

# AI & Robotics Project Documentation

## Plant Disease Detection Neural Network

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### Problem Statement

I developed an AI-powered solution to help farmers detect plant diseases early and accurately. Farmers often face challenges in identifying diseases due to limited access to expert knowledge and the visual similarity between symptoms of different infections. This results in poor crop health, reduced yield, and overuse or misuse of pesticides, which also affects the environment. I identified this problem by scouring youtube videos, reddit threads, and reading news articles. The consistent mention of disease misdiagnosis and lack of technical support for small farmers confirmed the importance of building a reliable AI-based detection tool. This issue directly impacts small and medium-scale farmers who lack access to trained agricultural experts. Correct and early identification of plant diseases can help them take timely action, reduce crop loss, and lower their dependence on harmful chemicals. It contributes to improving food security and protecting livelihoods.

### Relevance to SDG

My project supports the United Nations Sustainable Development Goal 15, Life on Land. It promotes sustainable farming practices by helping reduce chemical use and encouraging healthier crop management, which in turn protects ecosystems and biodiversity.

### Technical Details

I used the PlantVillage dataset, which includes around 38 plant disease classes and 37,000 leaf images. I processed and cleaned the data, then tested multiple deep learning models including MobileNetV2, MobileNetV3, and Inception. MobileNetV2 performed best in terms of accuracy and speed, which made it ideal for deployment. I built the user interface using Flask for the backend and HTML for the frontend, allowing users to upload images and receive instant predictions.

The system works by taking an image of a plant leaf as input, passing it through the trained MobileNetV2 model, and returning the predicted disease class with high accuracy. The model was trained on labeled image data and optimized using cross-entropy loss. The Flask web app handles the image input, runs inference using the model, and displays the results to the user.

## Project Execution

This approach is lightweight and works well on mobile devices or low-power hardware, which makes it better suited for rural deployment than heavier models. It combines an efficient model architecture with a simple user interface, making it practical for real-world use. The main cost involved was cloud computing resources for training, but the system itself can be deployed at low cost. It took about three weeks to complete the project, including data processing, model experimentation, UI development, and testing. The model is efficient and promotes sustainability by helping farmers use chemicals more responsibly.

The model currently relies on clear, close-up images of leaves. It may not perform well on images with multiple leaves, poor lighting, or background noise. Future improvements can include support for real-time mobile camera input and multi-disease detection in a single image.

## Github Repository

<https://github.com/gwenolith/Plant-Disease-Detection-LGP>

## PlantVillage Dataset

<https://www.kaggle.com/datasets/emmarex/plantdisease/>