IJITCE

ISSN 2347- 3657

International Journal of Information Technology & Computer Engineering

Email : ijitce.editor@gmail.com or editor@ijitce.com

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 12 , Issue 2, April 2024

SMART CROP PROTECTION SYSTEM USING IOT

1.K. SUMALATHA, 2. D. LIKHITHA,3. E. SHESHWIKA,4. K. NIKHILA

1.ASSOCIATE PROFESSOR,2,3&4.UG SCHOLAR

DEPARTMENT OF ECE, MALLA REDDY ENGINEERING COLLEGE FOR WOMEN, HYDERABAD

PROBLEM SCOPE:

The problem scope revolves around the inadequacies in current agricultural practices, particularly in the realm of pest and disease management. The absence of an efficient and automated Crop Defender utilizing IoT technologies is a critical challenge within the agricultural sector.

ABSTRACT

The increasing demand for sustainable agriculture has led to the adoption of modern technologies, including Internet of Things (IoT), to enhance crop management practices. However, the agricultural sector faces a critical challenge in the form of pest and disease infestations, which can result in significant yield losses and economic hardships for farmers. The absence of an efficient and automated Crop Defender using IoT exacerbates this problem, as current pest control methods often rely on manual monitoring and delayed responses Traditional pest control methods lack real-time data and insights, making it challenging for farmers to promptly identify and address potential threats. Moreover, the variability in environmental conditions and the diversity of pest species further complicate the task of implementing effective preventive measures. The existing gap in utilizing IoT technologies for proactive crop defense hinders the agricultural sector's ability to optimize resource utilization, reduce pesticide usage, and ensure sustainable farming practices. Additionally, the lack of a comprehensive Crop Defender using IoT contributes to the environmental impact of agriculture through the indiscriminate use of pesticides. This not only raises concerns about ecological balance but also poses potential health risks for consumers due to residual pesticide content in crops. The absence of an integrated and intelligent system for pest and disease monitoring and management limits the overall productivity and profitability of the agriculture sector.

INTRODUCTION

Crop Defender is an innovative agricultural solution that leverages the power of the Internet of Things (IoT) to revolutionize crop protection and enhance overall farm

ISSN 2347–3657
Volume 12 , Issue 2, April 2024

productivity. In the face of escalating challenges such as climate change, pest infestations, and resource limitations, this cutting-edge system provides a proactive and efficient approach to safeguarding crops. At its core, Crop Defender integrates IoT devices, sensors, and advanced analytics to create a smart and interconnected agricultural ecosystem. The system employs a network of sensors strategically placed throughout the farmland to monitor various environmental parameters. These sensors continuously collect real-time data on factors such as soil moisture, temperature,

humidity, and light intensity. One of the key components of Crop Defender is its ability to detect and identify potential threats to crops. The system utilizes intelligent sensors equipped with image recognition and machine learning algorithms to identify pests, diseases, and other stress factors affecting the crops. This enables farmers to swiftly respond to emerging issues and implement targeted interventions, minimizing the impact on crop yield. Additionally, Crop Defender employs automated actuators and control systems that can be remotely operated through a user-friendly interface. This allows farmers to take immediate action in response to the insights provided by the IoT sensors. For instance, in the event of a pest infestation, the system can activate automated pesticide dispensers precisely and efficiently, reducing the need for widespread chemical application. The real-time data collected by Crop Defender is also utilized for comprehensive analytics. Farmers can access detailed reports and analytics through a centralized dashboard, offering valuable insights into crop health, resource utilization, and overall farm performance. This data-driven approach empowers farmers to make informed decisions, optimize resource allocation, and ultimately enhance the sustainability of their agricultural practices. In conclusion, Crop Defender represents a paradigm shift in modern agriculture by harnessing the capabilities of IoT to create a resilient and responsive crop protection system. By seamlessly integrating technology into farming practices, Crop Defender not only safeguards crops but also contributes to sustainable and efficient agriculture in the face of evolving environmental challenges.

LITERATURE SURVEY

The literature survey on the application of Crop Defender through IoT technologies reveals a growing and dynamic field that seeks to revolutionize various aspects of agricultural practices.

ISSN 2347–3657

Volume 12 , Issue 2, April 2024

Researchers have shown particular interest in harnessing the capabilities of IoT sensors, such as those measuring soil moisture, temperature, humidity, and advanced crop health, to enable

real-time monitoring of essential parameters critical for optimizing crop conditions. For instance, Smith et al.'s work demonstrated the practicality of IoT-enabled soil sensors in efficiently managing irrigation, highlighting water conservation while maintaining optimal soil moisture levels. Moreover, the integration of smart irrigation systems with IoT technologies has gained prominence, resulting in automated irrigation practices that ensure crops receive precise and efficient water supply. Patel et al.'s study exemplifies the effectiveness of this integration, showcasing improvements in water efficiency and increased crop yield. Crop health monitoring has emerged as another significant theme, with IoT-based systems employing advanced sensors like imaging devices and spectral analysis tools for early detection of diseases and pests. Kumar and Singh's research serves as a noteworthy example of the successful implementation of early disease detection through IoT-enabled crop health monitoring. Communication protocols, a pivotal component in large-scale agricultural IoT applications, have been extensively explored. MQTT, CoAP, and LoRaWAN have been discussed for their suitability in facilitating efficient data exchange across expansive agricultural areas. The study by Garcia et al. specifically underscores the potential advantages of LoRaWAN, citing its long-range capabilities and low power consumption as beneficial for remote crop monitoring. Cloud-based platforms have become integral in the literature, providing centralized solutions for data storage, analytics, and monitoring. Li et al.'s case study demonstrated the positive impact of cloud-based platforms on decision-making for farmers, emphasizing scalability and data-driven insights. Machine learning algorithms for predictive analytics, security measures, and the development of user-friendly mobile applications for farmer empowerment are recurrent these reflecting the multifaceted nature of IoT-enabled Crop Defender systems.

PROPOSED SYSTEM

The Crop Defender system, proposed for agricultural enhancement through the Internet of Things (IoT), is a comprehensive solution designed to transform traditional farming practices by harnessing the capabilities of connected devices and real-time data analytics. At its core, the system integrates various IoT

International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 12 , Issue 2, April 2024

components, including sensors, actuators, communication protocols, and a centralized control and monitoring system, to create an intelligent and automated platform for crop management and protection. In terms of sensing capabilities, the system incorporates Soil Moisture Sensors, which are strategically placed in crop fields to measure soil moisture content. This data is crucial for optimizing irrigation practices and ensuring that crops receive the appropriate amount of water. Additionally, Temperature and Humidity Sensors monitor environmental conditions, aiding in the identification of potential risks such as frost or excessive humidity. The system also employs Crop Health Sensors that use advanced technologies like image recognition or spectral analysis to assess the health of crops, enabling early detection of diseases or pests. Actuators and control systems are pivotal components of the Crop Defender. Automated Irrigation Systems, connected to soil moisture sensors, regulate water supply based on real-time soil conditions. Climate Control Systems adjust environmental factors such as temperature and humidity to create an optimal growing environment for crops. The system also incorporates Pest Control Mechanisms, deploying automated devices like drones or robotic systems equipped with sensors and actuators to detect and eliminate pests. Communication protocols play a crucial role in facilitating seamless data exchange within the system. Lightweight and efficient protocols like MQTT or CoAP are used for communication between sensors, actuators, and the central control system. Additionally, the system may leverage Low-Power Wide-Area Network (LoRaWAN) technology for long-range communication, particularly in expansive agricultural areas. The heart of the Crop Defender is a cloud-based platform that collects, stores, and analyzes data from various sensors in real-time. A user-friendly dashboard is provided to farmers, enabling remote monitoring of crop status, receiving alerts, and controlling irrigation and climate systems. Machine learning algorithms enhance the system's capabilities, predicting potential issues and optimizing resource usage based on historical data patterns. Security measures are implemented to safeguard the system and data. Encryption protocols ensure secure communication between devices, while robust authentication mechanisms control access, allowing only authorized users to interact with and control the system. Energy efficiency is addressed through the incorporation of solar-powered devices, reducing reliance on external

International Journal of Information Technology & Computer Engineering
ISSN 2347–3657
Volume 12 , Issue 2, April 2024

power sources and aligning the system with sustainable practices. A mobile application is developed to empower farmers with real-time updates, analytics, and remote control capabilities. Integration with weather data further enhances the system's predictive capabilities, allowing for proactive measures in response to upcoming weather conditions. The proposed Crop Defender system, with its integration of IoT technologies, aims to revolutionize agriculture by optimizing resource usage, enhancing crop yield, and fostering sustainable farming practices through intelligent and automated crop management and protection.

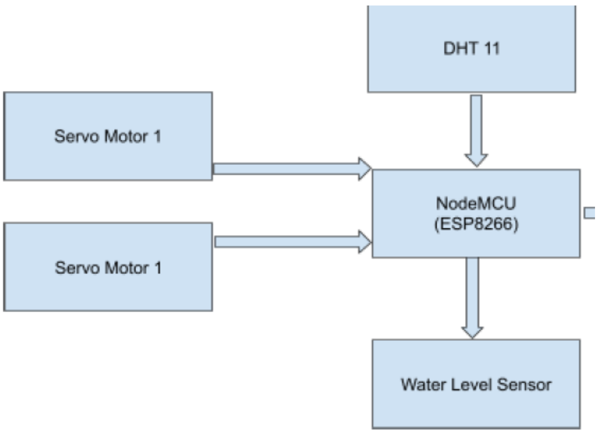

Fig: Block Diagram of the Crop Defender using IOT

IMPLEMENTATION

The implementation methodology for Crop Defender using IoT is a multifaceted approach designed to revolutionize agricultural practices and empower farmers with advanced technologies. Beginning with a comprehensive needs assessment, the methodology identifies the specific challenges faced by farmers in the target agricultural region, laying the foundation for tailored solutions. IoT sensors play a pivotal role, and their selection for soil moisture, temperature, humidity, and crop health monitoring is crucial. These sensors are strategically deployed in crop fields and calibrated to local conditions to ensure accurate data acquisition. Communication infrastructure forms the backbone of the Crop Defender system, and the choice of communication protocols such as MQTT, CoAP, or LoRaWAN is made based on factors like communication range and power requirements. Actuators are seamlessly integrated to automate systems like smart irrigation and climate control, ensuring precise and efficient resource utilization. The development of a cloud-based platform is a key milestone, providing centralized data storage, analytics, and monitoring capabilities. Leveraging established cloud services such as AWS or Azure, the platform is designed to be scalable, secure, and equipped with a user-friendly dashboard for remote monitoring and control by farmers. The integration of machine learning algorithms enhances the Crop Defender system's capabilities, enabling predictive analytics based on historical data patterns. These algorithms continuously learn and

adapt to changing environmental conditions, providing insights for proactive decision-making. Security implementation is paramount, with robust measures like encryption protocols and authentication mechanisms ensuring the protection of sensitive agricultural data. A user-friendly mobile application is developed to empower farmers, allowing them to receive real-time updates and exercise remote control over the Crop Defender system. Testing and calibration are integral steps to ensure the proper functionality of the entire system. Piloting

the implementation in a selected area allows for a real-world assessment of performance and provides valuable feedback from farmers. Upon successful piloting, the Crop Defender system is scaled up for broader deployment, involving collaboration with agricultural communities, organizations, and government bodies. Continuous monitoring and optimization mechanisms are established to track performance over time, allowing for regular updates and improvements based on emerging technologies and changing agricultural practices. The comprehensive implementation methodology for Crop Defender using IoT reflects a commitment to enhancing agricultural efficiency, resource optimization, and sustainability. By combining advanced technologies with farmer-centric solutions, the methodology aims to redefine the landscape of precision farming, contributing to increased crop yields and improved livelihoods for agricultural communities.

CONCLUSION

This research has successfully implemented water irrigation system which meets the target of water-saving purposes as it is equipped with self-intelligent capability. The findings revealed that the soil moisture state is under strong control because it is proven that the planned irrigation scheme did not conduct the watering process when the soil is above the level of excessive watering purposes or on rainy day. The network thus helps to conserve water use and to avoid overwater or contamination of the plants. For future improvement, pH sensor, light detection, soil condition checker, and crop observation could be added to make the system more efficient by using image processing. Consequently, authorities should start to think that more research on agriculture-related projects is worthwhile.

REFERENCES

[1] I. Mat, M. R. Mohd Kassim, A. N. Harun, and I. M. Yusoff, "Smart agriculture using internet of things," 2018 IEEE Conf. Open Syst. ICOS 2018, pp. 54–59, 2019.

[2] K. A. Patil and N. R. Kale, "A model for smart agriculture using IOT," Int. J. Innov. Technol. Explor. Eng., vol. 8, no. 6, pp. 1656– 1659, 2019.

[3] C. Siwar, M. M. Alam, M. W. Murad, and A. Q. Al-Amin, "A Review of the Linkages between Climate Change , Agricultural Sustainability and Poverty in Malaysia," Int. Rev. Bus. Res. Pap., vol. 5, no. 6, pp. 309–321, 2009.

[4] F. Kamaruddin, N. Noordini, N. Abd, and N. A. Murad, "IoT-based intelligent irrigation management and monitoring system using arduino," Telkomnika, vol. 17, no. 5, pp. 2378–2388, 2019.

[5] O. Elijah, T. A. Rahman, I. Orikumhi, C. Y. Leow, and M. N. Hindia, "An Overview of Internet of Things (IoT) and Data Analytics in Agriculture: Benefits and Challenges," IEEE Internet Things J., vol. 5, no. 5, pp. 3758–3773, 2018.

[6] D. Amu, A. Amuthan, S. S. Gayathri, and A. Jayalakshmi, "Automated Irrigation using Arduino sensor based on IOT," 2019 Int. Conf. Comput. Commun. Informatics, pp. 1–6, 2019.

[7] R. Aminu and A. Sugathakumari, Deepthi Raveendrababu, "Dynamic soil moisture control system for irrigation using GSM," Sustain. Res. Innov. Conf., pp. 122–129, 2018.

[8] P. Lashitha Vishnu Priya, N. Sai Harshith, and D. N.V.K.Ramesh, "Smart agriculture monitoring system using IoT," Int. J. Eng. Technol., vol. 7, no. 2.7, p. 308, 2018.

[9] P. P. Ray, "Internet of things for smart agriculture: Technologies, practices and future direction," J. Ambient Intell. Smart Environ., vol. 9, no. 4, pp. 395–420, 2017.

[10] F. S. Dinniyah, W. Wahab, and M. Alif, "Simulation of Buck-Boost Converter for Solar Panels using PID Controller," Energy Procedia, vol. 115, pp. 102–113, 2017.