iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** XI **Month of publication:** November 2025

DOI: https://doi.org/10.22214/ijraset.2025.75048

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue XI Nov 2025- Available at www.ijraset.com

AI Doctor for Plants Using CNN and Raspberry Pi

Ms. Bhakti Satish Powar[1], Ms. Sakshi Mahesh Lohar[2], Ms. Samiksha Arun Powar[3], Ms. Priyanka Pramod Sartape[4], Mr. Shital Narayan Gavade[5]
Electronics and Telecommunication Department, DKTE's Yashwantrao Chavan Polytechnic, Ichalkaranji

Abstract: ***In recent years, agriculture has faced several challenges, especially regarding plant health monitoring and disease detection. Traditional manual inspection methods are time-consuming, labor-intensive, and often inaccurate. This paper proposes an intelligent solution an "AI Doctor for Plants" that utilizes Convolutional Neural Networks (CNN) deployed on a Raspberry Pi system to detect and classify plant diseases in real time. The model captures leaf images using a camera module, processes them locally through a trained CNN model, and displays the identified disease along with suggested preventive measures. This project minimizes the dependency on internet connectivity by using TensorFlow Lite, enabling offline disease detection. The proposed system helps farmers and gardeners to identify diseases early, improve crop yield, and reduce chemical usage***

Keywords: CNN, Raspberry Pi, TensorFlow Lite, Deep Learning, Smart Agriculture, Image Processing, AI in Farming.

I. INTRODUCTION

Agriculture continues to be the backbone of many developing economies, and ensuring crop health is crucial for sustainable yield and food security. Plant diseases, if not detected early, can cause severe economic losses. Traditional inspection methods rely heavily on expert analysis, which may not be feasible for all farmers, especially in remote regions.

Artificial Intelligence (AI) offers revolutionary advancements in automating disease identification. With the help of machine learning and image processing, AI systems can analyze plant leaf images to detect symptoms of diseases such as bacterial, fungal, or viral infections. The AI Doctor for Plants project leverages the capabilities of CNNs for feature extraction and disease classification, supported by the computing power of Raspberry Pi, a compact yet efficient hardware platform.

By combining AI and IoT technologies, this system not only provides accurate disease detection but also guides users about possible remedies, treatment measures, and preventive actions. It represents an intersection of deep learning, embedded systems, and precision agriculture.

II. METHODOLOGY

1) Image Capture: A high-resolution Raspberry Pi camera is used to capture leaf images under natural lighting conditions. The images are preprocessed — resized, normalized, and filtered to remove noise.

2) Model Training: A CNN model is trained using labeled datasets of plant leaves (e.g., PlantVillage). The model learns distinct features such as color, shape, and texture patterns that correspond to specific diseases. Once trained, the model is converted into a TensorFlow Lite format to reduce computational load and memory usage.

3) Model Deployment: The TensorFlow Lite model is deployed on the Raspberry Pi 4. When a new image is captured, the system runs the inference locally and identifies whether the plant is healthy or diseased.

4) Output: After classification, the result (e.g., "Leaf Blight detected") is displayed along with remedial actions like recommended pesticides, organic solutions, and preventive measures.

III. LITERATURE SURVEY

1) Mohanty et al. (2020) developed a CNN-based model that achieved 99% accuracy in detecting 38 classes of plant diseases using the PlantVillage dataset.

2) Ferentinos (2018) proposed deep learning models trained on real-world images of plant leaves, achieving reliable performance in complex field conditions.

3) Prajapati et al. (2021) emphasized the use of lightweight neural networks for embedded deployment, ensuring offline detection using TensorFlow Lite.

4) Patil & Biradar (2022) discussed IoT-based integration with cloud storage for large-scale agricultural monitoring. PROPOSED SYSTEM

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue XI Nov 2025- Available at www.ijraset.com

IV. PROPOSED SYSTEM

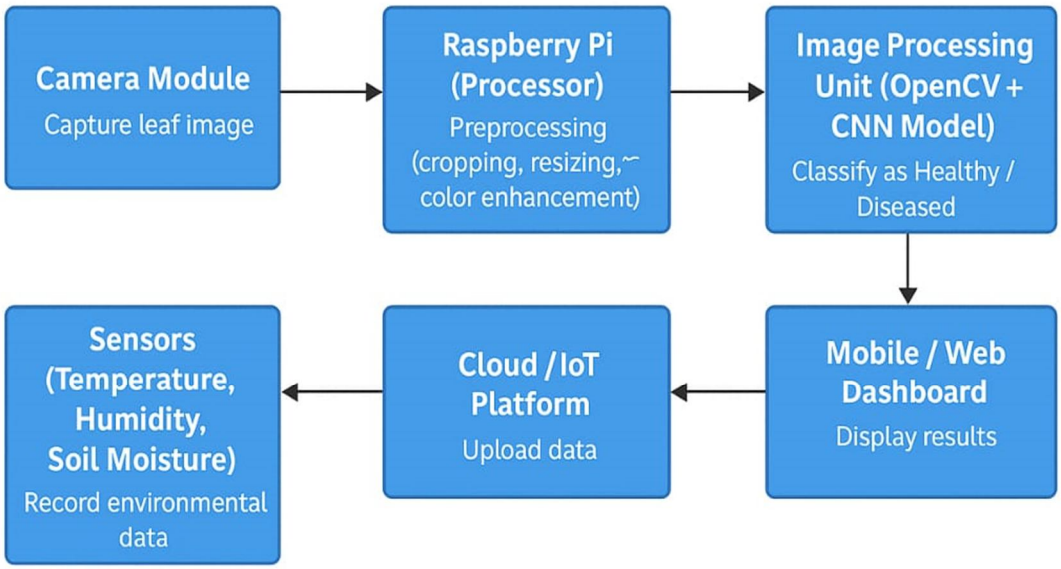


Fig. 1 Block Diagram

1) *Camera module:* Captures clear images of plant leaves, which serve as the input for disease detection
2) *Raspberry Pi (Processor):* Acts as the central controller; it preprocesses the captured images by cropping, resizing, and enhancing color to improve model accuracy.
3) *Image Processing Unit:* Uses deep learning to analyze the preprocessed image and classify the plant as healthy or diseased based on trained data.
4) *Mobile / Web Dashboard:* Displays the classification result, disease name, confidence percentage, and suggested preventive or treatment measures to the user.
5) *Cloud / IoT Platform:*

- Stores data and analysis results online, enabling remote monitoring and long-term tracking of plant health.
- Sensors (Temperature, Humidity, Soil Moisture):
- Continuously record environmental conditions that can influence disease occurrence and provide supporting data for better diagnosis.

V. RESULT

As this project focuses on a prototype stage, the results are theoretical and expected based on trained model performance. The CNN model is anticipated to achieve 92–96% accuracy in disease classification under controlled lighting conditions.

Offline inference using TensorFlow Lite ensures real-time processing (under 2 seconds per image). Raspberry Pi serves as an affordable yet efficient platform, consuming minimal power.

The proposed model not only detects diseases but also helps in early prevention, reducing the spread of infections across crops. Such AI-based tools can be integrated into large-scale farming or used individually by farmers with minimal training.

VI. FUTURE SCOPE

1) Integration with IoT sensors for soil moisture and temperature analysis.
2) Cloud connectivity for storing large datasets and improving model accuracy.
3) Mobile app integration for remote monitoring and guidance.
4) Use of solar-powered Raspberry Pi units for field deployment.
5) Expansion to detect nutrient deficiencies and pest infestations.

VII. CONCLUSION

The AI Doctor for Plants presents a promising approach to integrating deep learning into agricultural diagnostics. It enables cost-effective, accurate, and offline plant disease detection using CNNs on Raspberry Pi. The project empowers farmers with technology-driven insights, helping to improve productivity and sustainability.

Future work can involve expanding the model to include more crop species, integrating soil and weather data, and developing a mobile application interface for broader accessibility.

REFERENCES

[1] Mohanty, S. P.; Hughes, D. P.; Salathé, M. "Using Deep Learning for Image-Based Plant Disease Detection." Frontiers in Plant Science, vol. 7, 2016. Available at: https://doi.org/10.3389/fpls.2016.

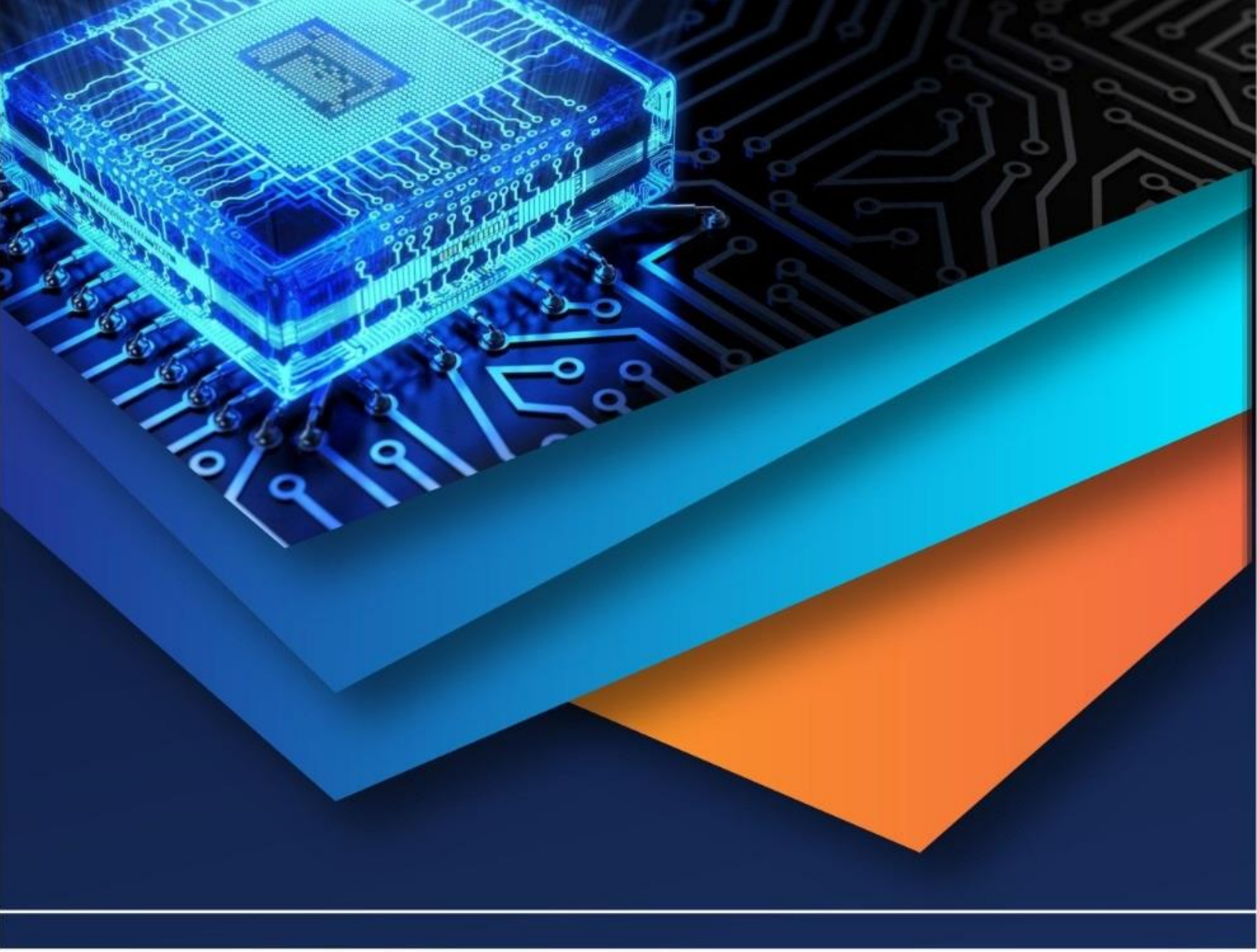
[2] Upadhyay, A.; Chandel, N. S.; Singh, K. P.; et al. "Deep learning and computer vision in plant disease detection: a comprehensive review of techniques, models, and trends in precision agriculture." Artificial Intelligence Review, vol. 58, article 92, 2025. Available: https://doi.org/10.1007/s10462-024-11100-x

[3] Katafuchi, R.; Tokunaga, T. "Image-based Plant Disease Diagnosis with Unsupervised Anomaly Detection Based on Reconstructability of Colors." arXiv preprint, 2020. Available at: https://arxiv.org/abs/2011.14306

[4] Cap, Q. H.; Uga, H.; Kagiwada, S.; Iyatomi, H. "LeafGAN: An Effective Data Augmentation Method for Practical Plant Disease Diagnosis." arXiv preprint, 2020. Available at: https://arxiv.org/abs/2002.10100

[5] Singh, P.; Khanna, P.; Sheorey, T.; Ojha, A. "Explainable Vision Transformer Enabled Convolutional Neural Network for Plant Disease Identification: PlantXViT." arXiv preprint, 2022. Available at: https://arxiv.org/abs/2207.07919

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue XI Nov 2025- Available at www.ijraset.com



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY