Smart Plant Monitoring System Using IOT and BLYNK

[1]Shivam Verma, [2]Avantika Sharma, [3]Lucky Yadav, [4]Prof. Meetu Rani
[1,2,3,4]Department of Computer Science and Engineering (Internet of Things)
[1,2,3,4]Meerut Institute of Engineering and Technology, Meerut, India
[1]shivam.verma.cseiot.2021@miet.ac.in, [2]avantika.sharma.cseiot.2021@miet.ac.in,
[3]lucky.yadav.cseiot.2021@miet.ac.in, [4]meetu.rani@miet.ac.in

***Abstract:* -** The increasing need for efficient plant care in urban and indoor settings has highlighted the limitations of manual monitoring, which can be inconsistent and time-consuming. This study presents a Smart Plant Monitoring System that utilizes Internet of Things (IoT) technology integrated with the Blynk application to automate and optimize plant care. The system continuously monitors essential environmental factors such as soil moisture, temperature, and humidity by employing IoT-enabled sensors. The data is then sent to the Blynk platform, allowing users to remotely observe plant conditions and receive notifications when intervention is needed. This research addresses the problem of ineffective plant care due to human error and environmental variability, proposing an automated approach that adjusts watering schedules based on real-time data.
Our methodology involves designing and implementing a sensor network connected to a user-friendly interface on the Blynk app, which displays live environmental data, sets alert thresholds, and facilitates remote control. Experimental results show that the system successfully maintains optimal growing conditions by reducing water consumption and minimizing manual effort. The findings suggest that this IoT-based system provides a more consistent and reliable alternative to traditional plant monitoring methods, benefiting individual users and commercial plant management. The Smart Plant Monitoring System enhances the precision and efficiency of plant care, supporting sustainable practices and responding to the demands of modern, technology-driven lifestyles.

The results demonstrate that this IoT-based approach offers a more reliable and consistent alternative to traditional plant care methods, making it useful for individual plant enthusiasts commercial growers. By promoting --sustainable practices and leveraging modern technology, the Smart Plant Monitoring System aligns with the needs of today's fast-paced, tech-driven lifestyles while ensuring healthier, happier plants.

Keywords: - Smart Plant Monitoring, IoT, Blynk, Automated plant care, soil moisture, environmental sensors, remote monitoring, sustainable plant management.

1. Introduction: -

As urbanization expands and people increasingly live in limited spaces, interest in home gardening, indoor agriculture, and sustainable plant care is on the rise. However, maintaining healthy plants in urban environments, where natural conditions can be limited or variable, poses challenges. Efficient plant monitoring becomes crucial for optimal growth, especially when factors such as soil moisture, temperature, and humidity require consistent attention. The rise of Internet of Things (IoT) technology has revolutionized automated and remote plant care. The Smart Plant Monitoring System, equipped with IoT functionality and the Blynk platform, offers a reliable, user-friendly, and sustainable solution for plant maintenance. It enables real-time monitoring of plant health and allows users to respond remotely to environmental fluctuations, ensuring efficient and accessible plant care.

Previous studies have shown that automated plant monitoring systems can reduce human error in plant care. Research has demonstrated the potential of sensor-based technologies to address issues in agricultural management, particularly in large-scale farming. Yet, these studies have largely focused on agriculture in rural or industrial contexts, with limited exploration of small-scale urban applications. Traditional plant monitoring systems often rely on manual checking, which can lead to inconsistent care and suboptimal plant health. In contrast, IoT-based systems for indoor and small-scale gardens are emerging as a novel solution, yet more research is needed to assess the effectiveness of these systems in urban, home, and controlled environments.

The rationale for this paper is based on the need for more adaptable and data-driven plant care solutions that cater to individuals and small businesses, such as indoor farms, urban gardeners, and plant enthusiasts. While traditional methods require manual intervention, which can be inconsistent and lead to plant stress, this IoT-based system aims to automate and optimize the monitoring process. By integrating sensors that continuously track environmental conditions and the Blynk platform for remote access and control, this system addresses gaps in prior research on plant care and provides a modern solution that aligns with current sustainability goals. Additionally, this approach responds to contemporary issues, such as urban environmental constraints, water scarcity, and increased interest in smart home technology.

To develop the Smart Plant Monitoring System, we utilized a network of IoT sensors for tracking essential parameters like soil moisture, temperature, and humidity. Data collected from these sensors is transmitted to the Blynk platform, where it is processed and displayed in real-time on a user-friendly interface. The Blynk app allows users to set thresholds for each parameter and receive notifications when these thresholds are breached, empowering users to take immediate action or automate responses. This methodology ensures that plant care remains consistent, reliable, and adaptable to specific user needs, thus overcoming the limitations of conventional plant care methods.

This paper is organized as follows: The first section delves into a comprehensive review of prior research on IoT applications in agriculture and plant care, emphasizing the transition from large-scale to small-scale systems. The second section provides an in-depth explanation of the system's design and implementation, covering sensor selection, data transmission, and integration with Blynk. The third section presents the findings, including system performance metrics and user feedback. Finally, the paper concludes by discussing the implications of IoT-based plant monitoring, highlighting potential improvements, and suggesting future research directions to further enhance plant care technology in urban and indoor settings.

2. Literature Review: -

Project	**Conference**	**Related Work**
Sustainable agriculture using eco-friendly and energy efficient sensor technology.	International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), Bangalore, India, 20–21 May 2016; IEEE: Bangalore, India, 2016; pp. 1442–1446.	To make sensor operational with in fixed intervals is depends on the change in weather conditions (Ferrández-Pastor et al. 2016), (Srisruthi et al. 2017).
Smart Greenhouse Monitoring System using blynk IOT App.	Journal of Engineering Research and Reports.	The proposed system allows for real-time updates of sensor data and enables remote control of connected devices via the mobile app from any location, with notable fast processing subject to the quality of the internet connection.
A Smart Indoor Gardening System Using IoT Technology.	Springer Nature Singapore Pte Ltd, 2018.	The benefits of gardening have been emphasized to improve the quality of life
Smart Garden with IoT based Plant Monitoring System.	Solid State Technology.	This smart gardening system will provide convenience and comfort to the user without their physical presence and helps better care of our garden.
IoT based Autonomous Percipient Irrigation System using Raspberry Pi, IEEE, 2016.	19th International Conference on Computer and Information Technology (ICCIT).	This system will help utilizing water resource wisely and reducing the human effort in maintaining crops which will consequently decrease damage from human errors.

Technology Used: -

1. **Sensor Layer: -**

i. **Soil Moisture Sensor:** A soil moisture sensor detects the water content in the soil, helping determine when plants need watering. It works by measuring electrical resistance or capacitance, providing data that enables automated irrigation systems to maintain optimal soil moisture levels for plant growth.

ii. **DHT11 Sensor:** The DHT11 is a low-cost digital sensor that measures temperature and humidity. It provides calibrated output, making it suitable for environmental monitoring in IoT applications and home automation systems. It measures temperature and humidity, offering insight into the microclimate.

iii. **PIR Motion Sensor:** A Passive Infrared (PIR) sensor detects motion by measuring infrared radiation changes in its environment. It's commonly used in security and automation systems, such as lighting controls, to sense the presence of people or animals in a given area.

2. Microcontroller Layer: -

- **ESP8266:** The ESP8266 is a low-cost Wi-Fi microchip with integrated TCP/IP protocol stack, widely used for IoT projects to enable wireless communication and remote control of devices, offering flexibility in development. It enables easy wireless connectivity and is widely used in smart devices and automation.

- **5V Relay module:** It is an electrically operated switch that allows low-power microcontrollers, like Arduino or ESP8266, to control higher voltage devices. It's widely used in automation projects for controlling lights, motors, and other high-power equipment safely.

- **Water Pump:** A water pump is a device that moves water from one location to another, typically using mechanical action. It's commonly used in irrigation, gardening, and household applications, enabling efficient water distribution for plants, cleaning, and other needs.

- **16x2 LCD Display:** A 16x2 LCD display shows information in two lines with 16 characters each. It's commonly used in electronics projects to display text, data, and messages, offering a simple interface for real-time feedback and easy readability in various applications.

- **Battery 7.4 V:** A 7.4V battery, typically lithium-ion or lithium-polymer, provides stable power for electronics and portable devices. Known for its lightweight and rechargeable nature, it's often used in drones, RC cars, and robotics for reliable, long-lasting energy.

- **Motor ON/OFF Button:** A motor ON/OFF button is a simple switch used to control the operation of a motor. By toggling between the ON and OFF states, it enables or disables the motor, providing manual control in various applications, such as robotics or automation.

3. Application Layer (BLYNK Platform): -

Blynk Cloud: The Blynk Cloud receives and stores data from the microcontroller, making it available for users via the Blynk app.

Blynk App: This is the user interface that displays real-time sensor data and provides control over the system. It presents data visually through graphs and gauges. Users can set custom threshold values, receive notifications when thresholds are breached, and manually control actuators such as a water pump or fan from a remote location.

4. Experimental results and Discussion: -

The smart plant monitoring system was tested under different environmental conditions to evaluate its efficiency. Sensors accurately measured soil moisture, temperature, and light intensity, with real-time data displayed on the Blynk app. The automated watering system activated when soil moisture dropped below a set threshold, preventing overwatering. Users received instant alerts for critical conditions, ensuring timely intervention. The system demonstrated reliable performance, reducing manual effort while maintaining healthy plant growth. Some challenges included occasional sensor calibration issues and network connectivity disruptions. Overall, the system proved effective in optimizing plant care through automation and real-time monitoring.

5. Conclusion: -

This study developed a cost-effective and user-friendly IoT-based Smart Plant Monitoring System utilizing Blynk. The system proved effective in real-time monitoring and notification, enhancing plant care with minimal effort. The smart plant monitoring system using IoT and Blynk successfully automates plant care by providing real-time data on soil moisture, temperature, and light intensity. The integration of sensors and the Blynk app ensures efficient monitoring and timely alerts, reducing manual effort. Automated watering improves water conservation and prevents plant stress. Although minor challenges like sensor calibration and network issues were observed, the system performed reliably in maintaining healthy plant growth. Overall, this technology offers a practical solution for both home gardeners and large-scale farming, promoting smart agriculture with improved efficiency, convenience, and resource management. Future enhancements could include predictive analytics for more adaptive interventions, further improving plant health management.

REFERENCES

1. Srikruthi, S.; Swarna, N.; Ros, G.M.S.; Elizabeth, E. Sustainable agriculture using eco-friendly and energy efficient sensor technology. In Proceedings of the 2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), Bangalore, India, 20–21 May 2016; IEEE: Bangalore, India, 2016; pp. 1442–1446.

2. Ain Zulaikha Mohd Zaki1, Fitri Yakub, Alyani Nadhiya Fakharulrazi,Normaisharah Mamat, Azizul Azizan, Aizul Nahar Harun, Zulhasni AbdulRahim, “Building a Smart Gardening System and Plant Monitoring Using IoT.”

3. Shakib Sadat Shanto, Mushfiqur Rahman, Jaber Md. Oasik and Hamim Hossain - Smart Greenhouse Monitoring System Using Blynk IoT App.

4. T. R. M. K. H. a. S. Z. Ahmed Imtiaz, IoT based Autonomous Percipient Irrigation System using Raspberry Pi, IEEE, 2016.

5. H. D. M. V. S. K. Mitul Sheth, Smart Automated Home Application using IoT with Blynk App, IEEE, 2018.

6. M. B. A. S. R. Prakhar Srivastava, "Overview of ESP8266 Wi-Fi module based Smart Irrigation System using IOT", *IEEE (AEEICB-18)*, 2018.

7. S. J. P. Byung-Wook Min, A Smart Indoor Gardening System Using IoT Technology, Springer Nature Singapore Pte Ltd, 2018.

8. P. Jain and S. Soni, "Development of an IoT-based smart monitoring system for efficient plant growth," *IEEE Transactions on Industrial Informatics*, vol. 14, no. 4, pp. 2112-2121, 2021.

9. S. R. Ahamed and P. Ch, "Smart Plant Managing System using IoT," *2020 IEEE International Conference on Electronics, Computing and Communication Technologies (CONECCT)*, Bangalore, India, 2020, pp. 1-5.

10. Stephen Bassi Josepha*, Emmanuel Gbenga Dadab, Emmanuel Partha Musac, Muhammed SadiqAbdullahia and Suleiman Fatima Unekwu - Environmental Parameters Monitoring for Greenhouse Farming Using Wireless Sensor Networks.

11. A. Patil, A. Singh, and N. Sharma, "IoT-Based Smart Plant Monitoring System," *2023 IEEE International Conference on Advances in Computing and Communication Engineering (ICACCE)*, Jaipur, India, 2023, pp. 450-455.

12. J. Mathew, A. Gupta, and S. B. Patil, "Blynk-Powered IoT System with Machine Learning for Personalized Plant Care," *2024 IEEE International Conference on IoT and Smart Environments (ICISE)*, Singapore, 2024, pp. 82-89.

13. A. Sharma, R. Kumar, and M. Singh, "Smart Farm Monitoring via the Blynk IoT Platform: Case Study on Humidity Monitoring," *2018 IEEE International Symposium on Smart Agriculture Technologies*, Hyderabad, India, 2018, pp. 12-18.

14. M. R. Khan and K. N. Singh, "IoT-Based Smart Irrigation and Monitoring System," *2023 IEEE International Conference on Intelligent Systems (ICIS)*, Kuala Lumpur, Malaysia, 2023, pp. 310-315.

15. S. P. Singh, Arif Iqbal, Jaswant Singh, R. Kumar and Ashwin Kumar Yadav- Smart Garden with IoT based Plant Monitoring System.