IOT BASED SMART GREEN HOUSE

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ABSTRACT: *The growing need for sustainable farming methods has prompted the development of smart greenhouse technologies that combine advanced automation, data analytics, and eco-friendly systems. This study describes the design and execution of a smart greenhouse system aiming at optimising resource consumption and crop output while lowering the environmental effect of conventional farming. The system uses the Internet of Things (IoT), sensors, and machine learning algorithms to monitor and adjust critical environmental variables including as temperature, humidity, soil moisture, and light intensity. The smart greenhouse achieves ideal growth conditions while minimising water and energy usage by automating irrigation, ventilation, and fertiliser supply using real-time data.*

Keywords:*DHT11, GSM, Soil moisture, humidity.*

INTRODUCTION

The goal of this study is to design and build a smart greenhouse system that uses current technology to improve plant growing conditions, increase production, and minimise resource use. The major objective is to establish an automated environment in which temperature, humidity, and irrigation can be accurately regulated and monitored to provide the best growth circumstances for diverse plant species. One of the main goals of the smart greenhouse paper is to improve plant development conditions. This entails maintaining optimal levels of temperature,

humidity, and soil moisture within the greenhouse. By adjusting these characteristics, the system hopes to create an environment that promotes plant growth and production.

Fig : 1 Greenhouse

Another important goal is to increase agricultural output through effective resource utilisation and ideal growing conditions. The smart greenhouse system aims to increase produce output and quality by supplying plants with the appropriate environmental elements at the correct time and in the right amounts. This is accomplished by careful control of climatic conditions, irrigation timing, and nutrient management[1-5].The report also seeks to minimise resource usage in greenhouse agricultural operations. Traditional techniques frequently consume excessive amounts of water, energy, and fertilisers, resulting in environmental deterioration and economic inefficiencies. The smart greenhouse system may improve resource utilisation and reduce waste by adopting automated temperature control, irrigation, and nutrient delivery systems.

- Technology Integration: Utilizing IoT technology, precision farming, and sophisticated data analytics for real-time monitoring and management of environmental factors impacting plant development.
- Sensor Selection and Integration: The study focusses on selecting and integrating sensors to monitor environmental factors in greenhouses. Temperature sensors, humidity sensors, and soil moisture sensors are some examples of these sensors. The data obtained by these

sensors will be utilised to dynamically change temperature control systems and improve growth conditions.

- Implementation of User Interface: The paper will also contain the development of a user interface for remote monitoring and control of the greenhouse environment. This interface will allow users to monitor environmental conditions, alter settings, and get alerts or notifications for any deviations and optimal conditions.
- Testing and Validation: The study will validate the smart greenhouse system in a real-world greenhouse situation. This will entail evaluating the system's performance and efficacy in optimising plant growth conditions and increasing production. Adjustments may be made depending on testing results to ensure that the system achieves its objectives.
- System Development: Our focus is on using the Arduino as a central unit to integrate sensor inputs and manage actuator outputs, resulting in a responsive and efficient greenhouse automation system.
- Sustainability and Efficiency: This section emphasises the benefits of resource efficiency, including water and energy savings, as well as environmental impact reduction and eco-friendly farming techniques.

2.Existing System

The current plant cultivation system is mostly based on conventional agricultural practices, which are labour-intensive and frequently inefficient[6-9]. Manually monitoring environmental indicators like as temperature, humidity, soil moisture, and precipitation is typical, which can lead to mistakes and poor growth conditions. Automation, when it exists, is limited, leading in poor resource utilisation and sensitivity to external variables such as weather variations and pests. Furthermore, the absence of real-time data analysis impedes proactive decision-making. In short, the existing system's dependency on manual intervention and vulnerability to external factors underscore the need for a more sophisticated approach, such as that proposed in the Smart Greenhouse study.

Fig :2 Manual Irrigation

2.1 Drawbacks:

- Traditional agricultural methods need heavy physical labour for operations like planting, watering, and harvesting, resulting in high labour costs and inefficiency.
- Manual monitoring and management of crops and environmental conditions can lead to inefficient resource utilisation, such as water, fertiliser, and energy.
- Outdoor farming exposes crops to unpredictable weather patterns, pests, diseases, and other environmental dangers, resulting in production losses and poor crop quality.
- Lack of Precision: Without automated monitoring and control systems, it is difficult to maintain accurate environmental conditions matched to individual crop needs, resulting in unsatisfactory growth and yield.
- Inefficient irrigation and fertilisation procedures can waste water and fertilisers, leading to environmental deterioration and higher production costs.
- Farmers struggle to make educated decisions and optimise farming techniques due to a lack of real-time data analysis tools.

3.Proposed System

The suggested method intends to address the limits of traditional agriculture by applying a Smart Greenhouse solution. This system uses sophisticated technology like the Internet of Things, sensors, and automation to produce an ideal environment for plant development. The Smart Greenhouse provides real-time data insights by using sensors to monitor critical elements such as temperature, humidity, soil moisture, and precipitation.

Automated actuators, controlled by a microcontroller such as the Arduino Uno, allow for exact adjustments to irrigation, ventilation, and other environmental variables depending on gathered data[10-14].

This proactive approach to farming not only increases resource efficiency but also reduces the influence of external elements like weather and pests. Furthermore, the use of data analytics enables informed decision-making and continual optimisation of farming processes. Overall, the suggested Smart Greenhouse system provides a comprehensive solution for increasing production, sustainability, and resilience in modern agriculture[15-17].

Fig : 3 Smart Greenhouse

3.1Advantages:

1. The Smart Greenhouse optimises resource usage by monitoring environmental factors including soil moisture, temperature, and humidity. This allows for exact regulation of irrigation and ventilation systems, resulting in effective use of water, electricity, and other resources.
2. Optimal growth conditions adapted to individual plant requirements improve crop production, quality, and consistency. This can boost farmer profitability while also providing customers with higher-quality products.

3. Automation decreases labour requirements for functions like watering, ventilation, and data monitoring, saving farmers time and money while minimising human mistake.
4. Environmental Sustainability: By maximising resource utilisation and minimising waste, the Smart Greenhouse supports environmental sustainability by lowering water use, fertiliser runoff, and greenhouse gas emissions associated with traditional agricultural operations.
5. Remote monitoring and management of environmental conditions allows Smart Greenhouses to quickly adapt to weather, pests, and diseases, reducing risks and protecting crops from damage.
6. Real-time data gathering and analysis helps farmers make educated decisions and enhance farming techniques for optimal production and sustainability.

4.RESULTS

Our article aims to revolutionise plant cultivation by leveraging technology. Our study automates environmental control, which reduces the requirement for manual intervention. Our objective is to develop an innovative solution that maximises plant growth and health while reducing environmental impact through accurate monitoring and management. We can also see the kit's LCD, which shows every information about the paper on the display, as well as the wifi module.

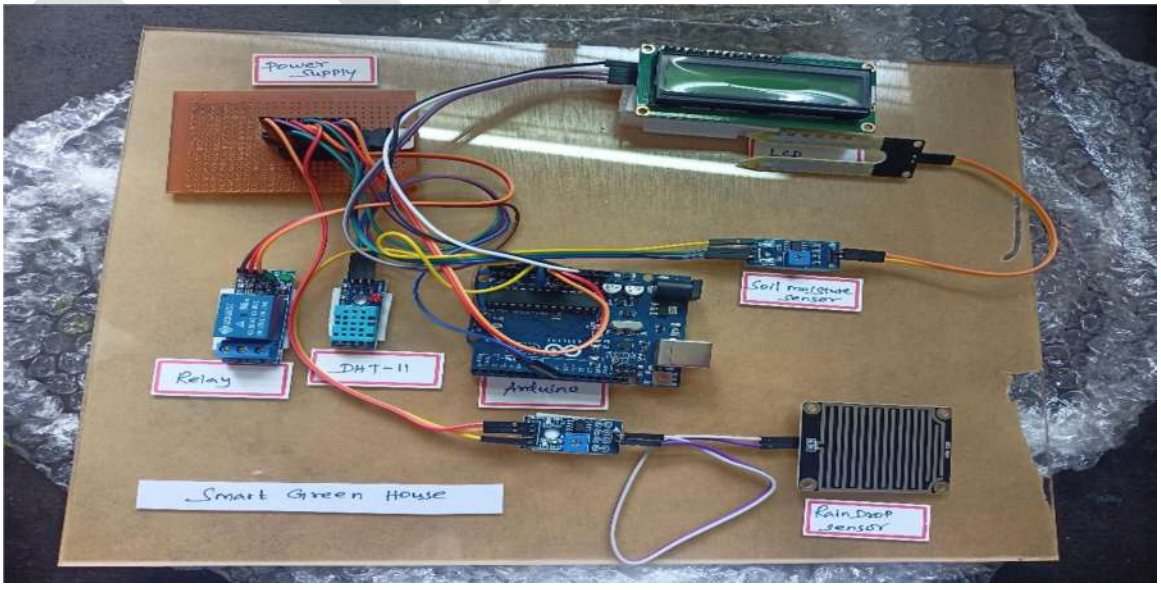

Fig : 4 Smart Greenhouse Kit

The humidity sensor is critical in establishing a favourable and regulated climate for plant development, resulting in better crops, larger yields, and, eventually, a more successful smart greenhouse paper. The data from the temperature sensor can be accessed remotely via the GSM module, allowing growers to monitor temperature levels in real time and make adjustments as needed even when they are not physically present in the greenhouse. This remote accessibility makes greenhouse management more convenient and efficient. The temperature sensor continually monitors the ambient temperature within the greenhouse. The soil moisture sensor detects changes in soil moisture levels before they are evident to the naked eye.In our Smart Greenhouse paper, we discuss how the soil moisture sensor helps to optimise watering techniques, promote healthy plant development, and conserve water resources.

5.CONCLUSION

To sum up, the Smart Greenhouse study is a noteworthy development in contemporary agriculture, utilising technology to improve resource efficiency, foster sustainability, and optimise plant growth conditions. It draws attention to its potential to lower labour costs, enhance agricultural output quality, and lessen risks related to environmental elements like pests and weather variations. Farmers can contribute to food security and environmental conservation efforts by implementing the Smart Greenhouse system, which can increase productivity, reduce resource consumption, and increase resilience to external challenges. Innovation and interdisciplinary collaboration are crucial in meeting the changing needs of the agricultural sector. The Smart Greenhouse paper is an excellent example of a comprehensive approach to contemporary farming that strikes a balance between environmental stewardship and economic viability by utilising technology, data analytics, and sustainable methods.

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