

1. Model Selection

- Convolutional Neural Network (CNN) model is used for image classification.
- Chose CNN because it is highly effective for image recognition and pattern detection tasks like disease classification from leaf images.

2. Dataset

- Dataset: 4 GB grape leaf disease dataset downloaded from Kaggle.
- The dataset contained images of healthy and diseased grape leaves belonging to multiple classes (disease types).

3. Data Preprocessing & Splitting

- Preprocessed images (resized, normalized, and augmented for better generalization).
- Dataset split into:
 - 80% Training data → Used for model learning.
 - 10% Validation data → Used to tune hyperparameters and prevent overfitting.
 - 10% Testing data → Used to evaluate the model's final accuracy.

4. Model Training

- Trained the CNN model on the prepared dataset.
- Monitored accuracy and loss on both training and validation sets.
- Used techniques like Dropout and Batch Normalization to improve model performance and reduce overfitting.

5. Model Saving

- After achieving satisfactory accuracy, saved the trained model in .keras format.

6. Model Conversion

- Converted the .keras model into TensorFlow Lite (.tflite) format.
- This step was done to optimize the model for mobile deployment by making it lightweight and faster.

7. Mobile App Development (Flutter)

- Developed a Flutter-based mobile application to integrate the trained model.
- Integrated the TFLite model using TensorFlow Lite plugin for on-device inference.

8. App Functionalities

- Upload an image of a grape leaf from the gallery.
- Capture a photo directly using the camera.
- The app processes the image through the TFLite model and predicts the disease name (or healthy status).

9. Additional Features

- Displays disease symptoms for the detected class.
- Provides possible solutions and treatments, including:
 - Recommended medicines or Actions.
 - Preventive measures to protect other plants.

10. Outcome

- Successfully built a smart, AI-powered grape disease detection app.
- The app helps farmers and agriculturists quickly identify diseases and take timely actions.
- It runs offline, ensuring accessibility even in areas without internet.