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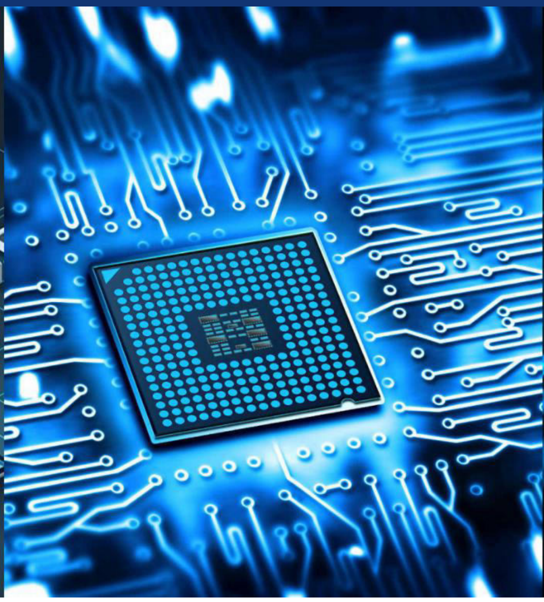


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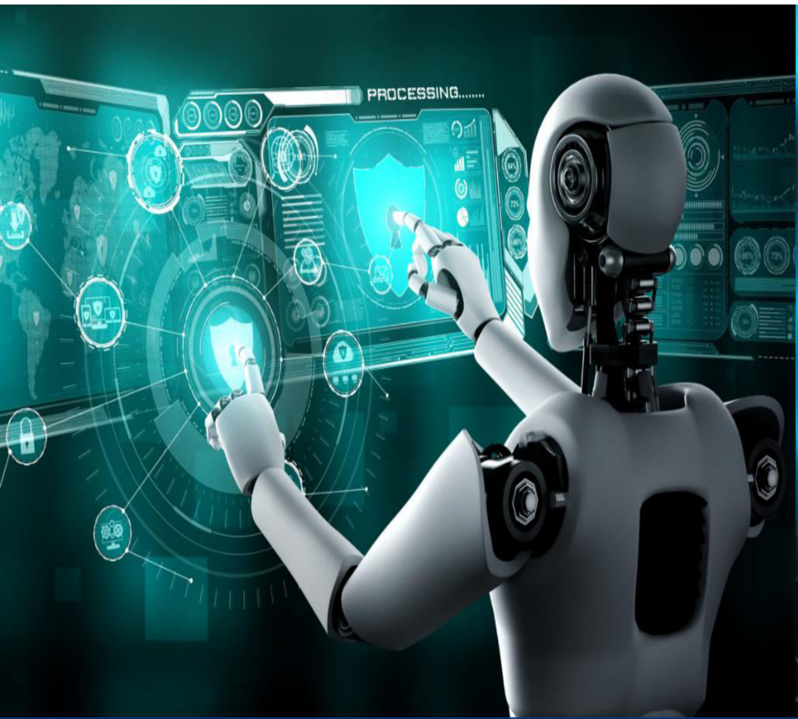

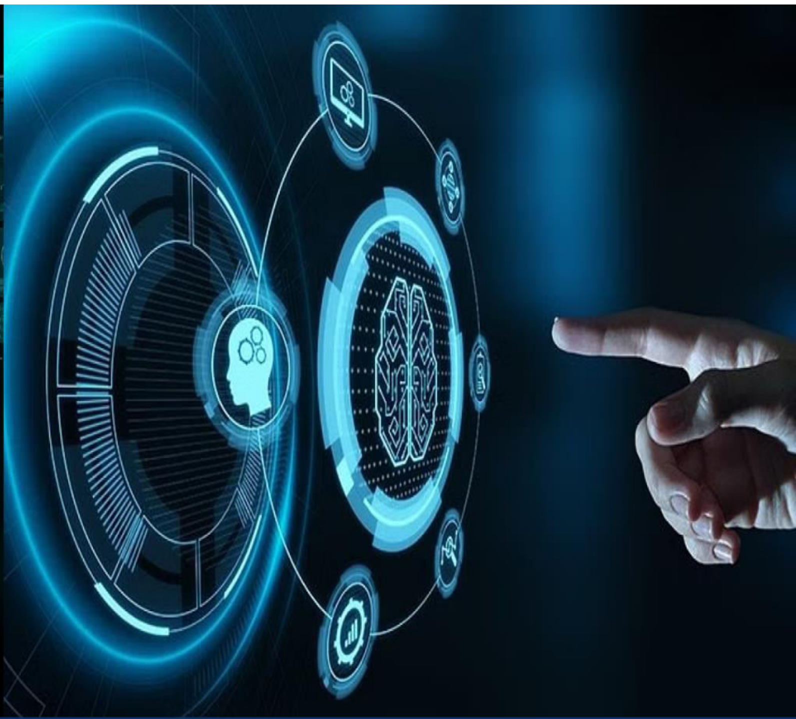

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International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

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Smart Crop Monitoring System using IoT and Machine Learning

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ABSTRACT: The Smart Crop Monitoring System integrates IoT hardware and AI-driven software to facilitate intelligent irrigation and crop disease prediction. Sensors like soil moisture, rain, temperature, and humidity feed real-time data to an ESP32 microcontroller. Based on this, motors control water and fertilizer supply. On the software side, a CNN-based leaf disease detection model trained on real datasets analyzes plant images and recommends remedies. These insights are relayed to the ESP32, which automates the response. The system supports sustainable farming by reducing manual effort, minimizing resource use, and enhancing productivity.

KEYWORDS: Smart Agriculture, IoT, CNN, Soil Moisture, Disease Detection, Precision Farming, and Automation.

I. INTRODUCTION

Agriculture is evolving with the advent of smart technologies. Traditional methods are often inefficient and resource-intensive. The Smart Crop Monitoring System addresses this by integrating IoT sensors and AI models for automated, data-driven crop management. The system monitors soil moisture, rainfall, temperature, and humidity, and automates irrigation and fertilizer dispensing based on sensor feedback. It also identifies plant diseases using image classification and offers actionable insights to farmers through mobile interfaces.

II. LITERATURE SURVEY

Several studies have demonstrated the effectiveness of IoT in precision agriculture. Moisture-based irrigation systems reduce water usage but often lack integration with other functionalities. CNN-based disease detection models using the PlantVillage dataset achieved over 90% accuracy, but were rarely tested in field environments. Some mobile apps help identify plant diseases but lack automation. Many existing tools are not farmer-friendly or integrated into a single system.

III. PROPOSED METHODOLOGY

The system consists of two major components: hardware and software. The hardware includes ESP32, soil moisture sensor, rain sensor, temperature and humidity sensor, water and fertilizer pumps. When moisture is low, irrigation is triggered. On the software side, a CNN model developed using TensorFlow and OpenCV identifies plant diseases and suggests remedies. Using serial communication, these suggestions control the fertilizer pump. A mobile interface via Bluetooth allows users to view live condition and operate pumps manually.

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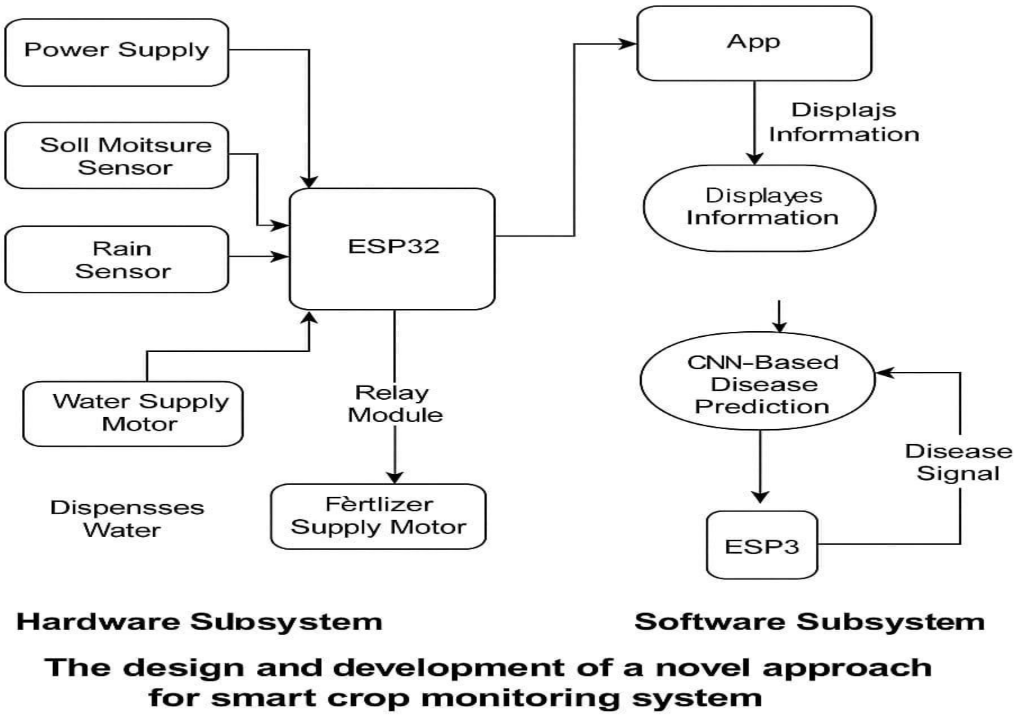
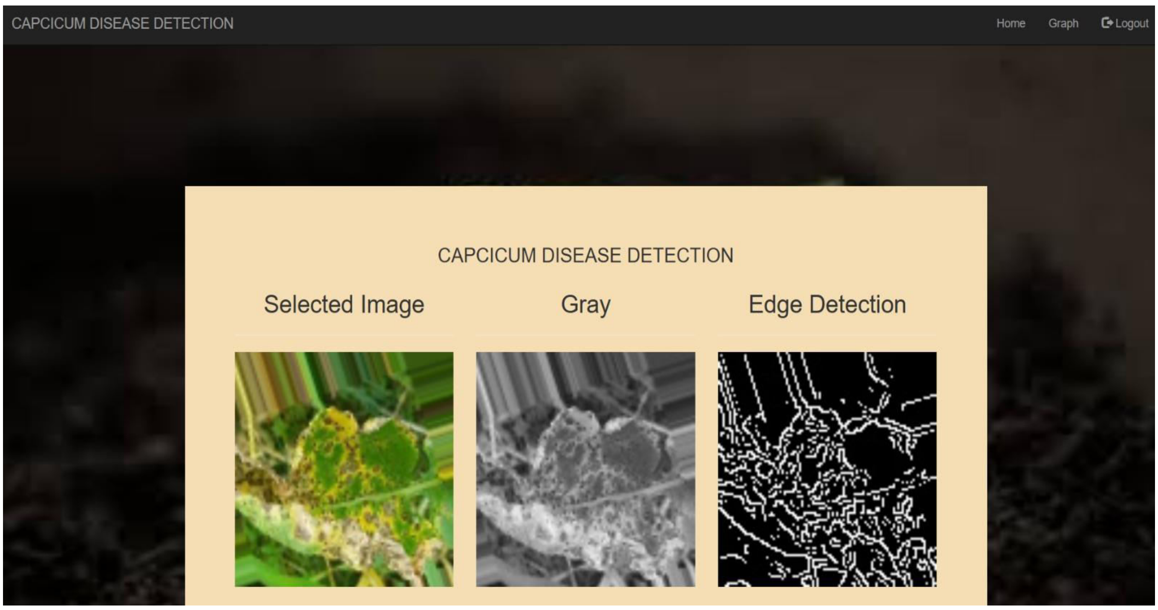
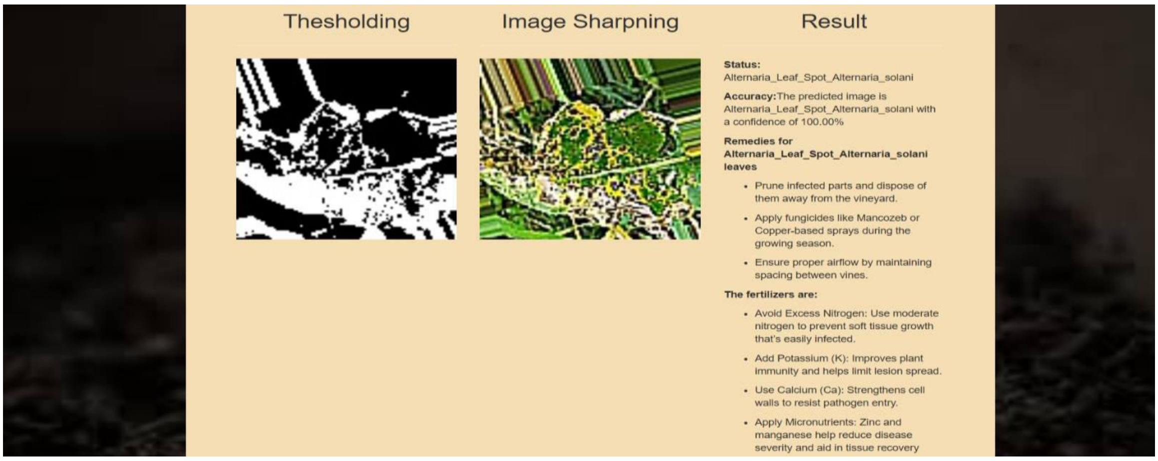
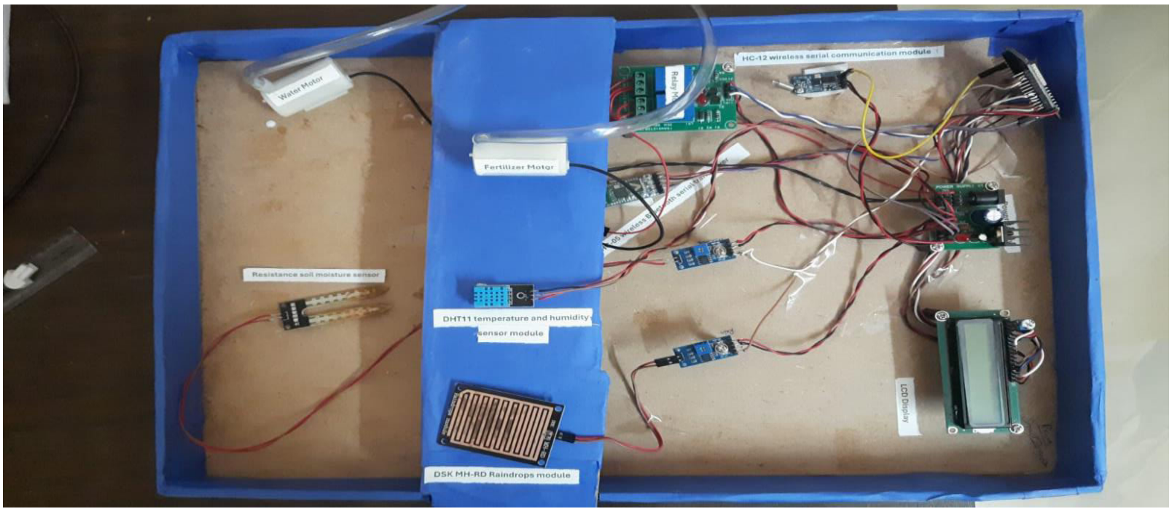


IV. RESULTS

The CNN model demonstrated ~92% accuracy in detecting diseases from leaf images. The irrigation system responded effectively to moisture thresholds. The integration of mobile control and automated hardware was tested successfully in field conditions. Overall, the system proved to be a practical and scalable solution for smart farming.







V. CONCLUSION

The Smart Crop Monitoring System presents a unified, intelligent solution to modern agricultural challenges. By combining IoT and AI, the system reduces manual workload, optimizes resource usage, and increases productivity. It empowers farmers with real-time insights and automated interventions, promoting sustainable farming practices.

REFERENCES

[1] Kamilaris, A., and Prenafeta-Boldú, F. X. (2018). "Deep learning in agriculture: A survey," *Computers and Electronics in Agriculture*, vol. 147, pp. 70–90.
[2] Mohanty, S. P., Hughes, D. P., and Salathé, M. (2016). "Using deep learning for image-based plant disease detection," *Frontiers in Plant Science*, vol. 7, p. 1419.
[3] Weng, M., et al. (2020). "An IoT-based smart irrigation system using machine learning for prediction," *IEEE Access*, vol. 8, pp. 132846–132857.
[4] Maroju, P.K.; Bhattacharya, P. Understanding Emotional Intelligence: The Heart of Human-Centered Technology. In Humanizing Technology with Emotional Intelligence; IGI Global Scientific Publishing: Hershey, PA, USA, 2025; pp. 1–18
[5] Brahim-Belhouari, S., and Bermak, A. (2021). "Intelligent agriculture system using ESP32 and IoT-based monitoring," *International Journal of Advanced Computer Science and Applications*, vol. 12, no. 9, pp. 537–544.
[6] Ferentinos, K. P. (2018). "Deep learning models for plant disease detection and diagnosis," *Computers and Electronics in Agriculture*, vol. 145, pp. 311–318.

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