AI-POWERED PLANT DISEASE DETECTION

MINOR PROJECT REPORT

By

KOTTAM AKKHIL REDDY (RA2311027010155)
V.SUBBA REDDY (RA2311027010188)

Under the guidance of

Dr. M. Anand

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BONAFIDE CERTIFICATE

Certified that this minor project report for the course **21CSC206T ARTIFICIAL INTELLIGENCE** entitled in "AI-POWERED PLANT DISEASE DETECTION " is the bonafide work of **KOTTAM AKHIL REDDY (RA2311027010155), V.SUBBA REDDY (RA2311027010188)** who carried out the work under my supervision.

Signature

Dr. M. Anand
Assistant Professor
Data Science and Business Systems
SRMIST
Kattankulathur

Signature

Dr. V. Kavitha
HOD & Professor
Data Science and Business Systems
SRMIST
Kattankulathur

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CHAPTER 1
ABSTRACT

In the modern era of digital transformation, agriculture continues to face critical challenges in timely and accurate plant disease diagnosis. Farmers frequently encounter signs of plant distress such as leaf spots, discoloration, or damage, yet hesitate to seek expert advice due to high consultation costs, limited expert availability, or uncertainty regarding the issue’s severity. As a result, delayed or incorrect treatments, inappropriate pesticide use, and increased crop loss are common. Although online agricultural information is abundant, it often lacks the personalization, regional specificity, and scientific credibility needed to support effective decision-making. This project aims to bridge this gap by developing an intelligent, real-time system that offers accurate, image-based plant disease detection, eco-friendly pesticide recommendations, organic treatment options, and personalized farming guidance. The solution also emphasizes user education with clear instructions, safety alerts, and timely expert consultation prompts, ultimately supporting sustainable and efficient crop management.

CHAPTER 2
INTRODUCTION

Agriculture remains the backbone of many economies, particularly in developing regions, yet farmers continue to face persistent challenges in managing plant health. One of the most critical issues is the early and accurate identification of plant diseases. Farmers often notice irregularities such as unusual spots, discoloration, or deformities on leaves, but due to limited access to agricultural experts, high consultation costs, or a lack of awareness, they frequently delay taking action. This delay can lead to the spread of disease, misuse of pesticides, and significant crop loss.

While the internet offers a vast amount of agricultural information, much of it is generic, lacking local relevance, personalization, and scientific validation. As a result, farmers often feel overwhelmed, misinformed, or unsure of how to proceed. Additionally, current systems do not offer integrated features like proactive health monitoring, sustainable treatment recommendations, or smart farm intervention tracking.

With increasing emphasis on sustainable farming and food security, there is a pressing need for a real-time, intelligent plant disease management solution that empowers farmers with instant, accurate, and actionable insights.

2.1 Objectives

The main objective of this project is to design and develop an intelligent, real-time plant disease diagnosis and management system that:

- Accurately identifies plant diseases using image analysis
- Recommends appropriate chemical and organic treatments,
- Provides detailed application guidelines and safety instructions,
- Promotes sustainable and eco-friendly farming practices,
- Alerts users when expert consultation is necessary,
- Assists in tracking crop health and managing interventions over time.

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2.2 Functional Needs

To achieve these objectives, the system must fulfill the following functional requirements:

Image-Based Disease Detection

Allow users to upload or capture leaf images.

Use machine learning to analyze symptoms and predict diseases.

Smart Treatment Recommendations

Suggest targeted chemical treatments and eco-friendly alternatives.

Provide dosage, method of application, and safety precautions.

Personalized Farming Guidance

Offer organic treatment options based on crop type and region.

Share sustainable farming tips tailored to user practices.

Expert Consultation Alerts

Notify users when a condition appears severe or unidentifiable.

Suggest connecting with local agricultural experts.

Crop Health Monitoring

Maintain a history of diagnoses and treatments.

Enable users to track disease recurrence and treatment outcomes.

CHAPTER 3

TECH STACK & WORK FLOW

Frontend Development

Designed using HTML, CSS, and JavaScript for a clean, responsive, and user-friendly interface.
Users upload images of plant leaves or select symptoms through an intuitive form.
Dynamic image preview, validation, and feedback for an enhanced user experience.

Backend Development

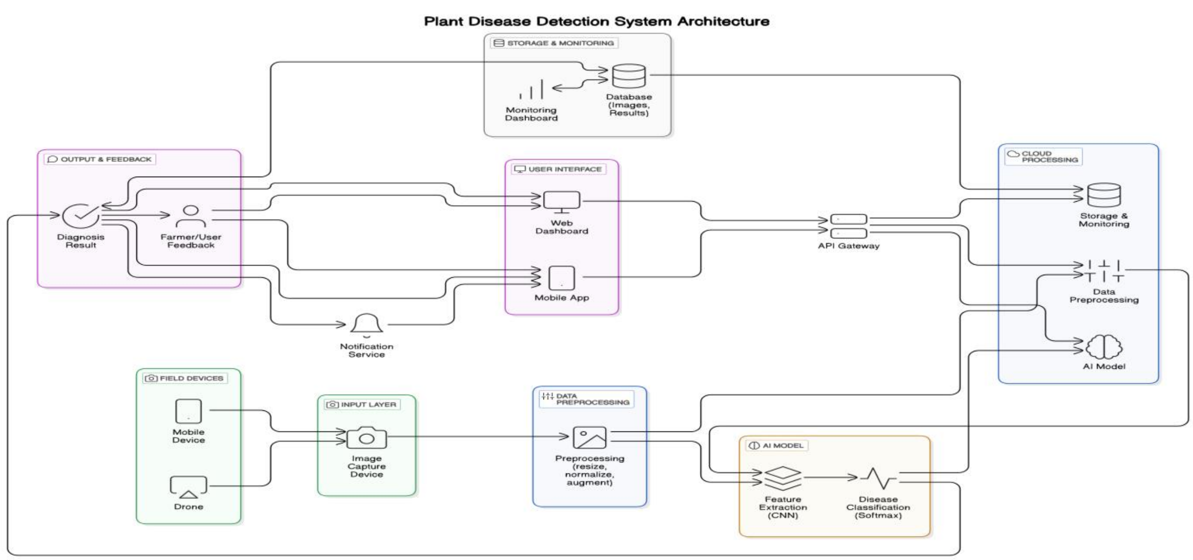
Built with Flask (Python) to handle image uploads, HTTP requests, and securely process user input.
Backend routes process image data and interact with the AI model to generate disease .

AI/ML Integration

A CNN model is integrated to analyze leaf images and detect plant diseases with high accuracy.
The AI analyzes uploaded plant images and provides:
Accurate disease prediction (e.g., bacterial spots, leaf blight, mildew)
Recommended treatment options and pesticides
Application instructions, safety precautions, and environmental guidelines
Preventive care tips and sustainable farming recommendations

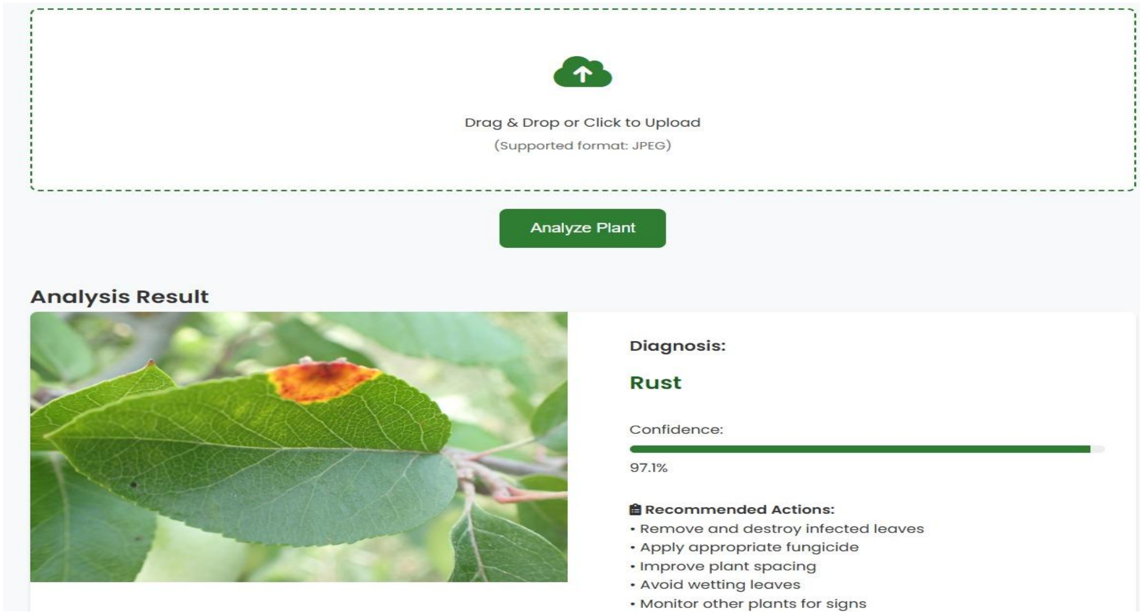
Deployment

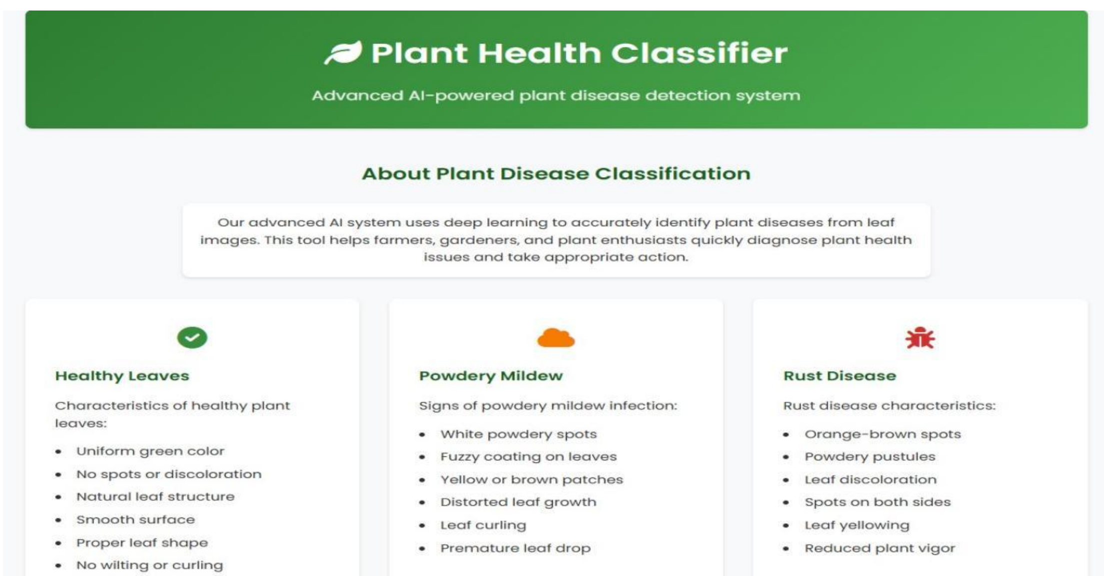
Hosted on a cloud server or local server using Flask.
Designed to be scalable for future mobile app development or integration with full-stack farm management platforms.



CHAPTER 4

DEMO





CHAPTER 5

APPLICATIONS, SCALABILITY & COSTS

Real Time Applications

Applications:

Farmers: Early disease detection, eco-friendly pesticide recommendations, and personalized farming guidance.

Agricultural Experts: Decision-support tool for remote disease diagnosis and treatment.

Agrochemical Companies: Precision pesticide recommendations, promoting alternatives.

Research Institutions: Data collection on disease trends and treatment outcomes.

Governments/NGOs: Support for large-scale agricultural initiatives and disease outbreak management.

Scalability:

Geographical Expansion: Regional customization for diverse crops and climates.

Technology Growth: Integration with IoT sensors and improved machine learning models.

User Base Growth: Scalable cloud infrastructure to handle increasing users and data.

Platform Integration: API integration with farm management and supply chain systems.

Costs:

Development: Software, machine learning model training, cloud infrastructure.

Operational: Cloud hosting, data storage, customer support.

Scalability: Infrastructure scaling, regional customization.

Revenue Models: Freemium, subscription, and partnerships with agrochemical companies

CHAPTER 6

BENEFITS & CONCLUSION

Benefits

Improved Efficiency: Rapid, accurate disease identification reduces crop loss and enhances productivity.

Cost Savings: Prevents unnecessary pesticide use and minimizes the need for costly expert consultations.

Sustainability: Promotes eco-friendly farming practices through smart treatment recommendations and organic options.

Data-Driven Decisions: Provides farmers with personalized, real-time insights for better crop management.

Scalability: The platform's flexible design ensures it can grow with the evolving needs of farmers worldwide.

Conclusion:

The proposed plant disease management system represents a transformative approach to agricultural practices. By providing **real-time, accurate disease diagnosis** through image analysis, the system helps farmers make **informed decisions**, preventing the spread of disease, reducing crop loss, and optimizing resource use. This platform promotes **sustainable farming** by recommending eco-friendly and organic treatment alternatives, minimizing the environmental impact of chemical pesticides.

In addition, the system's scalability ensures that it can adapt to various agricultural regions and crop types, making it a valuable tool for both smallholder farmers and large-scale operations worldwide. The integration of **smart tracking, personalized recommendations**, and **proactive expert alerts** significantly enhances farm management efficiency.

Ultimately, this solution has the potential to **revolutionize plant health management**, empowering farmers to enhance their productivity, ensure food security, and contribute to more sustainable agricultural practices globally.

CHAPTER 7

REFERENCES

- **Chakraborty, S., & Newton, A. C. (2011).** "Climate change, plant diseases, and food security: An overview." *Plant Pathology*, 60(1), 2-14

  This paper discusses how climate change can affect plant diseases and the importance of early disease diagnosis in managing crop health, which aligns with your project's focus on real-time disease detection.

- **Ferreira, S., & Slabbert, M. (2015).** "Development of a mobile-based agricultural application for smart disease management." *South African Journal of Agricultural Extension*, 43(2), 44-58.

  This reference highlights the role of mobile applications in supporting disease management in agriculture, which could relate to your system's mobile-first design.

- **Singh, S. R., & Bhattacharya, S. (2016).** "Machine learning in plant disease prediction: A review." *Computers and Electronics in Agriculture*, 124, 90-99.

  A detailed review of machine learning techniques applied to plant disease prediction, which can provide insights into the algorithms used in your project's image-based disease identification system.

- **Kamilaris, A., & Prenafeta-Boldú, F. X. (2018).** "A survey of the usage of deep learning in agriculture." *Computers and Electronics in Agriculture*, 147, 70-90.

  This paper explores the applications of deep learning in agriculture, including disease prediction, which can be valuable in understanding the technological foundations of your project.

- **González, L. M., & González, R. (2019).** "Plant disease management using integrated pest management systems: A review." *International Journal of Pest Management*, 65(1), 1-16.

  Provides insights into the integrated pest management systems that can work alongside your proposed solution to ensure holistic and sustainable crop protection strategies.

- **Feng, G., & Chen, X. (2018).** "Using mobile technologies for pest and disease management in agriculture." *Agricultural Systems*, 162, 41-49.

  Discusses mobile technologies and their integration into pest and disease management, closely aligned with your project's emphasis on mobile-friendly platforms for farmers.