e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 7, July 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.521

6381 907 438 6381 907 438 ijmrset@gmail.com www.ijmrset.com

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707068 |

Smart Greenhouse Monitoring System using IOT: Arduino UNO-based Solution

Yogitha M, Suha Shakeer

Assistant Professor, Department of MCA, Mangalore Institute of Technology & Engineering, Karnataka, India

PG Student, Department of MCA, Mangalore Institute of Technology & Engineering, Karnataka, India

ABSTRACT: As the agriculture has a significant part in the Indian economy, if we do not maintain Greenhouse farming plant health will be reduced, hence there'll be the loss of crop production. Manually maintaining of greenhouse monitoring is highly time and cost consuming. It is more convenient and effective for farmers with automated working environment using Arduino Uno. This system detects condition of soil such as humidity, soil moisture, and temperature. This study analyzes and alerts regarding the health of soil and crop conditions. This paper showcases an Arduino Uno greenhouse monitoring system that optimizes plant development conditions and maintains moisture of soil that uses LM35 temperature sensor and an LDR sensor to regulate soil moisture levels and improve plant development conditions. The system WiFi connectivity which permits real-time data transfer using IoT.

KEYWORDS: LM35 temperature sensor, LDR sensor, Arduino Uno, WiFi, IoT**.**

I. INTRODUCTION

India may greatly increase agricultural sustainability and output with greenhouse farming. A greenhouse is a closed environment that provides optimal conditions for plant growth and promotes plant growth by controlling indoor and outdoor environments [7]. However, due to manual and conventional techniques of greenhouse management, Indian farmers frequently face difficulties like inefficient resource utilization, irregular crop yields, and high operating expenses. These challenges are exacerbated by the requirement for exact environmental management to maximize crop development, which is frequently challenging to accomplish without automation and real-time monitoring. Using wireless sensor networks, the monitoring of the greenhouse environment can be not only simplified but can also contribute to production efficiency increase [6].

Consequently, the natural fertility of the soil is depleting and the soils are losing their resilience characteristics [8]. Among the biggest problems facing agriculture is the depletion of soil fertility, which is frequently brought on by wasteful resource usage and poor oversight. This problem can be solved by a smart greenhouse mechanism that can deliver precise management of water and nutrients by giving real-time data on soil conditions. By promoting sustainable agricultural methods, preventing excessive fertilizer usage, and maintaining ideal soil health, this approach increases crop yields while halting soil deterioration. The main cause of low yield per hectare is the low fertility of soil and less care to replenish it through green manure, fertilisers, fallowing, and scientific rotation of crops[8]. Poor soil fertility and inadequate replenishment techniques, such as crop rotation, fertilization, and green manuring, are the main causes of low crop yields per hectare. A solution is provided by an IoT-based greenhouse surveillance mechanism that keeps an ongoing eye on soil conditions and optimizes water and nutrient management. enhanced crop yields and sustainable farming methods result from this system's support of scientific crop rotation, efficient soil replenishment, and enhanced general soil health.

Farmers may precisely and efficiently manage resources by using an Internet of Things-based greenhouse surveillance system to deliver real-time insights into environmental conditions and soil health. In addition to promoting sustainable farming methods and improving soil fertility, this strategy opens the door for increased crop yields and more resilient agricultural systems. We can address these important agricultural issues and advance a more sustainable and fruitful future for greenhouse farming by integrating IoT technologies.

II. LITERATURE SUREVY

In [1], "IoT Based Automated Greenhouse Monitoring System" by Danita, M. & Mathew, Blessy & Shereen, Nithila & Sharon, Namrata & Paul. This system is set up to gather vital information on soil moisture, temperature, and humidity

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707068 |

content—elements required sustaining ideal growing circumstances within the greenhouse. Utilizing a web page that displays the information in real-time and is continuously monitored, users can remotely track and manage greenhouse conditions from any location. The automated controls within the system modify the surrounding circumstances automatically, guaranteeing constant and optimal conditions for plant development. Significant improvements in greenhouse farming efficiency are demonstrated by the system, which maintains ideal soil moisture, temperature, and humidity levels while also improving plant health and productivity and streamlining the management process.

In [2], "Precision Agriculture Monitoring System Using Green Internet of Things (G-IoT)" by Ali, Terteil & Choksi, Viraj & Potdar, Madhukar. It is affordable and accessible for a wide range of users, with a total cost of 7996.00 Rs (about $123.00 USD). As a decision support tool, this real-time technology helps farmers raise crop yield without sacrificing quality. The technology reduces the environmental impact of chemicals and stops soil degradation by precisely controlling agricultural water resources and applying fertilizers and pesticides based on exact sensor data. While reporting actual Information is not the main focus of this work, it does highlight the possibility for major gains in sustainable farming methods through accurate and economical agricultural monitoring.

In [3], "Green house based on IoT and AI for societal benefit" by Nargotra, Meghal & Khurjekar, Mandar. IoT and AI are used in this study to enable remote monitoring and real-time data storage. Predicting plant water requirements based on different environmental parameters is among the principal conclusions of the decision tree C4.5 algorithm. The algorithm's benefit over other examined algorithms was its ability to handle both nominal and numeric properties, resulting in improved performance. Overall performance indicators repeatedly demonstrated that C4.5 performed better than the Regression Support Vector Machine (SMO) algorithm, even on unbalanced datasets. With an emphasis on anticipating plant water requirements, the work highlights the potential of AI-driven systems to optimize resource management and boost crop output in greenhouse settings—a significant addition to precision agriculture.

In [4], "IOT Based Greenhouse Monitoring and Controlling System" by J S, Sujin & Murugan, R & Nagarjun, M & Praveen, Akash. This paper presented important vegetative elements include light intensity, temperature, soil moisture and humidity. Through the observing and managing of these crucial factors, this system demonstrated efficiency, economy, and dependability, ultimately increasing agricultural productivity through optimal farming techniques. The results of the measurement cover a broad spectrum of environmental parameters, including air pressure, temperature, amount of light, and moisture content of the soil, air water content, and gas presence. This all-encompassing strategy not only illustrates how the framework can completely transform greenhouse management, but it additionally identifies regions where more innovative sustainable agriculture techniques might be developed.

In [5], "Greenhouse Monitoring System Using IOT" by Kumar, Sahil & Kumar, Raj & Kumar, Sonu & Chincholkar, Yugendra. This system automate greenhouse conditions, maximizing temperature, light intensity, and soil moisture to promote optimal crop development conditions with the least amount of operator intervention. Large-scale farming with fewer workers is made possible by this technology, which also improves operational efficiency and lessens the workload for farmers. Real-time sensor data transfer to the farmer's mobile device, which enables remote monitoring and control, is necessary for its operation. The major metrics used to quantify the system's effectiveness are temperature, soil moisture, and light intensity. These measurements demonstrate how successfully the framework can sustain ideal growing conditions and raise total agricultural productivity by increasing control and efficiency.

III. PROPOSED SYSTEM

1. LDR Sensor: An LDR sensor measures light dependence. Another name for It's an photoconductor. In essence, the passive component is a resistor whose resistance value drops as light intensity does. The sensor's job within this framework is to recognize an approaching light from the car before it and alert The microcontroller that possesses the appropriate signal.

2. Soil Moisture Sensor: This device gauges the volume of water in the soil. Soil moisture sensors measure the proportion of water in volume indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. This is because the direct gravimetric measurement of free soil moisture necessitates the removal, drying, and weighing of a sample.

3. Temperature Sensor: The temperature near the LM35 precession integrated circuit temperature sensor causes its output voltage to change. This tiny, inexpensive integrated circuit (IC) has a temperature measurement range of -55°C

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707068 |

to 150°C. Any microcontroller with an ADC function or any programming platform like An Arduino could readily interfaced with it.

4. Jumper Wires: Jumpers Wires are accustomed to connect components electrically onto the Arduino board or to other components on a breadboard. They make testing and prototyping simple and eliminate the requirement for soldering.

5. I2C model: Using the I2C (Inter-Integrated Circuit) protocol, the I2C module makes it easier for using the Arduino board communicate with other devices. With just two cables, it enables serial connection between numerous devices.

6. Sliding window and coolers: A greenhouse's side walls have sliding windows and coolers to manage the greenhouse's interior temperature and ventilation.

7. Alarm System: To ensure that inform users of any changes to the predetermined environmental conditions, an alarm system should be in place.

8. BreadBoard: In IoT, a breadboard is a prototype tool that makes it easy to quickly assemble and test electronic circuits without soldering. In the construction of IoT devices, it is crucial for integrating different parts such as sensors, microcontrollers, and communication modules. In IoT projects, breadboards allow for quick experimentation and iteration, it enables them to be extremely helpful for professional's additionally educational reasons.

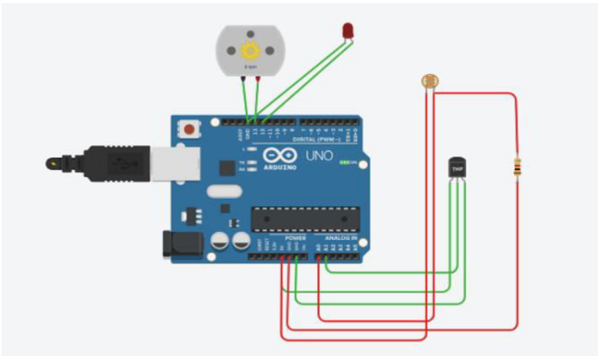

Fig. 1 Circuit Diagram

IV. WORKING OF SYSTEM

This project creates an automated, remotely accessible environmental observing and managing system with this Arduino Uno. It includes several sensors, actuators, and WiFi connectivity. Coolers to lower temperature, sliding windows to control ventilation, an LM35 temperature sensor to record surrounding temperature, an LDR sensor for light measurement intensity, and a a soil moisture sensor for detecting soil moisture levels are the main portions of the system. Remote data transfer and control are additionally made possible with a WiFi module ESP32.

The sensors constant data collection allows the system to function. This data is processed by the Arduino Uno to ascertain the current situation regarding the surroundings. The device has the capacity for activate extra lights when the light intensity drops below a predetermined level. Too little soil moisture might cause an irrigation system to kick on. The system permits enhanced ventilation and cooling by opening the sliding windows and activating the coolers when the outside temperature rises above a certain threshold.

The system needs WiFi connectivity to be able to transmit sensor data to a distant server. To be able to accomplish this, a WiFi module must be linked with the Arduino and configure up to connect to a nearby WiFi network. After that, the information is forwarded to the server using MQTT protocol or HTTP requests, where it may be seen by a mobile app or web dashboard for monitoring. Every minute, for instance, the Arduino is able to transmit data to the server that is handled and displayed, like moisture content of the soil and temperature, and and the brightness of the light.

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707068 |

Furthermore, the system is capable of remote control, meaning that users can instruct the Arduino from the server. This enables manual override and web interface/mobile app control of the coolers and sliding windows. For example, commands to open or close the windows can be delivered according to user preferences or the situation as of right now with the environment, offering flexibility and improving the operation within the system.

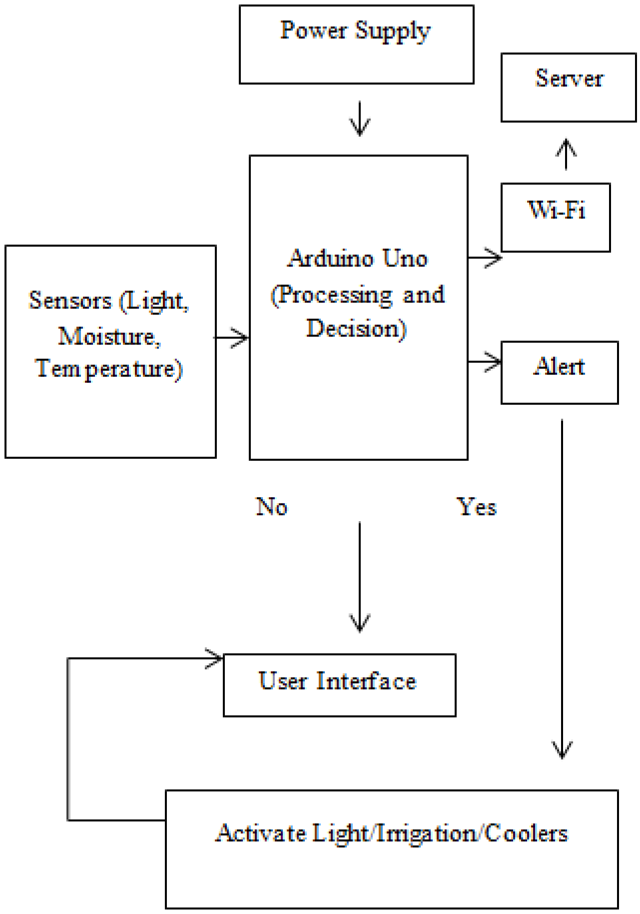

Fig. 2 System FlowGraph

V. RESULT AND DISCUSSION

A variety of sensors were effectively utilized by the IoT-based greenhouse monitoring system to build an automated and effective environmental control system. Optimal photosynthesis was ensured by the LDR sensor's effective monitoring of light intensity, which triggered additional lighting as needed. In order to maintain the right amount of moisture, irrigation systems are automatically triggered by the soil moisture sensor's accurate detection of water levels in the soil. By managing sliding windows and coolers, the LM35 temperature sensor controlled the interior temperature and avoided overheating. Remote observing and managing were made possible by real-time data transfer to mobile devices, which eliminated the need for manual work. The system's ability to provide consistent and ideal growing conditions shows how well it manages important environmental elements and how this could enhance agricultural methods.

VI. CONCLUSION

An IoT-based greenhouse monitoring system that efficiently automates and optimizes environmental conditions for increased agricultural yield is presented in this research article. Important sensors used by the system include the LM35 temperature sensor for temperature adjustment, the LDR sensor for light intensity, and the soil moisture sensor for

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.521| Monthly, Peer Reviewed & Referred Journal|

| Volume 7, Issue 7, July 2024 |

| DOI:10.15680/IJMRSET.2024.0707068 |

water levels. Together, these elements provide an automated system that sustains optimum circumstances for plant growth, greatly minimizing the need for manual intervention and enhancing resource management.

Farmers can effectively manage their greenhouses with the flexibility of remote observing and managing made possible by the system's real-time data transfer to mobile devices.This system tackles the problems of constant growing conditions and manpower shortages by incorporating technology into conventional farming practices. It shows a great deal of promise for boosting sustainable agricultural methods, preserving water, and raising crop yields.

Future enhancements may encompass the incorporation of renewable energy resources, augmenting sensor functionalities, and executing sophisticated watering methodologies. All things considered, this IoT-based solution presents a viable strategy for improving agricultural sustainability and upgrading greenhouse management.

REFERENCES

[1] Danita, M. & Mathew, Blessy & Shereen, Nithila & Sharon, Namrata & Paul, J.. (2018). IoT Based Automated Greenhouse Monitoring System. 1933-1937. 10.1109/ICCONS.2018.8662911.
[2] Ali, Terteil & Choksi, Viraj & Potdar, Madhukar. (2018). Precision Agriculture Monitoring System Using Green Internet of Things (G-IoT). 481-487. 10.1109/ICOEI.2018.8553866.
[3] Nargotra, Meghal & Khurjekar, Mandar. (2020). Green house based on IoT and AI for societal benefit. 109-112. 10.1109/ESCI48226.2020.9167637.
[4] J S, Sujin & Murugan, R & Nagarjun, M & Praveen, Akash. (2021). IOT Based Greenhouse Monitoring and Controlling System. Journal of Physics: Conference Series. 1916. 012062. 10.1088/1742-6596/1916/1/012062.
[5] Kumar, Sahil & Kumar, Raj & Kumar, Sonu & Chincholkar, Yugendra. (2020). Greenhouse Monitoring System Using IOT. Journal of University of Shanghai for Science and Technology. 22. 10.51201/jusst12371.
[6] https://tektelic.com/expertise/iot-greenhouse-monitoring/
[7] https://www.renkeer.com/sensors-for-greenhouse-remote-monitoring-systems/
[8] GOYAL, S. & Prabha, & Rai, Dr & Singh, Shree Ram. (2016). Indian Agriculture and Farmers-Problems and Reforms.

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com