Advanced Plant Disease Analyzer: Automated Detection and Management System Quality Measurement - Vanilla

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Team Member

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Presentation Outline

1. **Overview of the Project**
2. **Development progress**
   - Understanding the Research Area
   - Process of UI Design
   - Wireframe User Interface Design
   - Implimented Models
   - Technologies used
3. **Future works**
4. **Individual Process**

INTRODUCTION

Problem: Vanilla farmers need better tools

- Vanilla farming is becoming more complex due to new technologies.
- Growers struggle with diseases, inefficient techniques, and inconsistent quality.

Solution: Data visualization and decision support

- A research project called "Data Visualization and Decision Support" is underway.
- This project will provide real-time data and smart recommendations to farmers.

Benefits: Healthier plants, faster decisions, higher yields

- Farmers will have access to insights that improve plant health.
- Easier decision-making will lead to quicker responses to problems.
- The project aims to increase vanilla production through these improvements.

Background

High Disease Susceptibility: Vanilla cultivation is highly vulnerable to diseases, which can significantly affect both yield and quality.

Inefficiency of Traditional Methods: Current methods for disease detection and quality assessment are labor-intensive, time-consuming, and prone to human error, making them inefficient.

Need for Automation: An integrated automated system for early disease detection and accurate quality assessment would be invaluable for vanilla farmers, allowing timely interventions to reduce losses and enhance product quality.

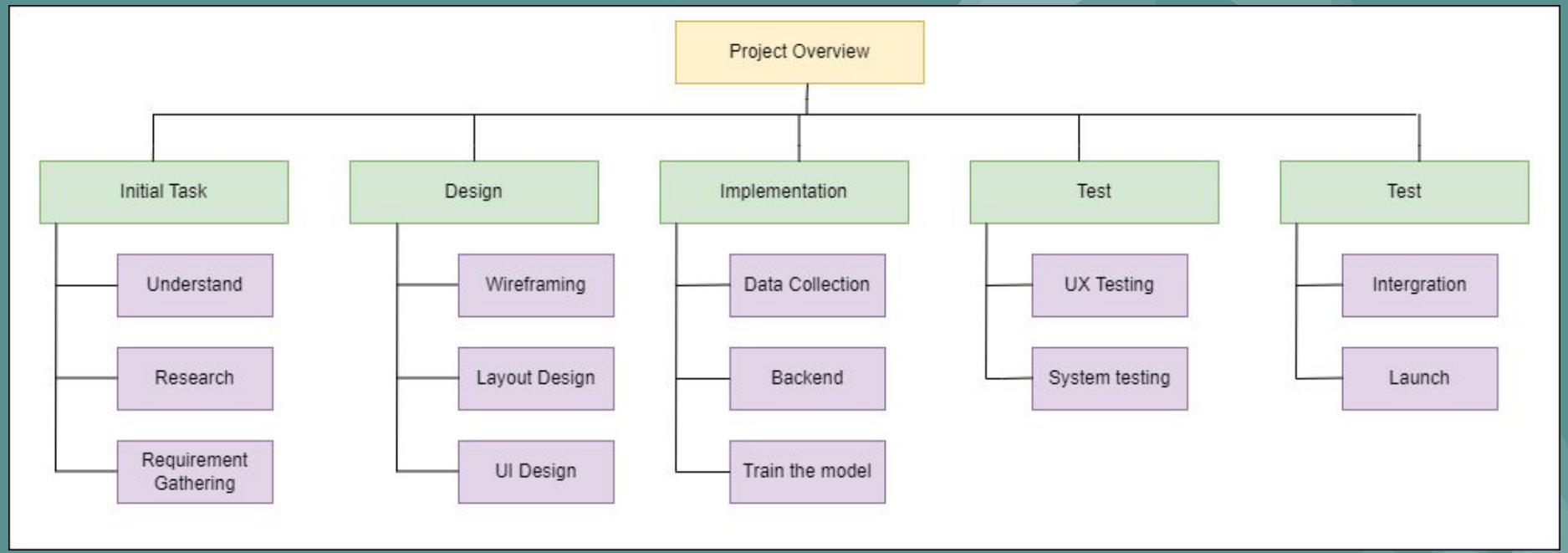
Research Question

How can image processing and machine learning be utilized to detect and classify diseases in vanilla plants with high accuracy?

What are the key attributes that determine vanilla pod quality, and how can these be measured automatically?

What are preferred data visualization formats and user communication channels?

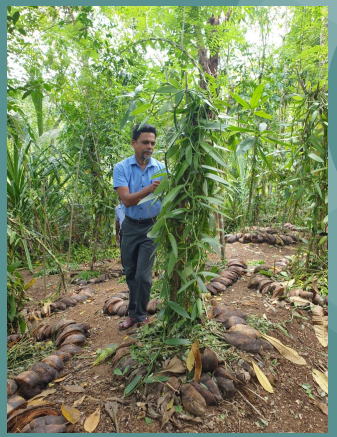
Project Overview



Overall progress

- [x] Data Collection
- [x] Backend
- [x] Model Training
- [x] Front End
- [x] Software Quality Testing
- [x] Launch product

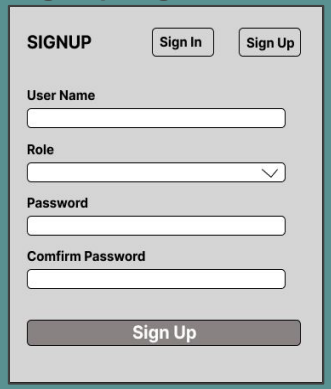
Understanding Research Area



Wireframing

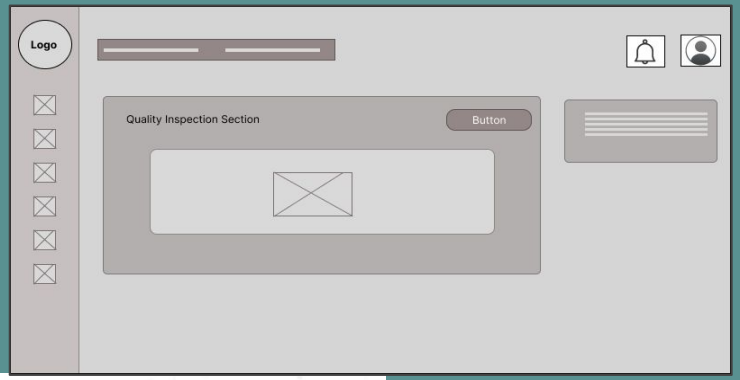
Sign In Page

Sign Up Page

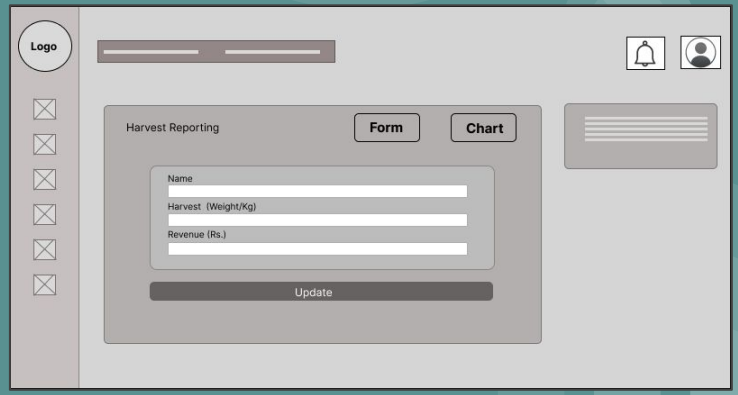


Home Page

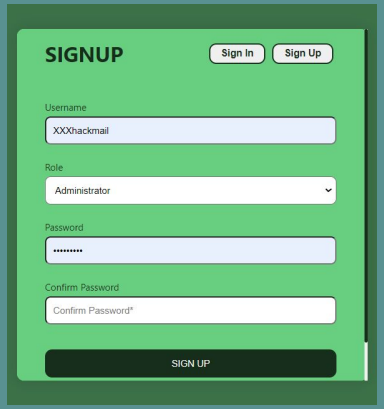
Quality Inspection Section

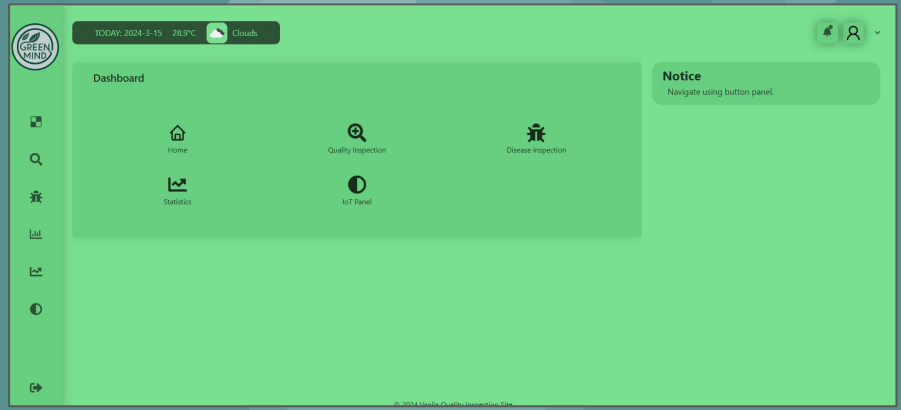


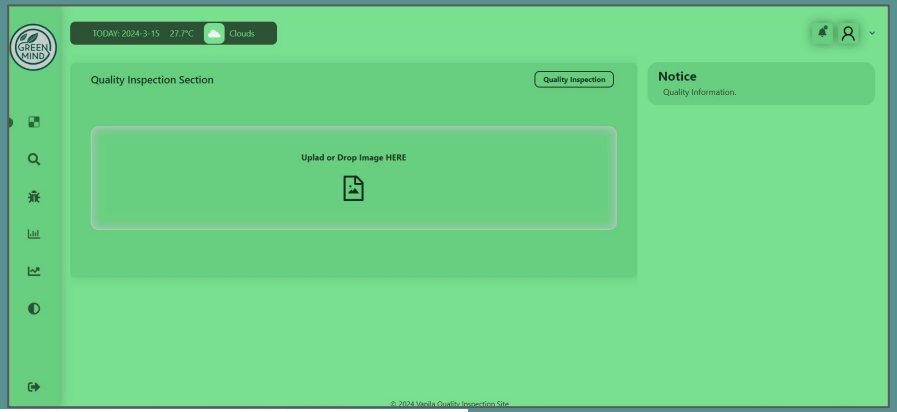
Harvest Reporting



User Interface Design







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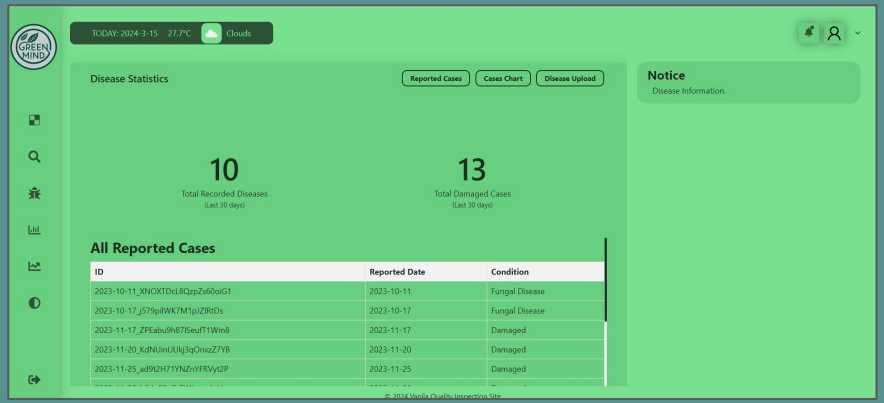

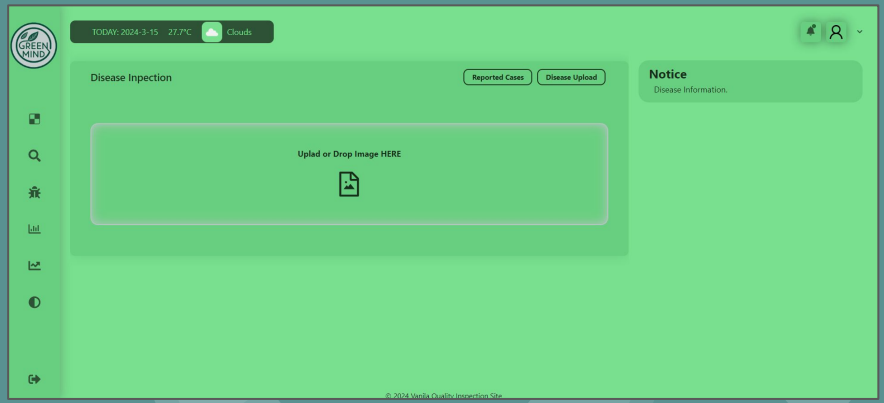

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Data Visualization and Decision Support

Background

Vanilla Cultivation Challenges:

- ❏ Disease Risks
- ❏ Complex Cultivation
- ❏ Stringent Quality Demands

These challenges limit real-time insights for farmers, hindering informed decision-making.

Our Solution:

"Data Visualization & Decision Support" empowers farmers with:

- ❏ Detailed Harvest & Crop Data (Tables & Graphs)
- ❏ AI-Powered Predictions for informed cultivation choices.

Research Problem

Challenges:

- Intuitive Interface: Catering to diverse tech skills of vanilla farmers (beginner to advanced).
- Data Integration: Seamlessly combining data from various sources (Plant Disease Analyzer, Growing/Fertilization) for accurate, real-time insights.
- AI Prediction Accuracy: Enhancing speed and precision of machine learning predictions for informed decision-making.

Main Objective:

- Empower Vanilla Farmers with Real-Time Insights

Through:

- Data Visualization Techniques (Tables, Graphs)
- Intelligent Decision Support Systems (AI Predictions)

Outcomes:

- Informed Decision-Making
- Optimized Cultivation Practices
- Increased Productivity & Success

Sub-Objectives:

Machine Learning Integration:

- ❏ Analyze data from fault detection, condition measurement, and disease detection.
- ❏ Seamlessly integrate AI predictions for real-time insights.

Data Visualization Design:

- ❏ Visually appealing representations of harvest and crop data.

Data Flow Optimization:

- ❏ Ensure smooth data exchange between components.

Requirements

Functional Requirements

- The system must feature an intuitive and user-friendly interface to ensure easy accessibility for vanilla farmers.
- Incorporate machine learning algorithms to process and analyze data, enabling the generation of real-time predictions for farmers.
- Use of tables and graphs.

Non - Functional Requirements

- The interface shall adhere to accessibility standards (e.g., WCAG 2.0), ensuring that it is usable by individuals with disabilities.
- The codebase and design of the interface should adhere to best practices, facilitating ease of maintenance and future enhancements.

Technologies Used

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Quantitative Quality Measurement

Background

- Quantitative Quality Measurement" is indispensable in smart vanilla cultivation, akin to the significance of disease management in crop health.
- Similar to disease detection, timely intervention based on quantitative quality measurements is vital for ensuring optimal vanilla pod quality.
- Vanilla pod quality assessment holds immense importance for market value and desirability.
- Accurate measurements and standardization of attributes such as size, color intensity, and surface texture are pivotal for determining vanilla pod quality.

Research Problem

- Ensuring the accuracy and precision of automated measurements for attributes like size, color intensity, and surface texture in vanilla pods.
- Developing methods to effectively integrate multiple attributes into a comprehensive quality assessment framework for vanilla pods.
- Addressing variability in vanilla pod attributes due to environmental conditions, genetic variation, and post-harvest factors to improve measurement reliability.

Main Objectives

- Establish standardized protocols for consistent measurement of vanilla pod attributes across different environments and cultivars.
- Develop automated systems for precise measurement of vanilla pod attributes like size, color intensity, and surface texture.
- Validate and calibrate measurement techniques against established standards to ensure accuracy in assessing vanilla pod quality.

Sub Objectives

- Conduct comparative analyses of vanilla pods assessed with traditional methods and the quantitative measurement system.
- Identify relevant environmental parameters affecting quality attributes (e.g., humidity, light).
- Collect a diverse dataset of vanilla plant images for algorithm training and validation.

Requirements

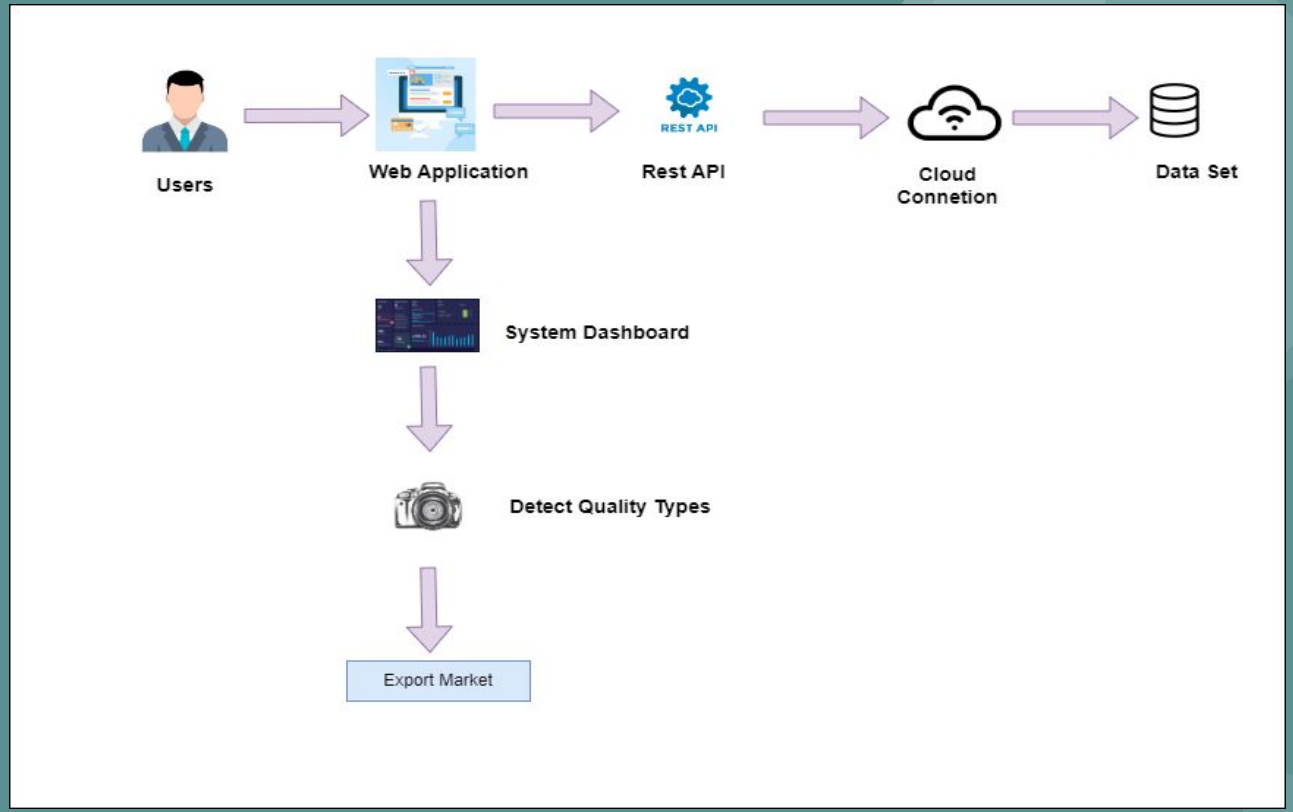
Functional Requirements

- Standardized Measurements:
- Image Processing Algorithms:
- Cultivar Adaptability:

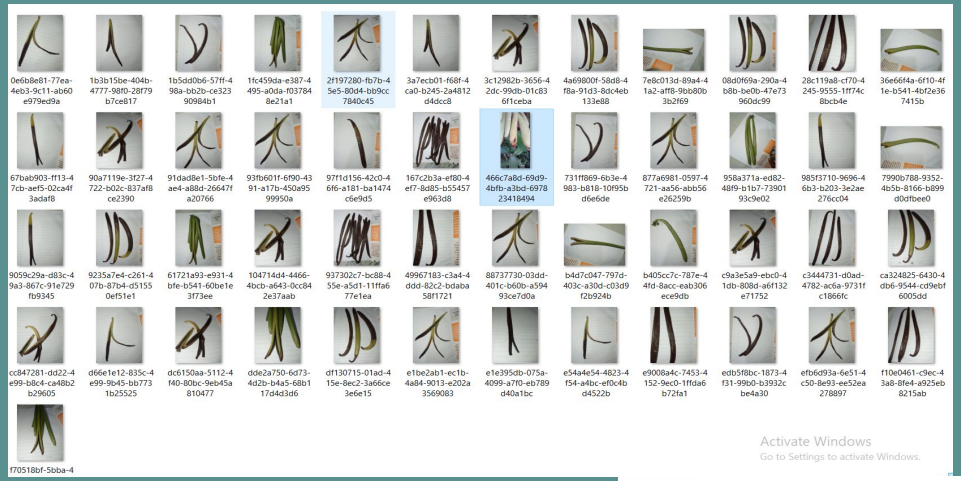
Non - Functional Requirements

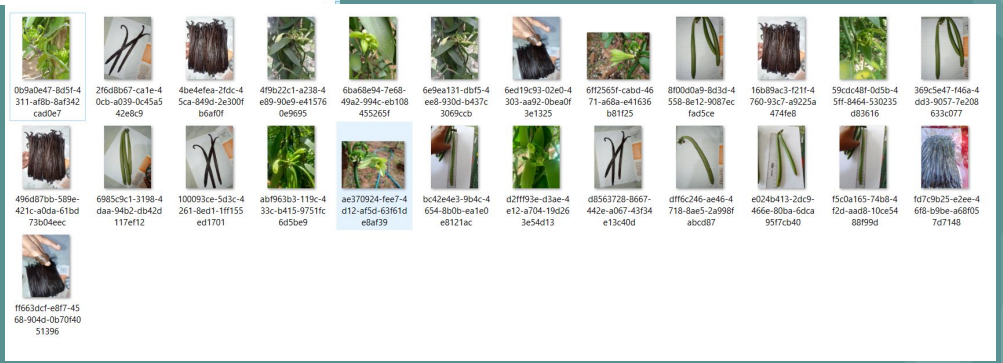
- Accuracy and Precision:
- Usability and User-Friendly Interface:
- Compatibility and Integration:

System Overview Diagram



DataSet





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Plant Disease Analyzer

Background

- Vanilla, a crucial export crop in Sri Lanka, faces significant challenges due to its susceptibility to various diseases, posing a significant crisis for farmers, researchers, and exporters.

- The "Plant Disease Analyzer" component uses to assess the health of vanilla plants, provide information on disease symptoms, and suggest appropriate remedies.

- By using this component, various diseases occurring in vanilla plants can be detected quickly and the necessary remedies can be obtained efficiently and accurately, so the impact on vanilla cultivation can be minimized.

Research Problem

- How to identify the various diseases of vanilla plants and how to efficiently and accurately give the details of the necessary remedies ?

Objectives

Main Objectives -

★ To develop a vanilla plant disease analyzer component that can accurately and reliably identify vanilla plant diseases based on images of affected Vanilla plant parts.

Sub Objectives -

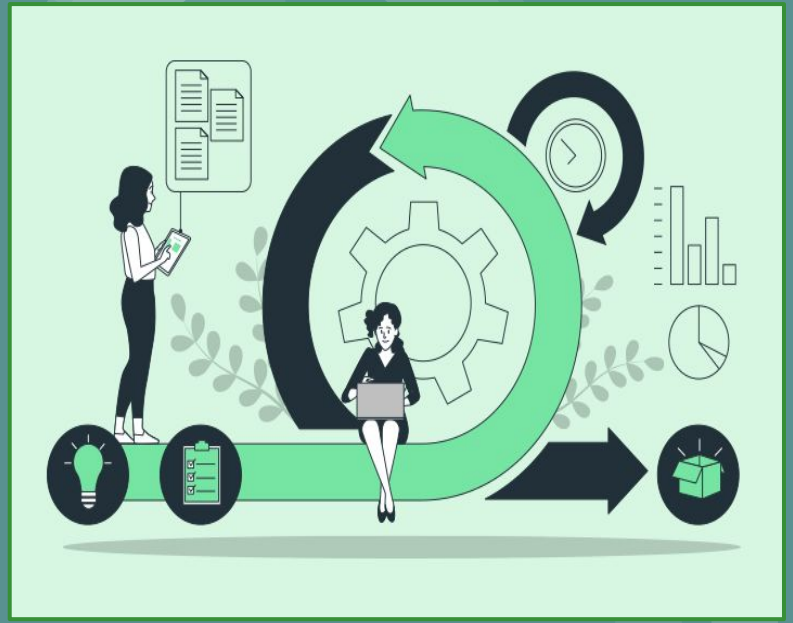
★ To collect and annotate a dataset of vanilla plant disease images.

★ To develop algorithms that can robustly handle variability in vanilla plant images.

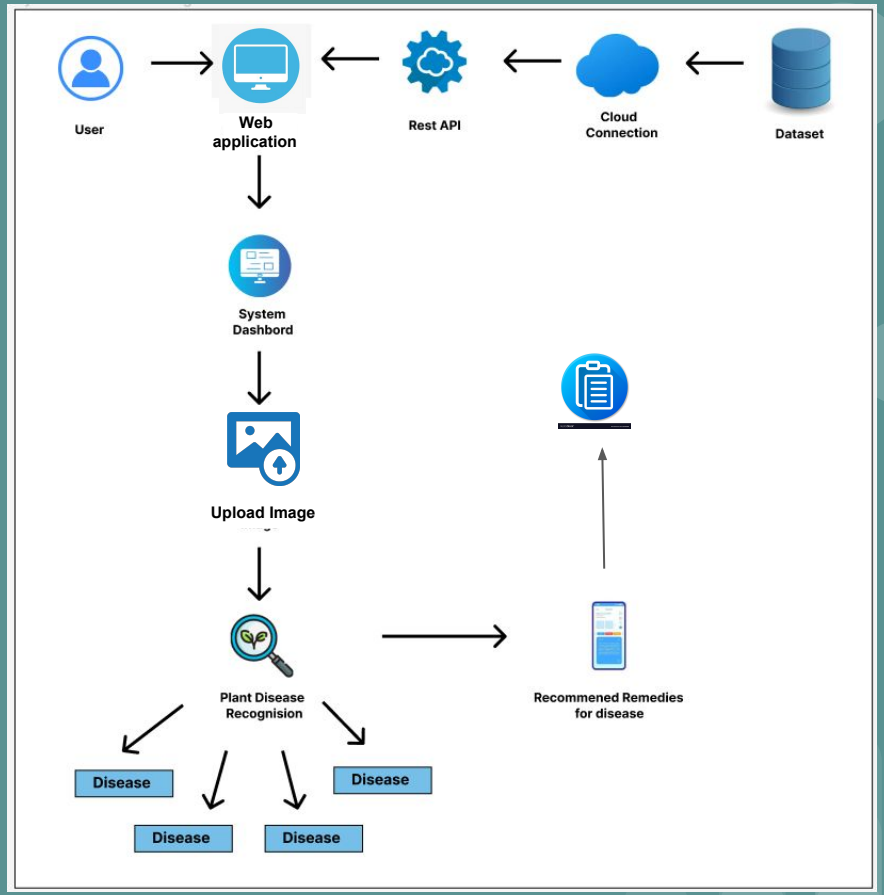
★ To develop a user-friendly interface that makes it easy for users to use the web application.

Requirements

- ★ Performance and Efficiency
- ★ Scalability
- ★ Security and Data Privacy
- ★ Reliability and Availability
- ★ Usability and Accessibility

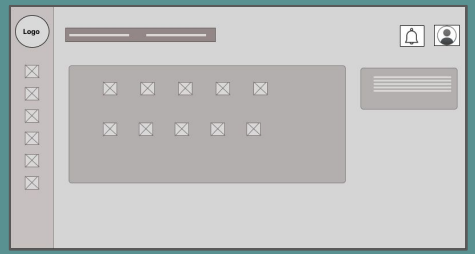


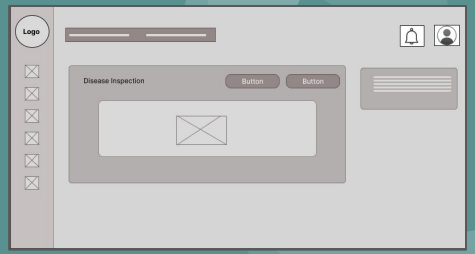
System Overview Diagram

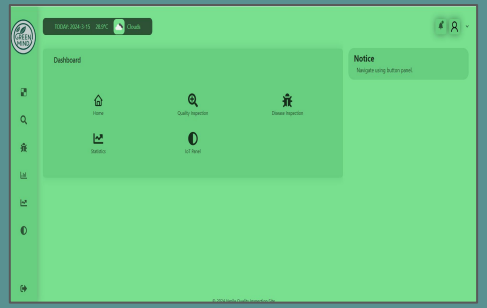


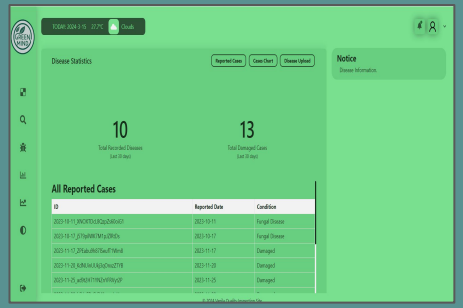
Progress up to now

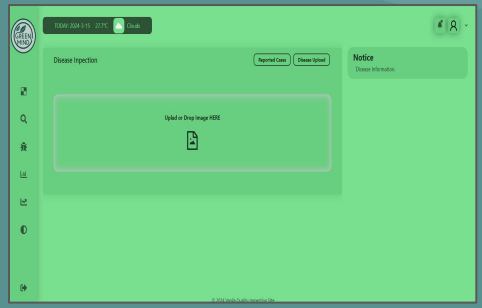
- Wireframe and UI designing











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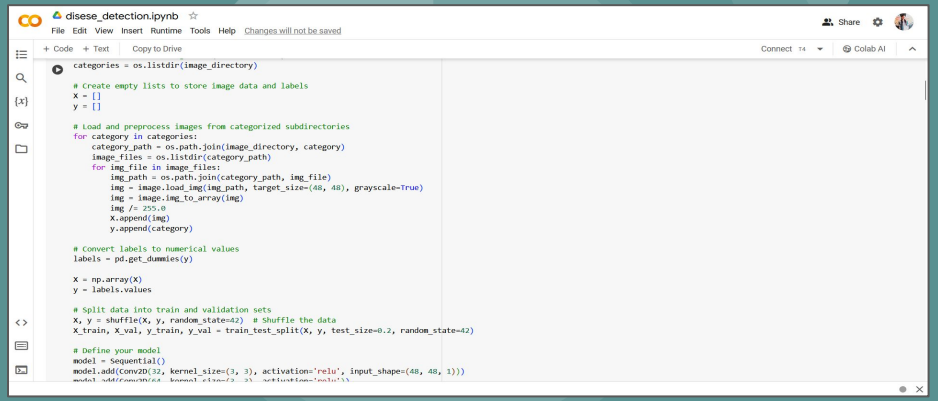
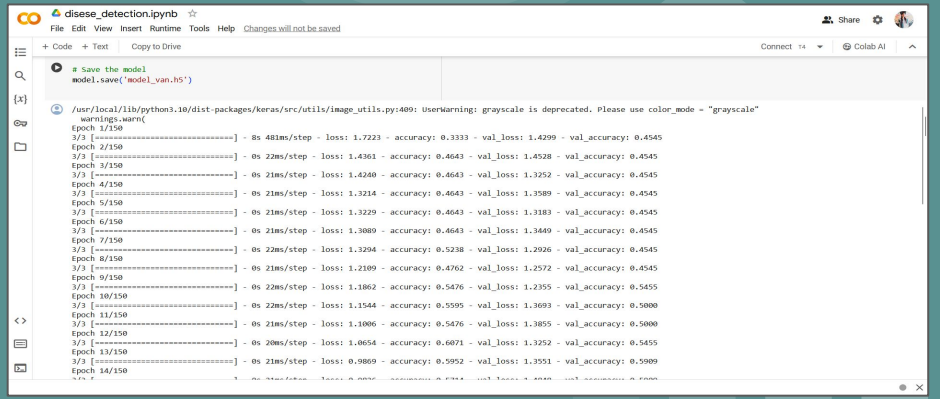
❑ DataSet

Diseases and Damage Vanilla

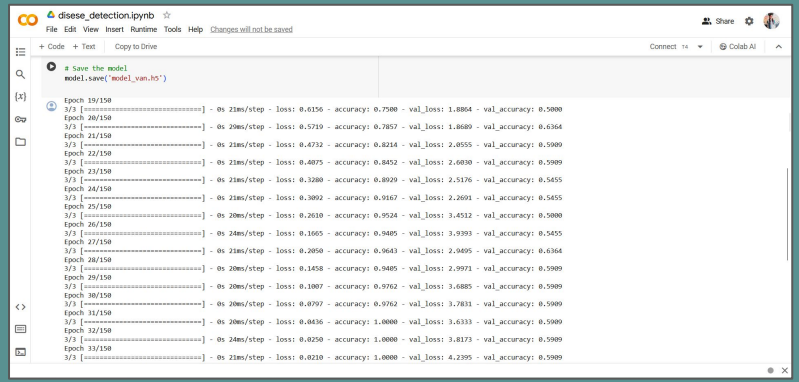
Healthy pods and flowers

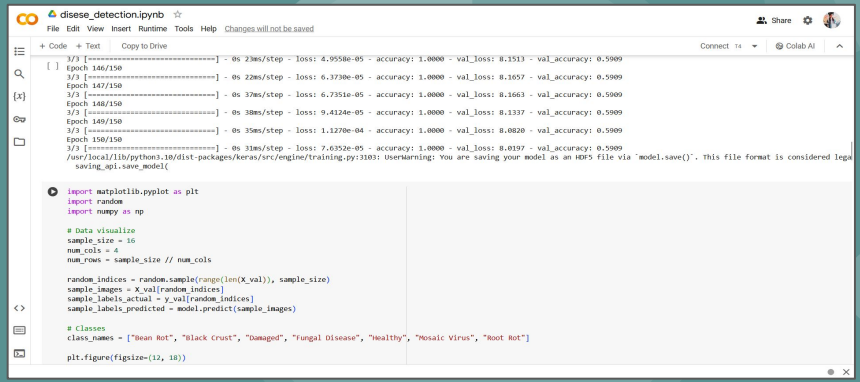
❑ Model Training - Google Co-Lab was used to train the model

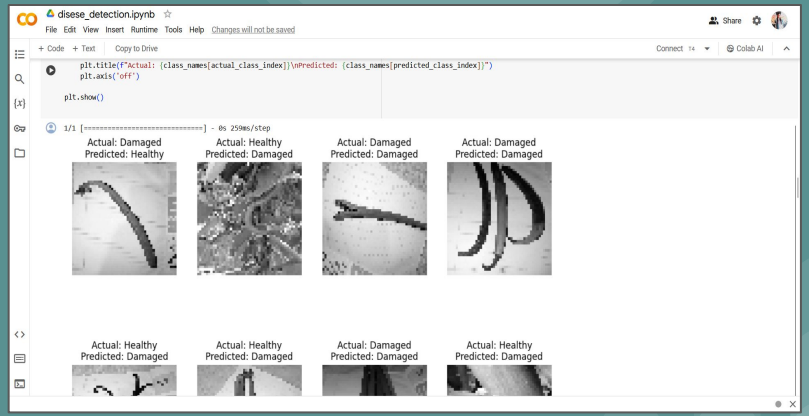




❑ Model Training







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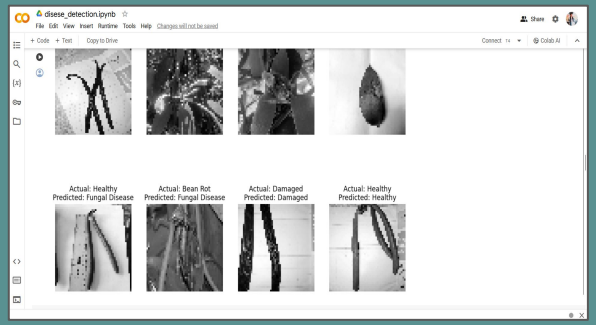
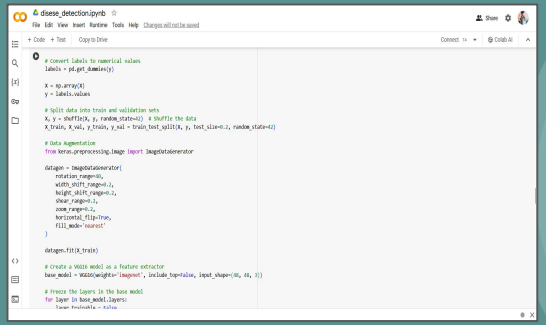
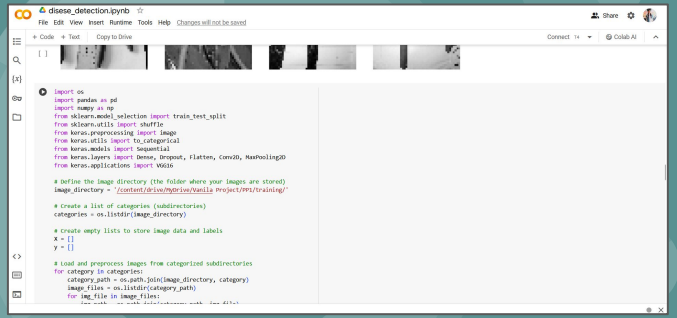
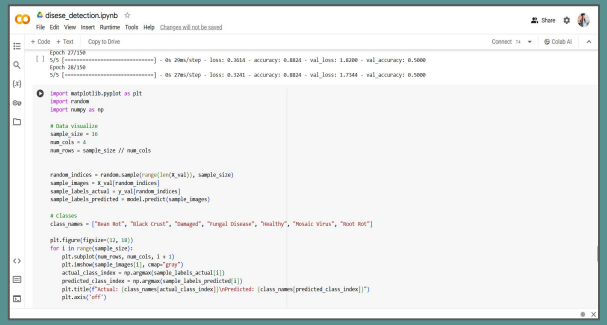
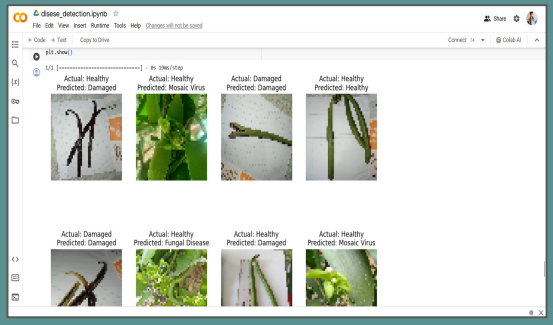
❑ Model Training

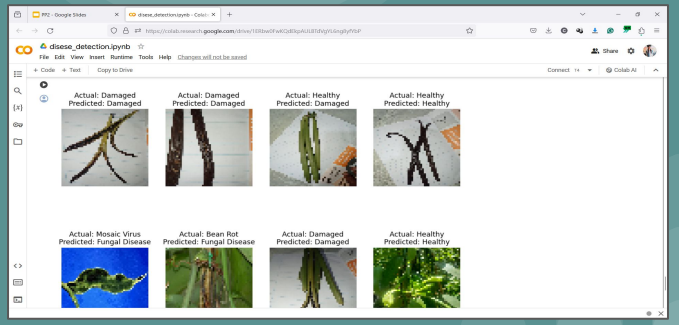












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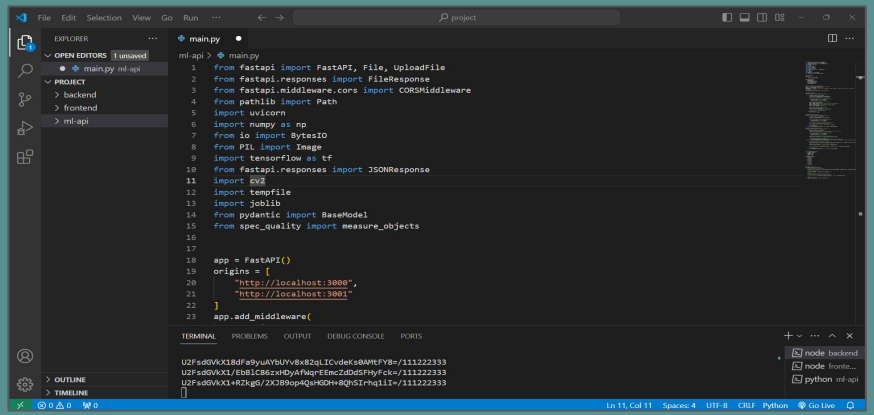
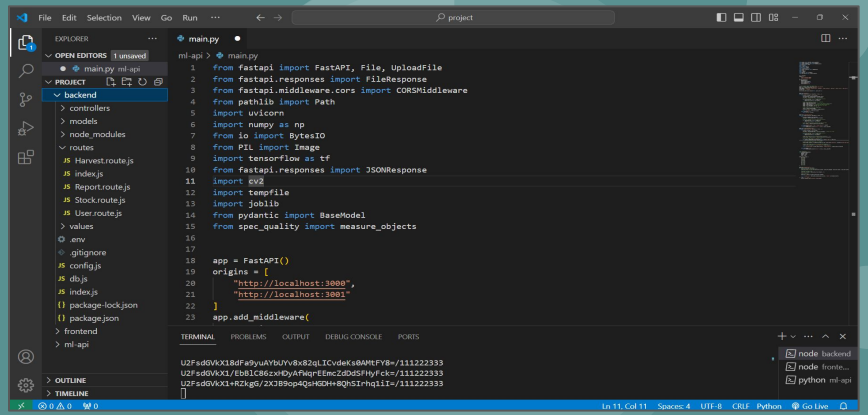
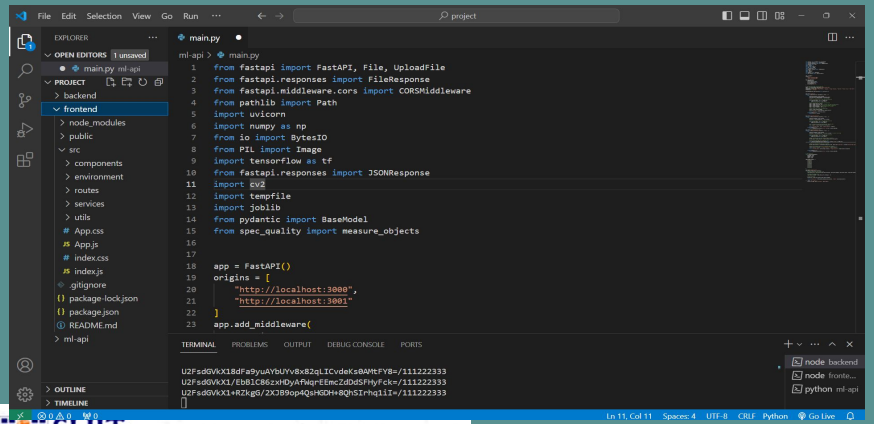
❑ VS Codes

Backend





Frontend



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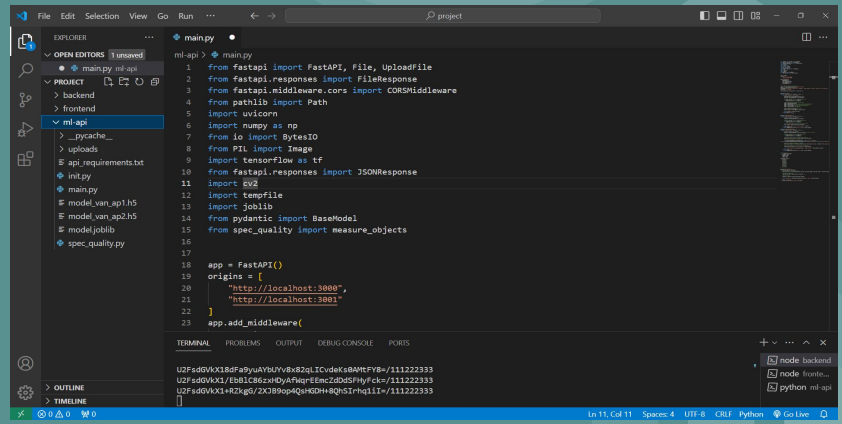

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Plant Growing and Fertilization

Background

- **Environmental Interactions:** Achieving optimal plant development and robust yields depends on understanding how environmental factors like light, water, temperature, and soil quality interact.
- **Prudent Fertilization:** Researchers emphasize the importance of judicious fertilizer use to maximize plant growth while minimizing environmental impact.
- **Customized Tactics:** By tailoring fertilization tactics to the unique needs of each plant species, researchers promote sustainable practices that protect crop health and ecosystem integrity.

Research Problem

- Identify the key indicators of vanilla quality. What are the physical, chemical, and sensory properties that contribute to the quality of vanilla?
- Develop methods for quantitatively measuring these indicators. This could involve using spectroscopy, chromatography, or other analytical techniques.
- Validate the accuracy and reliability of these methods. This could be done by comparing the results of the methods to those of human experts.

Main Objectives

- Create advanced image processing algorithms to extract relevant features from vanilla plant images, including size, color intensity, and surface texture.
- Promote healthy plant development by providing essential nutrients, water, and ideal environmental conditions.
- Enhance crop yield and quality, focusing on factors like size, flavor, and nutritional content.
- Implement sustainable practices to reduce the use of synthetic fertilizers, conserve water, and protect soil health.

Sub Objectives

- Conduct comparative analyses of vanilla pods assessed with traditional methods and the quantitative measurement system.
- Identify relevant environmental parameters affecting quality attributes (e.g., humidity, light).
- Collect a diverse dataset of vanilla plant images for algorithm training and validation.

Requirements

Functional Requirements

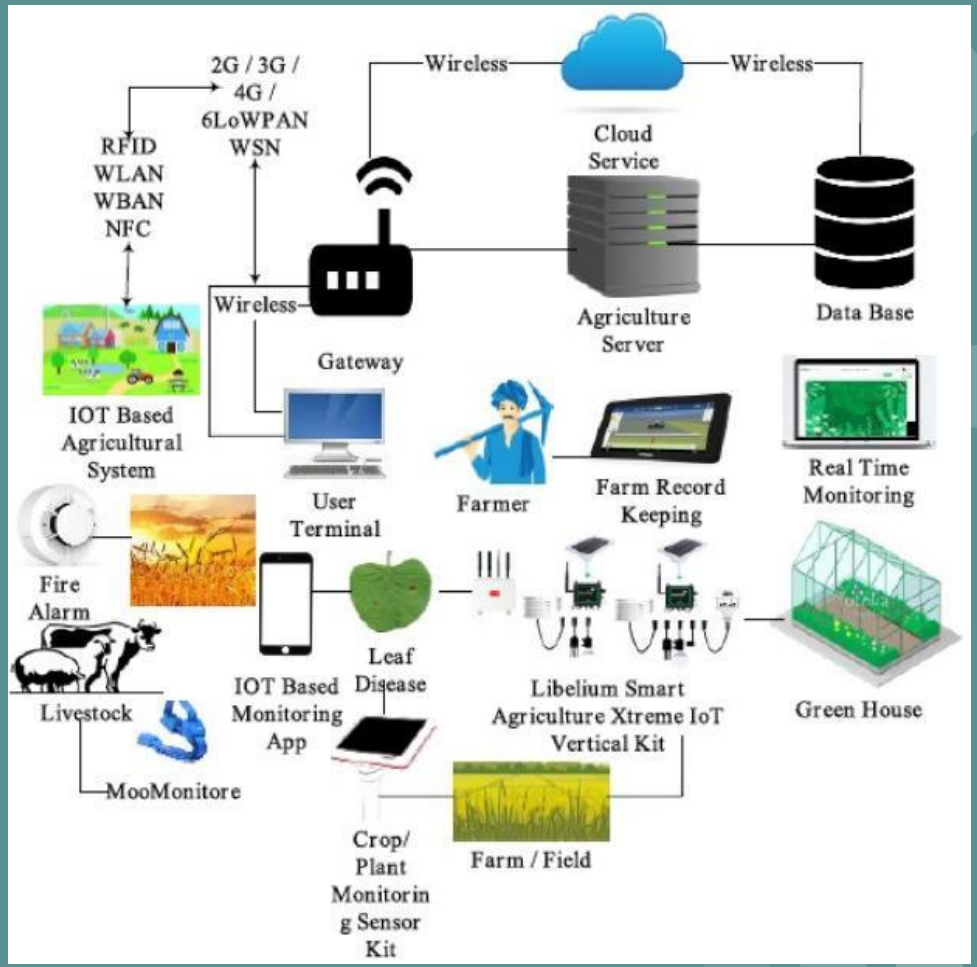
- ❑ Using IoT Devices
- ❑ Calculation of usage history
- ❑ Soil Moisture Monitoring
- ❑ Automated Watering System
- ❑ Fertilization Management
- ❑ Environmental Monitoring
- ❑ Predictive Analytics

Requirements

Non - Functional Requirements

- Reliability
- Scalability
- Usability
- Performance
- Security

System Overview Diagram



Technologies Used

THANK YOU

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