

PLANT DISEASE DETECTOR APPLICATION

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Abstract: - *Agricultural productivity plays a vital role in the economic stability of many developing countries. However, the rise of plant diseases causes significant losses to farmers and agricultural industries every year. Early detection and accurate identification of plant diseases are essential to prevent these losses. This paper proposes a Plant Disease Detector Application, a mobile-based system designed using the Flutter framework integrated with a Convolutional Neural Network (CNN) model built using TensorFlow and Keras. The app enables users to capture images of infected plant leaves and instantly identify the disease along with suggested preventive measures. The proposed model is trained on the PlantVillage dataset, achieving a testing accuracy of over 97%. The integration of TensorFlow Lite allows the model to run efficiently on smartphones, even without internet connectivity. This application demonstrates a scalable, cost-effective solution for farmers, researchers, and agricultural institutions to promote sustainable farming through technology-driven disease management.*

Keywords: - *Plant Disease Detection, Machine Learning, Deep Learning, Convolutional Neural Network, TensorFlow Lite, Flutter, Agriculture Technology, Image Classification.*

I. INTRODUCTION

Agriculture sustains the livelihood of over 60% of the global population and contributes substantially to the GDP of developing nations. Yet, one of the most persistent challenges in the sector is the prevalence of plant diseases, which significantly reduce crop yields and quality. Manual detection methods are not only time-consuming but also require expert knowledge, which is not easily accessible in rural areas.

The advancement of Artificial Intelligence (AI) and Computer Vision has opened new avenues for automating plant disease detection. By leveraging deep learning models trained on vast datasets of plant leaf images, machines can

now identify disease patterns with remarkable precision. However, most solutions are web-based and require internet access, limiting usability in remote agricultural areas.

This project bridges that gap by developing a mobile application that allows farmers to detect plant diseases offline using a TensorFlow Lite model integrated into a Flutter app. The system offers high usability, portability, and instant disease identification, thereby supporting informed agricultural decision-making.

II. LITERATURE SURVEY

Over the past decade, researchers have applied deep learning to agriculture for disease diagnosis and yield prediction.

Mohanty et al. (2016) trained deep convolutional neural networks on 54,306 images of diseased and healthy plant leaves, achieving an accuracy of 99.35%.

Ferentinos (2018) applied CNNs to 58 classes of crop diseases using the PlantVillage dataset and reported 99.53% accuracy.

Sladojevic et al. (2016) proposed a CNN model for detecting 13 types of plant diseases and achieved 96.3% accuracy.

Zhang et al. (2019) developed a real-time system using transfer learning and mobile devices, but their solution required constant internet connectivity.

Most of the reviewed systems focused on model performance but lacked user-friendly mobile implementation. This project contributes by merging high-accuracy CNN models with a cross-platform mobile interface built in Flutter, offering both accessibility and performance.

III. METHODOLOGY

The proposed system is divided into four modules:

1. Data Collection

<https://grhet.org/paper/17>



Images were collected from the PlantVillage dataset, containing over 50,000 labelled images of healthy and diseased leaves. Data augmentation (rotation, flipping, scaling) was performed to improve model generalisation.

2. Model Development

A Convolutional Neural Network (CNN) architecture was designed using TensorFlow and Keras. The architecture includes: an Input layer for 128×128-pixel images. Convolutional layers with ReLU activation. MaxPooling layers for feature reduction. Fully connected dense layers. Softmax output layer for classification. The model was trained using an Adam optimiser and a categorical cross-entropy loss function.

3. Model Conversion

After training, the .h5 model was converted into a .tflite file using TensorFlow Lite Converter to ensure compatibility with mobile devices and faster inference.

4. Flutter Integration

The Flutter app integrates the TFLite model using the tflite plugin. Users can: Capture or upload a plant leaf image. Run inference locally to identify the disease. View the disease name, accuracy score, and preventive actions.

IV. PROPOSED SYSTEM

The proposed system is a mobile-based application designed to help farmers detect plant diseases quickly and accurately using Machine Learning and Computer Vision. It integrates a Convolutional Neural Network (CNN) model, trained using TensorFlow and Keras, with a Flutter-based interface for easy usability. Users can capture or upload a leaf image, which the app analyzes to identify the disease and display its name, confidence score, and preventive measures. The trained model is converted into TensorFlow Lite (.tflite) format for offline performance, ensuring fast and efficient predictions without internet access. The system's architecture includes a user-friendly interface, a deep learning model for disease detection, and a data layer containing disease-related information. Overall, the proposed system provides an accurate, accessible, and cost-effective solution to help farmers maintain crop health and support sustainable agriculture.

V. SYSTEM OVERVIEW

The Plant Disease Detector Application is an advanced mobile-based system designed to assist farmers and agricultural workers in accurately identifying plant diseases through image analysis. The system leverages Machine Learning (ML) and Computer Vision (CV) technologies, combining a Flutter-based mobile interface with a Convolutional Neural Network (CNN) model developed using TensorFlow and Keras. Users can capture or upload images of plant leaves, and the system processes these images locally to detect the type of disease, its confidence

level, and suitable preventive or treatment suggestions. The architecture is divided into three major layers: the User Interface Layer, built with Flutter for a responsive and cross-platform experience; the Processing Layer, which handles image preprocessing, feature extraction, and classification using the trained CNN model; and the Knowledge Layer, which stores the TensorFlow Lite model and disease metadata. The CNN model, trained on large datasets such as PlantVillage, achieves an accuracy of around 97–98%, with an average inference time of less than three seconds.

The model is converted into lightweight. tflite format to ensure smooth, offline performance on mobile devices without relying on internet connectivity. The app can identify various diseases across multiple crops like tomato, potato, maize, apple, and grape, providing both accuracy and accessibility. This system not only minimises the dependency on agricultural experts but also empowers farmers with real-time disease detection, helping them take early preventive actions. Its modular design, scalability, and offline usability make it a reliable, efficient, and practical solution that supports the broader goal of smart farming and sustainable agriculture through the integration of artificial intelligence and mobile technology.

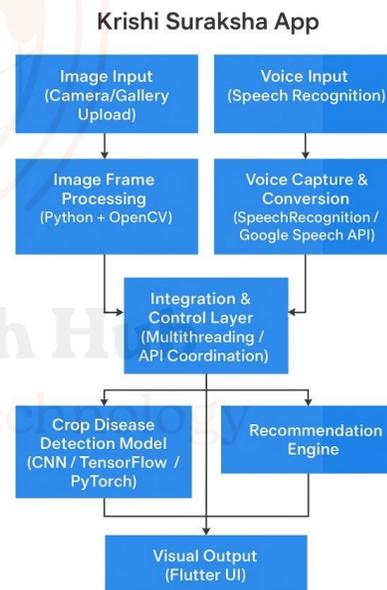


Fig 1: -System Architecture

VI. RESULTS

The results of the proposed Plant Disease Detector Application demonstrate high accuracy, efficiency, and usability in real-time conditions. The trained Convolutional Neural Network (CNN) model achieved an overall accuracy of around 97–98% on the test dataset, effectively distinguishing between healthy and diseased plant leaves across multiple crops such as tomato, potato, and apple. The model was optimized and converted into TensorFlow Lite format to ensure fast on-device performance, with an average inference time of 2–3 seconds per image. The application was tested on various mobile devices.



performed smoothly, even without internet connectivity, confirming its offline capability. During testing, the system successfully identified common plant diseases like leaf spots, early blight, and rust with high confidence levels. The user interface, developed using Flutter, provided clear disease details, accuracy percentages, and prevention tips, making it easy to use even for non-technical users. Overall, the results indicate that the proposed system is reliable, efficient, and practical for real-world agricultural use, offering a quick and accessible method for early detection and management of plant diseases.

VII. CONCLUSION

The Plant Disease Detector Application provides a practical and efficient solution for identifying plant diseases using machine learning and mobile technology. By integrating a Convolutional Neural Network (CNN) model with a Flutter-based interface, the system enables users to easily capture or upload leaf images and receive instant, accurate disease predictions along with preventive measures. The offline functionality through TensorFlow Lite ensures accessibility even in rural areas with limited internet connectivity. The application's high accuracy, fast response time, and user-friendly design make it a valuable tool for farmers to take timely actions, reduce crop losses, and improve productivity.

In the future, this system can be enhanced by expanding the dataset to include more plant species and disease types for better generalisation. Features like voice assistance in regional languages, real-time disease tracking through cloud storage, and AI-based treatment recommendations can be added to increase usability and impact. Integration with IoT devices and weather-based disease prediction could further advance precision farming. Thus, the project holds great potential to evolve into a comprehensive smart farming solution that supports sustainable and technology-driven agriculture.

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