TECHFIESTA 2025

TITLE PAGE

- **Problem Statement ID –** T2K25A1
- **Problem Statement Title-** Crop Disease Detection
- **Domain -** Agriculture
- **Team Name -** Team Shourya
- **Team Leader Name -** Shubham Pawade

Idea/Approach Details

Our Solution

- **Analyze crop images using AI** to accurately detect diseases and provide tailored **treatment recommendations**, including chemical and organic options.
- **Geospatial Visualization** of disease occurrences on a map, helping farmers see regional risks
- Offer **offline functionality**, enabling farmers in remote areas to access disease detection and treatment advice without internet connectivity.
- Provide a user-friendly interface with **multi-language support**, making it **accessible** to farmers from diverse regions and backgrounds.
- Farmers also get **personalized expert advice.**
- Include an **educational resource hub** to help farmers learn about modern farming techniques, disease prevention, and **sustainable crop management.**

Prototype : https://shetkarisahayak.onrender.com

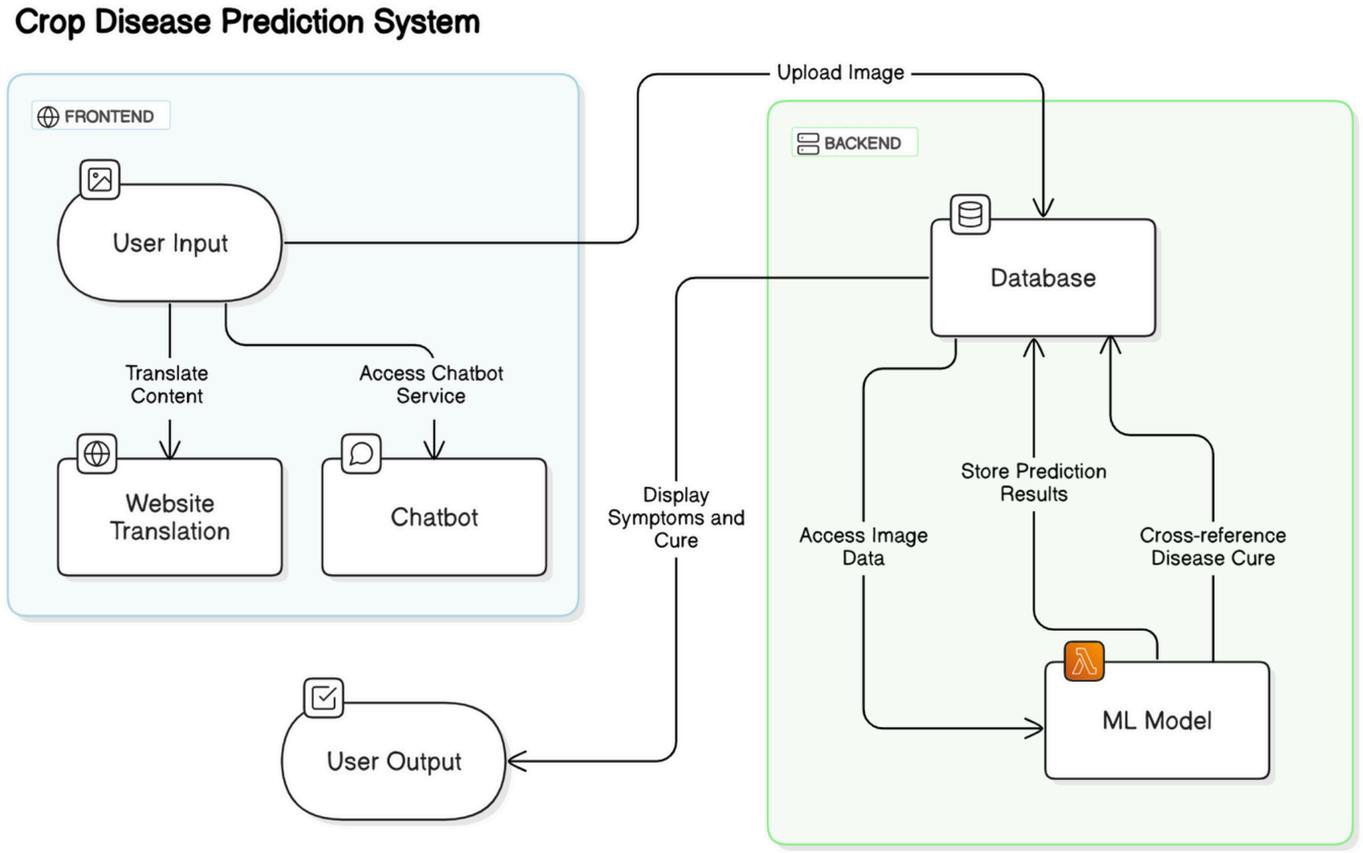
Problem Resolution

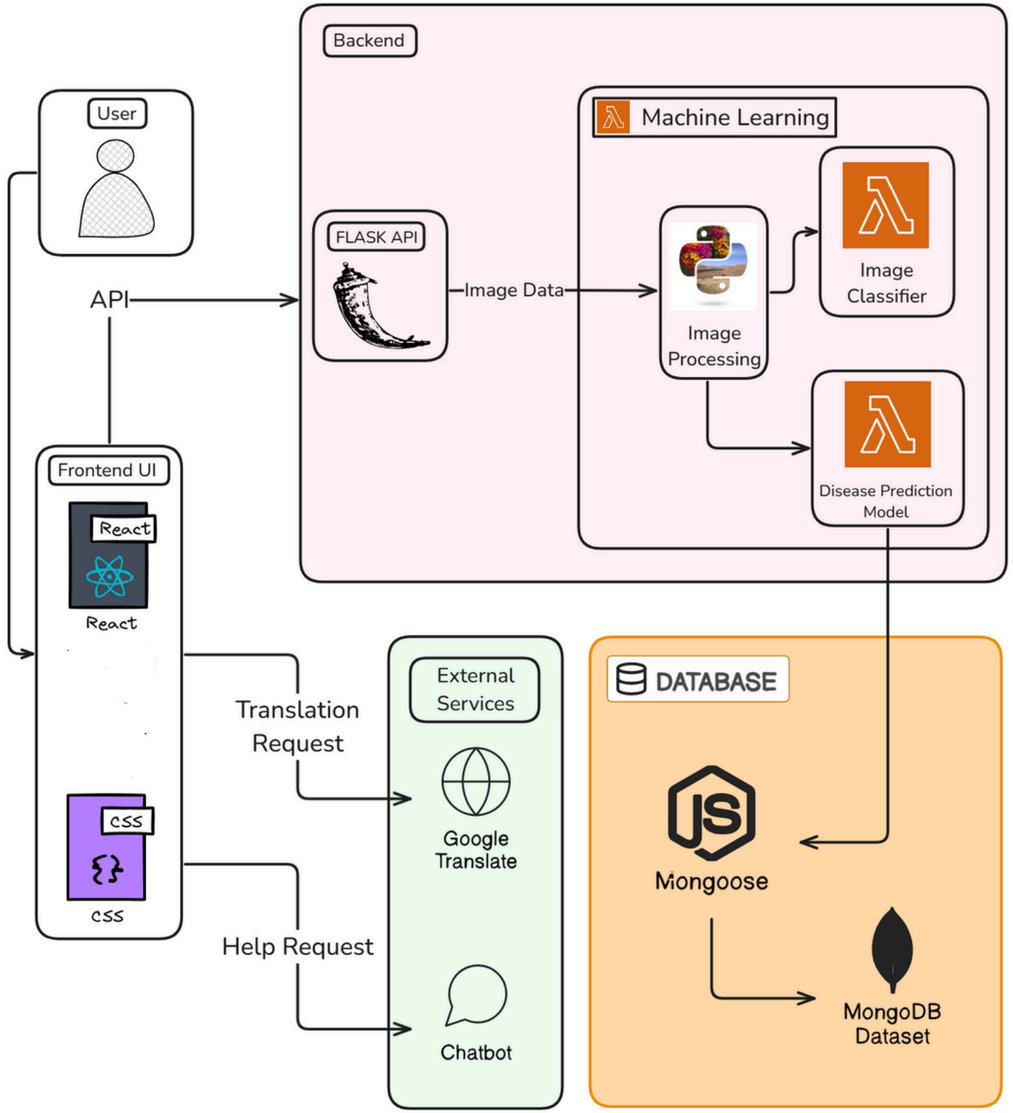
- **Early Detection :** Our AI driven system predicts crop diseases early and provides **personalized treatment recommendations** by integrating real-time crop, soil and environmental data.
- **Educational Awareness :** Our platform provides **awareness** about correct usage offertilizers by an appropriate amount and also spreads awareness to improve soil health and foster good crops.

Unique Value Propositions

- **Multi-Language Support:** Provide recommendations and interface in regional languages for accessibility across diverse locations.
- **Mobile-Friendly and Offline Capability:** Develop a lightweight mobile app with offline functionality for use in low-connectivity areas.

Process Flow Diagram and System Architecture





Methodology Used

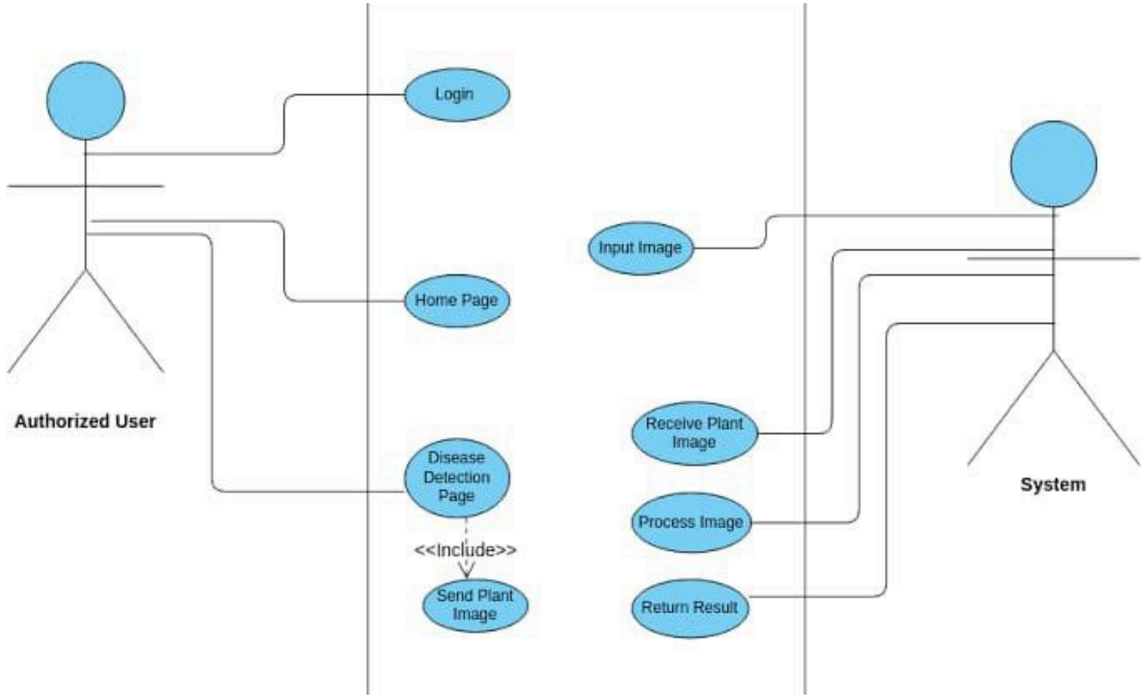
- **Problem Research:**
  - Performed in-depth research on crop diseases, their symptoms, and existing detection techniques. Also interacted with local farmers and professors to get ground problems. Which leads to get Identified target crops and diseases based on severity and prevalence.
- **Data Collection & Preparation:**
  - Collected **10K–12K images** from various sources, including field surveys with local farmers, to gather real-world disease samples.
- **Image Pre-processing:**
  - Converted images into RGB numerical arrays, representing pixel intensities as input for the deep learning model.
  - Standardized image dimensions to **224x224 pixels** for uniform model input.
  - Pre-processed images to remove noise and improve clarity using **Gaussian Blurring.**
- **Model Development:**
  - Decided to go with **Convolutional Neural Network (CNN)** as the core architecture for image classification
  - Used Transfer Learning with model **ResNet-50** (Residual Network is a pre-trained model with Millions of parameter) for faster training and high accuracy.
  - Implemented Batch Normalization for performance improvement and also conducted **HyperParameter Tuning** to optimize the model for **F1 Score, Accuracy, Recall and Precision**.
- **Customising Pre-Trained Model:**
  - *Two Nodes at output layer one for prediction of crop and another for simultaneous prediction of disease.*
  - Using **Softmax Activation Function** for the output layer.
  - Modifying existing **ResNet-50** architecture to support **Multi Task Learning.**
- **Model Deployment:**
  - We deployed the trained model on **AWS** (Amazon Web Services).
  - Used Flask for communication between the frontend and backend.
- **User Interface:**
  - Created a responsive web interface using HTML and CSS for user experience.
  - Developed a cross platform Mobile App to endure accessibility across mobile devices.
- **Post-Detection Analytics:**
  - Designed interface which shows:
    - Identified Disease.
    - Treatment for the Disease
    - Recommendations based on the detected disease.
    - Preventive measures, remedies and disease.
    - Suggest sources for further actions
- **Extra Features:**
  - Upto date Government schemes.
  - Current weather status as well as future weather recommendation.
  - Provided contacts and Sites for fertilizers and Remedies.

SOLUTION CONCEPT AND FEASIBILITY

SOLUTION CONCEPT	FEASIBILITY
End-to-End Platform	• Farmers upload images, receive diagnosis, and obtain treatment options or market recommendations. • Feasible with mobile apps and cloud-based image processing services.
Availability in Rural Areas	• Achievable with TensorFlow Lite or PyTorch Mobile for offline support on low-resource devices.
Scalability	• Our solution requires minimal infrastructure, allowing easy deployment through cloud-based services.

Use cases & description

- **Real-Time Disease Diagnosis:** Farmers can upload crop images via a mobile app for instant disease detection and treatment suggestions.
- **Offline Functionality:** Supports rural areas using lightweight frameworks like TensorFlow Lite.
- **Policy Support:** Enables data-driven policymaking through disease analysis.
- **Educational Tool:** Assists agricultural students and workers in learning disease characteristics through real-life examples.
- **Multi-Crop Support:** Diagnoses diseases across various crops for diversified farming.
- **Research Tool:** Provides datasets for researchers to uncover patterns and develop advanced crop protection strategies.
- **Early Warning System:** Detects regional patterns to issue warnings and prevent epidemics.



Technology stack used

Technology Stack

- **Preprocessing**: PIL (Python Imaging Library), NumPy, Pandas
- **Deep Learning Model:** ResNet-50, TensorFlow, Keras, PyTorch
- **Backend:** Flask, MongoDB
- **Frontend:** React.js, Tailwind CSS
- **Deployment:** AWS

PIL

React

Tailwind CSS

Constraints

Potential Risks	Overcoming Strategies
Generalized ML Model	Built localized data pipelines with user-uploaded images and regional agricultural data.
Internet Availability	**In-App Functionality:** Enable farmers to check for potential crop diseases offline
Resistance to Change	• Simple and user friendly interface • **Performance Metrics:** Monitor and publish success stories showing improved yield and reduced costs to build trust and confidence
Limited Farmer Tech Awareness	Provide in-app interactive tutorials to simplify usage for non-tech-savvy users.