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Green house Automation using ESP 8266

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I. ABSTRACT :

Agriculture is the backbone of global food security, yet traditional farming methods often struggle with challenges like unpredictable weather, water scarcity, labor shortages, and inefficient resource use. While greenhouses offer a controlled environment for crop cultivation, manual monitoring and maintenance can be time-consuming and prone to human error.

This project addresses these challenges by developing an IoT-enabled smart greenhouse automation system powered by the ESP8266 microcontroller. The system integrates multiple sensors—including DHT11 for temperature and humidity, soil moisture sensors, and an LDR for light intensity—to continuously monitor the internal conditions of the greenhouse.

These sensors are connected to the ESP8266 NodeMCU, a compact and affordable microcontroller with built-in Wi-Fi. It enables seamless communication with cloud platforms such as ThingSpeak or Blynk, where real-time data is uploaded and visualized. Users can remotely access environmental readings via mobile or web dashboards, ensuring full control and visibility from anywhere.

Keywords: NodeMCU, DHT11, Soil Moisture Sensor, LDR, Relay, DC Motor, Buck Converter, IoT, Smart Farming.

INTRODUCTION

Agriculture is truly the backbone of India's economy, and over the past 50 years, we've seen just how closely agricultural growth is tied to overall economic prosperity. However, farming in India still largely relies on traditional methods and hasn't fully embraced modern technologies. If we want India to rise as a global economic powerhouse, we need innovative and effective technologies that can consistently boost the productivity, profitability, and sustainability of our major farming systems. One promising solution is greenhouse technology. While it's an age-old technique, we can enhance it with modern advancements to increase yields and produce healthy organic food. The greenhouse industry is one of the fastest-growing sectors out there. Greenhouses create controlled environments for plants, allowing them to thrive year-round, even during chilly or overcast days. That said, extreme conditions inside a greenhouse, like high temperatures and humidity, can harm the plants, making it crucial to manage this environment for optimal growth. The primary goal of this project is to design and build a greenhouse controller that can maintain the right environmental parameters by responding to real-time sensor data and displaying the system's status to the owner. We'll be using the ESP8266 as our controller, which will gather input from various sensors and manage motors, lights, and other actuators. By separating crops from the external environment, greenhouses provide a protective shelter.

LITERATURE SURVEY

Paper 1 Author:

Li Daoliang. "Internet of things and wisdom agriculture". Agricultural Engineering, 2022.

Description:

As China forges ahead with its intelligent agriculture initiatives, it faces a host of practical challenges. Among these are a significant shortage of skilled professionals and the hurdles in translating scientific research into real-world applications. This paper delves into the evolving landscape of intelligent agriculture in China, specifically examining the training model for agricultural engineering postgraduates. It looks at four key areas: the goals of training, the development of the curriculum, the establishment of practical training bases both in and out of schools, and the evaluation methods for theses and degree assessments. The ultimate goal is to enhance the quality of graduates in agricultural engineering, ensuring a steady supply of highly skilled professionals to support the growth of intelligent agriculture in the country. Focusing on Chengdu, the paper evaluates the current state of agricultural information and explores the advantages, opportunities, and challenges of advancing smart agriculture in the region. By considering the unique characteristics of Chengdu's agricultural landscape, a tailored development plan for smart agriculture has been crafted, building on the existing framework of agricultural informatization.

Paper 2 Author:

Ravi Kishore Kodali, Vishal Jain and Sumit Karagwal "IoT based Smart Greenhouse".

Publish through Research Gate, December 2021

Description:

This project focuses on enhancing current farming methods by incorporating modern technologies to boost crop yields. It introduces a smart greenhouse model that allows farmers to automate their tasks, reducing the need for constant manual checks. The greenhouse, being an enclosed space, shields plants from harsh weather elements like strong winds, hailstorms, harmful UV rays, and pest invasions. Irrigation is managed through an automatic drip system that activates based on the soil moisture levels, ensuring that plants receive just the right amount of water. By utilizing data from soil health cards, farmers can apply the appropriate quantities of nitrogen, phosphorus, potassium, and other essential nutrients through drip fertigation techniques. Additionally, water management tanks are built and filled based on readings from ultrasonic sensors that monitor the water levels. During nighttime, plants receive the necessary light wavelengths from growing lights. Humidity and temperature are regulated using dedicated sensors, while a fogger helps maintain optimal conditions. A tube well is operated via a GSM module, allowing control through missed calls or text messages. For pollination, bee-hive boxes are set up and monitored with ultrasonic sensors to track honey production.

Paper 3 Author:

P.Dedeepya, Srinija, M.Gowtham Krishna, G.Sindhusha, T.Gnanesh "Smart Greenhouse Farming based on IOT" IEEE 2nd International conference on Electronics, 2023

Description:

The core idea here is to boost the production of vegetables, fruits, and crops by leveraging modern technology. The proposed IoT-based smart greenhouse farming system keeps an eye on important factors like temperature, humidity, soil moisture, and light using sensor elements. It also sends alerts to users through a mobile app. The data collected from the sensors, displayed on a GSM module, can be analyzed to gain insights into agricultural trends. Plus, with a secure mobile app, you can monitor these parameters from anywhere!

Paper 4 Author:

Aji Hanggoro, Rizki Reynaldo, Mahesa Adhitya Putra "Green House Monitoring and Controlling Using Android Mobile Application "IEEE Quality in Research, 2020

Description:

The current system has some capabilities but still struggles with managing indoor humidity. The Green House Monitoring and Controlling system is a comprehensive solution designed specifically to keep tabs on and regulate humidity levels within a greenhouse. This software operates through an Android mobile phone that connects via Wi-Fi to a central server, which in turn communicates with a microcontroller and humidity sensor through serial communication. The results indicate that the conditions outlined in the sensor's datasheet align well with the actual system performance. The test results confirm that the system is functioning as intended.

METHODOLOGY

System Analysis & Requirements: Start by pinpointing what needs monitoring—think voltage, current, and temperature—and clarify your goals, like wanting real-time data, detecting faults, or setting up predictive maintenance. Collaborate with MSEB engineers to get their insights.

System Architecture Design: Map out the system's components, including sensors, RTUs, SCADA, and communication protocols, while weaving in AI/ML for predictive maintenance.

Hardware & Software Selection: Pick out dependable sensors, RTUs, and communication devices that you can trust.

Testing & Validation: Carry out tests for functionality, performance, and redundancy to guarantee reliability and accuracy, including validating the AI-based predictive maintenance.

Pilot Deployment: Roll out the system in a select few substations, gather feedback, and provide training for the operators.

Full-Scale Deployment: Expand the system to all substations, making sure everything is fully integrated and scalable.

Continuous Monitoring & Optimization: Keep an eye on how the system performs, update the predictive algorithms, and fine-tune based on the feedback you receive.

Post-Deployment Support & Training: Offer ongoing support and training for operators, ensuring that the system stays updated and continues to improve.

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