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

TMP-2023-24-105

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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

The cultivation of crops, including vanilla, is constantly evolving with the integration of advanced technologies. The success of growers and exporters in the vanilla industry depends on mitigating disease risks, refining growing techniques, and guaranteeing high-quality outputs. "Data Visualization and Decision Support," the research component, aims to provide vanilla farmers with real-time insights and data-driven assistance by utilizing data visualization techniques and intelligent decision support systems. This part seeks to improve plant health, expedite decision-making, and increase production in the vanilla sector by offering an easy-to-use interface and customized advice.

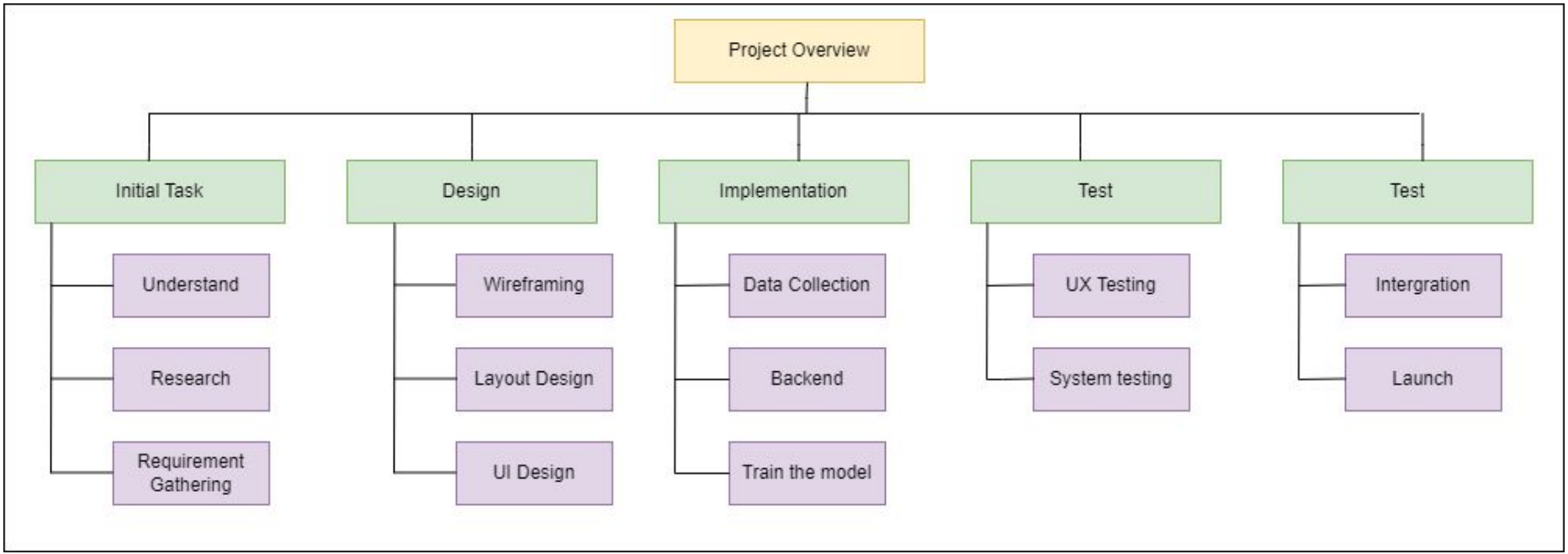
Research Question

What data sources and parameters are essential for personalized decision support in vanilla cultivation?

How to integrate machine learning for dynamic cultivation advice based on real-time data?

What are preferred data visualization formats and user communication channels?

Project Overview



Overall progress

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

Understanding Research Area

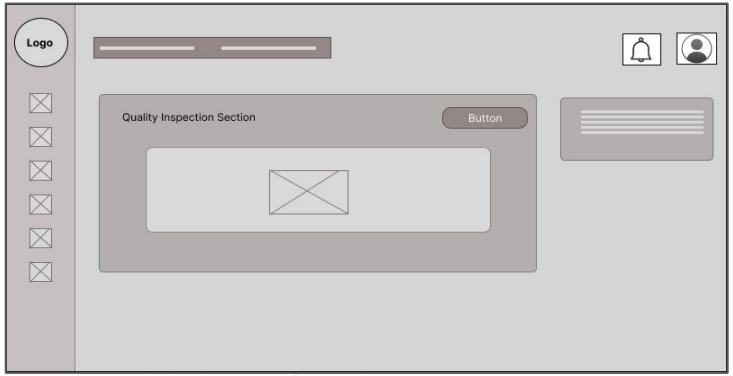
Wireframing

Sign In Page

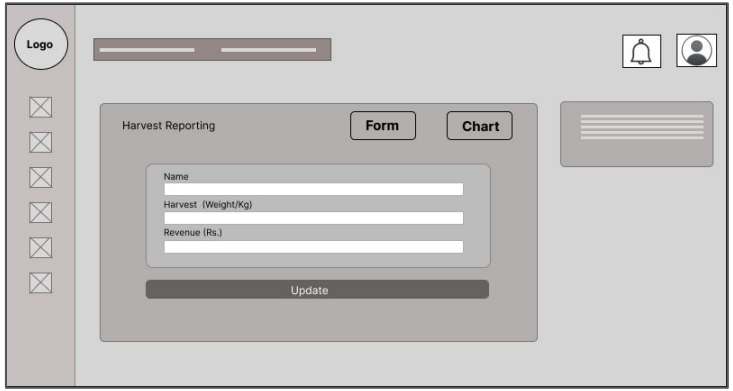
Sign Up Page

Home Page

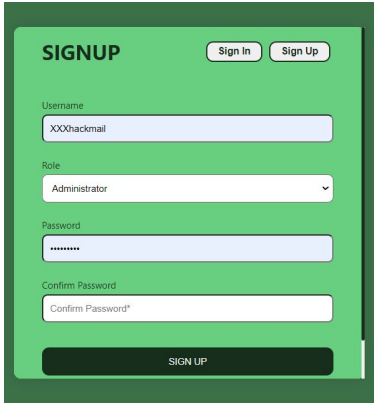
Quality Inspection Section

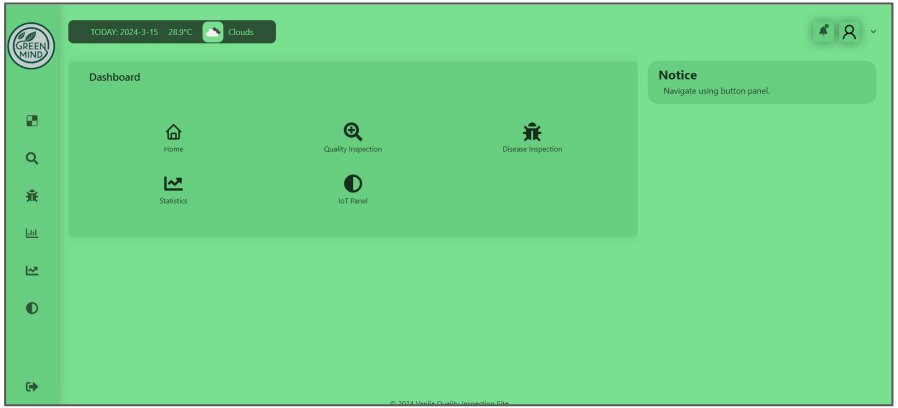


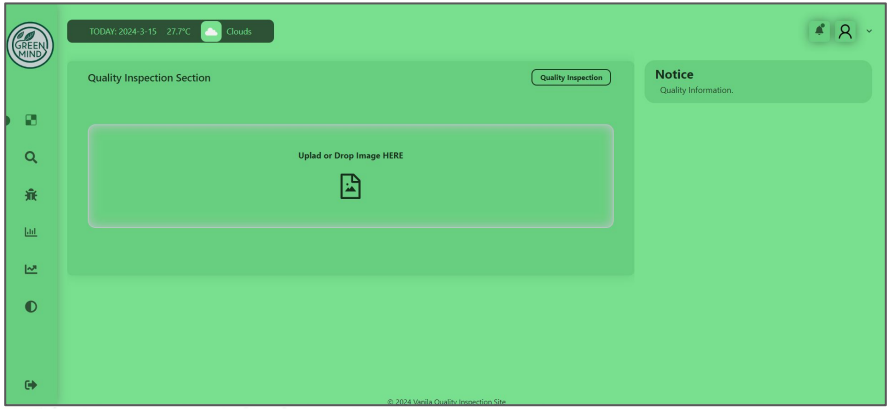
Harvest Reporting

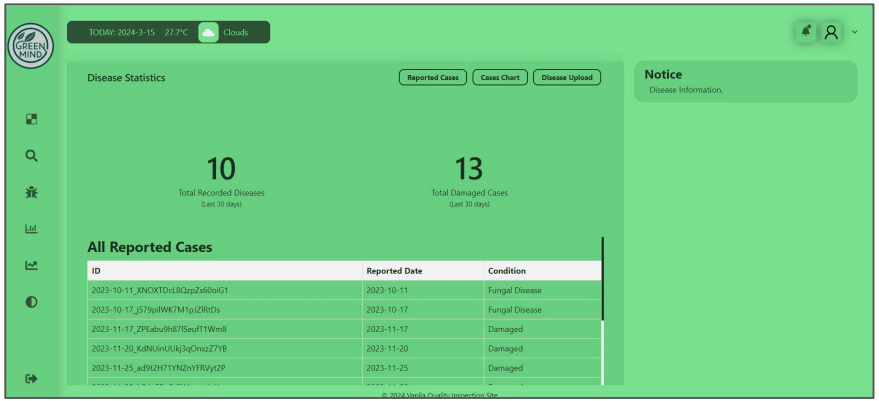


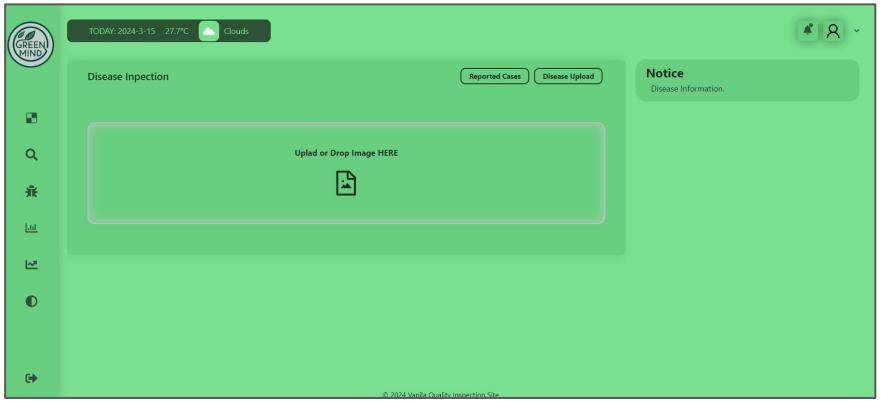
User Interface Design

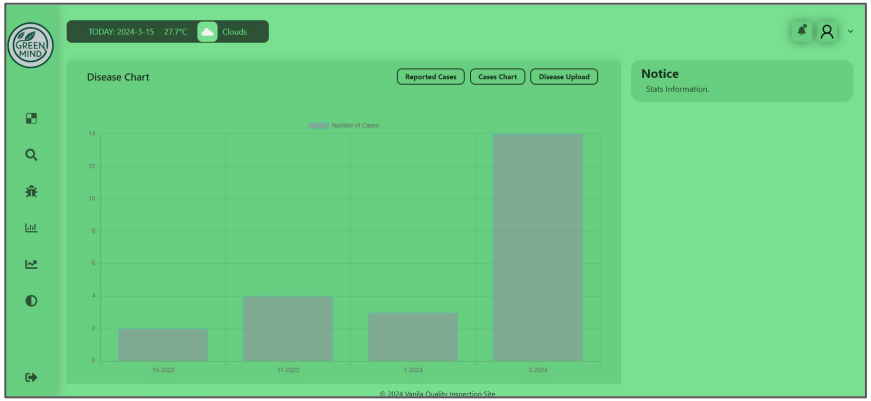












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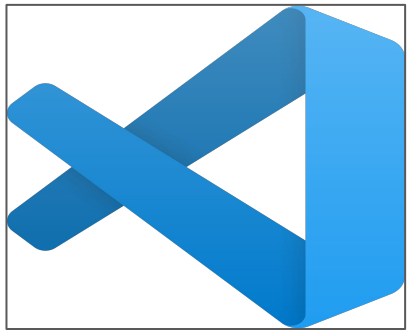
Technologies Used



Future Works

- It also creates qualitative interfaces using advanced algorithms
- Develop mobile app
- Increase accuracy in ml

INDIVIDUAL PROGRESS

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Data Visualization and Decision Support

Background

Vanilla cultivation, a cornerstone of the agricultural industry, continually faces challenges exacerbated by disease risks, cultivation optimization complexities, and the imperative for stringent quality assessment. The conventional methodologies often fall short in providing real-time insights and tailored guidance to farmers, hindering their ability to make informed decisions promptly. Recognizing this gap, our research endeavors to pioneer an integrated solution, focusing on the "Data Visualization and Decision Support" component to empower vanilla farmers with the tools they need for success.Tables and graphs provide detailed insights into harvest data and other crops, while a sophisticated machine learning system processes information from the other three components, offering predictions crucial for informed cultivation decisions.

Research Problem

Problem : Designing an intuitive interface that effectively caters to the diverse technological backgrounds of vanilla farmers.
Context: Vanilla farmers may have varying levels of technological proficiency, requiring the interface to be user-friendly and accessible to a broad audience.

Problem: Ensuring seamless integration of data from the Plant Disease Analyzer and Plant Growing and Fertilization components for real-time insights.
Context:Context: Integrating data from multiple sources poses challenges in maintaining data accuracy, consistency, and timeliness.

Enhancing the accuracy and speed of real-time predictions generated by the machine learning system.

Main Objectives -

By leveraging data visualization techniques and intelligent decision support systems, this component aims to provide real-time, actionable information to farmers, enhancing their ability to make informed decisions, optimize cultivation practices, and ultimately elevate the productivity and success of vanilla farming.

Sub Objectives -

Integrate machine learning algorithms to process and analyze data from fault detection, condition measurement and disease detection components and seamlessly integrate machine learning predictions to provide real-time insights.

Design visually appealing representations of harvest and crop data using tables, graphs, and charts.

Ensure smooth data exchange between the Data Visualization and Decision Support component and other components such as Plant Disease Analyzer and Plant Growing and Fertilization.

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.

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Plant Disease Analyzer

Background

- Vanilla is an economically and commercially important export crop in Sri Lanka. The main challenge for high commercial-value vanilla plants is susceptibility to various diseases. Vanilla farmers, agricultural researchers, and exporters face a huge crisis as vanilla plants are susceptible to various diseases.
- The "Plant Disease Analyzer" component contained in our research determines whether the vanilla plant is healthy or not, and if it has a disease, it gives details about the disease and what remedies should be done for it.
- 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

Functional Requirements

1. Image Capture and Upload:

- Users should be able to upload images of diseased plants.
- The system should support various image formats, including photos.

2. Image Processing:

- The system should process the uploaded images to extract relevant information.
- It should identify key plant parts, such as leaves, stems, and fruits.
- Image enhancement and noise reduction may be required to improve analysis accuracy.

3. Disease Detection:

- The system should be able to detect diseases or anomalies in the plant based on the processed images.
- It should use image analysis techniques, machine learning, or AI algorithms for disease identification.

4. Disease Classification:

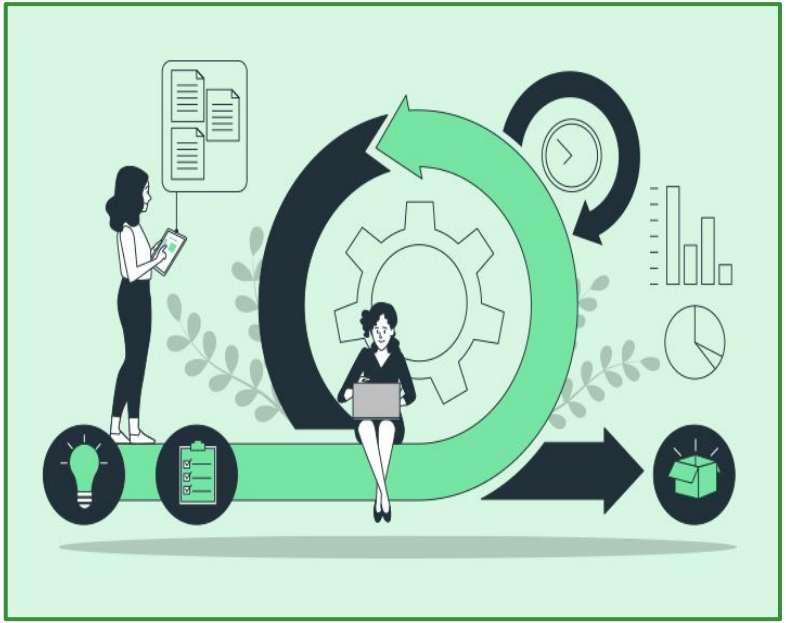
- The system should classify the detected diseases into specific categories.
- It should provide information on the identified disease, including its name and symptoms.

5. Accuracy and Confidence Levels:

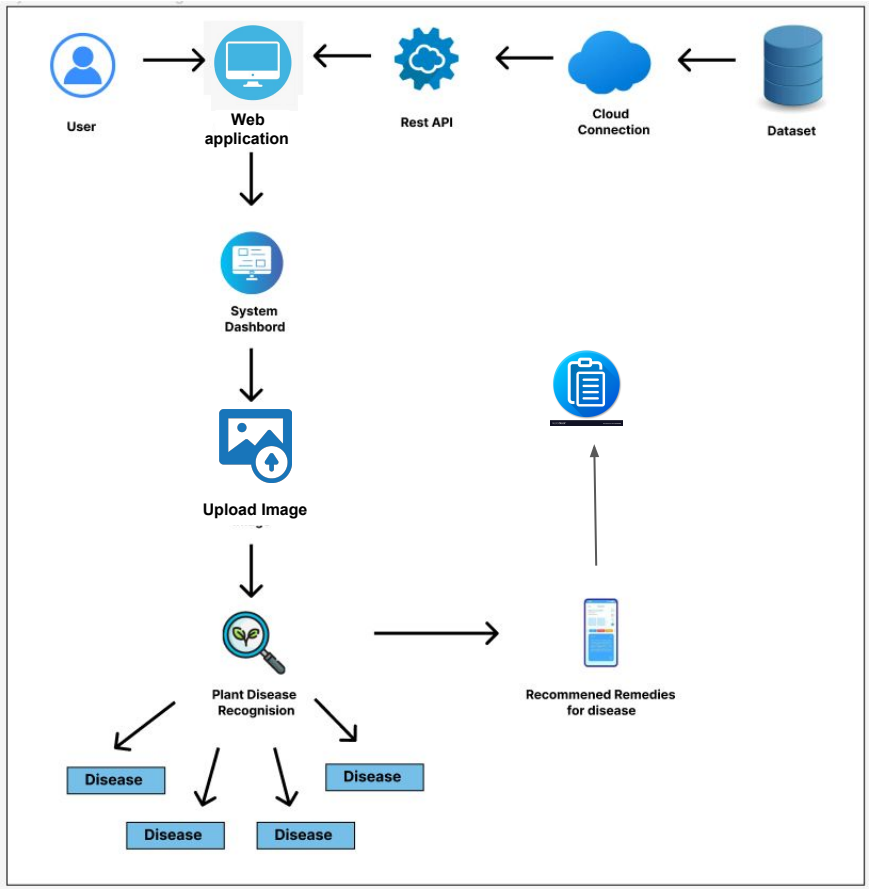
- The system should provide a confidence level or accuracy score for the disease detection.
- Users should be aware of how certain the system is in its diagnosis.

Non - Functional Requirements

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

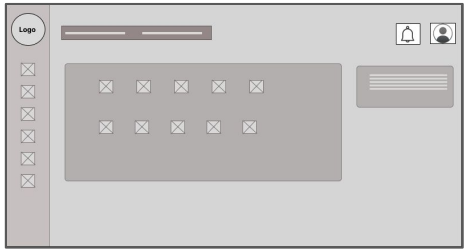


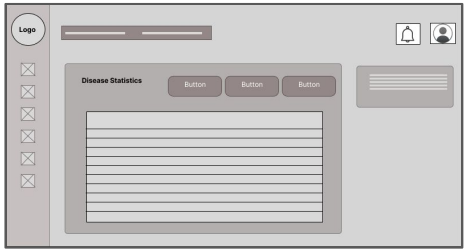
System Overview Diagram

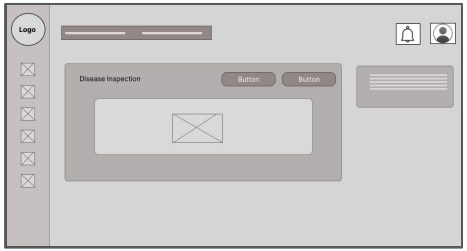


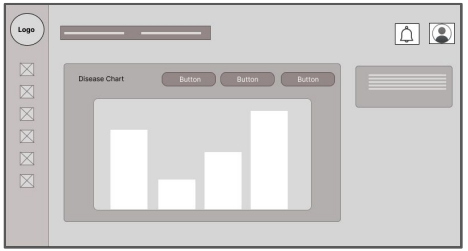
Progress up to now

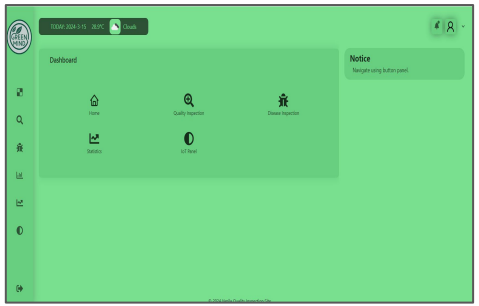
- Wireframe and UI designing

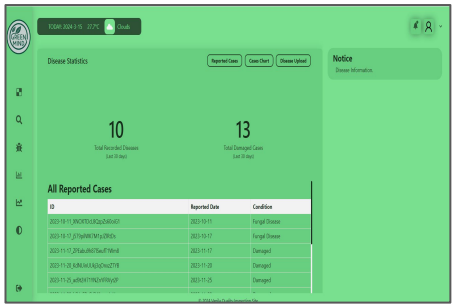


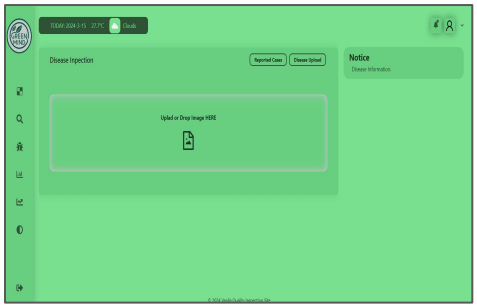


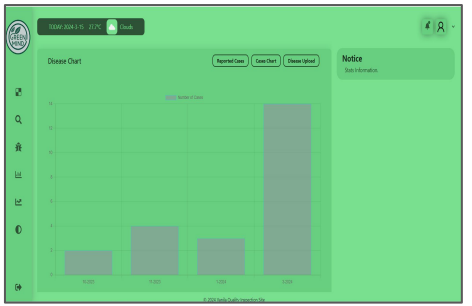










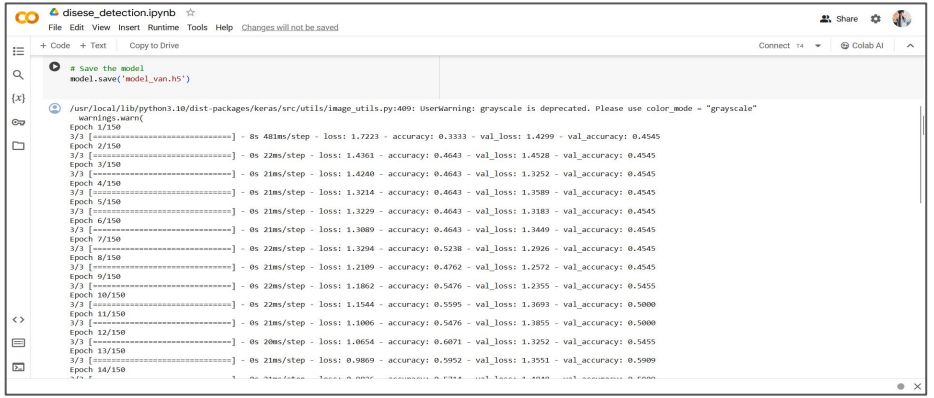


❑ DataSet

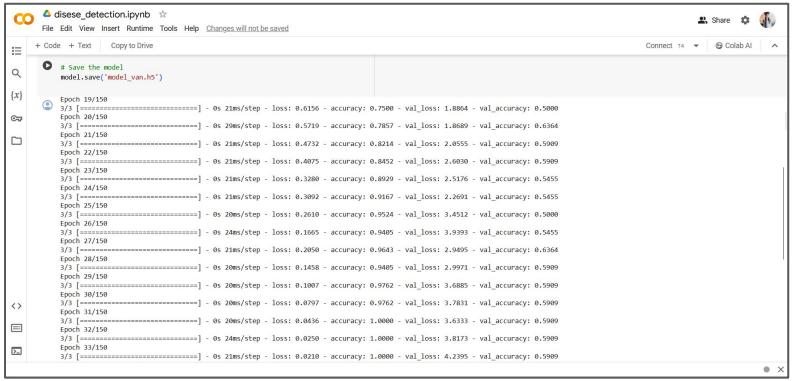
Diseases and Damage Vanilla

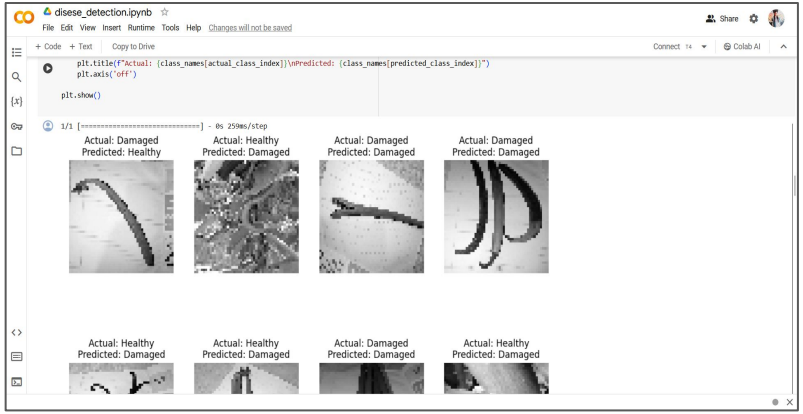
Healthy pods and flowers

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

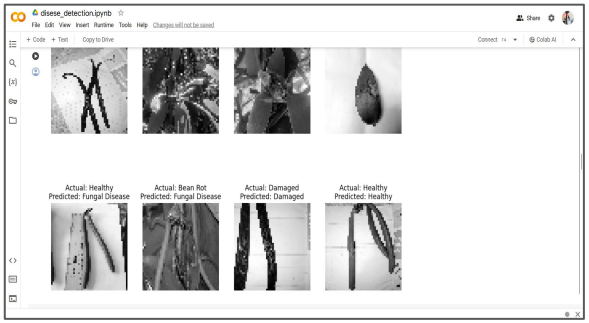


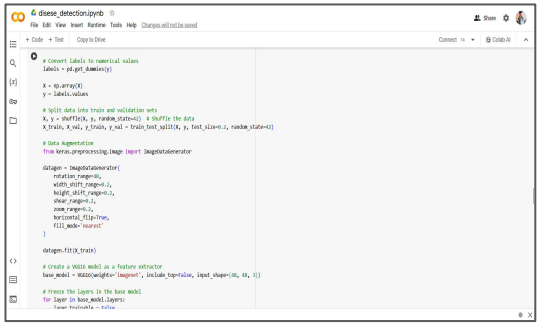
❑ Model Training

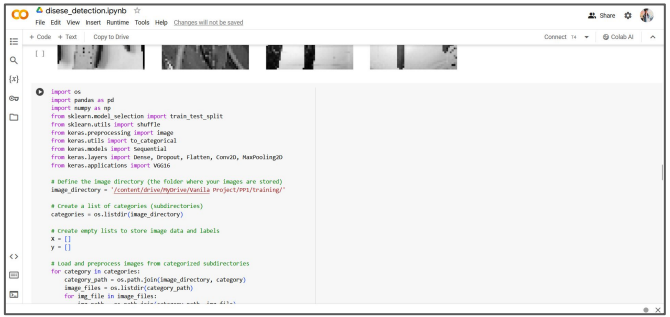


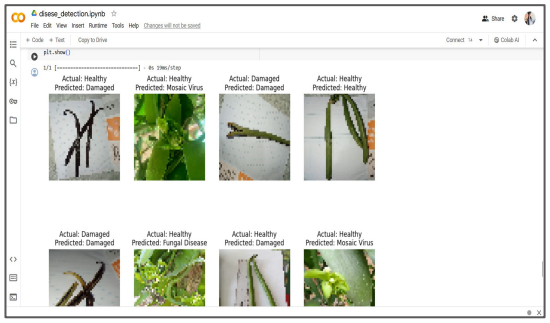


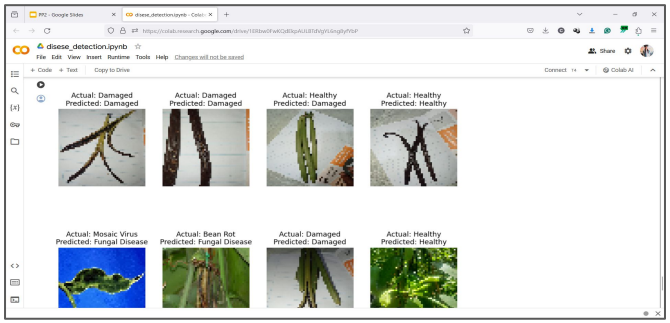
❑ Model Training





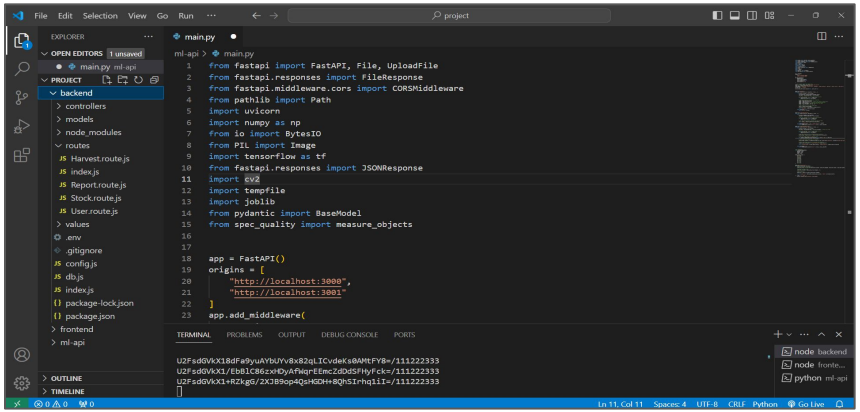




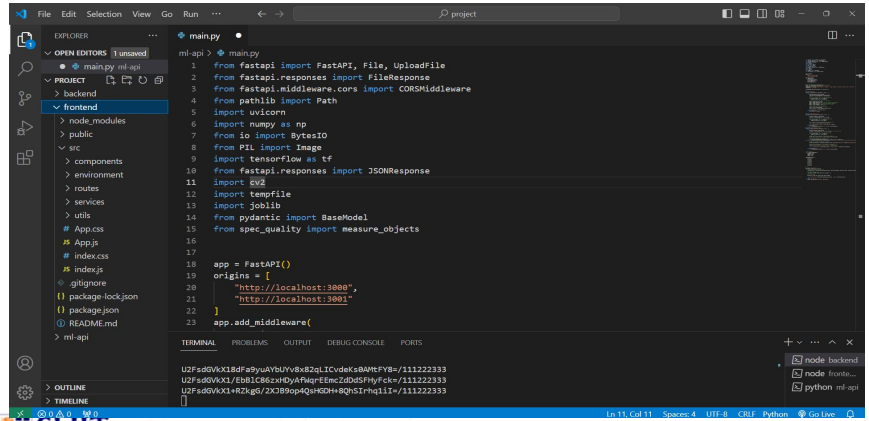


❑ VS Codes

Backend



Frontend



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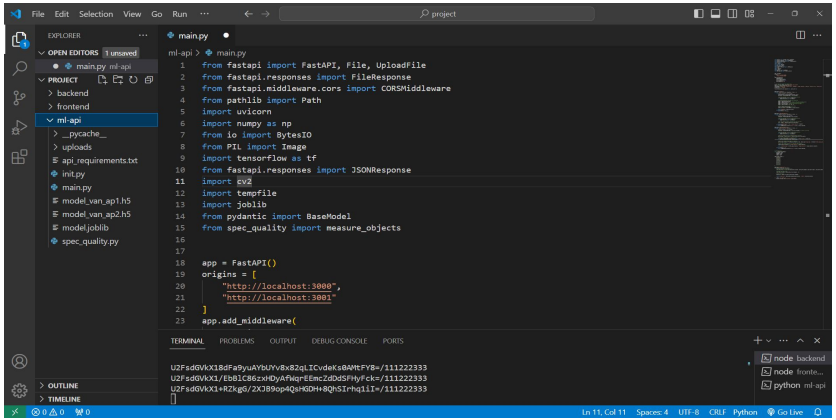
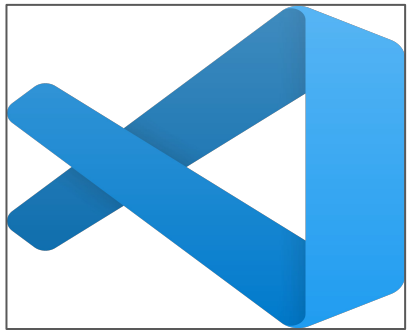


Technologies Used



Future work

- Improve the data set and Increase accuracy.
- Develop mobile app

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Quantitative Quality Measurement

Background

The "Quantitative Quality Measurement" component is crucial in smart vanilla cultivation, analogous to disease management's significance in crop health. Like disease detection, timely intervention is vital. Vanilla pod quality assessment holds immense importance as well. Accurate measurements and standardization of attributes like size, color intensity, and surface texture are pivotal for market value and desirability. This component bridges the gap between traditional subjective methods and precise, data-driven evaluations, enhancing vanilla cultivation practices and establishing consistent quality standards.

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.

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

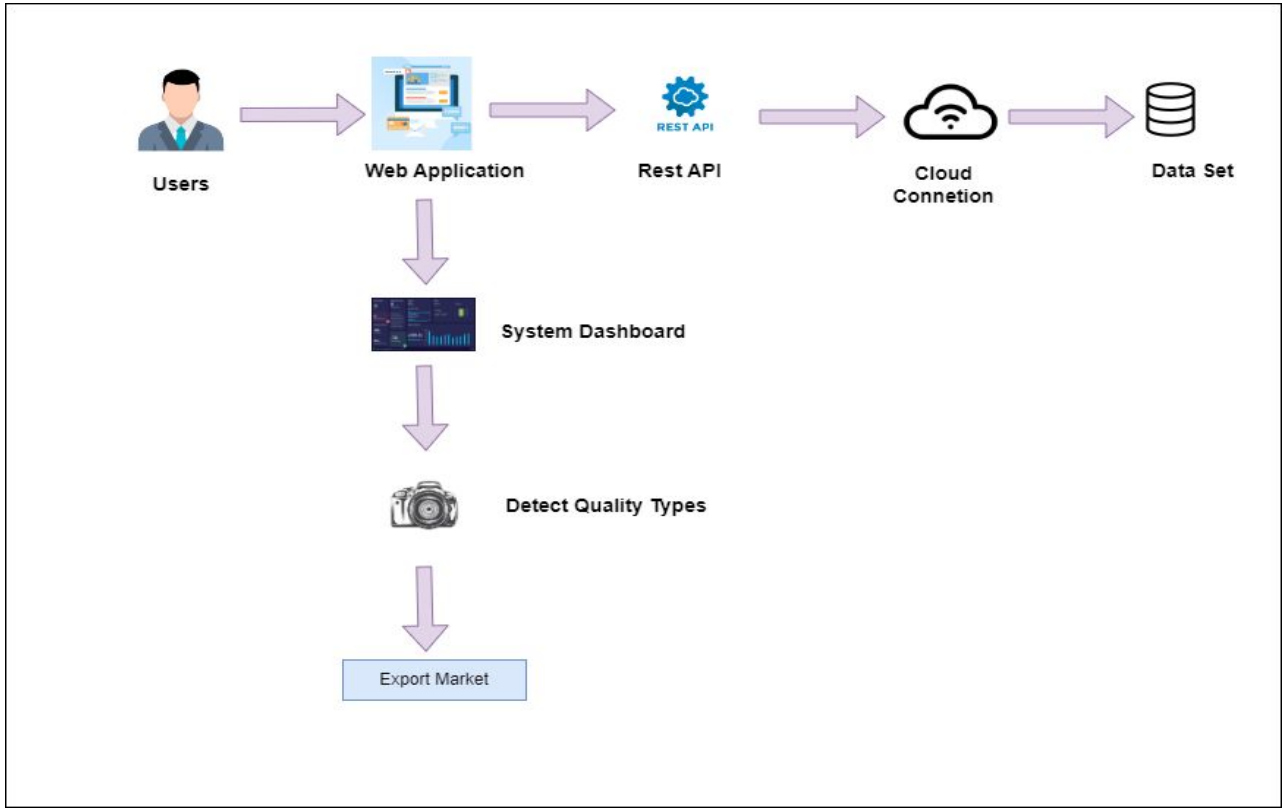
Functional Requirements

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

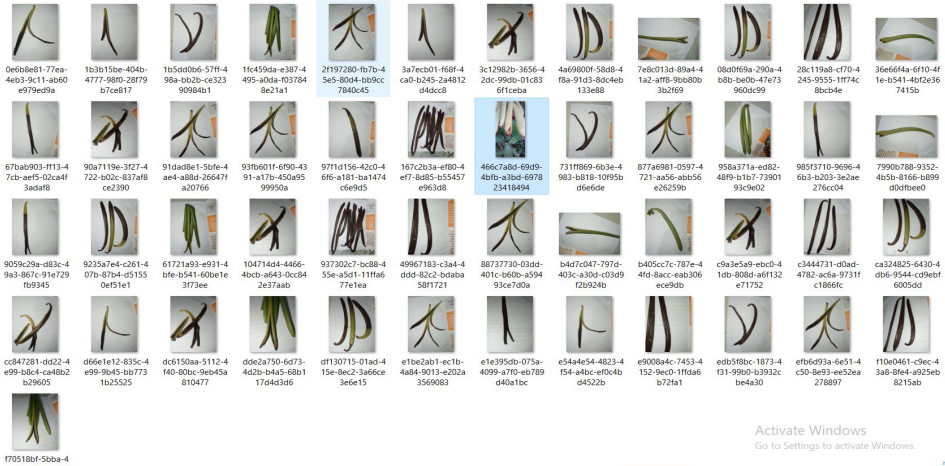
Non - Functional Requirements

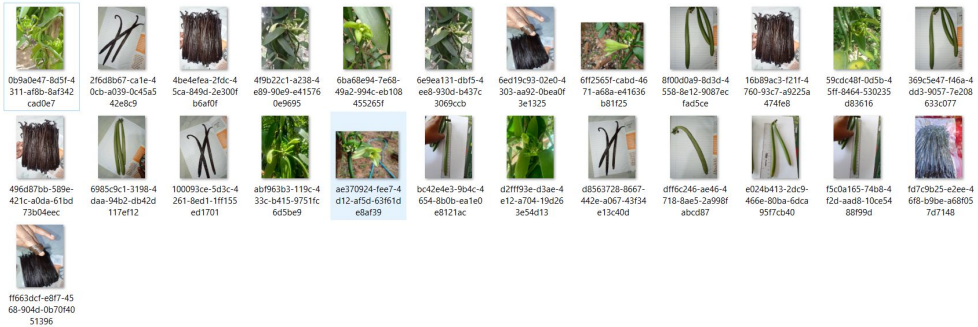
- Accuracy and Precision:
- Usability and User-Friendly Interface:
- Compatibility and Integration:

System Overview Diagram



DataSet





Future work

- Looking forward to using the iot sensors to see the weight of the pods.

Demo

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Plant Growing and Fertilization

Background

Optimizing plant development and guaranteeing robust yields requires an understanding of the complex interactions between environmental factors like light, water, temperature, and soil quality as well as the prudent use of fertilizers. Researchers seek to improve agricultural output while reducing environmental impact and promoting sustainable practices that protect crop health and ecosystem integrity. They do this by carefully examining the needs unique to each plants and developing customized fertilization tactics.

Research Problem

Sustainability of the environment and global food security depend on research on sustainable fertilizing methods for particular crop cultivation. In addition to reducing resource waste and environmental harm, effective fertilizers tailored to various soil types can boost output. Comprehending soil microbes improves plant health, while precision farming and controlled-release fertilizers maximize nutrient usage. Research over the long term preserves soil fertility and ecosystem resilience. There are sustainable substitutes by investigating other nutrient sources like compost and biochar. Resilient agricultural systems that protect natural resources and fulfill future demands are promoted by interdisciplinary research.

Main Objectives -

Using IoT devices and machine learning technology to create quality crops by controlling water and fertilizer application and environmental climate

Sub Objectives -

Determining the history, and future of fertilizer and water rates using IOT data

Using IoT devices to use rainwater for water conservation

Requirements

Functional Requirements

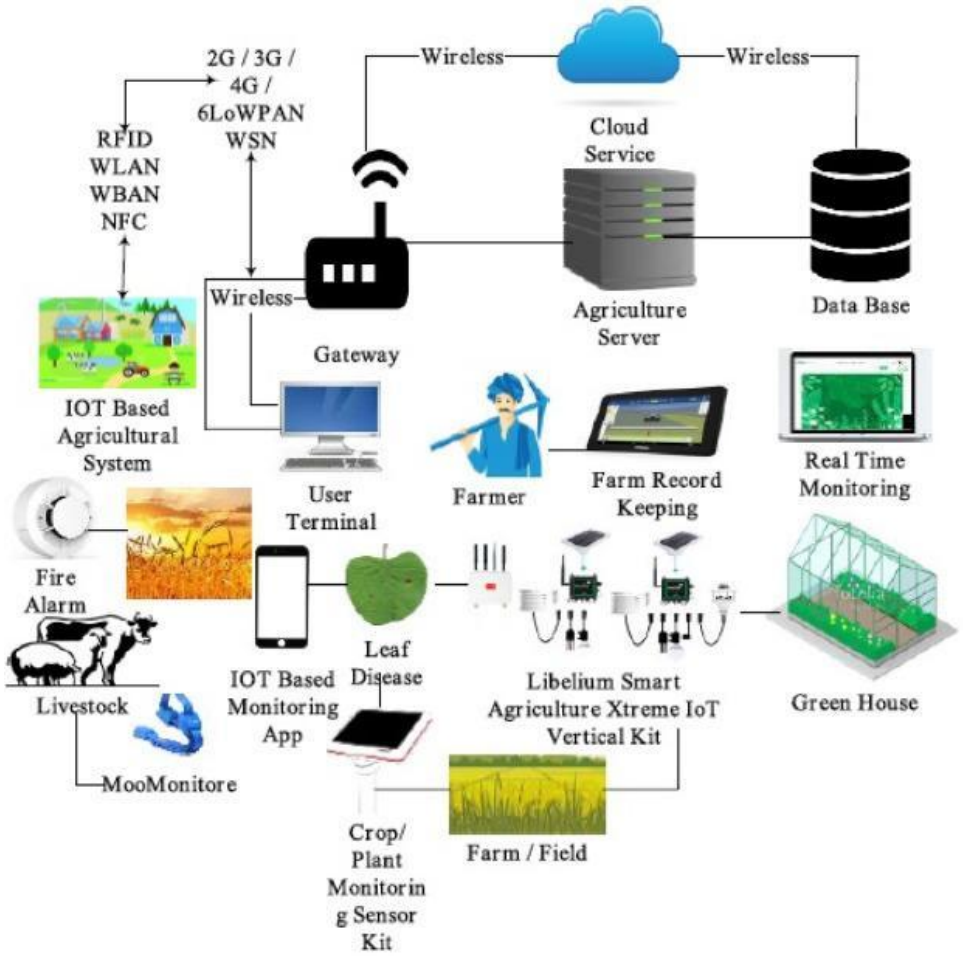
- Using IoT Devices
- Calculation of usage history
- Soil Moisture Monitoring
- Automated Watering System
- Fertilization Management
- Environmental Monitoring
- Predictive Analytics

Requirements

Non - Functional Requirements

- Reliability
- Scalability
- Usability
- Performance
- Security

System Overview Diagram



Future work

- Water and fertilizer collection using drones for a large area
- Using a camera to measure the quality of the vanilla plant
- Use of renewable energy
- Removal of diseased leaves and harvesting by robots
- Integration of additional environmental sensors for comprehensive monitoring
- Enhancement of machine learning algorithms for more accurate predictions
- Incorporation of remote monitoring and control features for ease of management

Demo

THANK YOU