

Software Design Specification

Potato Leaf Disease App

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Definition of Terms, Acronyms and Abbreviations

This section should provide the definitions of all terms, acronyms, and abbreviations required to interpret the terms used in the document properly.

Term	Description
CNN	Convolutional Neural Network
RAG	Retrieval-Augmented Generation
LLM	Large Language Model
GCP	Google Cloud Platform
UI	User Interface

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1. Introduction

1.1 Purpose of Document

This document describes the design specifications of the Potato Leaf Disease App. It targets software developers, testers, and farmers. The design is based on object-oriented methodologies and focuses on scalability and usability.

1.2 Project Overview

The app aids farmers and researchers by identifying potato leaf diseases through a CNN model. It provides actionable insights using RAG-based knowledge retrieval. Key functionalities include image processing, disease classification, and preventive recommendations.

1.3 Scope

The app is built for Android and iOS, targeting users ranging from farmers to agricultural researchers. Core features include real-time image processing, disease severity analysis, and knowledge base integration. Non-goals include handling non-potato plants or past identification..

2. Design Considerations

This section describes many of the issues which need to be addressed or resolved before attempting to devise a complete design solution. In other words, this section is used to formally set the groundwork for the system design.

2.1 Assumptions and Dependencies

- *Users have access to smartphones with a camera.*
- *The backend infrastructure, including GCP services, is stable and reliable.*
- *Annotated datasets are available for training the CNN model.*

2.2 Risks and Volatile Areas

- *Risks include model performance on diverse datasets and backend outages.*
- *Mitigation: Continuous model updates and redundant cloud services.*
- *Contingency: Graceful degradation of features and fallback mechanisms..*

3. System Architecture

This section provide a high-level overview of how the functionality and responsibilities of the system are partitioned and then assigned to subsystems or components. The main purpose is to gain a general understanding of how the system is decomposed, and how the individual parts work together to provide the desired functionality.

3.1 System Level Architecture

The app is divided into frontend and backend components. The frontend (React Native for mobile) interacts with a backend hosted on GCP. The backend includes:

- *CNN model for disease detection.*
- *RAG system for knowledge retrieval.*
- *APIs for secure data exchange.*

3.2 Sub-System / Component / Module Level Architecture

Frontend: User interaction layer supporting image uploads and result display.

Backend:

- CNN module: Processes images and classifies diseases.
- RAG module: Retrieves detailed information from a vectorized database.
- Notification service: Sends alerts and updates.

Database:

- Firebase for user authentication and storage.
- Vector database for disease-related knowledge.

3.3 Sub-Component / Sub-Module Level Architecture

Frontend Modules:

- Camera and upload interface.
- Result visualization.

Backend Subsystems:

- Data preprocessing pipeline.
- Model inference service.
- Knowledge base management system.

4. Design Strategies

Describe the design strategies or decisions that impact the overall organization of the system and its high-level structures. This information provides the reader with insights into the key abstractions and mechanisms used in the system architecture.

4.1 Strategies

Strategy 1: Modularity and Scalability

- The app is designed with modular architecture to enable future enhancements. Backend components are containerized for scalability and maintenance.

Strategy 2: Secure Communication

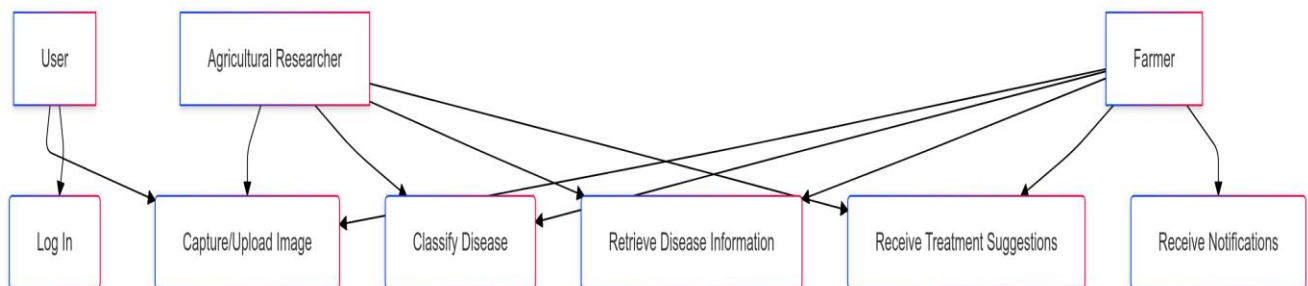
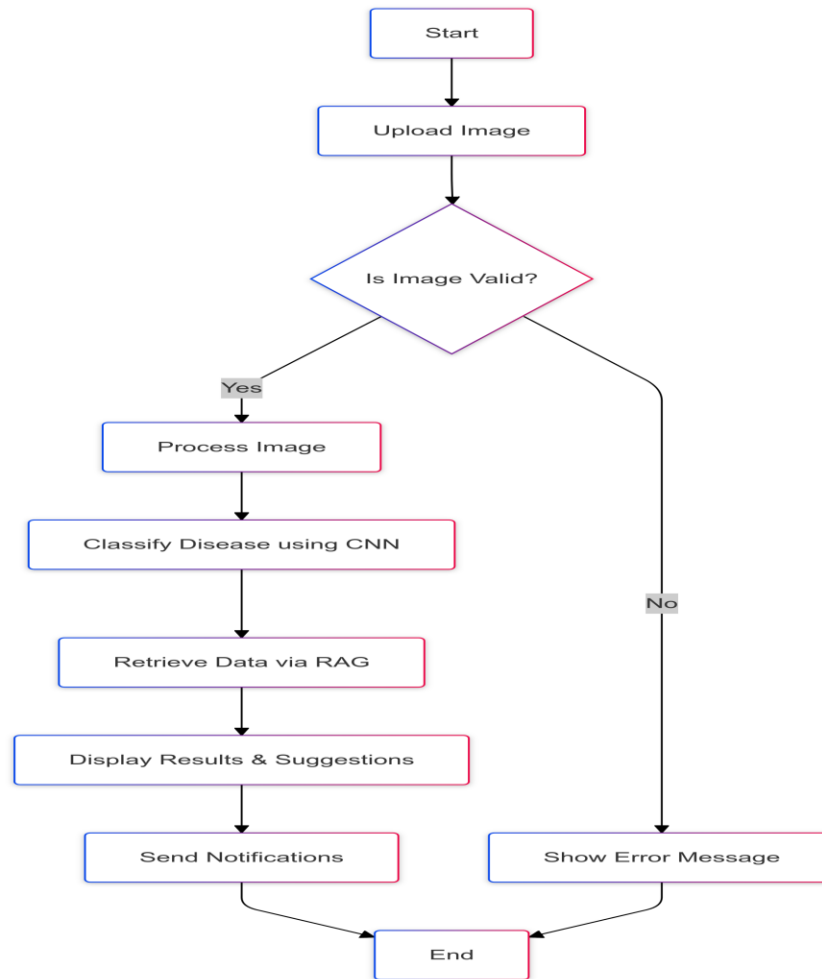
- All interactions between components use HTTPS and OAuth2 for secure communication.

Strategy 3: User-Centric Design

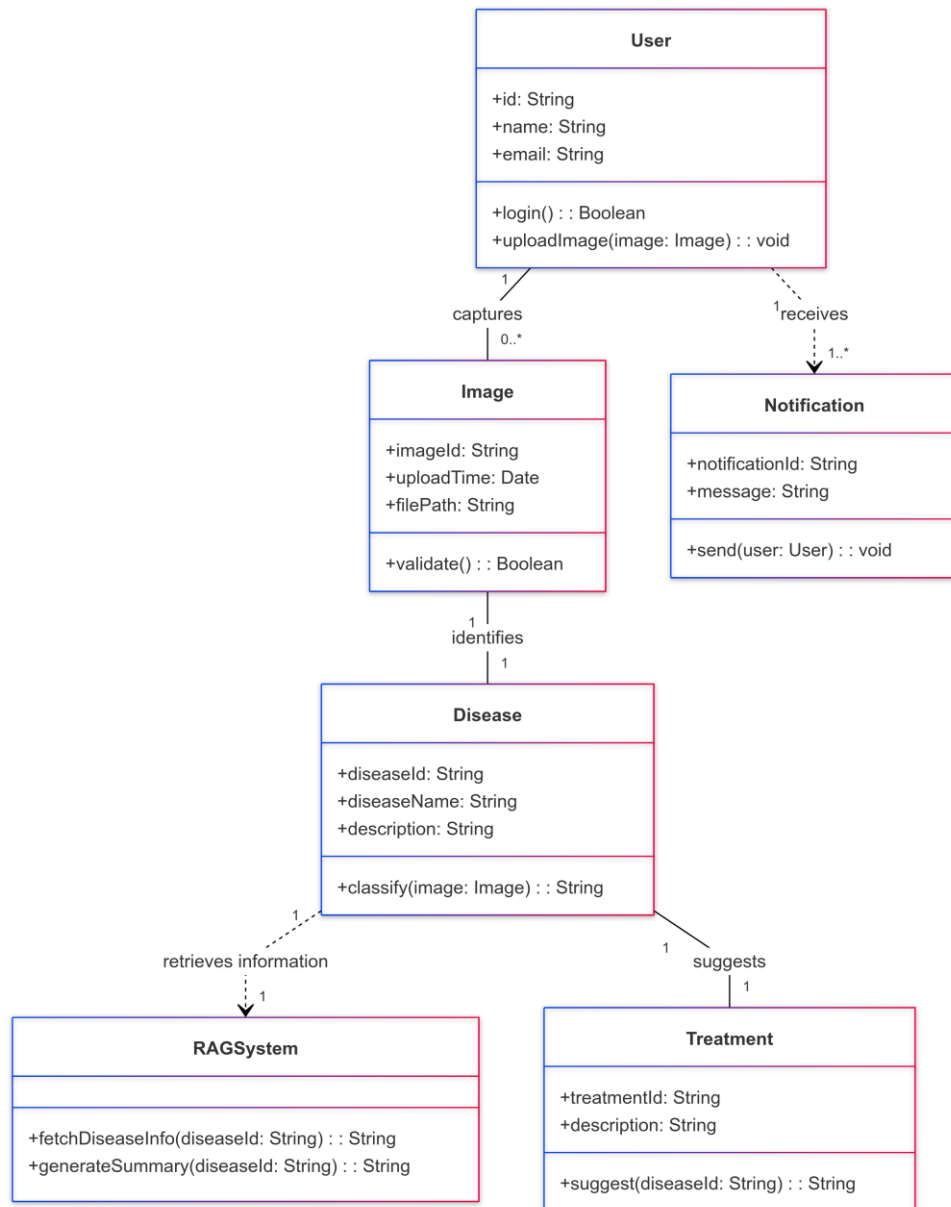
- UI/UX focuses on accessibility for farmers with minimal technical expertise.

5. Detailed System Design

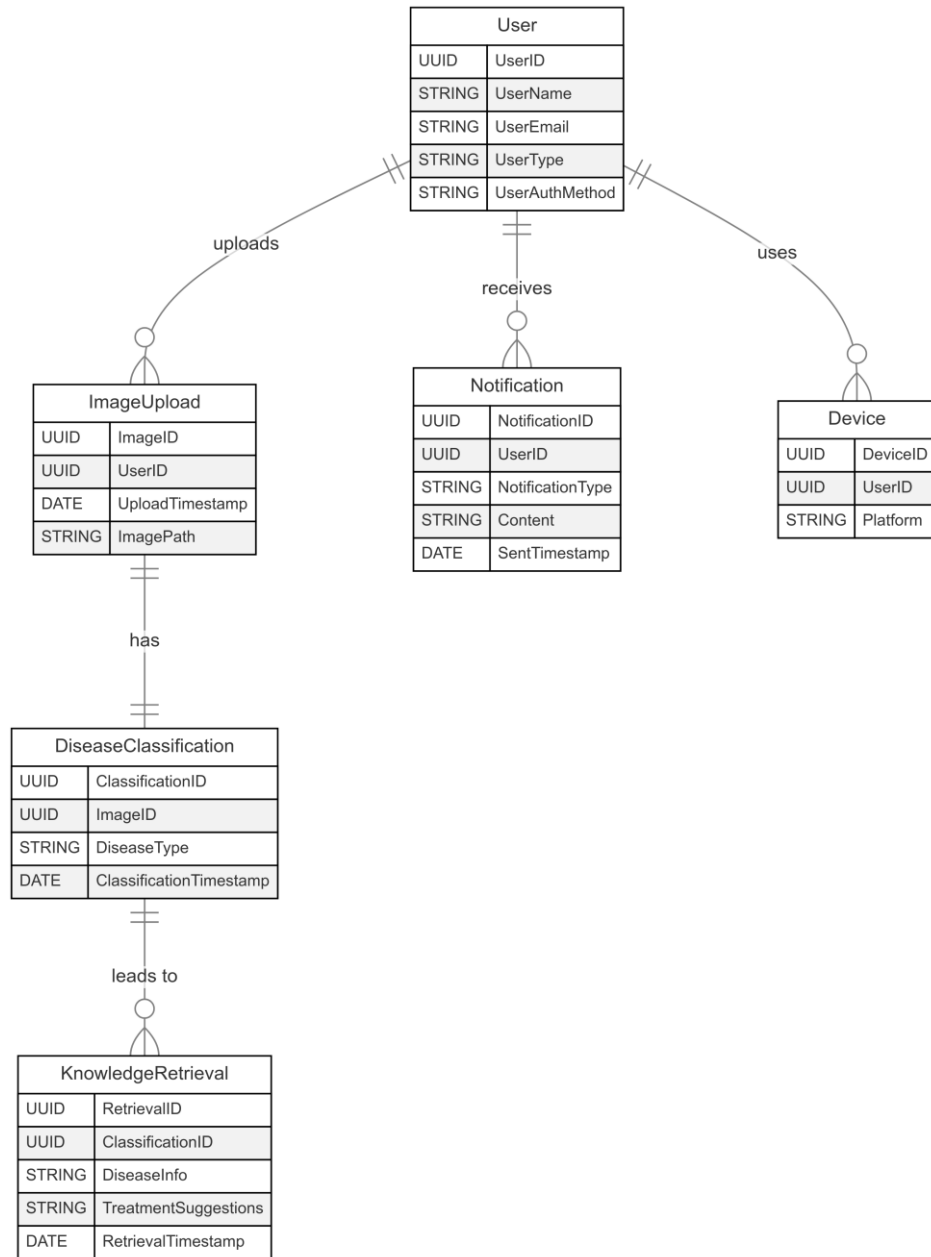
1. State Transition Diagram



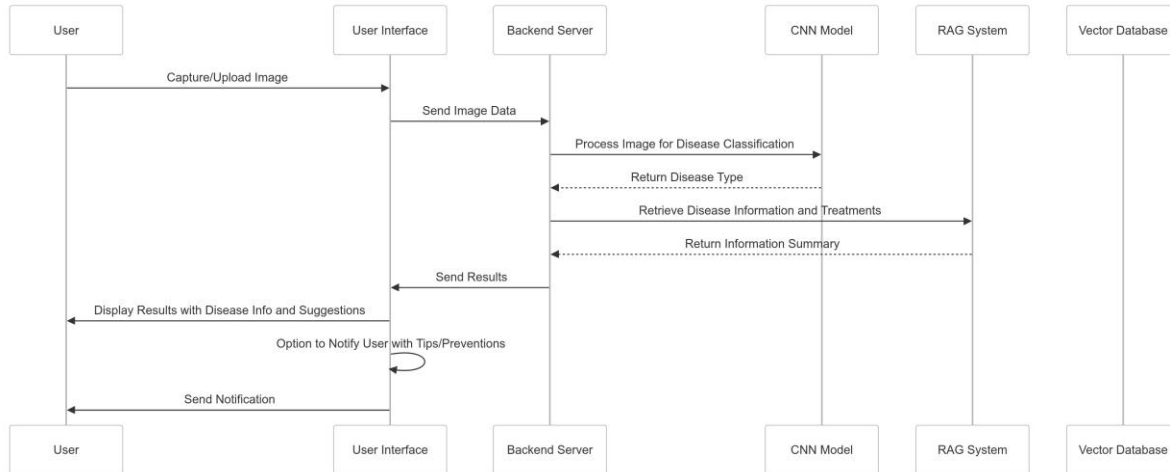
2. Class Diagram



3. ERD Diagram



4. Sequence Diagram



References

This section provides a complete list of all documents referenced at specific point in time. Each document should be identified by title, report number (if applicable), date, and publishing organization. Specify the sources from which the references can be obtained (This section is like the bibliography in a published book).

Ref. No.	Document Title	Date of Release/ Publication	Document Source
[1]	A novel framework for potato leaf disease detection using an efficient deep learning model	19 Apr 2022	https://doi.org/10.1080/10807039.2022.2064814
[2]	Early Detection of Potato Disease Using an Enhanced Convolutional Neural Network-Long Short-Term Memory Deep Learning Model	20 June 2024	https://link.springer.com/article/10.1007/s11540-024-09760-x
[3]	Potato Leaf Disease Detection using Deep Learning	11 November 2022	https://www.researchgate.net/publication/365344910
[4]	Artificial Intelligence in Potato Leaf Disease Classification: A Deep Learning Approach	6 January 2021	https://www.researchgate.net/publication/347877211

Ref. No.	Document Title	Date of Release/ Publication	Document Source
	Potato Leaf Disease Classification Using Optimized Machine Learning Models and Feature Selection Techniques	25 June 2024	https://link.springer.com/article/10.1007/s11540-024-09763-8
[5]	Potato Plant Leaves Disease Detection and Classification using Machine Learning Methodologies	8 June 2021	https://iopscience.iop.org/article/10.1088/1757-899X/1022/1/012121
[6]	CLASSIFICATION OF POTATO LEAF DISEASES USING CONVOLUTIONAL NEURAL NETWORK	2 September 2023	https://www.researchgate.net/publication/374861487_CLASSIFICATION_OF_POTATO_LEAF_DISEASES_USING_CONVOLUTIONAL_NEURAL_NETWORK
[7]	Potato Leaf Disease Detection and Classification using CNN	5 December 2022	https://www.proquest.com/openview/14291bc74fe8758a972f2c1c131fb595/1?pq-origsite=gscholar&cbl=2035897

6. Appendices

Include supporting detail that would be too distracting to include in the main body of the document.
