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Greenhouse Monitoring and Controlling Device

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ABSTRACT

The "IoT-Based Greenhouse Monitoring and Controlling System" is a sophisticated project designed for efficient agriculture by incorporating Internet of Things (IoT) technology. This system utilizes sensors, including a soil moisture sensor and DHT11 sensor, to monitor environmental conditions Within a greenhouse. The soil moisture sensor updates information on Thingspeak and activates a relay for water supply when needed. The DHT11 sensor measures temperature and humidity, providing valuable data for optimizing greenhouse conditions. This project aims to enhance crop yield by automating and improving the management of crucial environmental factors.

Keywords: Soil Moisture Sensor, DHT11 Sensor, IoT Connectivity, Relay

1. INTRODUCTION

The ecosystem plays a crucial role in plant development. The amount of moisture inside the greenhouse cannot be adequately understood by farmers in the greenhouse. The condition in the green building they just understand manually, and they experience it on their own. Experience plays a significant part in their regular activities at the end of the day. The plants would have water if the soil has minimum water content, but if it is too moist, in the greenhouse the roof will be opened during day time. Efficiency in greenhouse plant production must be achieved to achieve effective growth increases, so that high production rates can be achieved at lower cost, higher quality and low environmental burdens.

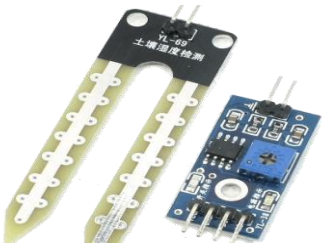
The green house can be controlled by IOT which involves refrigeration, ventilation, immersion of the soil, etc.

2. LITERATURE REVIEW

The proposed IoT-Based Greenhouse Monitoring and Controlling System integrates IoT components to create a smart agriculture solution. A soil moisture sensor detects soil moisture levels, updating the information on Thingspeak, and activating a relay for water supply when required. The DHT11 sensor measures temperature and humidity, providing additional insights into the greenhouse environment.

3.COMPONENTS:

1.Soil Moisture Sensors: This sensor can measure volumetric content of water inside the soil.



2. DHT11 Sensor: DHT11 humidity and temperature sensor is available as a sensor and as a module.

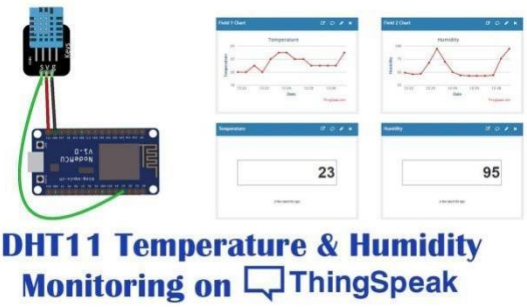
3. Relay: A Relay is a simple electromechanical switch. But instead of a manual operation, a relay uses an electrical signal to control an electromagnet, which in turn connects or disconnects another circuit.

Fig: Relay

Software tools in greenhouse monitoring and controlling system

1.AurdinoIDE: The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

2. ThingSpeak: ThingSpeak is an open-source software written in Ruby which allows users to communicate with internet enabled devices. It facilitates data access, retrieval and logging of data by providing an API to both the devices and social network websites.



Hardware tools in greenhouse monitoring and controlling system

Microcontroller: A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system.

Fig: Microcontroller

IoT Module: A typical IoT system works through the real-time collection and exchange of data.

Soil Moisture sensor: The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil.

DHT11 sensor: DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously.

Power Source: Using Keysight AC power supplies will lower the cost of ownership with global support and the longest standard warranty in the industry.

4.TESTING &RESULTS

The whole purpose of this system is to create an effective greenhouse environment which will drastically reduce the cost of labor and also help small scale farmers cultivate crops all year round. The system consists of sensors, microcontrollers, and actuators. The system

works in such a way that when the environmental parameters cross a safety threshold, the sensors detect a change and the microcontroller reads the data from its input ports and performs the suitable action in order to bring the parameter back to its required level. The actuators (fan, led, buzzer) are switched on based on the instruction passed to the microcontroller. An LCD is employed to show the condition inside the greenhouse. Lastly, the entire setup becomes userfriendly, easy to put together and quite portable.

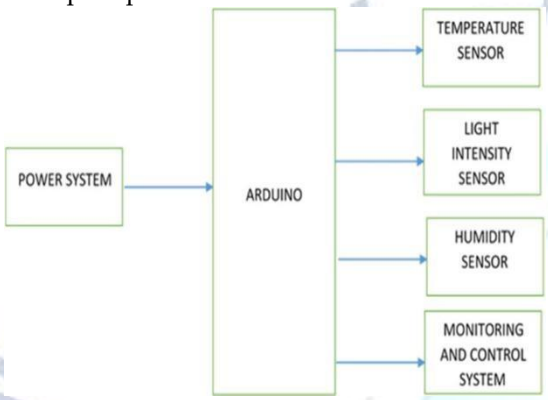


Fig: Green House Monitoring and Control System Architecture

The four parameters that we are going to discuss are:

Temperature: Thetemperature sensor is used for sensing temperature. When temperature exceeds from a defined level or critical level, the system automatically turns on the fan and a message is also sent to the owner or the operator with information of all parameters (Temperature, Humidity, Light intensity and Electrical appliance on off status.

Humidity: Humidity is measured by using humidity sensor .If the humidity of the environment is below the defined levels, sprays are automatically turned on and if the humidity level exceeds from the defined level sprays are automatically turned off. A status or notification message is also sent to the owner by the system using GSM Module.

Light Intensity: Light intensity is an important factor for the plant growth. If the light intensity is low then it affects the growth of the plants. To resolve the problem of low light, artificial lights are used. Here in this project 100 watt bulb is used for demonstration. When light intensity is lower than a defined level, the artificial lights turns on, and when the light intensity comes in normal range artificial lights automatically turns off and a notification message is also sent to the owner.

Soil Moisture: Water supply for plants is very important for good growth. So here in this demonstration I have used a water pump and a soil moisture sensor, for detecting soil moisture. Two problem of soil moisture sensor are used and placed in soil. When the sensor does not sense moisture in soil then the system turns on the water pump until it reaches the required level. A notification is also sent to the owner with status of water pump like Motor On or Motor Off. Here for sensing soil moisture a transistor is used as a switch.

Challenges in implementing Greenhouse Monitoring and Controlling System

Sensor Selection and Placement :Selecting the right sensors and determining their optimal placement within the greenhouse is critical for accurate data collection.

Power Supply and Connectivity : Ensuring uninterrupted power supply and reliable connectivity for monitoring and controlling systems can be challenging, especially in remote or off-grid locations.

Maintenance and Support :Regular maintenance and timely technical support are essential for ensuring the continued functionality and effectiveness of monitoring and controlling systems.

Result and Discussion: This control unit collects all the details regarding the plant growth, consisting of moisture, temperature and light sensor with a mini water tank attached for supplying sufficient amount of water to plants. The whole controlling system is having a power supply of 5V. LED is present in the controlling unit for providing enough light for the plants and a mini fan for controlling the temperature. Display console shows the measured values of moisture and temperature. We have created a cloud for storing all the details about the growth of plants. And have developed an android application for monitoring the greenhouse and controlling the environment inside the greenhouse.

CONCLUSION

A smart greenhouse monitoring system has been implemented successfully using the concept of IoT which can prove to be a boon for agriculture sector. The traditional system for greenhouse monitoring is labour-intensive and time consuming. The proposed system saves time, money and human effort. It provides

a controlled environment for the plants and thus increase the overall yield. The smart greenhouse automatically optimizes the various parameters for the plant growth. It sends the real time data of parameters to the mobile app for continuous and effective monitoring.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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