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SMART POLYHOUSE AUTOMATION SYSTEM USING ARDUINO UNO IN IOT

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ABSTRACT :

The "SMART POLYHOUSE AUTOMATION SYSTEM USING ARDUINO UNO IN IOT" is an IoT-based system designed to simulate real-time weather conditions from any chosen city. Using an ESP8266 microcontroller, AWS IoT platform, and a weather forecast API, the chamber replicates environmental factors like temperature, humidity, wind speed, and lighting in a controlled acrylic space. The hardware setup includes a heater coil, Peltier module, DHT11 sensor, fan, and grow lights to simulate the retrieved weather data. This system provides a compact, cost-effective solution for agricultural research, environmental studies, and materials testing, offering accurate, real-time weather simulations that contribute to better decision-making in relevant fields. This also discusses advanced features like data analytics and decision support systems while addressing challenges and future directions including scalability and security with its comprehensive coverage of IOT, mobile app and cloud-based databases in the context of polyhouse management. It also facilitates real-time data visualizing and analyzing techniques for empowering farmers with insights for informed decision-making the integration of real-time firebase database is a key focus of this review as it provides a robust cloud-based platform for storing and synchronizing sensor data. The advantages of real-time firebase database including real-time values updates, seamless synchronization across more than one device and simplified integration with the android application are discussed in detail.

Keywords: Polyhouse, Smart Farming, off season crops, protected environment, IoT technology, Node MCU, Sensors, Android App

INTRODUCTION:

In recent decades the integration of internet of things technology mobile app and cloud-based databases has brought about significant advancements in the field of agriculture one such application is the management of polyhouse also known as greenhouse or controlled-environment agriculture structures which provide an ideal environment for cultivating crops by leveraging iot and mobile technologies. Smart polyhouse management system has emerged enabling farmers to remotely monitor and control various parameters within their polyhouses. Various sensors deployed within polyhouses such as temperature and humidity, soil moisture is examined highlighting their significance in monitoring and maintaining optimal environmental parameters for crop growth. The android application allows farmers to remotely monitor and adjust critical parameters such as temperature and humidity and irrigation systems ensuring optimal growth conditions for crops. It also facilitates real-time data visualizing and analyzing techniques for empowering farmers with insights for informed decision-making the integration of real-time firebase database is a key focus of this review as it provides a robust cloud-based platform for storing and synchronizing sensor data. The advantages of real-time firebase database including real-time values updates, seamless synchronization across more than one device and simplified integration with the android application are discussed in detail.

If moisture level is low then Arduino switches on a water pump to provide water to the plant automatically. Water pump gets automatically off when system finds enough moisture in the soil. Updating the status of water pump and soil moisture. An irrigation system for efficient water management and crops suggestion according to temperature, humidity and moisture level which is sensed by implemented sensors. Parameters like moisture, temperature, humidity are measured by using sensors. In present, is added which is a platform to control the Arduino that supports hardware platform.

Monitoring the temperature, humidity and moisture level by using sensor and sending the status to the webpage via IOT module. Watering will be done automatically by predefined time delay. This project includes various features like IoT based remote controlled soil monitoring, moisture & temperature, humidity sensing, crop suggestion and proper irrigation facilities. It makes use of wireless sensor networks for noting the soil properties and environmental factors continuously. Various sensor nodes are deployed at different locations in the farm. Controlling these parameters are through any remote device or internet services and the operations are performed by interfacing sensors. This concept is created as a product and given to the farmer's welfare.

So making Automatic Plant Irrigation System using Arduino, which automatically provides water to plants. In this System, the Soil Moisture Sensor checks the moisture level in the soil and if moisture level is low then Arduino switches on a water pump to provide water to the plant. Water pump gets automatically off when system finds enough moisture in the soil. System will also provide feature to measure the temperature and humidity of soil and suggest the crop suggestion according to the sensed value by sensor suitable for that location. If guest user just to know about crop suggestion, then user just log in and enter the city name the system will automatically fetch the temperature and humidity of that location and system show the crop. This system also provide an IoT-enabled weather simulation chamber that mimics real-time weather conditions from any city. The system utilizes data fetched from a weather forecast API, processed and transmitted via AWS IoT, and replicated within the chamber using temperature control, humidity management, wind simulation, and lighting control.

LITERATURE SURVEY:

Title: Smart Agriculture using IOT

Employing intelligent agriculture IoT is essentially the development of a wireless irrigation automation system that uses several different sensors, such as those for light, humidity, temperature, soil moisture, and more. Using these modern methods, farmers may keep an eye on their crops at any time and from anywhere. For these reasons, IoT-based modern agricultural technology is a very powerful and reliable persuasion weapon. It is a technique for improving farming's accuracy and precision.

Benefits: Smart agriculture with IoT offers us numerous benefits, including effective use of herbicides and water. Agriculture benefits from agricultural drones, livestock monitoring, intelligent greenhouses, and precision farming and other IoT applications. An alarm is set off to notify the farmer if the motion sensors detect any theft. The lack of accuracy is a drawback.

Title: Using Arduino, a smart crop protection system against fire and living things.

In addition to providing people with the food they need, agriculture also generates a range of basic materials for industry. Nevertheless, there will be a huge loss of crops because animal interference and fire in agricultural fields. Crop destruction will be complete. There will be significant loss of farmers. It is crucial to preserve agricultural fields and farms from animals and fire in order to prevent these costly losses. To solve this issue, we propose to create a system that uses PIR to prohibit animals from entering the farm. Developing an intruder alert system for the farm is the primary goal of our project in order to prevent animal and fire losses. These intrusion warning systems prevent agricultural damage and hence indirectly boost crop productivity.

Benefits: prevents loss to farmers by ensuring that crops are completely safe from animals and fire. Cons: less data samples are collected due to the longer execution duration.

Title: Environmental Monitoring System Development for Disease Management

The substantial geographical heterogeneity in the microenvironment around a crop in a greenhouse significantly hinders this environmental method to disease management. A field crop's environment is thought to be more or less consistent, but a crop cultivated in a greenhouse may have a more variable environment. The exact placement of an object is difficult to determine. The crop is susceptible to environmental changes, and these changes are what they are. A huge network of sensors would be needed for high resolution geographical and temporal monitoring to regulate the environment for disease in a greenhouse crop. In order to identify the actual environmental conditions, the plants are experiencing, these sensors would need to be placed close to the plant canopy. Crop growers can pay fees and experience disruptions to their regular chores if a vast sensor network is integrated into agricultural operations. The disease monitoring system created for this study addresses these difficulties by being portable and taking up little more room than a miniature flowerpot. It also uses low-cost wireless technology. Point-to-point connection between sensor stations in the system is not necessary. The system offers a number of advantages, including short setup time, wireless connectivity that allows sensor stations to be moved around the greenhouse as needed, and the capacity to be scaled to any size business.

Zuraida Muhammad, Muhammad Azri Asyraf Mohd Hafez, Nor Adni MatLeh, Zakiah Mohd Yusoff , Shabinar Abd Hamid [1] The term "Internet of Things" refers to the connection of objects, equipment, vehicles, and other electronic devices to a network for the purpose of data exchange (IoT). The Internet of Things (IoT) is increasingly being utilised to connect objects and collect data. As a result, the Internet of Things' use in agriculture is crucial. The idea behind the project is to create a smart agriculture system that is connected to the internet of things. The technology is combined with an irrigation system to deal with Malaysia's variable weather. This system's microcontroller is a Raspberry Pi 4 Model B. The temperature and humidity in the surrounding region, as well as the moisture level of the soil, are monitored using the DHT22 and soil moisture sensor. The data will be available on both a smartphone and a computer. As a result, Internet of Things (IoT) and Raspberry Pi-based Smart Agriculture Systems have a significant impact on how farmers work. It will have a good impact on agricultural productivity as well. In Malaysia, employing IoT-based irrigation systems saves roughly 24.44 percent per year when compared to traditional irrigation systems. This would save money on labour expenditures while also preventing water waste in daily needs.

Divya J., Divya M.,Janani V. [2] Agriculture is essential to India's economy and people's survival. The purpose of this project is to create an embedded-based soil monitoring and irrigation system that will reduce manual field monitoring and provide information via a mobile app. The method is intended to help farmers increase their agricultural output. A pH sensor, a temperature sensor, and a humidity sensor are among the tools used to examine the soil. Based on the findings, farmers may plant the best crop for the land. The sensor data is sent to the field manager through Wi-Fi, and the crop advice is created with the help of the mobile app. When the soil temperature is high, an automatic watering system is used. The crop image is gathered and forwarded to the field manager for pesticide advice.

3. PROPOSED METHODOLOGY:

Monitoring: Sensors monitor temperature, humidity, light intensity, soil moisture, and nutrient levels.
Controlling: The data collected by sensors is used to automatically control the climate inside the polyhouse. For example, if the temperature rises too high, the IoT can activate ventilation or cooling systems.
Adjusting light: The intensity of artificial light can be adjusted based on natural light conditions and the growth stage of the plants.
Detecting pests and diseases: The system can detect early signs of pests or diseases.
Managing fish tanks: In hydroponic farming setups, the IoT can manage fish tanks and optimize nutrient delivery to plants.
Remote access: Polyhouse automation systems can be accessed from a smartphone, tablet, or computer
Data Fetching: The user selects a city from the web interface, and the system fetches real-time weather data (temperature, humidity, wind speed, and lighting) via a weather forecast API.
AWS IoT Integration: The weather data is stored and transmitted to the ESP8266 microcontroller through AWS IoT services.
Environment Simulation: The ESP8266 controls the chamber components based on the retrieved weather data:
Temperature: Managed by the heater coil and Peltier module.
Humidity: Monitored and regulated using the DHT11 sensor.
Wind Simulation: A fan adjusts its speed according to the wind speed data.
Lighting: Grow lights simulate sunlight conditions based on the API data.
Monitoring: Users can monitor the chamber environment remotely via the web interface.

4. BASIC BLOCK DIAGRAM:

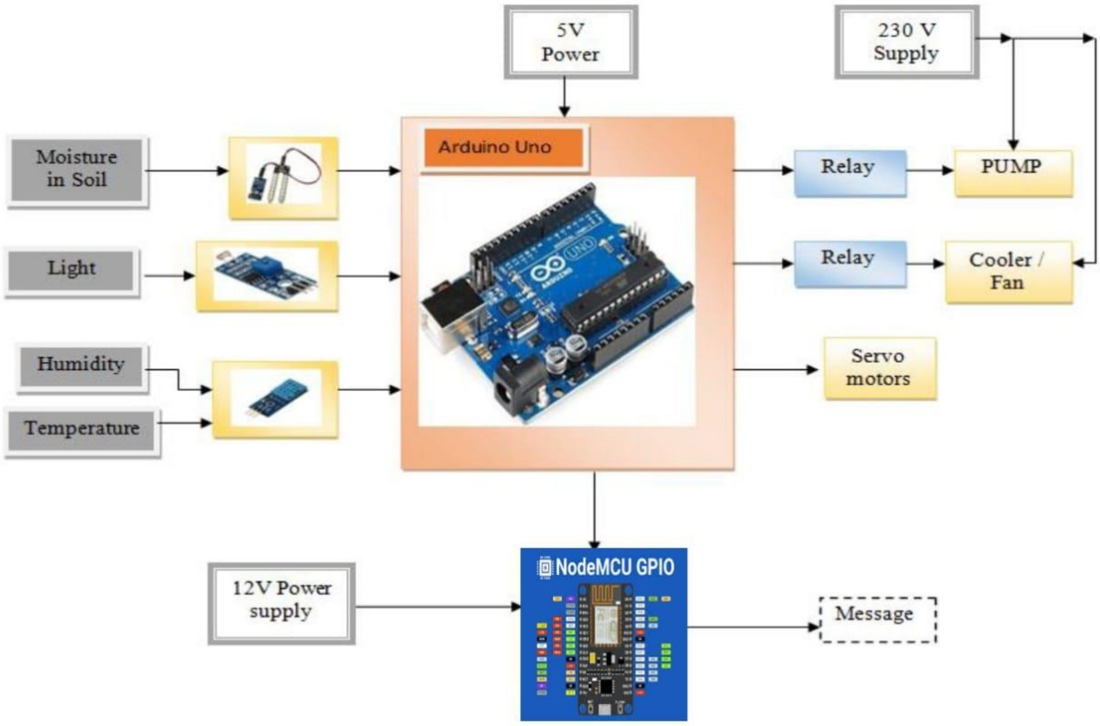

Fig: Block Diagram Of Smart House Polyhouse System

5. SYSTEM ARCHITECTURE:

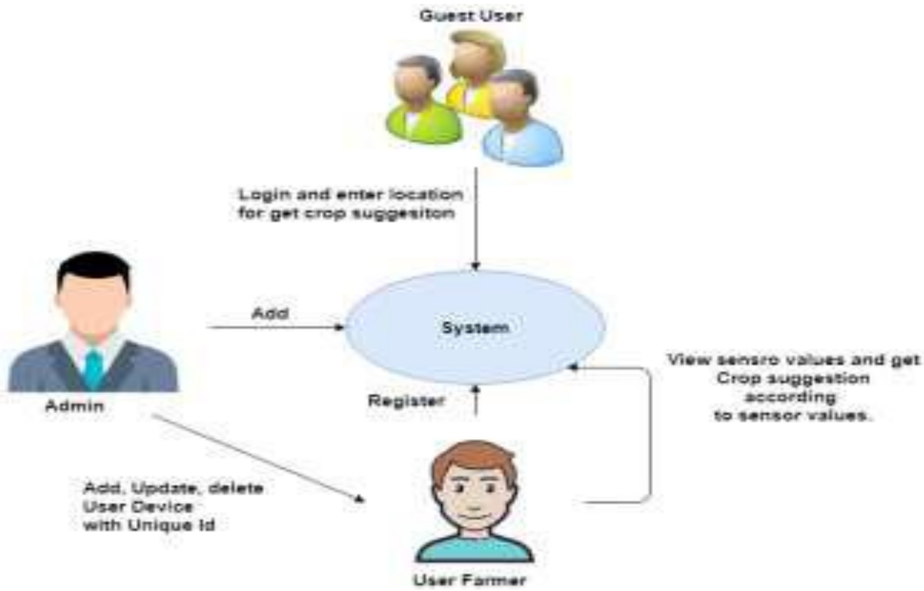

Fig: System Architecture of Smart House Polyhouse System

6. COMPONENTS USED:

Sr. No	Components	Quantity
1	Node MCU Esp 8266	1
2	Heater coil	1
3	Peltier Module	1
4	Grow Light	1
5	DHT11 Sensor	1
6	Soil Moisture Sensor	1
7	LM35 Temperature Sensor	1
8	Relay Module	8
9	L293D Motor Driver Module	1
10	Fogger Module	1
11	9V Battery	1
12	Battery Connector	1
13	Acrylic Chamber (1*1 foot)	1
14	Solenoid Valve	1
15	DC Pump	3
16	PH Sensor	1
17	DC Motor	2
18	12V Transformer	1

7. ADVANTAGES:

▪ Reduce the workload of farmers
▪ Organic farming is easier under these structures.
▪ Production of uniform quality crops.
▪ Management of insect pests, diseases and weeds is easier under these structures.
▪ You can grow off-season crops. Such crops can yield higher profits as they are in increased demand with little supply.
▪ We can enjoy a whole year's yield of crops without having to wait for the season’s rotations.

▪ As we are controlling the factors like humidity, temperature, and sunlight, etc. There are very few chances of crop damage and loss.
▪ A drip irrigation system provides an effective solution for the scarcity of water supply. It is also more beneficial for crop growth.
▪ Cost-effective: Provides a budget-friendly solution compared to traditional weather simulation chambers.
▪ Real-time Weather Replication: Accurately simulates weather conditions from any global city.
▪ Remote Monitoring: Users can monitor and control the chamber through the web interface, offering flexibility.
▪ Compact Design: The 1x1-foot chamber is space-efficient and can be used in research labs or classrooms.
▪ Scalability: Can be expanded to simulate larger environments or multiple weather conditions.

8. DISADVANTAGES:

▪ Battery power should be required.
▪ Sensors may get fail sometimes.
▪ Limited Simulation Parameters: Currently focuses on temperature, humidity, wind, and lighting, but lacks other environmental factors like air pressure and precipitation.
▪ Dependent on Internet Connection: Requires a reliable connection for fetching weather data and communicating with AWS IoT.
▪ Basic Sensors: The use of simple sensors (like DHT11) may limit the accuracy of environmental control.

9. RESULTS:

Polyhouse automation systems can help farmers improve crop quality and yield by creating an ideal environment for plants to grow in. They can also help farmers reduce labor costs and manage resources more efficiently. With the use of Polyhouse automation, a grower can increase the yield and improve the quality of crops and minimize climate for the crop by monitoring and controlling temperature, humidity, light, and CO2 in the Polyhouse. The system developed produces optimal results for effective maintenance of controlled conditions in the polyhouse. Pump is turned on automatically when the moisture content in the soil is less than the predefined value and simultaneously the farmer received message related to it. Fig.9 and Fig.10 shows the message received for water pump operation.

8. CONCLUSION:

Polyhouse automation systems can help farmers improve crop quality and yield by creating an ideal environment for plants to grow in. They can also help farmers reduce labor costs and manage resources more efficiently. With the use of Polyhouse automation, a grower can increase the yield and improve the quality of crops and minimize climate for the crop by monitoring and controlling temperature, humidity, light, and CO2 in the Polyhouse. The system developed produces optimal results for effective maintenance of controlled conditions in the polyhouse. Pump is turned on automatically when the moisture content in the soil is less than the predefined value and simultaneously the farmer received message related to it. With the developed system using IoT, polyhouse is made smarter that takes care of controlled conditions automatically without any manual intervention.

With these manual errors can be reduced in monitoring polyhouse conditions and also farmers can achieve high productivity. IoT being the latest emerging technology helps to improve quality and quantity of polyhouse yield. This agriculture monitoring system serves as a reliable and efficient system and corrective action can be taken. Wireless monitoring of field reduces the human power and it also allows user to see accurate changes in crop yield. It is cheaper in cost and consumes less power. The smart agriculture system has been designed and synthesized. The developed system is more efficient and beneficial for farmers. It gives the information about the temperature, humidity of the air in agricultural field to the farmer. The application of such system in the field can definitely help to advance the harvest of the crops and global production. The ‘‘Smart Polyhouse Automation System Using Arduino Uno In Iot” provides a scalable and affordable way to simulate real-time weather conditions from any city using IoT technology. By integrating AWS IoT, it allows for accurate monitoring and control, making it useful for research in agriculture, environmental science, and materials testing. The project demonstrates the potential of IoT in automating and replicating environmental conditions, providing a flexible tool for researchers and educators. In future this system can be improved by adding several modern techniques like irrigation method, solar power source usage.

9. REFERENCES:

1. Sahu K. & Mazumdar S.G., 2019, “Digitally Greenhouse Monitoring and Controlling of System based on Embedded System”, International Journal of Scientific & Engineering Research (IJSER), ISSN: 2229-5518, Vol. 3, Issue 1, pp. 1-4.
2. Pawar S.D. & Rane U.A., 2019, “Environment Monitoring and Device Control using ARM based Embedded Controlled Sensor Network”, SSRG International Journal of Electronics and Communication Engineering (SSRGIJECE), ISSN: 2348 – 8549, Vol. 2, issue 1, Jan 2019, pp. 34-37.
3. "IoT-based smart greenhouse for optimized crop cultivation" https://www.researchgate.net/ publication/331862628_IoT-based_smart_greenhouse_for_optimized_crop_cultivation
4. "IoT-enabled Greenhouse Farming for Sustainable Agriculture" https://www.researchgate.net/ publication/334125062_IoT-enabled_Greenhouse_Farming_for_Sustainable_Agriculture
5. "IoT-based Greenhouse Monitoring System" https://www.electronicsforu.com/electronicsprojects/hardware-diy/iot-based-greenhouse-monitoring-system]

6. "Smart Greenhouse Management System using IoT" https://ieeexplore.ieee.org/document/8274876
7. "IoT-based Intelligent Greenhouse for Smart Agriculture" https://www.sciencedirect.com /science/article/pii/S221201731630042X
8. Y. R. Sonawane, S. Khandekar, B. K. Mishra and K. K. S. Pandian, "Environment monitoring and control of a poly house farm through Internet," in Proceedings of 2nd Intelligent Computing and Information and Communication, IIT Kanpur, 2016.
9. Weather API documentation for real-time weather data.
10. AWS IoT Developer Guide for cloud-based data storage and transmission.
11. IoT-based environmental control systems research papers.
12. Technical specifications and guides for ESP8266, DHT11, and Peltier modules.