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Plant Monitoring and controlling system

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Abstract: - The plant monitoring system is an innovative approach designed to optimize plant growth and health by using an advance technology such as microcontroller Iot. The system continuously monitors surroundings key environmental parameters like soil moisture, temperature, humidity which are crucial for plant growth. Many plants like mushrooms, lettuce, Autumn Crocus, etc grow in certain temperature and humidity range in order to grow high quality of plants, it is necessary to adjust the temperature and the humidity. But when we don't have time to pay attention by other important works, that becomes a problem. To solve this problem, we are using Internet of Things to monitor anytime, anywhere. Also, this monitoring system saves us a lot of time. This system is particularly beneficial in agriculture and indoor gardening, where maintaining the right environmental conditions. The Arduino Integrated Development Environment (IDE) software is used to create the source code, IoT platform use to monitor and the ESP 12-E acts as the brain of the technology and can connect to the internet. DHT11 Sensor is used to provide us to check temperature and humidity readings. This represents a significant advancement in agricultural technology, offers a sustainable solution.

Keywords: - *ESP8266 Module, Soil Moisture, DTH11, Arduino IDE,Blynk App as Remote Monitoring.*

I. INTRODUCTION

The integration of Internet of Things (IoT) in an agricultural practice has revolutionized the way we cultivate and taking care for plants. Plants are playing a vital role for maintaining proper health for the healthy growth. So, that the aim to make plant healthy and monitoring system in smart is using by mechanization and Internet of Things (IOT) technology. This topic tells the various features such as sensible decision making based on soil moisture and temperature and humidity real time data.

Internet of Thing (IoT) can plays an important role in the field and gardens. The use of IoT increased because of the various technology adding. The agriculture is the area where a lot need an improvement because that is one of the essential needs and a large sector of people is involved in that. The IoT devices can also be used in home for monitoring and the garden for real time data.

This topic tells us about various features such as smart decision making based on soil moisture temperature and humidity real-time data. For this, sensors like a soil moisture sensor

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and DHT11 sensor. Many methods are proposed to gather crop information or sensor data with better irrigation. IoT devices such as node micro-controller units (NodeMCU) and sensors can also track farms in real-time and gather crop information remotely. The costs of these systems are affordable; the main challenge would be properly using large amounts of sensors and other instruments. This technology is used to predict a field's irrigation requirements using ground parameter sensing such as soil moisture, soil temperature and humidity and environmental conditions. Today, irrigation systems are an important part of ensuring high plant productivity in the agricultural industry Effective management of key environmental factors such as temperature, humidity, and soil moisture is crucial in especially in controlled environments including greenhouses and indoor gardens. These variables affect horticultural plants to the highest degree and even slight changes in these factors can significantly influence plant health, grow rate and yield.

One of the biggest problems in gardening is using more amount of water, which wastes resources and eventually harms the soil's health. Plus, keeping the right temperature and humidity can be hard, especially in areas where the weather changes quickly. Traditional watering methods often waste water because they're not adjusted based on real-time needs, causing some plants to get too much water and others too little.

This introduces a smart IoT system for gardening and small-scale agriculture to make plant care easier and more efficient. The system uses soil moisture, temperature, and humidity sensors to collect live data and manage watering as well as other environmental needs. It runs on an ESP8266 Wi-Fi module, which means the pump only activates when necessary, following a time-based schedule to avoid constant watering.

By the Blynk app, users can monitor and control the system. They also receive alerts for critical situations, like if the temperature gets too high or the soil becomes too dry. This system offers a simple and water-efficient way to care for plants, reducing the hassle for gardeners while saving water.

II. EASE OF USE

The use of a plant monitoring system using the ESP8266 module is ease depends on several factors, including the design of the system, the user interface, and the setup process. Here's how the system can be enhanced for ease of use.

- *Inherent User Interface:*

Designing a user-friendly interface is crucial for ensuring ease to use. Whether it's a web-based dashboard or a mobile application, the interface should be intuitive, visually appealing, and easy to navigate easy to use. Users should be able to quickly access relevant information about their plants, adjust watering settings, and receive alerts or notifications if there is any issues arise.

- *Simple Setup Process:*

The setup process should be straightforward the installation and configuration steps are very easy. This configuration connects the ESP8266 module with the internet or WIFI. Install the app and register in it then pair and the easy to customization. So, that the soil moisture sensors, motors and configuring watering schedules.

- *Automated Operation:*

Once the system is set up, it should require some manual intervention from the user. Automated watering based on preset schedules or real time sensor data ensures that plants receive the right amount of water at the right time without any need for any constant monitoring. Users can simply set their preferences and let the system take care of the rest.

- *Scalability and Compatibility:*

The system should be scalable and to accommodate different garden sizes and configurations, it can allow users to expand or customize their setup as they needed. It should also be compatible with a wide and small range of plants and growing conditions, supporting various watering requirements and plant species

alerts. The user can tailor the interface as their preferences.

- *Alerts and Notifications:*

The system gives us instant notifications for critical changes of temperature.it is useful for preventing damage to plants.it set specific thresholds for parameters then it gives notifications when thresholds are breached.

III. LITERATURE REVIEW

Recent water scarcity, drying rivers, and erratic climate patterns have shown increased urgency for efficient water management in agriculture. A tiny 35% of the land in India retains dependable irrigation, and this leaves farmland mostly with the heavy reliance on the monsoon rains. Proper irrigation systems reduce dependency on the unpredictable rainfall and enhance food security and increased productivity of agriculture. This will also increase job opportunities. However, so much remains a challenge to a farmer; the amount of water to apply and when. Overwatering can badly damage crops with severe wastage. Under-watering can delay growth as well. Thus, maintaining soil moisture at ideal levels is worthwhile for these problems.

The plant root zone is fitted with humidity and moisture as well as temperature sensors to ensure that the conditions prevailing are continually observed. It processes this sensing data via a NodeMCU ESP8266 module and sends it over to the Android application. The app computes real-time values from sensors, automatically adjusting the water supply to ensure the right amount of water is delivered

Title: "An Automated Plant Watering System".

Author: Abhishek Gupta et al

This system consists of a soil moisture sensor, a water pump, and a microcontroller that control the watering process. The system has benefits compared to manual watering: improved growth of plants and less waste of water overall. Therefore, the article should be useful for people interested in efficient automation of watering plants with minimal water expenditure.

Title: "Smart Garden Monitoring Using IoT"

Author: T. Thamaramanalan et al

This paper discusses how data on temperature, humidity, soil moisture, and light intensity are sensed. The sensed data is fed into a cloud-based server and accessed remotely using a mobile application. The system allows users to monitor environmental conditions in their garden fromanywhere across the globe and, in return, reaps the fruit of increased growth, lesser water intake, and large-scale farming applications.

Title: "Embedded-Based Greenhouse Monitoring System Using Microcontroller"

Author: Arul Jai Singh et al

The monitoring system in the greenhouse controls and maintains optimal environment parameters such as temperature, humidity, and light intensity, thus promoting the healthy growth of plants inside. This also allows remote monitoring and control via a web-based interface for increased yield at lower energy levels, thus being potentially useful in commercial agriculture.

IV. METHODOLOGY

System Design and Assembly:

System design and assembly: Crop monitoring and control require the development of various sensors and components that automatically monitor irrigation and environmental conditions. At the heart of this system is the NodeMCU-ESP8266 microcontroller chosen for its Wi-Fi capabilities, which permits it to send real-time data to the application in Blynk. The design of the system with enable the automatic control of irrigation by continuously measuring the soil moisture, temperature, and humidity, among other factors.

The setup consists of connection of the NodeMCU to the soil moisture sensor, DHT11 temperature as well as humidity sensor, and relay module regulating the operation of a DC water pump. Sensors were collecting real-time data the microcontroller can activate the pump. After

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reaching suitable moisture levels, the pump automatically turns off.

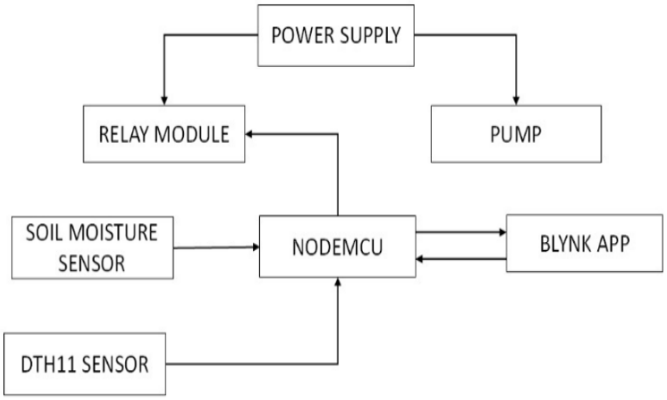
Step-by-Step Procedure:
The setup of hardware started with NodeMCU ESP8266, follows by the sensors and relay module. This relay module can control the pump, and the whole system powered by a battery. The whole assembly was mounted using jumper cables for electrical connections. Software and Programming The controlling code were written in the Arduino IDE and was then uploaded into the NodeMCU. Through Blynk's IoT platform, the configuration was done by setting up a template of the project and the Data Streams for monitoring soil moisture, temperature, and humidity readings. The control algorithm was designed, where the water pump will start only when needed to continue running only if the desired moisture of the soil is reached it will stop**.**

Data Collection:
The system continuously captures environmental data and transfers it to the Blynk application in real-time for monitoring current values and, at the user's discretion, manually controlling the pump. Notifications were also configured for parameters such as temperature or moisture when they fall outside of specified limits, so the system was assured of intervening at the right time.

Testing and Validation:
This system has been tested at different levels of soil moisture to demonstration of automatic response. All the sensor readings are verified as compared to calibrated tools for confirmation. Moreover, its reliability was checked under changing environmental conditions and it confirms its working under such scenarios where Wi-Fi connectivity will be fluctuating so that data loss doesn't occur**.**

Challenges and Limitations:
Some of the issues identified in this project include low accuracy of sensors across different types of soil and most prominently the instability of Wi-Fi in remote areas. Future enhancements of the system may focus on reducing power consumption to extend battery life during active use, as well as the enhancing the sensing arrangement by including more sensors to improve the overall system performance.

V. BLOCK DIAGRAM



VI. Physical Structure of the Project

All sensors are connected to the NodeMCU, the DC pump and relay module is connected to a power supply as a battery. The output from the system is presented on the Blynk App it allowing not only the monitoring and control of the hardware project but also the presentation of parameters on the Blynk Dashboard.

Components list

1. NodeMCU-ESP8266-12E Board
2. Soil Moisture Sensor
3. DHT11 Humidity Temperature Sensor
4. Relay Module
5. DC Motor Pump
6. Jumper Cables

Software Required

1. Blynk Application
2. Arduino IDE

1.NodeMCU-ESP8266 WIFI Module

The Node MCU is a powerfull IoT platform. ESP8266 module is a system on a chip microchip which offers hardware configuration for input and output devices in simple terms.it is given in a low cost and small in size, It supports the basic programming language with interactive and development similar to Arduino but with greater flexibility. The ESP Fullform is Espressif System

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it is an open-source platform for the running of this system. It contains 16 I/O pins, multiple devices can be connected through one network node. It has built in Wifi, can connect to the Wifi and send data through it below shows the ESP8266.

Fig: Node MCU (ESP8266)

2.Soil Moisture Sensor

The soil moisture sensor can show water content in soil is measured by soil it senses by detecting changes in the physical properties of the soil. It is a Direct method, samples of soil that would to test the soil in a simple way. It can measure the amount of water present in the soil these sensors are portables easily theses are placed in a particular place to check the water content continually this device is portable so we can measure the moisture in several locations. By this Farmers and gardeners can also use this portable probe instruments for on-site moisture monitoring. The primary function of these sensors is to estimate the water content of the soil, although some sensors, like tensiometers and gypsum blocks, measure soil water potential, providing additional insights into water availability.

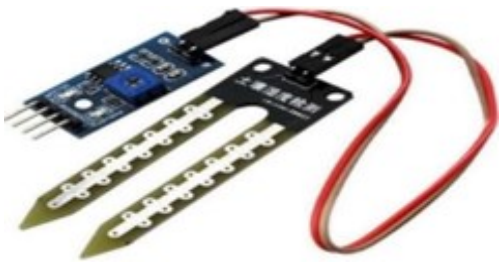

Fig -: Soil Moisture Sensor

3.DHT11 Humidity Temperature Sensor

DHT11 is another low-cost temperature and humidity-sensing device. It has a capacitive-type humidity sensor and a thermistor that will sense the air humidity and temperature, respectively. The sensor sends out a digital signal through its data pin so no analog input pins are required, making it easy to connect to a microcontroller like Arduino and Raspberry Pi.

The humidity sensor utilizes a capacitor with two electrodes, separated by the moisture-absorbing dielectric material. The capacitance of the sensor changes in response to the changes in humidity levels and is then processed by the IC of the sensor to generate a digital output. The thermistor of the DHT11 operates under the NTC principle, whose resistance decreases as the temperature increases.

The DHT11 offers:

Temperature ranges from 0 to 50°C with ±2°C accuracy Humidity range from 20% to 80% accuracy of ±5%.

Sampling rate is 1Hz, i.e., one reading per second.

Operating voltage: From 3 to 5 volts with the maximum current consumption at 2.5mA when measuring.

Fig - DHT11 Humidity Temperature Sensor

4.Relay Module:

Relay is one kind of electro-mechanical component that functions as a switch. It connects to the microcontroller send signal then actions done by the relay module. The relay coil is energized by DC so that contact switches can be opened or closed. A single channel 5V relay module generally includes a coil, and two contacts like normally open (NO) and normally closed (NC). This article discusses an overview of the 5V relay module & it is working but before going to discuss what is relay module is, first we have to know what is relay and its pin configuration.

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Fig - 5V Relay Module

Software required

1.Blynk IoT Platform:

The Blynk IoT platform plays an important role in the current project by facilitating real-time monitoring and control of a variety of environmental parameters. First, the users install the Blynk app from the play store and complete their account creation process. Developer mode is used to create a new template as appropriate for the current project. Subsequently, DataStream are set up for each of the parameters involved, namely temperature, humidity, and moisture content in the soil. Blynk's Web Dashboard is equipped with the means of a graphical interface, in the form of gauges. The dashboard feeds live reading from the monitored parameters. The platform allows its users to keep track and control the system remotely, thus being a must-have tool for IoT-based projects. Blynk supports smooth data visualization and management enabling effective monitoring of the plant health.

Fig - Blynk IoT

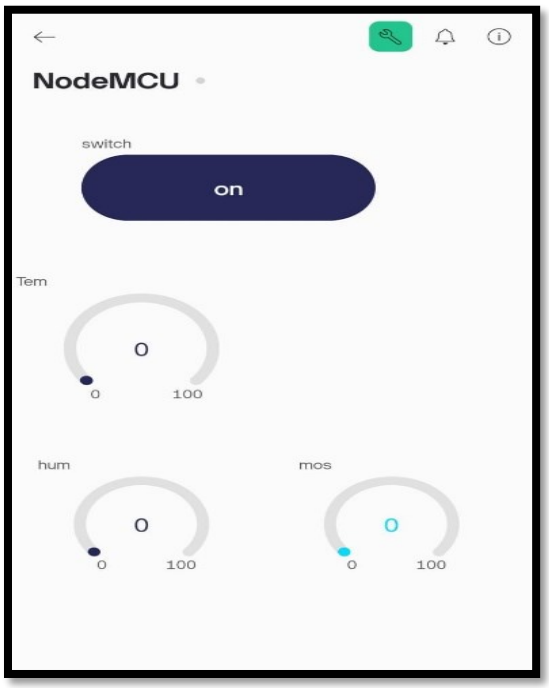
2.Arduino IDE:

Arduino Integrated Development Environment (IDE) is a free source software program that was specially designed by Arduino. cc which is mainly used for writing, compiling and uploading code in the Arduino compatible boards like NodeMCU ESP8266. This makes the IDE versatile for IoT projects as it supports multiple programming languages including C and C++. Arduino IDE supports all features and provides a rich library so that it is easy to do development and deployment of embedded applications in agricultural automation system.

Arduino IDE is an Open-source hardware and software company, project, and user community that designs and manufactures single board microcontroller and microcontroller kits for building digital devices.

Fig - Arduino IDE

VII. App interface:



This is the blynk app interface in our mobile it can show the temperature values, humidity values and the soil moisture of the plants so we can easily know the realtime data of the plant and also contains one on off switch for controlling the water when we want to on the motor we will easily on the water from any where easily.

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VIII. Conclusion

We design this project, a totally automated irrigation system, which is easy remotely monitored by the online application. Automation of the watering process reduces labour highly and provides the results much and more accurately than manually controlled systems and give an alert message. The amount of water conservation is achieved through proper placement of sensors above the soil to measure its moisture levels. This system measures and integrates various environmental parameters, like soil moisture, humidity, and temperature, for efficient management of agricultural fields. The Plant monitoring System has been designed and well tested to automatically work when using a variety of hardware components that will facilitate achievement of the intended performance.

Moisture sensors continuously monitor the water content in the soil, and any water content below the predefined threshold sends a signal to the microcontroller. This will then activate the water pump supplying the amount needed by the plants. The system automatically stops when the set moisture level is achieved, while the pump is turned off, without causing any form of wastage of water. Hence being a very useful instrument in modern agriculture.

IX. Result:

Plant monitoring using ESP8266 use the Internet of Things to monitor anytime, anywhere. Also, this monitoring system saves lot of time. This system is particularly beneficial in agriculture and indoor gardening, where to maintaining the right environmental conditions so it is very benifical to the formers those who farms a sensitive plant which need a specific temperature and humidity levels to grow. So, that it helps them and give accuracy results to farmer and help to monitor the Realtime temperature and humidity from anywhere and everywhere.

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