

IoT Based Nutrients Monitoring and Vision System for Plants

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ABSTRACT: This project presents an IoT based nutrients monitoring and vision system designed to monitor plant health and soil conditions automatically. The system uses sensors such as a soil moisture sensor and DHT11 temperature and humidity sensor connected to an ESP32 microcontroller. An ESP32-CAM module captures plant leaf images for visual monitoring of plant health. The collected data is transmitted through Wi-Fi to an IoT monitoring platform where users can observe environmental conditions in real time. The system also includes DC motors, a motor driver, and a servo motor for movement and positioning of the monitoring unit. The proposed system helps farmers detect plant problems early, manage irrigation efficiently, and improve crop productivity. The system provides a low-cost and easy-to-implement solution for smart agriculture and precision farming.

KEYWORDS: IoT, Smart Agriculture, ESP32, Soil Moisture Sensor, DHT11, ESP32-CAM, Plant Monitoring

I. INTRODUCTION

Agriculture is one of the most important sectors that supports food production and economic development. Plant growth depends on several environmental factors such as soil nutrients, moisture level, temperature, humidity, and plant health. If these factors are not maintained properly, crop productivity can decrease significantly.

In traditional farming methods, farmers monitor these parameters manually. This process is time-consuming and sometimes inaccurate because it depends on visual observation. In addition, manual monitoring does not provide continuous data about plant conditions.

With the development of Internet of Things (IoT) technology, smart monitoring systems can be developed to automatically measure environmental parameters. IoT systems use sensors, microcontrollers, and communication technologies to collect and transmit data in real time.

The proposed system uses an ESP32 microcontroller along with sensors and a camera module to monitor soil and plant conditions. The system provides continuous monitoring of plant health and environmental parameters, which helps farmers take timely actions for better crop growth.

II. LITERATURE SURVEY

Many researchers have proposed smart agriculture systems using IoT technology. One study developed an IoT based soil monitoring system that uses wireless sensor networks to measure soil moisture and environmental parameters. The system helped farmers monitor irrigation conditions more efficiently.

Another research work introduced a plant monitoring system using image processing techniques to detect plant diseases from leaf images. This method allowed early identification of plant diseases, which helped farmers take preventive actions.

Some other systems focused on automated irrigation where soil moisture sensors are used to control water pumps automatically. Although these systems improved water management, they did not include visual plant health monitoring.

The proposed system combines sensor-based monitoring and vision-based plant health analysis to provide a more complete smart agriculture solution.

III. METHODOLOGY

The proposed system consists of sensors, microcontroller, camera module, and IoT communication. The ESP32 microcontroller acts as the main controller that processes data from sensors.

The DHT11 sensor measures temperature and humidity of the surrounding environment, while the soil moisture sensor measures the water content present in the soil. A servo motor is used to position the moisture sensor properly in the soil for accurate measurements.

The ESP32-CAM module captures images of plant leaves to observe plant health conditions. A motor driver controls DC motors that enable movement of the monitoring system. All collected data is transmitted to an IoT platform through Wi-Fi for real-time monitoring.

IV. EXPERIMENTAL RESULTS

The developed system was tested in a small plant monitoring setup. The soil moisture sensor successfully detected different moisture levels in the soil and provided real-time readings to the ESP32 microcontroller. The DHT11 sensor measured temperature and humidity of the surrounding environment.

The ESP32-CAM module captured images of plant leaves and allowed observation of leaf color and condition. The collected sensor data was transmitted to the IoT monitoring platform where it could be viewed through a mobile device. The experimental results showed that the system was able to continuously monitor soil conditions and environmental parameters. This helped in understanding plant conditions more accurately and allowed timely decisionmaking.

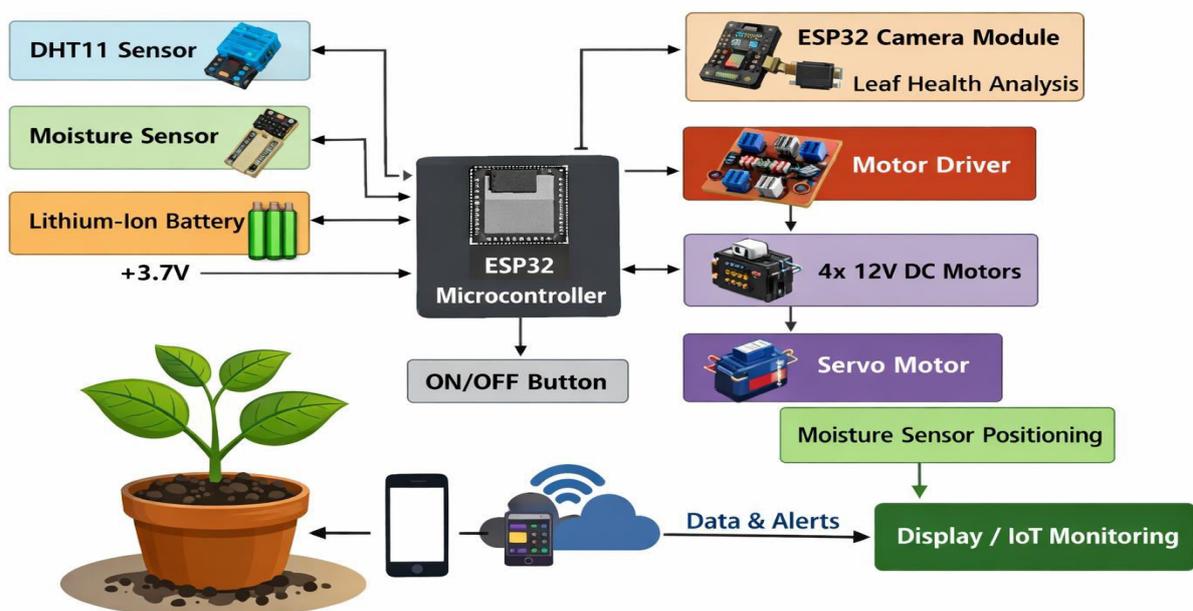


FIGURE:1

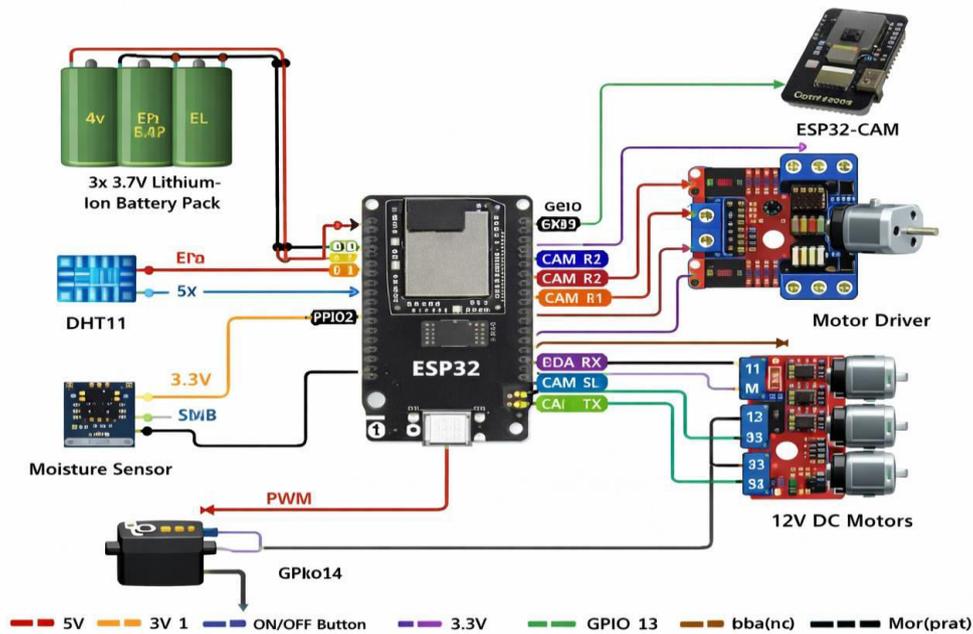


Figure:2

V. CONCLUSION

The IoT based nutrients monitoring and vision system for plants provides an effective solution for smart agriculture. The integration of sensors, camera module, and IoT communication enables continuous monitoring of plant conditions. The system helps farmers detect plant problems early and improve crop productivity. In future, additional sensors such as soil pH sensors and nutrient sensors can be integrated along with machine learning techniques for advanced plant disease detection.

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