Department of Computer Engineering

Faculty of Science and Technology

A

Preliminary Project Report on

Plant Leaf Health Detection: Nirgundi and Eranda Plant Leaves

Submitted to Vishwakarma University, Pune

In the partial fulfilment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER ENGINEERING

By

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UNDER THE GUIDANCE OF

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Academic Year

2023-2024

CERTIFICATE

This is to certify that the project report entitled

Plant Leaf Health Detection: Nirgundi and Eranda Plant Leaves

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is a Bonafede work carried out by them under the supervision of **Dr. Bharti Ainapure Ma'am** and it is approved for the partial fulfilment of the requirement of Vishwakarma University for the award of the Degree of Bachelor of Technology in Computer Engineering.

This project report has not been earlier submitted to any other Institute or University for the award of any degree or diploma.

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Date: 2nd June 2024

DECLARATION

We here by declare that this submission is our own work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

Place: Vishwakarma University, Pune **Date: 2nd June 2024**

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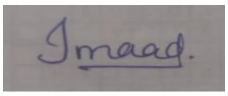

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ACKNOWLEDGEMENT

We extend our heartfelt appreciation to Dr. Bharti Ainapure Ma'am, whose guidance, expertise, and unwavering support have been pivotal in shaping the development of the Plant Leaf Disease Detection Model.

Dr. Bharti Ainapure ma'am dedication to the project, coupled with her profound knowledge in the field of agriculture, medicine and technology, has been instrumental in navigating the complexities and challenges encountered along the way.

We are indebted to the research community for their seminal contributions to the fields of deep learning, image processing, and agricultural technology. The invaluable insights gleaned from works such as "Deep Learning for Plant Disease Detection: A Review" and "Image Processing Techniques for Plant Disease Detection: A Survey" have served as guiding beacons in our quest to develop an innovative disease detection model.

In conclusion, we acknowledge with deep appreciation the contributions of Dr. Bharti Ainapure Ma'am, our team members, collaborators, and the wider research community.

It is through their collective efforts that we have been able to advance our understanding of plant disease detection and pave the way for transformative solutions in agriculture.

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ABSTRACT

The Plant Leaf Disease Detection Model represents a groundbreaking initiative in leveraging Artificial Intelligence (AI) and Machine Learning (ML) techniques to address the critical challenge of plant disease detection in agricultural settings. This project aims to develop a robust and accurate model capable of detecting diseases on the leaves of **Nirgundi** and **Eranda** plants, with the ultimate goal of improving agricultural productivity and food security.

The methodology involves collecting a diverse dataset of leaf images depicting healthy and diseased states, followed by preprocessing and model development using Convolutional Neural Networks (CNNs).

The Plant Leaf Disease Detection Model aims to revolutionize disease management practices, promote sustainable agriculture, and contribute various medical researches.

Keywords:

- Image acquisition
- Preprocessing
- CNN-based model
- Output generation
- User-friendly interfaces
- Integration with mobile devices
- Cloud-based processing
- Alerting mechanisms

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CHAPTER I

INTRODUCTION

1.1. Introduction

The Plant Leaf Disease Detection Model is an innovative project that leverages Artificial Intelligence (AI) and Machine Learning (ML) techniques to detect diseases on the leaves of **Nirgundi** and **Eranda plants**. This project aims to develop a robust and accurate model that can aid agricultural experts and other medical expert to understand and analyse the leaf in early disease detection, reducing crop damage and improving yields. The model will be designed to analyse images of leaves and identify patterns and features that are indicative of diseases, providing a faster and more accurate diagnosis than traditional methods.

The project involves collecting a diverse dataset of images depicting Healthy, Medium Healthy and Unhealthy leaves of **Nirgundi** and **Eranda plants**. Each image will be annotated with labels indicating the presence or absence of diseases, enabling supervised learning for model training.

The project will focus on developing a scalable and adaptable solution that can be easily integrated into existing agricultural systems and workflows.

1.2. Need

The need for this project arises from the significant impact of plant diseases on agricultural productivity and food security. **Nirgundi** and **Eranda plants** are widely cultivated in not many regions, and diseases such as leaf spot, powdery mildew, and rust can cause substantial losses. According to the Food and Agriculture Organization (FAO) of the United Nations, plant diseases can result in crop losses of up to 40%, leading to significant economic and food security implications. Current disease detection methods rely on manual inspection, which is time-consuming, labour-intensive, and often inaccurate. An AI and ML-based model can provide a faster, more accurate, and cost-effective solution, enabling farmers and agricultural experts to take prompt action to prevent the spread of diseases and reduce crop damage.

CHAPTER II

LITERATURE SURVEY

2.1. Literature survey

Research papers from various journals have discussed the application of AI and ML in plant disease detection. Authors have employed techniques such as image processing, deep learning, and convolutional neural networks (CNNs) to detect diseases on various plant species. Studies have shown high accuracy rates in detecting diseases using these methods.

For instance, a study published in the Journal of Agricultural Science and Technology used a CNN-based approach to detect leaf spot disease on tomato plants with an accuracy of 96.5%. Another study published in the International Journal of Computer Applications used image processing techniques to detect powdery mildew disease on wheat plants with an accuracy of 93.2% and one of the model identified using ANN model with accuracy of 92.92%, with 92.50% respectively.

References:

- "Deep learning for plant disease detection and diagnosis" by P. Mohanty et al. (2016).
- "A survey on deep learning techniques for image and video analysis for plant disease detection" by R. K. Jha et al. (2018).
- "Review on Deep Learning Techniques Applied to Image Classification of Plant Diseases" by S. M. S. Rahman et al. (2019).
- "Deep learning techniques for plant disease detection using leaf images: A comprehensive review" by G. Kaur et al. (2020).

CHAPTER III

PROBLEM STATEMENT

3.1. Aim

The aim of this project is to design and develop an AI and ML-based model for identifying leaves with diseases on **Nirgundi** and **Eranda plan**t leaves. The model will be trained on a dataset of images of Healthy, Medium healthy and Unhealthy leaves and will learn to identify patterns and features that are indicative of diseases.

3.2. Objective

- Collect images of leaves and preprocess the dataset of images of Healthy, Medium healthy and Unhealthy leaves
- Develop various CNN-based model for disease or pattern detection in the leaves
- Evaluate the model's performance using accuracy metrics
- Deploy the model in a real-world setting to detect diseases on Nirgundi and Eranda plants

3.2. Feasibility Study

1. **Technical Feasibility:**

    - Availability of Image Dataset: Ensure the availability of a sufficient quantity and quality of images of Nirgundi and Eranda plant leaves with various health conditions.
    - Computational Resources: Assess the computational resources required for training deep learning models, including access to GPUs or TPUs for efficient training.
    - Software and Tools: Evaluate the availability and suitability of software frameworks like TensorFlow or PyTorch for developing and implementing the AI and ML models.

2. **Market Feasibility:**
    - Demand for Plant Disease Detection Solutions: Assess the market demand for AI and ML-based solutions for identifying diseases in Nirgundi and Eranda plants, considering factors such as the prevalence of plant diseases and the adoption rate of technology in agriculture.
    - Competitor Analysis: Evaluate existing solutions and competitors offering similar plant disease detection technologies, identifying potential opportunities for differentiation and market positioning.

CHAPTER IV

PROJECT REQUIREMENTS

4.1. Software Requirements

- Programming languages: Python, TensorFlow
- Visualization Libraries: Matplotlib, Seabon
- Libraries: OpenCV, Keras
- Operating System: Windows/Linux
- Hardware: High-performance computer with GPU support
- Camera or image acquisition device

4.2. Hardware Requirements

- High-performance computer with GPU support
- Camera or image acquisition device
- Storage device for dataset and model
- High resolution camera for dataset generation.
- Internet connection for real-time analysis of the leaves

CHAPTER V

SYSTEM ANALYSIS OF PROPOSED ARCHITECTURE

5.1. System Architecture

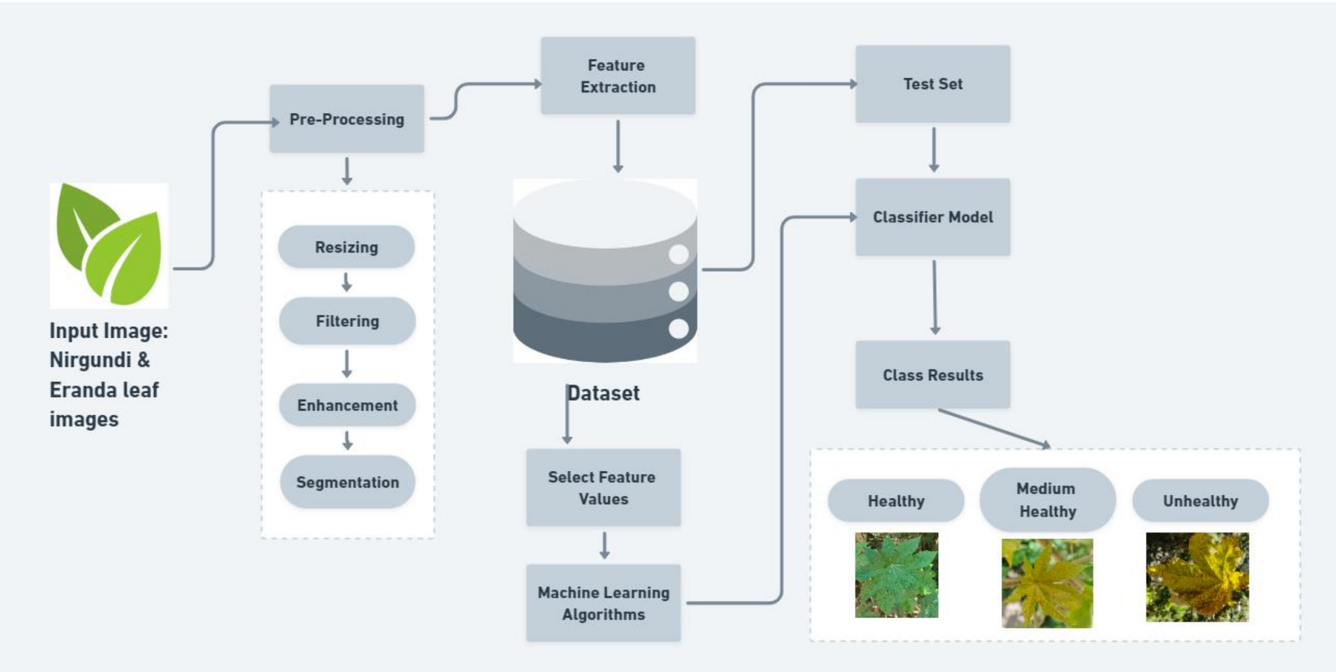


Figure: 1 System Architecture Diagram

5.2. Data Flow Diagrams

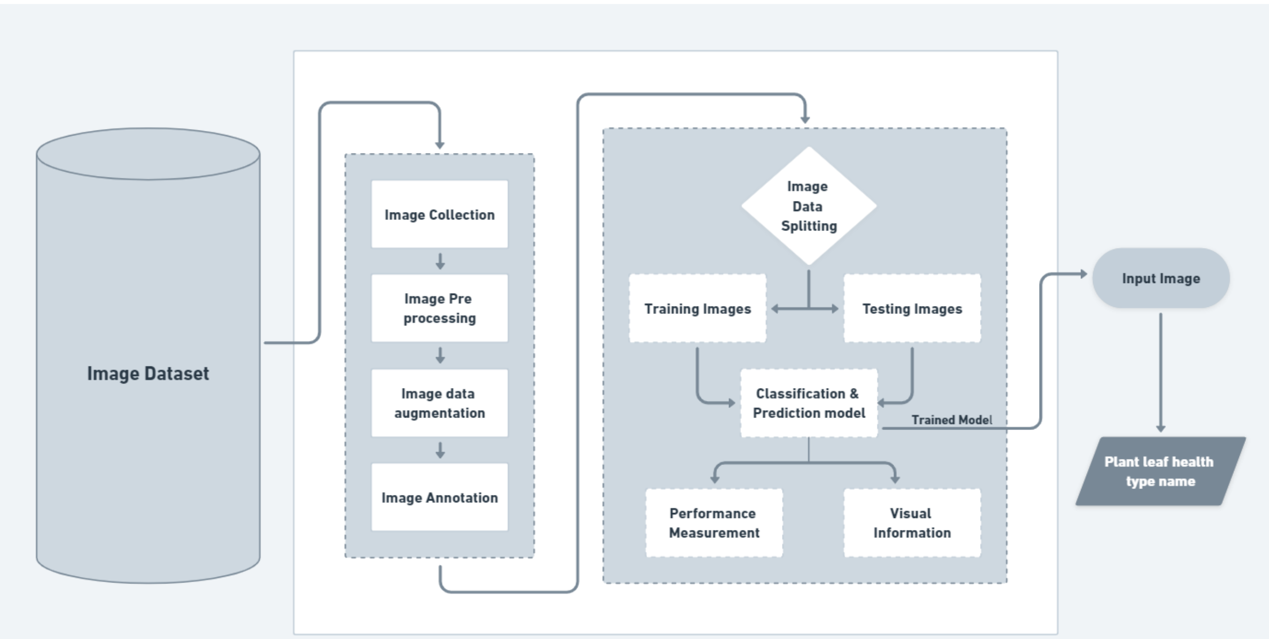


Figure: 2 Data Flow Diagram

5.3. UML Diagrams

5.3.1 Use Case Diagram

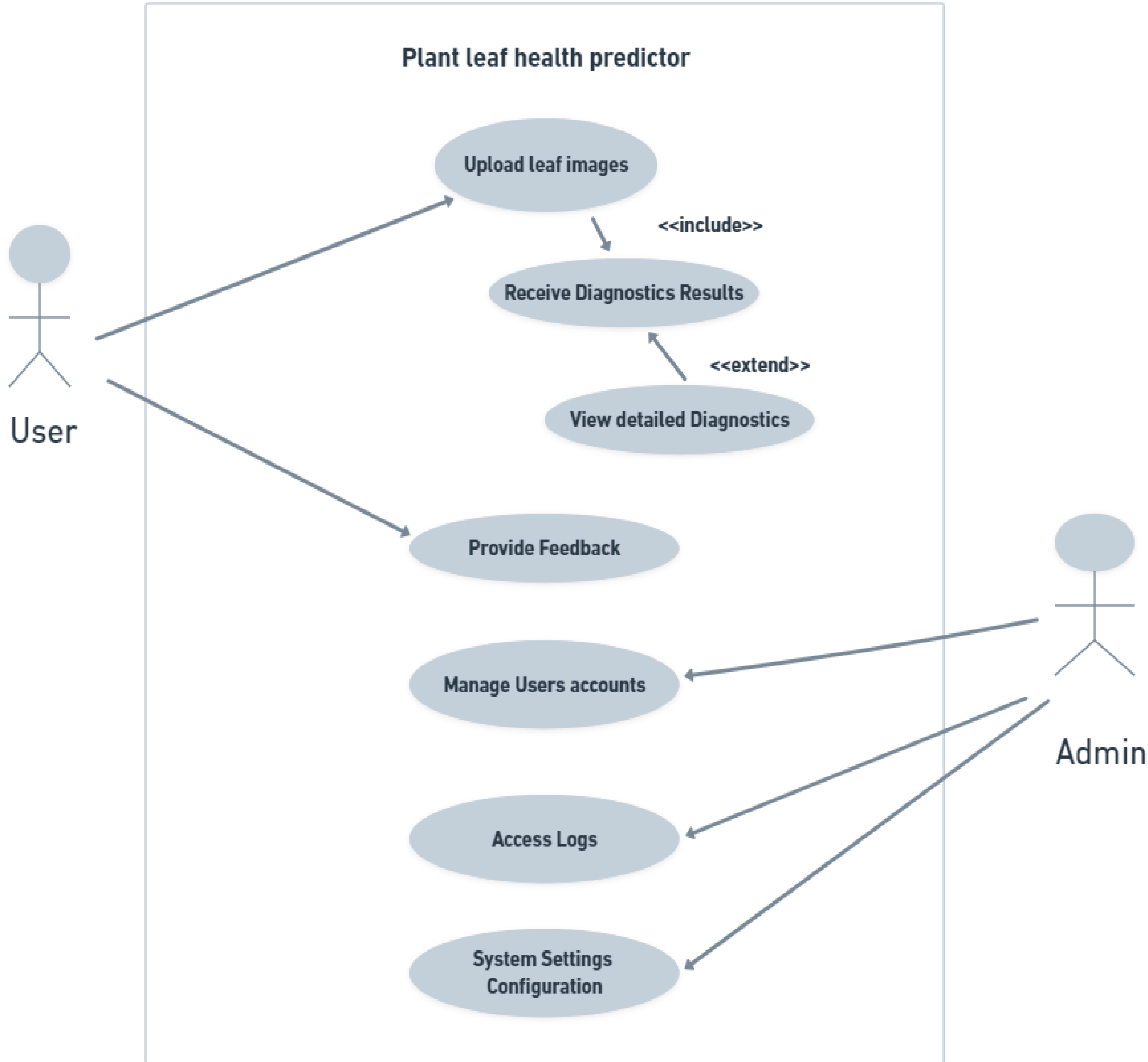


Figure: 3 Use Case Diagram

5.3.2 Activity Diagram

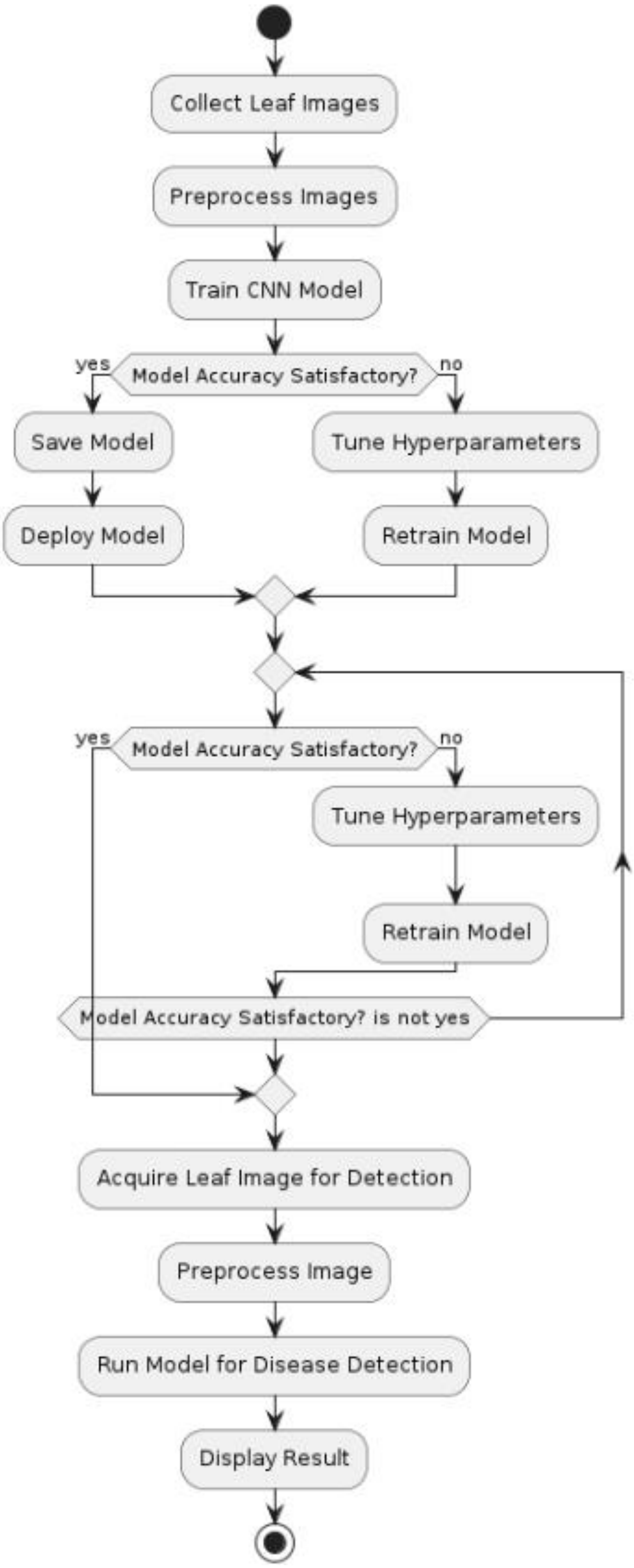


Figure: 4 Activity Diagram

5.3.3 Sequence Diagram

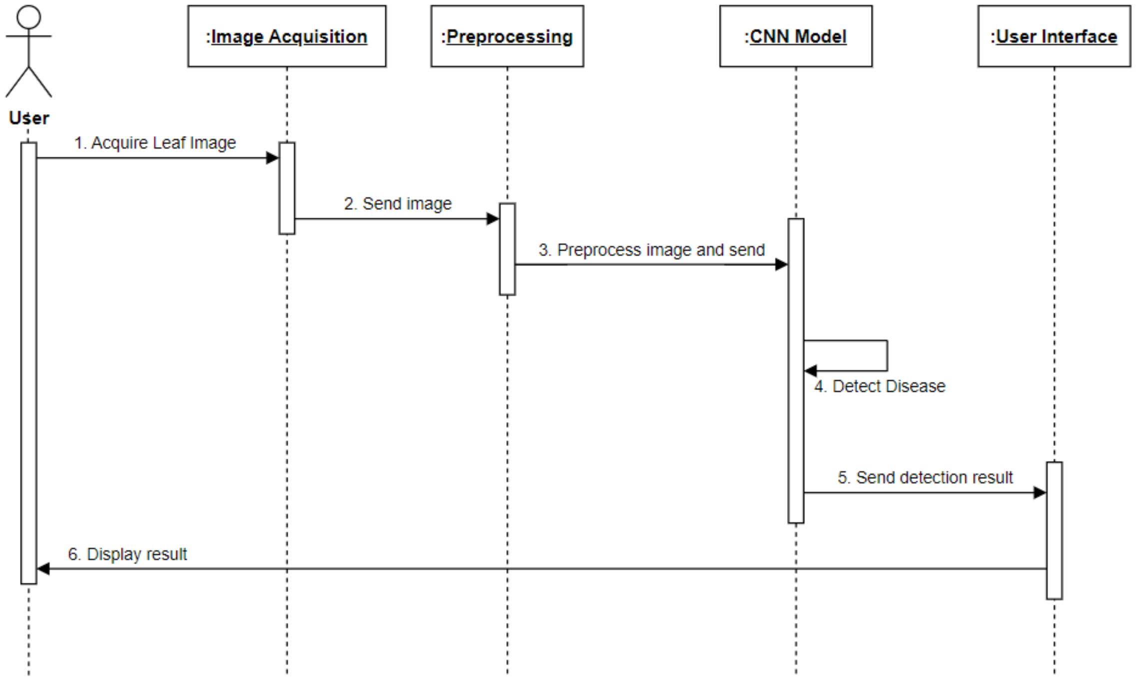


Figure 5: Sequence Diagram

5.3.4 State Diagram

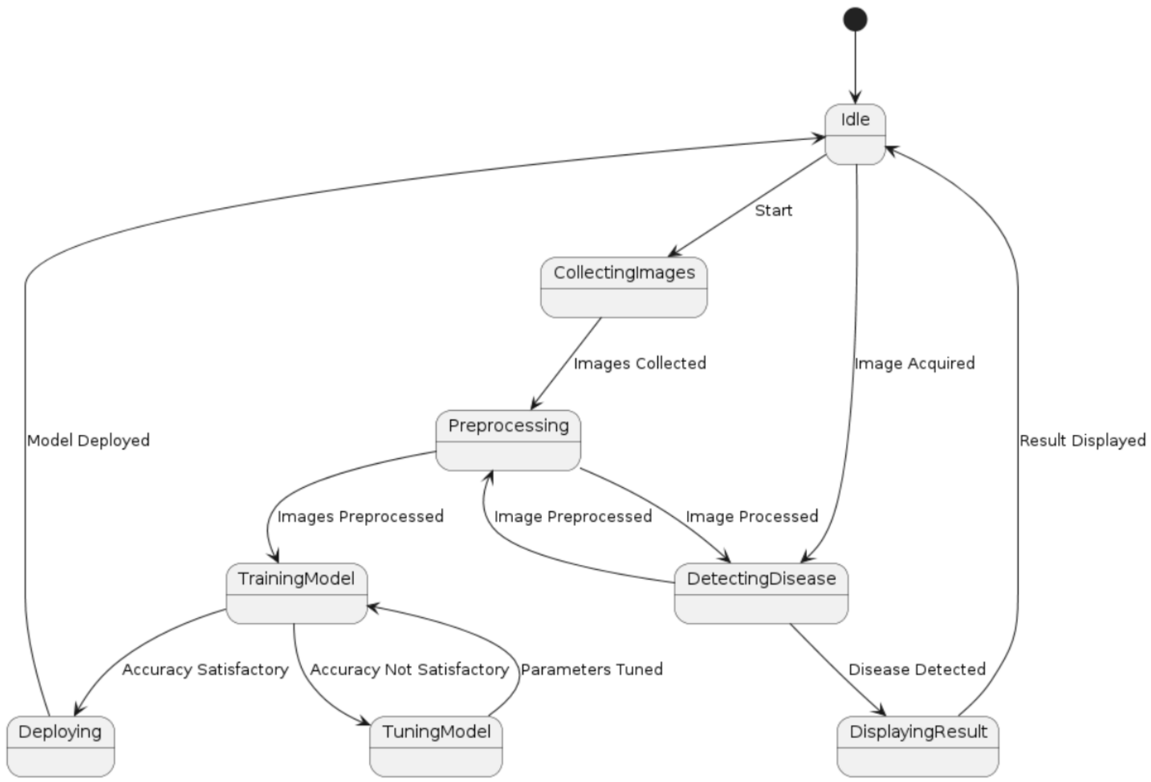


Figure 6: State Diagram

5.3.5 Deployment Diagram

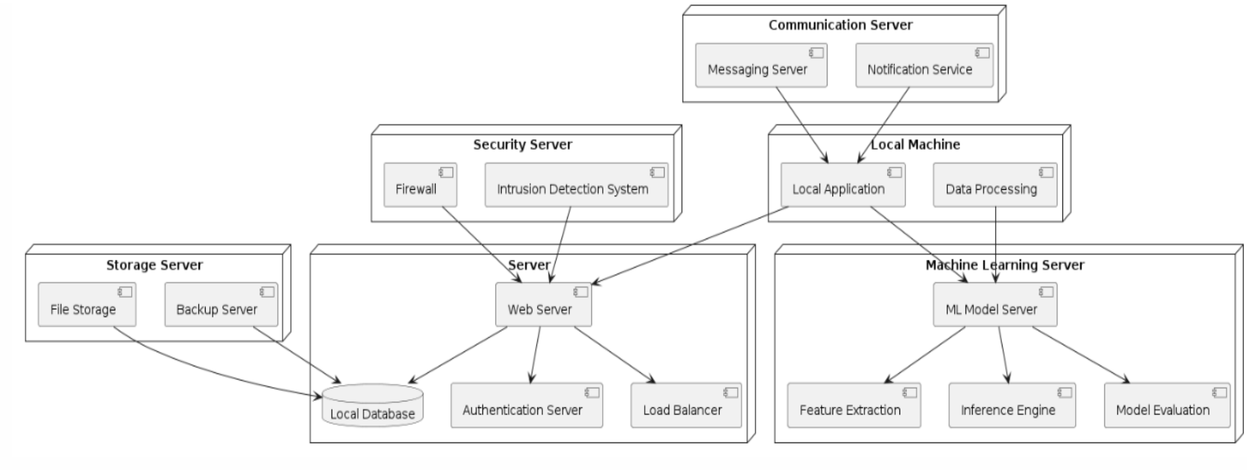
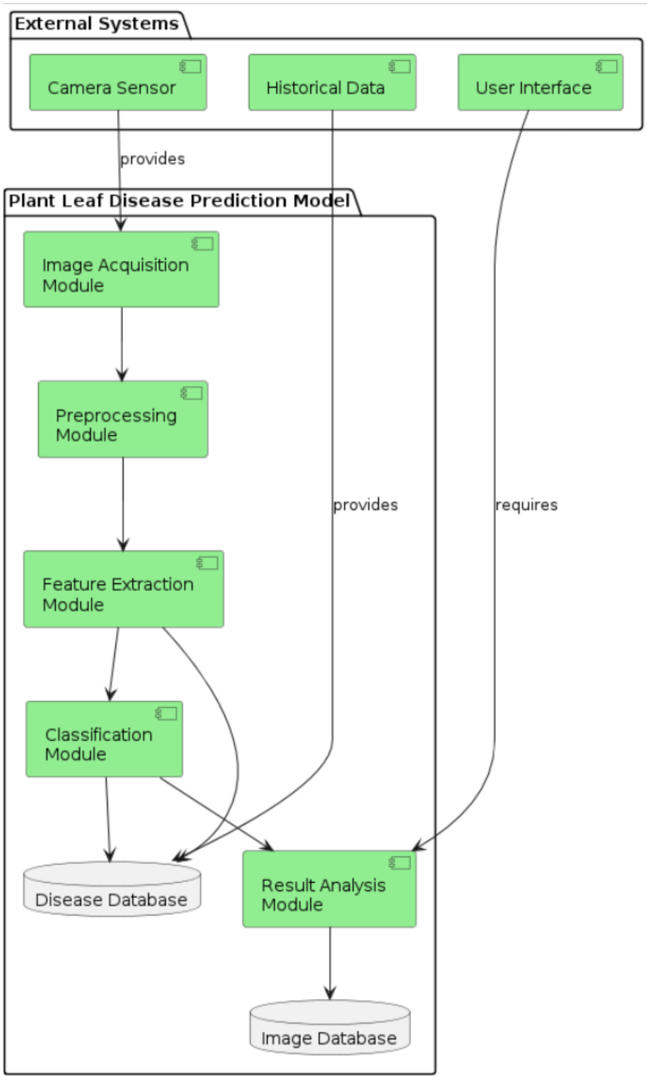


Figure 7: Deployment Diagram

5.3.6 Component Diagram



5.3.7 Class Diagram

Figure 9: Class Diagram

CHAPTER VI

IMPLEMENTATION

6.1. Methodology

- Data collection and preprocessing: A dataset of images of Healthy, Medium healthy and Unhealthy leaves will be collected and pre-processed to prepare them for analysis.
- Model development and training: Various CNN-based model will be developed and trained on the dataset to learn patterns and features that are indicative of diseases.
- Model evaluation and testing: The model will be evaluated and tested on a separate dataset to check the accuracy of the model.
- Various testing: Testing and Validation dataset are used to check the accuracy of the model
- Hyperparameter Tuning and Optimization: During model development, hyperparameter tuning techniques will be employed to optimize the performance of the CNN-based models.
- Interpretability and Explainability: The project will also focus on enhancing the interpretability and explainability of the model's predictions. Techniques such as gradient-based visualization and saliency mapping will be employed to provide insights into the decision-making process of the model, enabling users to understand the underlying factors contributing to disease detection.

6.2. System Overview

The Plant Leaf Disease Detection Model will be developed using a CNN-based approach. The system will take images of leaves as input, preprocess them, and output a disease detection result. The system will consist of the following components:

- Image Acquisition: This component will be responsible for acquiring images of leaves from the field or greenhouse.
- Preprocessing: This component will be responsible for resizing, normalizing, and enhancing the images to prepare them for analysis.
- CNN-based Model: This component will be responsible for analysing the images and detecting diseases.
- Output: This component will be responsible for providing the output of the model, which is the disease detection result.
- User Interface (UI): A user-friendly interface will be developed to facilitate interaction with the system.
- Continuous Learning and Improvement: The system can incorporate mechanisms for continuous learning and improvement over time.

CHAPTER VII

PROJECT PLAN

7.1. Timeline

The project is a task that has duration of completion of 12 months, out of 12 we have completed 6 months of the project timeline, with the following milestones:

- Month 1-2: Generation of dataset or the collection of images of **Nirgundi** and **Eranda** leaves
- Month 3-4: Literature Survey
- Month 5: Poster designing and Evaluation of Literature survey report
- Month 6: Final Approval of Report and Final Semester Evaluation.

7.2. Milestones

- Generation of dataset or the collection of images: 100%
- Literature Survey: 100%
- Poster designing and Evaluation of Literature survey report: 100%
- Final Approval of Report: 80%.
- Final Semester Evaluation: 20%

CHAPTER VIII

CONCLUSION

The Plant Leaf Disease Detection Model represents a significant advancement in leveraging AI and ML technologies to address critical challenges in agriculture and medical researches. By harnessing the power of deep learning and image processing techniques, this project offers a transformative solution for early disease detection in plants, particularly focusing on **Nirgundi** and **Eranda** plants. The potential impact of this model extends beyond individual farms to entire agricultural landscapes along with medical researches, with implications for global food security and sustainability.

The references cited provide a solid foundation for the theoretical and technical aspects of the project. "Deep Learning for Plant Disease Detection: A Review" and "Image Processing Techniques for Plant Disease Detection: A Survey" offer valuable insights into the state-of-the-art methodologies and challenges in this domain. "Convolutional Neural Networks for Image Classification" serves as a comprehensive guide to understanding the underlying principles of CNNs, which are pivotal in developing the disease detection model. Additionally, "Agricultural Technology" serves as a testament to the growing importance of technological advancements in modern agriculture.

In conclusion, the Plant Leaf Disease Detection Model represents a paradigm shift in agricultural technology, offering a potent tool for enhancing crop health, increasing yields, and ultimately ensuring food security for a growing global population.

As this project continues to evolve, it holds the promise of revolutionizing the way we approach plant disease management, setting new standards for innovation and sustainability in agriculture.

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[1] "PlantVillage: An open-access repository of images of plant species,"

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[3] "Tropical Plant Database,"

[4] "PlantNET,"

[5] "Kaggle: Plant Pathology 2020,"