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IOT Based Intelligent Greenhouse Monitoring System

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ABSTRACT
The Internet of Things (IoT) ecosystem is composed of web-enabled smart devices that use embedded systems, such as microprocessor, sensors, and communication devices, to collect, send, and act on the data they get from their surroundings. IoT devices transmit the sensor data they collect. This project aims to use a Node MCU microcontroller to develop and monitor temperature and humidity in a greenhouse using Internet of Things (IoT) technology. The system includes a sensor that detects and measures the temperature and humidity inside the greenhouse. If the temperature exceeds a certain threshold, the sensor will be connected to a buzzer that will automatically turn on and an alarm sound will be given as an alert and also to indicate that the temperature in the greenhouse is moderate, green LED is used with DHT11. So, farmers can take action to prevent damage to their crops from high temperatures.The information collected by the sensor will also be displayed on a serial monitor. In this project the IOT device are connected to the internet and equipped with sensor that can collect and transmit data, such as temperature and humidity. The goal of this project is to help maintain optimal climate conditions for the cultivation of plants in the greenhouse.
KEYWORDS: *IOT, DHT11, Buzzer, Greenhouse.*

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I. INTRODUCTION

IOT is used to implement the greenhouse temperature monitoring system, which keeps track of the greenhouse's internal temperature. This records the temperature inside the greenhouse. The system's first component is a temperature sensor, which measures the temperature inside the greenhouse. The sensor is typically placed so that it accurately monitors the temperature of the greenhouse. The temperature sensor sends data to the microcontroller, which uses that data to make decisions. For instance, the microcontroller may activate a buzzer to alert the user if the temperature exceeds a specified threshold. IoT platform is used to gather and analyze data from the temperature sensor and microcontroller. The platform allows temperature monitoring from any location with an internet connection by offering remote monitoring and management of the system. The buzzer is designed to alert the user directly if the temperature within the greenhouse rises above a predetermined level. The buzzer can be set off by the microcontroller, which will sound an alarm and notify the user of the situation. The greenhouse's temperature and any changes are displayed on the serial monitor, and green LEDs working with DHT11 are used to denote a moderate greenhouse temperature. The display might belong to a microcontroller board.

II. LITERATURE REVIEW

Greenhouse monitoring using IoT has gained significant attention in recent years due to its potential to improve crop yield and reduce costs. Several studies have been conducted to explore the feasibility and effectiveness of using IoT for greenhouse monitoring. This literature review summarizes some of the key findings from these studies.

The ability to collect and analyze real-time data on environmental factors like temperature, humidity, and light intensity is one of the main advantages of utilizing IoT for greenhouse monitoring. By using this information, the growing environment may be adjusted and the conditions for crop growth can be maintained. Improvements in crop quality and quantity have been noted in several researches when IoT is used for greenhouse monitoring.

1.IoT sensors were utilized in a study by Chen et al. (2018) to monitor temperature, humidity, and soil moisture in a greenhouse were tomato plants were being grown. The growing conditions were modified as needed after sensor data was reviewed to find patterns and trends. According to the research, utilizing IoT for greenhouse monitoring increased tomato yield by 12% when compared to traditional techniques [1].

2. In another study, IoT sensors were required to monitor the temperature, humidity, and CO2 levels in a hydroponic greenhouse where lettuce was just being cultivated. Vigneshwaran et al. whenever the growing environment was improved to use the sensor data, the yield of lettuce improved by 20% in a comparison with traditional techniques [2].

3..Also, a few studies have investigated into the use of machine learning algorithms to analyze the information collected from IoT sensors and predict agricultural quality and quantity. For example, machine learning techniques were used in a study by Sarker et al. (2020) to study data from IoT sensors in a greenhouse containing cucumber plants. On the strength of the environmental conditions monitored by the sensors, the algorithms were capable of predicting the crop's yield and quality with good accuracy [3].

III. METHODOLOGY

The connection of additional hardware into the IoT network is needed for greenhouse monitoring including buzzers and LED lights, which may be used to notify greenhouse managers when specific environmental conditions deviate from the appropriate range. Here are the stages in creating an approach for monitoring greenhouses using IoT, a buzzer, and an LED light.

3.1 DATAFLOW DIAGRAM

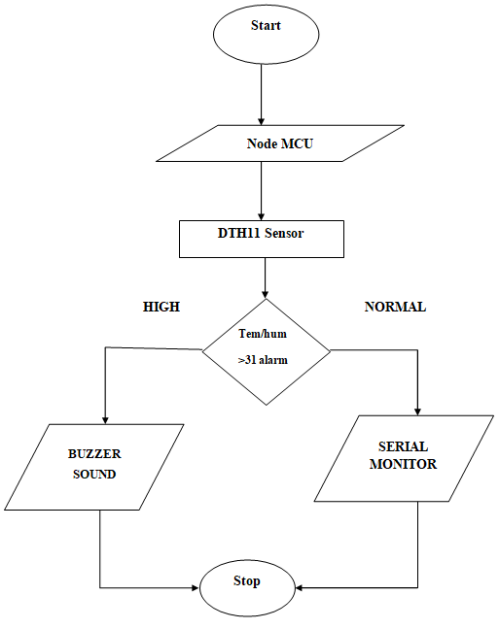

Fig.1 Flow Diagram

IV. WORKING PRINCIPLE

4.1 NODE MCU

NodeMCU is an open-source, low-cost, Wi-Fi-enabled microcontroller board based on the ESP8266 system-on-a-chip Also, it has a variety of input/output pins, such as digital and analogue pins, that can be used to connect to devices like sensors. The Arduino Integrated Development Environment (IDE), which offers a simple interface for writing and uploading code, can be used to program NodeMCU.

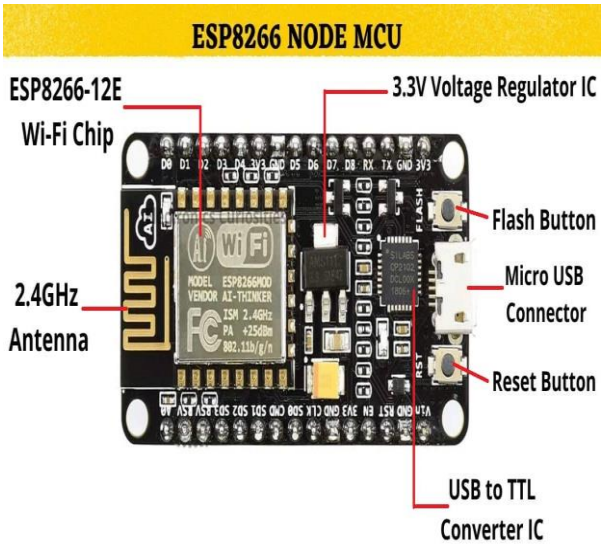

Fig.2 Node MCU

4.2 SENSOR

Monitoring temperature and humidity is essential in greenhouse management as it helps to ensure optimal growing conditions for plants. Depending on the type of plants being cultivated, temperature changes and levels of humidity are necessary for growth and yield. Temperature is one of the most important factors that affect plant growth and development in a greenhouse. The majority of plants prefer temperatures between 16°C and 20°C (60°F to 68°F) at night and 18°C to 28°C (65°F to 82°F) during the day. Plants can be harmed by temperatures that are either too high or too low, which can lower their yield. Sensors like the DHT11 can be used to maintain on a greenhouse's temperature and humidity levels. The temperature and humidity data from these sensors can be received by connecting them to the NodeMCU microcontroller.

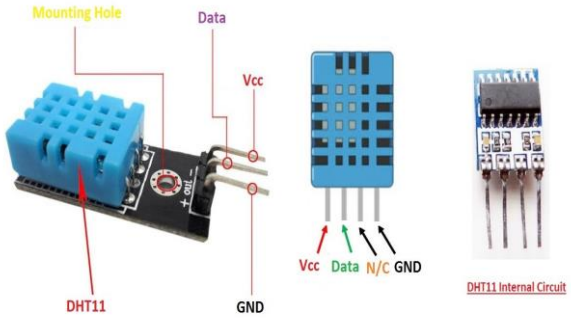

Fig.3 DHT11 Sensor

4.3 BUZZER

This audio device reacts to a signal from the microcontroller by generating an alarm. The buzzer notifies the growers of any abnormal conditions that might damage the plants. If the temperature exceeds a certain threshold, the sensor will be connected to a buzzer that will automatically turn on and an alarm sound will be given as an alert.

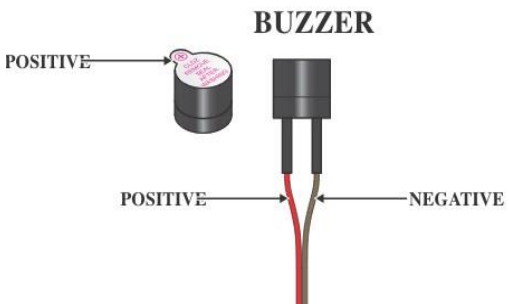

Fig.4 Buzzer

4.4 LED LIGHT

In a greenhouse using LED lights, it's important to frequently check the temperature and adjust as needed. If the temperature is normal the light indicates in Green.

4.5 NETWORK INTERFACE:

The microcontroller can send and receive data across a network, such as the Internet, due to this component. The network interface is used to remotely access the system from a computer or smart phone and to transfer data collected by the sensors to the microcontroller.

4.6 POWER SUPPLY

This is the part that gives the system power. Depending on the needs of the system, either a battery or an AC-DC adapter can serve as the power source.

V. RESULT AND DISCUSSION

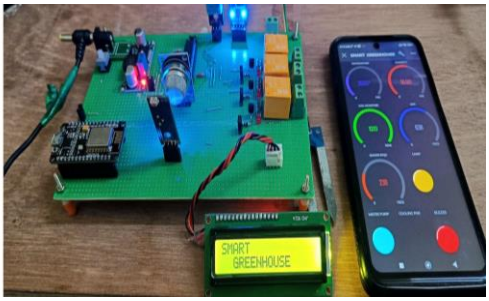

Fig.5 Screenshot

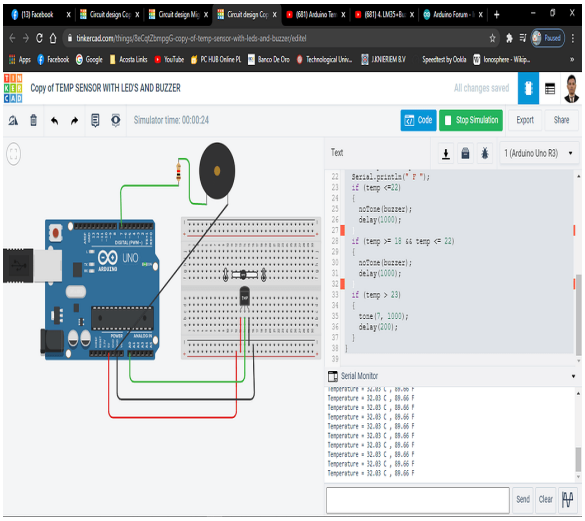

Fig.6 Coding

VI. CONCLUSION

In summary, an IoT-based intelligent greenhouse monitoring system is a practical way to increase greenhouse farming's productivity and effectiveness. With help of this technology, farmers might remotely monitor and manage a lot of variables that are essential for the development and productivity of plants, such as temperature, humidity and soil moisture. Farmer can automate and manage their greenhouse operations, consume less water and energy, lower the chance of crop failure, and improve their profitability by using the potential of IoT devices

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