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IoT BASED SMART PLANT WATERING SYSTEM

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ABSTRACT:

The science involved in tilling land, producing crops, and rearing animals is known as agriculture, or farming. Agriculture has always relied on technology, dating back more than ten thousand years, to the time when the first plough was made from sticks. The extent to which farming was feasible increased along with advances in science and technology. There are even more opportunities for technology to improve agriculture and support farmers worldwide as a result of the Internet of Things' (IoT) recent rise and popularity. In order to automate the watering process, we created and tested a smart IoT-enabled drip irrigation system utilizing an ESP32. The Blynk app, which is used to gather irrigation data, manually water plants, turn off automated watering, and create graphs based on sensor readings, is in communication with the ESP32. A soil moisture sensor, temperature sensor, air humidity sensor, and water flow sensor were all linked to the ESP32. The ESP32 periodically assesses the soil's dryness. The ESP32 activates a solenoid valve to irrigate the plants when the soil is dry and the temperature is suitable for doing so. The water flow sensor's measurement of the flow rate determines how long the drip irrigation system should operate for. When the humidity is too high or too low, the ESP32 detects it by reading the data from the humidity sensor and alerting the user. In accordance with the humidity level, the user may turn off the automated watering system. Green onions were successfully grown using the system, which functioned well in both the main and field testing.

Keywords: agriculture; agricultural technology; ESP32; Internet of Things

INTRODUCTION

A vital component of human existence are plants. They provide humans access to a variety of resources while also preserving the natural equilibrium. Maintaining the plant conservation problem is a top priority in one's life. In the event that water is not regularly planted, plants may decrease the fertility of the soil and waste water. Furthermore, overwatering damages the soil. An automated plant watering system is required for control and monitoring. Based on sensor readings, this system water plants automatically. Alternatively, it has a mobile application that controls the water motor by displaying ON and OFF values. This is a proposal for an inexpensive, sustainable automated plant-watering system that uses sensors to monitor the temperature, humidity, fertility, and moisture content of the surrounding soil. The soil fertility sensor monitors the soil's fertility. One of the most important aspects of managing plants and gardens is giving them enough water. The GSM module, which gives the system networking capabilities, is utilized to monitor the whole system and supports decisions about water management.

DESIGN AND COMPONENTS

The design and parts needed to build a smart plant watering system are covered in depth in this section.

Hardware components covered include the ESP32 microcontroller, moisture, temperature, air humidity, water flow, solenoid valve, relay, and step-down transformer.

Software components include the Blynk application, server, ESP32 module, and Visual Code.

III. PROBLEM STATEMENT

It may be challenging for individuals to maintain healthy and flourishing plants since many of them forget to water them while going about their everyday business. When there is a water scarcity, farmers also struggle to manage plant irrigation and preserve their harvests. In light of the aforementioned, we think it's essential to put in place an automated system that will look after plants, helping them grow healthily while considering all the different facets of home gardening (for systems based on household purposes) and larger landscapes (for systems based on agricultural farms).

SYSTEM OVERVIEW

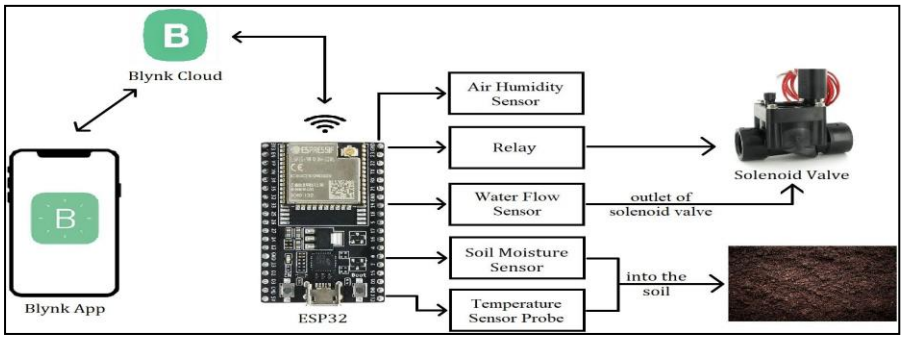


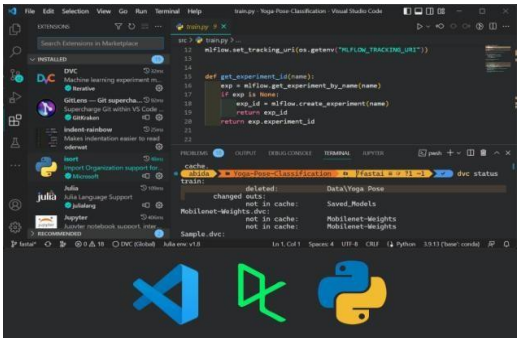
Figure 1 depicts the general layout of the smart drip irrigation system with IoT capabilities.The system's brain is the ESP32. We wired a relay and many sensors to the ESP32. After being put into the soil, the temperature sensor probe and soil moisture sensor probe measured the soil's moisture content and temperature, respectively. The humidity sensor gauges the air's humidity, while the water flow sensor gives information on the water flow rate. Through the use of a relay, the system opens the solenoid valve to water the plants. The ESP32 connects via Wi-Fi to the Blynk cloud online dashboard or mobile app. We plotted the soil temperature variation graph, manually adjusted the valve, and collected irrigation data using the Blynk app.

Watering the plants in the morning or early evening is ideal. If you water your crops in the afternoon, the water may become too hot and burn the plants. Watering crops in the late evening might cause water to stagnate, which can promote insect development, rot, and fungal growth . Our morning irrigation window was established from 5 a.m. to 8 a.m. and our evening irrigation window from 6 p.m. to 8 p.m. based on the hourly weather data in Qatar . Figure 2 illustrates the typical mild weather during these periods, with temperatures ranging from 24 to 30 degrees Celsius. During these intervals, the ESP32 will use real-time data to monitor the temperature and moisture content of the soil and water the plants as needed.

To get humidity data, we employed an air humidity sensor. A high relative humidity and high temperature will cause excessive evaporation of water via transpiration. The plants will try to absorb more water as a result of the water loss, and while they do so, they will also take in more nutrients. The tops of the leaves will burn from too much nutrition, causing the leaves to wilt. Therefore, it may not be a good idea to water the soil when the humidity is too low. If the humidity becomes too high or too low, the ESP32 will let us know. We may switch on or off the automated watering function based on the humidity measurements and other sensor data.

SOFTWARE COMPONENT

Microsoft Visual Studio Code, sometimes known as VS Code, is a well-liked source-code editor and developer tool. It is renowned for its adaptability, supporting a wide range of programming languages and offering a vast array of customization possibilities via extensions. Features of VS Code include version control integration, debugging capabilities, IntelliSense for intelligent code completion, and a large number of extensions for extra functionality catered to certain workflows. Its solid features and lightweight design make it popular among developers on several platforms.



RESULTS

Advantages

- Water Conservation.
- Lowered Operation Costs.
- Efficient and Saves Time.
- Increase in productivity.
- Reduce soil erosion and nutrient leaching.
- very accurate
- Ability to read soil volumetric water content directly.
- Continuous measurements at same location.

Disadvantages

- Difficult in maintaince.
- Difficult in setup/repairs.
- In the case of equipment like robots and computer based intelligent for running the devices, it is highly unlikely that a normal farmer will be able to possess this knowledge or even develop them.
- The process will cost huge amount.

CONCLUSION

So, an Internet of Things (IoT)-based smart plant watering system has been put into place. All sensor data is gathered by Node MCU and uploaded to the Blynk IoT server. The moisture content of the soil is detected by the soil moisture sensor. A strong signal is sent to the node MCU if the soil is dry, and this node then uses the relay to turn on the water pump. The water pump is automatically shut off when the soil becomes sufficiently moist, as detected by the sensor, which then sends a low signal to the Node MCU. As a result, the whole system is examined. It can be expanded for large-scale farmer agriculture and is more cost-effective when used in small home gardens.

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