interest.

b) Role assignment: To maintain equity and balance, each person is given particular responsibilities.

b) Evaluation: To make sure everything is proceeding as planned, we periodically review each person's work.

B. Identify the Headings

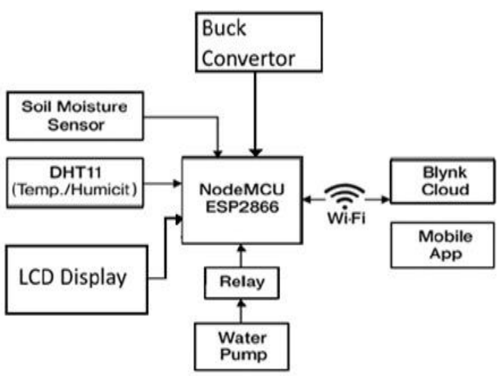
In a project report, headings perform a lot of heavy lifting. They divide up the information and lead readers through each section. Subheadings divide the major sections—such as Introduction, Methodology, Results, and Conclusion—into smaller, more concentrated subjects. The use of headings makes everything easier to understand and helps establish a clear order. Subheadings highlight the specifics, such as the sensors we employed, the algorithms used for detection, or the system's communication, while the main title summarizes the entire project.

Consistency in heading styles improves the overall appearance of the text and enables readers to quickly get the information they require.

C. Figures and Tables

Tables and figures greatly improve the Plant Monitoring System utilizing IoT project's presentation and clarity. They simplify the technical implementation by providing a visual representation of the system architecture, block diagrams, irrigation control workflow, sensor integration, and cloud communication process. The interactions between the soil moisture sensor, DHT11 sensor, NodeMCU ESP8266, relay module, water pump, and Blynk cloud platform are made evident in figures like the block diagram and system flowchart. While the Blynk dashboard graphic displays real-time monitoring and remote-control features, the hardware setup image illustrates the system's practical implementation.

Take Fig. 1, Take Fig. 1, Block Diagram of Plant Monitoring System Using IoT



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The intellectual and technical basis for the Plant Monitoring System using IoT is provided by the following sources, which include important ideas in cloud-enabled communication, IoT-based agricultural monitoring, precision irrigation, soil moisture sensing, and smart farming technologies.

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