IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 5, May 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 5, May 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1105245 |

Smart Green House Monitoring and Controlling System Using IOT

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ABSTRACT: The Greenhouse Monitoring System using IoT is a project aimed at implementing an efficient and automated solution for monitoring and controlling environmental parameters within a greenhouse. By leveraging the power of the Internet of Things (IoT), the system collects real-time data from various sensors placed inside the greenhouse. The objective of the project is to optimize growing conditions, improve crop yield, and enhance resource utilization. The system architecture includes sensors, data collection devices, and wireless communication protocols to enable seamless data transmission. By providing real-time insights and automated control mechanisms, the Greenhouse Monitoring System using IoT offers benefits such as increased crop yield, improved resource efficiency, and enhanced decision-making capabilities for growers. This project showcases the potential impact of IoT in revolutionizing greenhouse operations and promoting sustainable and efficient agriculture practices.

KEYWORDS -Greenhouse, Monitoring, IoT (Internet of Things), Environmental parameters, Sensors, Data collection, Real-time Control, Automation, Crop yield, Resource optimization, System architecture, Wireless communication, Data analysis, Decision support, Sustainable agriculture

I. INTRODUCTION

Greenhouse farming plays a critical role in ensuring food security and meeting the growing demand for agricultural products. To achieve optimal plant growth and maximize crop yields, maintaining precise environmental conditions within the greenhouse is crucial. Traditional manual monitoring and control methods have limitations in providing real-time insights and efficient resource utilization. The emergence of the Internet of Things (IoT) technology has revolutionized the way greenhouse monitoring and control systems are implemented.

The Greenhouse Monitoring System using IoT is a cutting-edge solution that integrates IoT technology with sensor devices and data analytics to create a smart and automated monitoring system for greenhouse environments. By leveraging IoT, this system enables real-time data acquisition, remote accessibility, and automated control of environmental parameters, such as temperature, humidity, light, soil moisture, and CO2 levels.

The primary objective of the Greenhouse Monitoring System using IoT is to optimize growing conditions and improve crop yield while minimizing resource consumption and labor requirements. By continuously monitoring and analyzing the data collected from sensors placed within the greenhouse, growers can make data-driven decisions to adjust environmental parameters and provide the ideal conditions for plant growth.

This system comprises various components, including sensors for data collection, data transmission devices, and a centralized control system. The collected data is processed and analyzed using advanced algorithms, providing growers with actionable insights and visualization of greenhouse conditions. Additionally, the system allows remote access, enabling growers to monitor and control the greenhouse operations from anywhere, at any time.

The implementation of the Greenhouse Monitoring System using IoT brings numerous benefits to growers. It improves operational efficiency by automating routine tasks and reducing manual labor. The system facilitates resource optimization by providing accurate and timely information for irrigation, lighting, and ventilation control. Ultimately, it leads to increased crop yield, improved quality, and more sustainable agricultural practices.

In this survey paper, we aim to provide an overview of the current state-of-the-art in the field of Greenhouse Monitoring Systems using IoT. We will explore existing literature, research advancements, and challenges associated with such systems. By synthesizing this information, we seek to contribute to the understanding and future development of IoT-based greenhouse monitoring systems, ultimately promoting efficient and sustainable greenhouse farming practices.

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II. LITERATURE SURVEY

Literature Survey for Greenhouse Monitoring System using IoT:

[1] Title: "IoT Based Smart Greenhouse Design with an Intelligent Supervisory Fuzzy Optimized Controller" (2021)
Authors: M. Aghaseyedabdollah, Y. Alaviyan, and A. Yazdizadeh
Key Points:

Benefits of IoT in Smart Agriculture: The paper highlights the advantages of using IoT technology in smart agriculture, specifically in the context of greenhouse farming.

[2] Title: "Secured IoT Based Smart Greenhouse System with Image Inspection" (2020)
Authors: S. Sundari.M, J. M. Mathana, and T. S. Nagarajan
Key Points:

Result Analysis: The paper focuses on analyzing the results obtained from the IoT-based smart greenhouse system.
Flow Chart: It presents a flow chart illustrating the sequence of operations or processes within the smart greenhouse system.

[3] Title: "Green house based on IoT and AI for societal benefit" (2020)
Authors: M. Nargotra and M. J. Khurjekar
Key Points:

Hardware: The paper discusses the hardware components involved in the construction of the IoT and AI-enabled greenhouse system.
Software: It highlights the software aspects and technologies used in the system's implementation.

III. PROBLEM STATEMENT

"In traditional greenhouse farming, monitoring and controlling environmental parameters such as temperature, humidity, light intensity, and soil moisture levels is a labor-intensive and inefficient process. Manual monitoring and intervention may lead to suboptimal growing conditions, increased resource consumption, and reduced crop yield. Additionally, the lack of real-time data and automated control mechanisms makes it challenging to respond quickly to changing environmental conditions.
Therefore, there is a need for an efficient and automated monitoring system that leverages IoT technology to continuously collect and analyze environmental data in a greenhouse. The system should enable real-time monitoring, data visualization, and automated control of various parameters to maintain optimal growing conditions. It should provide actionable insights for farmers, allowing them to make informed decisions, optimize resource usage, and improve overall crop productivity.

The objective is to design and implement a Smart Greenhouse Monitoring System using IoT, integrating sensors, actuators, data analytics, and communication protocols. The system should enable remote monitoring and control, ensuring timely adjustments to environmental conditions, and optimizing resource usage. By leveraging IoT capabilities, the goal is to enhance the efficiency, productivity, and sustainability of greenhouse farming, ultimately leading to improved crop quality and increased yield."

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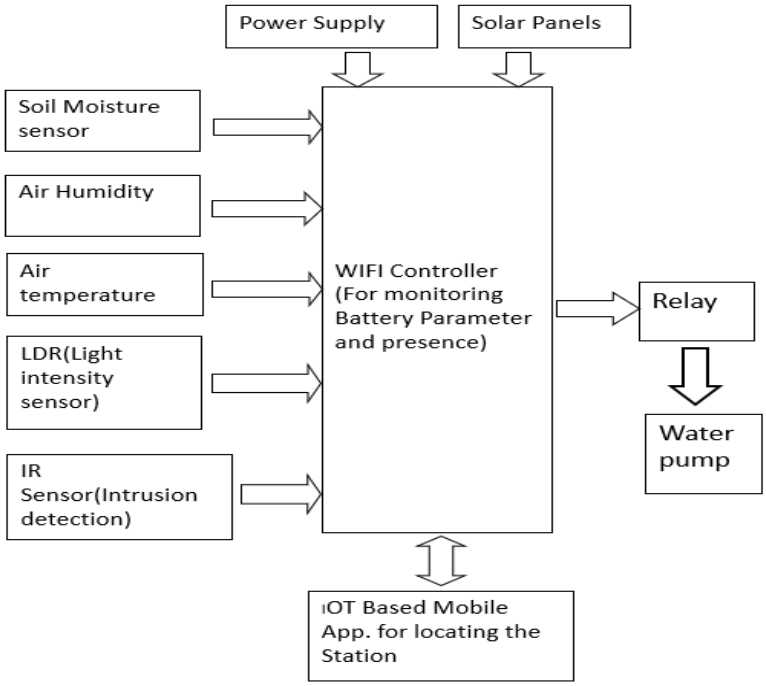
3.1SYSTEM ARCHITECTURE

Proposed Work for Smart Green House Monitoring and Controlling System using IoT:



The block diagram illustrates how these components are interconnected to form a complete smart greenhouse monitoring and controlling system using IoT and the ESP8266 Wi-Fi controller. The data flow starts from the sensors, which collect environmental data, and ends at the cloud server and user interface, where the data is processed and visualized for remote monitoring and control. The ESP8266 (WiFi Controller) module acts as the bridge between the local greenhouse system and the cloud server, facilitating data transmission and remote access.

A block diagram of a smart greenhouse monitoring and controlling system using IoT and an ESP8266 Wi-Fi controller typically consists of the following components:

1.Sensors: Various sensors are used to monitor environmental parameters such as temperature, humidity, light intensity, soil moisture, and CO2 levels inside the greenhouse. These sensors provide real-time data about the conditions within the greenhouse.

2.ESP8266 Wi-Fi Controller: The ESP8266 is a popular low-cost Wi-Fi module that acts as the main controller in the system. It connects to the internet and enables communication between the greenhouse and the cloud server.

3.Microcontroller: The microcontroller is responsible for interfacing with the sensors and controlling other components in the system. It gathers data from the sensors and communicates with the ESP8266 module for data transmission.

4.Cloud Server: The cloud server acts as a central hub for data storage and analysis. It receives the sensor data from the ESP8266 module and stores it securely in a database. The cloud server also enables remote access and control of the greenhouse system.

5.Internet Connectivity: The system requires an internet connection to enable communication between the greenhouse, ESP8266 module, and cloud server. This can be achieved through Wi-Fi or other means of internet connectivity.

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6.User Interface: The user interface can be a web or mobile application that allows users to monitor and control the greenhouse remotely. It provides real-time data visualization, alerts, and control options for adjusting parameters such as temperature, humidity, and irrigation.

7.Actuators: Actuators are used to control various aspects of the greenhouse environment based on the sensor data and user inputs. For example, actuators may control ventilation systems, heating or cooling devices, irrigation systems, and lighting systems.

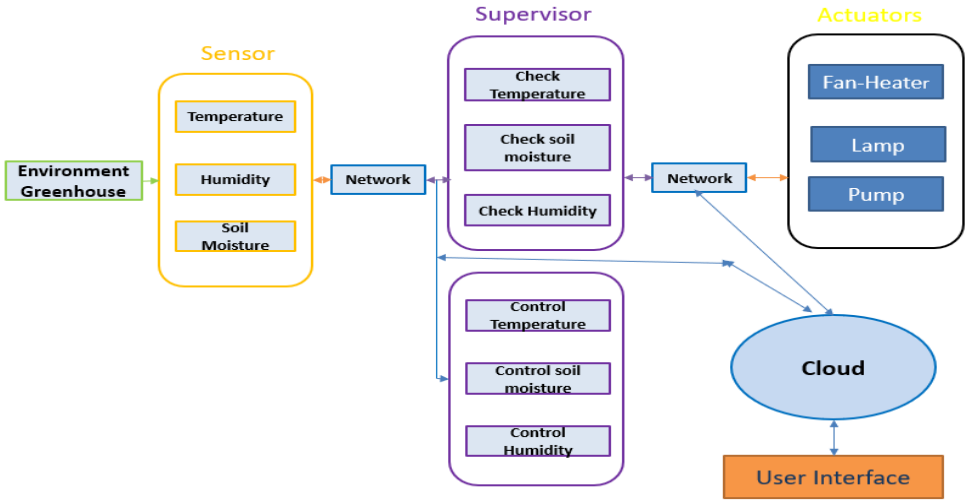
8.Power Supply: A stable power supply is required to power the entire system, including the sensors, microcontroller, ESP8266 module, and actuators. It can be achieved through a combination of mains power, batteries, or renewable energy sources.

3.2 SYSTEM OVERVIEW

The paper aims to develop a Greenhouse Monitoring and Controlling System using IoT. The system utilizes various hardware components, including an ESP8266 WiFi controller, soil moisture sensor, air humidity sensor, air temperature sensor, LCD display, pump, solenoid valve, and fan. The total cost of the hardware components amounts to 4408 currency units.

The ESP8266 WiFi controller serves as the main control unit of the system. It enables wireless connectivity and communication with other devices and the internet. The controller is responsible for collecting data from the sensors, transmitting it to the cloud or a local server, and receiving commands for control actions.

The soil moisture sensor measures the moisture level in the soil, providing essential data for irrigation control. The air humidity sensor and air temperature sensor monitor the surrounding environmental conditions within the greenhouse. These sensors help maintain optimal humidity and temperature levels for plant growth.



The LCD display is used for visualizing real-time sensor data and system status. It provides a convenient interface for users to monitor the greenhouse parameters and make informed decisions.

The pump and solenoid valve work together to control the irrigation system. The pump is responsible for pumping water to the plants, while the solenoid valve regulates the flow of water. This allows for automated and precise irrigation based on the moisture sensor readings.

The fan helps in regulating the temperature within the greenhouse. It can be controlled based on the air temperature sensor data to ensure the optimal temperature range for plant growth.

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Overall, the Greenhouse Monitoring and Controlling System leverages the ESP8266 WiFi controller and various sensors to collect data on soil moisture, air humidity, and air temperature. It utilizes the LCD display for data visualization and employs the pump, solenoid valve, and fan for automated control actions. By monitoring and controlling these environmental factors, the system aims to create an optimized and sustainable greenhouse environment, leading to improved crop yield and resource utilization.

Software:

The specific software used in the Greenhouse Monitoring and Controlling System project can vary depending on the implementation and requirements. However, here are some commonly used software components in such projects:

Programming Languages: The software development for the project may involve programming languages such as C, C++, or Python. These languages are commonly used for embedded systems and IoT applications and provide the necessary flexibility and control over the hardware components.

Arduino IDE: Arduino Integrated Development Environment (IDE) is a popular software tool used for programming microcontrollers like the ESP8266 WiFi controller. It provides an easy-to-use platform for writing and uploading code to the controller, configuring pins, and handling serial communication.

IV. RESULT ANALYSIS

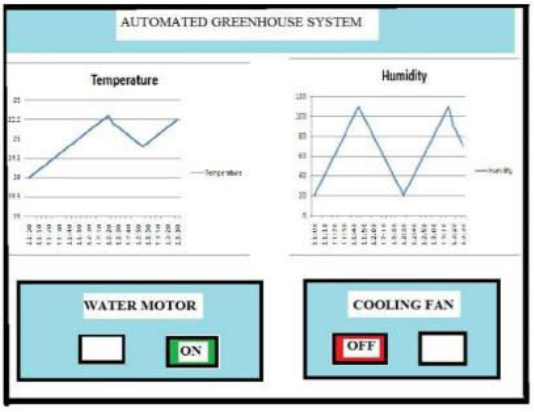
Temperature Sensor Reading	Greenhouse Environment	Controller Action
25^0C to 30^0C	Normal	No action
<25^0C	Cold	Turn OFF Fan
>30^0C	Hot	Turn ON Fan

Table 1: Predetermined Threshold Temperature Value

Soil Moisture Sensor Reading (%)	Soil Status	Controller Action
10 – 200	Dry	Turn ON Water Pump
200 – 400	Medium Wet	No Action
400 – 600	Wet	Turn OFF Water Pump

Table 2: Predetermined Threshold Soil Humidity Value

Automated Greenhouse System



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Model of Green House Monitoring System

VI. CONCLUSION

In conclusion, the Greenhouse Monitoring and Controlling System using IoT offers a comprehensive solution for efficient and optimized greenhouse management. By integrating hardware components such as the ESP8266 WiFi controller, sensors for soil moisture, air humidity, and temperature, as well as actuators including a pump, solenoid valve, and fan, the system enables real-time monitoring and control of critical environmental parameters.

Through the implementation of an IoT platform or cloud service, the system provides seamless connectivity, data storage, and analysis capabilities. The collected sensor data can be processed, visualized, and accessed remotely, empowering users with valuable insights into the greenhouse conditions and enabling informed decision-making.

By utilizing the system's automated control mechanisms, such as irrigation control based on soil moisture readings and temperature regulation through the fan, optimal growing conditions can be maintained. This leads to improved crop yield, resource efficiency, and overall sustainability in greenhouse operations.

The project's hardware components have been carefully selected and integrated to ensure reliable and accurate data collection, while the ESP8266 WiFi controller acts as the central hub for data transmission and control signals.

Overall, the Greenhouse Monitoring and Controlling System using IoT offers a cost-effective and scalable solution for greenhouse management. It enhances productivity, reduces manual intervention, and provides farmers with a user-friendly interface for monitoring and controlling their greenhouse environment. With further advancements and enhancements, this system has the potential to revolutionize modern agriculture practices and contribute to sustainable food production.

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ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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