Smart Greenhouse Using IOT

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Abstract — The increasing demand for sustainable agriculture has prompted the development of advanced technologies to enhance crop yield and quality. This project proposes an Integrated Greenhouse Monitoring System that combines sensor technologies, microcontrollers for effective greenhouse management. The system incorporates ESP32-based sensors for real- time monitoring of environmental parameters such as temperature, humidity, soil moisture, and ambient light. Additionally, the system employs a Relay, Water Pump, and DC Fan for automated control of the greenhouse environment. The primary components of the proposed system include ESP32 microcontrollers, a Liquid Crystal Display (LCD) for local data visualization, and a Nodemcu module for Internet of Things (IoT) connectivity. The ESP32-based sensors collect data from the greenhouse environment, providing valuable insights into the conditions required for optimal plant growth. The Relay is utilized to control the water pump and DC fan, maintaining appropriate soil moisture levels and temperature within the greenhouse.

Keywords: Smart Greenhouse, IOT

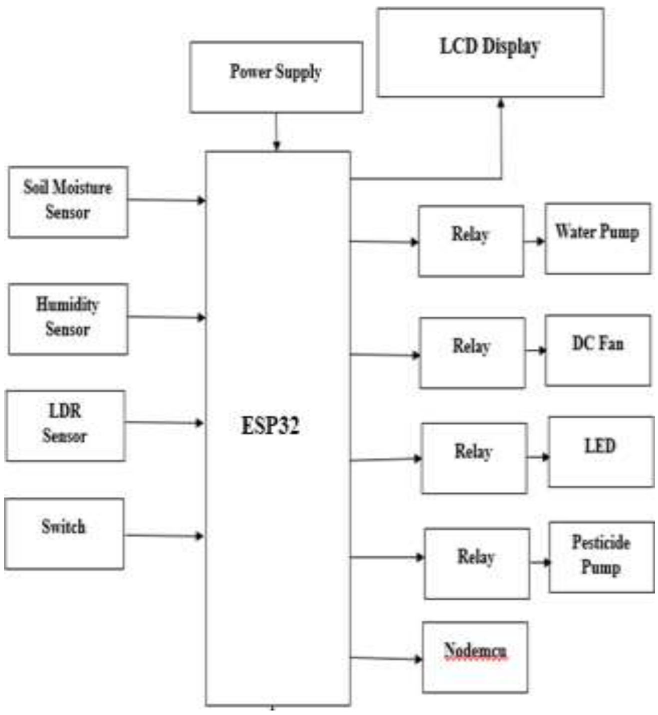
I. Introduction

The agriculture sector plays a pivotal role in ensuring global food security, and as the world faces challenges such as climate change and population growth, there is an increasing need for innovative technologies to enhance agricultural practices. Precision agriculture, facilitated by the integration of modern electronics and information technologies, offers solutions to optimize crop yield and quality. This paper introduces a comprehensive Greenhouse Monitoring System equipped with Arduino- based sensors, IoT connectivity. Greenhouse cultivation provides a controlled environment for plants, allowing farmers to overcome the limitations imposed by external factors. The proposed system employs a range of sensors, including those for temperature, humidity, soil moisture, and ambient light, to continuously monitor the greenhouse conditions. These sensors are connected to Arduino microcontrollers, which act as the central processing units for data collection and control mechanisms. The gathered data is then displayed on a Liquid Crystal Display (LCD), providing real-time insights into the environmental parameters crucial for plant growth. To automate the greenhouse environment, the system integrates a Relay, Water Pump, and DC Fan. The Relay facilitates the control of the water pump to manage soil moisture levels, ensuring an optimal hydration balance for the plants. The DC Fan regulates the temperature within the greenhouse, preventing extremes that could negatively impact plant health. This level of automation aids in creating an ideal environment for plant growth while minimizing resource consumption. Moreover, the system leverages the Nodemcu module for Internet of Things (IoT) connectivity. This enables remote monitoring and control of the greenhouse through a centralized platform. In case of critical events such as disease outbreaks, the Nodemcu is employed for immediate message intimation, ensuring that farmers can respond promptly to potential threats

II. Objectives:

- Environmental Monitoring: Implement sensors for real-time monitoring of crucial environmental parameters including temperature, humidity, soil moisture, and ambient light within the greenhouse.
- Data Acquisition and Processing: Utilize Arduino microcontrollers to collect, process, and analyze data from the sensors to gain insights into the greenhouse conditions.
- Automated Control Systems: Integrate a Relay, Water Pump, and DC Fan to automate the control of soil moisture and temperature, ensuring optimal conditions for plant growth.
- User Interface and Local Display: Incorporate a Liquid Crystal Display (LCD) to provide a user- friendly interface for local visualization of the collected data, enabling on-site monitoring and control.
- IoT Connectivity: Integrate the Nodemcu module for Internet of Things (IoT) connectivity, enabling remote monitoring and control of the greenhouse from a centralized platform.
- Message Intimation: Implement a system for immediate message intimation through the Nodemcu module in the event of critical conditions or anomalies, allowing timely response and intervention by farmers.

III. Block diagram:



- System Architecture Design: Define the overall architecture of the Greenhouse Monitoring System, including the placement of sensors, ESP32 microcontrollers, Relay, Water Pump, DC Fan, LCD, camera, and the Nodemcu module.
- Sensor Integration: Connect temperature, humidity, soil moisture, and light sensors to Arduino microcontrollers to measure environmental parameters.
- Control Mechanism Integration: Interface the Relay, Water Pump, and DC Fan with Arduino to control soil moisture levels and temperature within the greenhouse based on sensor readings.
- Local Display Setup: Connect the LCD to Arduino for local display of real-time data, allowing on-site monitoring of greenhouse conditions.
- IoT Connectivity Setup: Integrate the Nodemcu module with Arduino to enable IoT connectivity, allowing remote monitoring and control of the greenhouse.
- Message Intimation System: Implement a message intimation system using the Nodemcu module to send alerts or notifications in case of critical conditions, such as temperature extremes or soil moisture imbalances.

IV. HARDWARE AND SOFTWARE REQUIREMENTS

A. *Hardware Requirements:*

- ESP32
- LCD Display
- Humidity Sensor
- Soil Moisture Sensor
- Temperature Sensor
- Relay
- Water Pump
- DC Fan
- Lights
- Nodemcu
- Power Supply

B. *Software Requirements:*

- Arduino IDE
- Embedded C

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