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IoT Based Complete Green House Monitoring And Controlling System

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Abstract: An overview of a greenhouse monitoring system that was constructed utilizing IoT devices and sensors is provided in this abstract. By offering real-time monitoring and management of environmental elements essential for plant development, the system attempts to optimize the cultivation process. Sensors with IoT capabilities gather information on temperature, humidity, light intensity, soil moisture, and CO2 levels, which is then sent to a central hub or cloud platform for analysis. The system has benefits including automation, data-driven decision-making, and remote monitoring. On their cell phones, farmers may get real-time data and warnings, allowing for flexible control of greenhouse operations. In order to find trends and recommend measures for enhancing agricultural output and resource utilisation, machine learning algorithms analyse the sensor data. Automation enables accurate environmental parameter management, lowering human error and increasing productivity. Farmers may increase crop output, maximise resource usage, and support sustainable agricultural practises by putting in place an IoT-based greenhouse monitoring system.
Index: IOT-internet of things, CO2-carbon dioxide, PWM–Pulse width modulation, USB-Universal serial bus

I. INTRODUCTION

Resource management and plant development are greatly improved through greenhouse monitoring. Traditional monitoring techniques have undergone a transformation with the rise of Internet of Things (IoT) technology. Real-time monitoring and management of environmental factors have been more efficient and effective by combining IoT devices and sensors. An overview of an Internet of Things-based greenhouse monitoring system is given in this abstract. The system's goal is to continually track key environmental factors including temperature, humidity, light intensity, soil moisture, and CO2 levels that are crucial for plant development. IoT capable sensors are carefully positioned all over the greenhouse to collect current data. To be stored and analysed, this data is wirelessly transferred to a central node or cloud platform. The suggested approach has a number of advantages, including data-driven decision-making and remote monitoring. On their smart phones, users may access real-time data and notifications, giving them flexibility and convenience in controlling greenhouse operations. The system can find trends in data using machine learning techniques, and it may then recommend steps to improve agricultural productivity and resource use. Another benefit of the IoT-based greenhouse monitoring system is automation. Based on pre-set criteria or custom settings, it enables precise management of environmental conditions. By automating the process, we can maintain ideal growth conditions with less human error and more efficiency.

II. PREVIOUS WORK

Paper [2]. N. Kaur, S. Rana, and M. Singh, "Smart Greenhouse Monitoring System using IoT," Explained about Telemetry Transfer protocol was chosen over Constrained Application Protocol and Extensible Messaging and Presence Protocol in the experiment conducted in terms of its light weight transmission, resource consumption and effectively providing the different quality of services to detect the temperature and humidity as well as the gas leaks encountered in a greenhouse environment.

Paper [3]. S. S. Patel, DOI: P. L. Kumar, and D. C. Jinwala, " IoT Based Greenhouse Environment Monitoring System, Explained about system receives three parameters from the sensors and activates the actuators if the actual values are more than the threshold values and also stores these values in the cloud database enabling them to be accessed from anywhere, anytime. This paper also sheds light on the automatic control over the climatic conditions inside the greenhouse.

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There are different seasonal crops which can be grown only under certain conditions. Onions, garlic, shallots etc. are the winter crops which require cold conditions for their growth. Cucumbers, melons etc. are the summer crops which require moderate or hot climatic conditions.

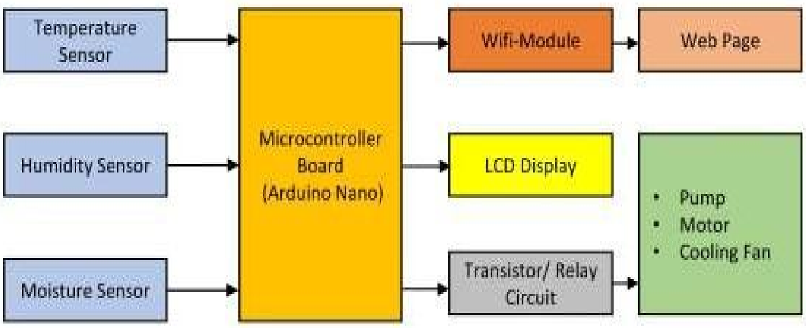
Paper [5]. M.T.H. Sultan, S. Aziz, and M. S. Wahab, "IoT-Based Smart Greenhouse Monitoring and Control System," This project designs a concept of scheduling to monitor real-time plant growth and ensure it maintains optimum conditions by introducing interventions based on the growth phases. This concept of scheduling realizes a fully integrated and automated greenhouse monitoring and management system.

III. METHODOLOGY

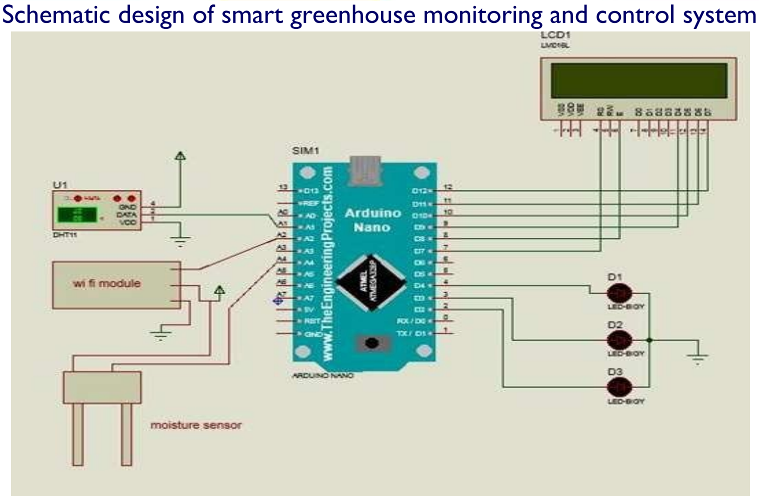
A successful system is built through exceptional designs, which is a creative process. Giving specific information about the intended task in a tangible manner is the process of system design. As a system is developed, many designs are created that explain the features, components, and client interactions with the system. As part of the input design process for an IoT-based greenhouse, key environmental parameters are identified, suitable sensors are chosen, sensor placement is decided, data communication is established, an IoT gateway is integrated, data storage and analysis is implemented, a user interface and control system are designed, and testing and calibration are carried out. This strategy makes sure that sensor data is effectively collected, used, and monitored in real time to manage greenhouse conditions. The methodology for output design for an IoT-based greenhouse entails determining output requirements, designing data visualisation displays, putting in place an alert and notification system, incorporating decision support tools, enabling remote access, creating a user-friendly interface, and establishing a feedback mechanism. The technique focuses on delivering sensor data in visually appealing formats, prompt alerts and notifications, decision-support tools based on data analysis, remote monitoring and control, enabling user engagement and feedback, and all of these. The IoT-based greenhouse system provides optimal data utilisation, improves decision-making skills, and increases overall greenhouse management by adhering to this technique.

IV. BLOCK DIAGRAM

A well-known microcontroller board built around the ATmega328P is the Arduino Uno. Because of its simplicity and broad community support, it is frequently used in prototype projects and is a fantastic option for novices. Either an external power source or the USB connection can be used to power the board. A voltage regulator built inside it can handle input voltages of 7 to 20 volts. A reader may read analogue voltage readings from the board's six analogue input pins. There are six PWM output pins available out of the total 14 digital input and output pins on the device. The Arduino programming language, which is based on C and C++, can be used to programme the Arduino. Working principle of the smart greenhouse system is described in this section. If the moisture level of soil is below the required level, the system turns on a water pump to enhance soil moisture level.



Schematic design of smart greenhouse monitoring and control system



If the temperature of the greenhouse rises very high, the system turns on a cooling fan. On the other hand, if the temperature becomes too low, the system turns on Light to make the environment warmer.

All the values are displayed in the LCD display. In this system, everything is monitor as well as control remotely. In order to implement the greenhouse monitoring and control system, proper design is required. In order to do so, Proteus software has been used to create the schematic of the system. Full schematic of the smart greenhouse is presented above. All the sensors and modules are connected to the central microcontroller (Arduino Nano). The microcontroller works as the heart of the system which takes input from the sensors, processes the input signals and exhibits required instructions to the system.

V. IMPLEMENTATION

The smart greenhouse system is described in this section. If the moisture level of soil is below the required level, the system turns on a water pump to enhance soil moisture level. If the temperature of the greenhouse rises very high, the system turns on a cooling fan. On the other hand, if the temperature becomes too low, the system turns on Light to make the environment warmer. All the values are displayed in the LCD display. In this system, everything is monitor as well as control remotely. The greenhouse environmental monitor and control mechanism in the work used Arduino Nano as the central controller. Humidity, sensor and temperature sensors are being used in this work to provide necessary data inputs to the microcontroller. Attachment of Wi-Fi module enabled remote monitoring and control of the system which improves its usability. Due to the smart and automatic features available in the proposed smart greenhouse prototype, the system can be of great use in case of patronizing smart farming.

VI. RESULT

After completing the implementation of the design by connecting the components, the system has been tested for different conditions. The design worked successfully as per required. To check the performance of the system, we have also observed the different parameters conditions in the website through internet from different location. We can also smoothly controlled the systems through the website (Fig. 5). Hence, the smart greenhouse environment monitoring and control system can be an effective alternative for traditional process of greenhouse monitoring and control techniques.

VII. CONCLUSION

The way we grow plants in controlled conditions has changed dramatically as a result of the use of Internet of Things (IoT) technology in greenhouse monitoring. The Internet of Things (IoT)-based greenhouse monitoring systems provide real-time data gathering, analysis, and automation of environmental factors essential for plant development. Farmers and operators of greenhouses may maximise crop output, enhance resource management, and advance sustainable agricultural practises by utilizing IoT devices, sensors, and cloud platforms. Remote real-time data access, data-driven decision making, precise environmental management, and increased resource efficiency are all advantages of IoT-based greenhouse monitoring. Real-time monitoring and control of variables including temperature, humidity, light intensity, and soil moisture promotes the best possible plant development while minimising human error.

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