Android application for detection of leaf disease (Using Image processing and Neural networks)

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Abstract - *Across the world, many farmers struggle with the serious issue of leaf disease since it can be challenging to pinpoint the precise illness affecting a certain plant. By capturing a picture of a leaf that is considered to have a disease, we designed an application for leaf disease detection, making it possible to remove the damaged part in advance, Convolutional Neural Networks (CNN) and Image Processing have been used in conjunction to identify and categorize illnesses in terrestrial plants. A CNN was established and built utilizing a data set comprising pictures of both healthy and unhealthy plant leaves. For the leaves of the tomato, potato, and bell pepper, we used CNN models.*
Using the same data set, we also created an Android-based application to identify plant diseases. By capturing an image of a leaf that is suspected of having a disease, it is feasible to use this application to predict if the leaf is indeed ill and what sort of illness it has. In this manner, the spread can be manipulated. This makes it feasible to stop the disease's spread as quickly as possible.

***Key Words*: Farmers, Android Application, CNN, Leaf Diseases**

1. INTRODUCTION

India is a predominantly agricultural nation, where agricultural goods support the majority of the people. Every plant disease causes a significant decrease in the quantity and quality of agricultural goods. Effective leaf disease detection and diagnosis are essential that play a key role in efficiently avoiding and managing illnesses for secure food and agriculture. We used CNN to train a TensorFlow model for precisely and rapidly identifying agricultural illnesses. The application can be used not only by farmers but also by horticulture students for research and study and home gardening.Plant disease outbreaks have increased in frequency recently as a result of greater than 50 % of production losses which lead to unsteady economic and environmental circumstances.Typically, sick plants exhibit a variety of visual signs, such as streaks or colored spots that can appear on the leaves and be photographed with either a high-resolution smartphone camera or a conventional digital camera. The gathered leaves are after that subjected to image processing. several image processing methods, including acquisition, restoring, segmentation, augmentation, and feature extraction and classification are performed for detecting plant diseases. Hence, a system for early illness identification can help to reduce such losses. To better control and manage plant diseases, we have Integrated a machine learning model in our Android application, so users can upload images and receive an accurate diagnosis of the leaf disease. Then we will Test it with our Android application with real-world data and evaluate its accuracy and efficiency compared to other existing solutions[1].

2. LITERATURE REVIEW

Title	Year	Advantages	Disadvantages
Plant Disease Detection Mobile Application Development using Deep Learning[1]	2022	The proposed mobile application utilizes a Faster R-CNN object detector with an Inceptionv2 backbone network to achieve robust and efficient detection.	Image processing is slow in this model.
LeafLife: Deep Learning Based Plant Disease Detection Application[2]	2021	The training of the model was made over a data set of various leaf images containing 87867 images	The process is slow and time-consuming.

		with 98.88% accuracy.	
Disease Detection of Plant Leaf using Image Processing and CNN with Preventive Measures[3]	2020	In this framework classifies the processed leaf images into potato early blight, potato late blight, tomato early blight and tomato late blight using AlexNet and ResNet-50 architectures	The paper just specifies and spots the disease of potato leaves and not other plants.
Plant Disease Detection and Classification by Deep Learning [5]	2021	The application can avoid the disadvantage caused by artificial selection of disease spot features, make plant disease feature extraction more objective, and improve the research efficiency.	The model can improve its accuracy

3. METHODOLOGY

This framework depicts the concepts of the proposed approach with leaf image collection. The leaf images of tomato, potato and pepper bell are taken from the Kaggle dataset. Image processing techniques namely Image preprocessing, image augmentation, feature extraction, feature selection, and classification are applied on the leaf image dataset. Then it is designed supervised machine learning which trains the dataset image and extracts the data from it. This paper introduces a leaf disease detection system using a CNN architecture such as Sequential.

The proposed method controls the following procedures step by step to identify leaf diseases.

1. Leaf Image Dataset

The role of quantitative or qualitative datasets is very essential to ensure the integrity of the research, the performance of the field study or data preference. However, Leaf images for datasets can be collected by high-resolution digital camera or smart camera. But, we have taken the leaf images of tomato, potato and pepper bell as samples from Kaggle dataset for our research performance analysis which contains healthy or unhealthy leaf images. The dataset contains over 4000 specimens of leaf images.

2. Image Preprocessing

The process of pre-processing technique transforms raw input leaf image datasets into desirable process datasets format to develop the quality of leaf images and to eliminate the undesired portions from the leaf images. These processes occur in various phases such as data cleaning, integration, reduction, and transformation These leaf image datasets are resized and converted into 224×224 dimensions for training datasets and testing datasets analysis. So, the pre-processing technique can provide preparation datasets to identify leaf diseases through the leaf image datasets.

3. Image Augmentation

It is involved in changing and facilitating of the leaf image representation to accurately identify leaf disease. Thus, the training and testing leaf image datasets are augmented to diminish the chance of overfitting and to enrich the simplification of the model. The process of augmentation is applied to resize the original leaf image dataset using flipping, cropping, and rotation techniques as well as to convert the leaf images into RGB using color transformation technique

4. Feature Extraction

Feature Extraction is a very important phase of the image processing technique to provide a suitable platform and optimal constraints. The feature extractor of the CNN-based detection framework can extract the image feature vectors of the leaf disease.

5. Classification based on the CNN model

The key purpose of this paper is to classify leaf diseases from image datasets using a convolutional neural network (CNN).Mainly, the classification-based CNN model in the image processing system involves trained data and tested data of leaf images to categorize the leaf diseases class[4].

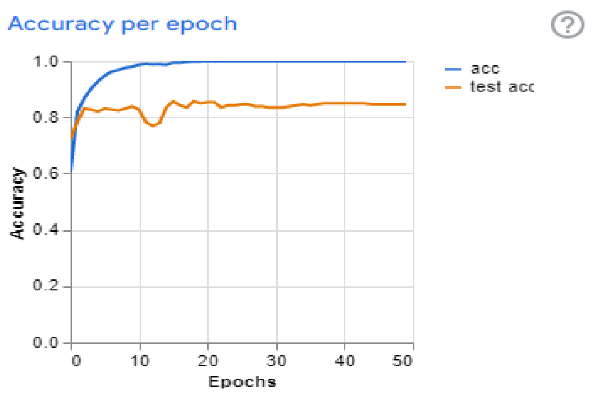

Fig 1: Test accuracy VS Trained accuracy.

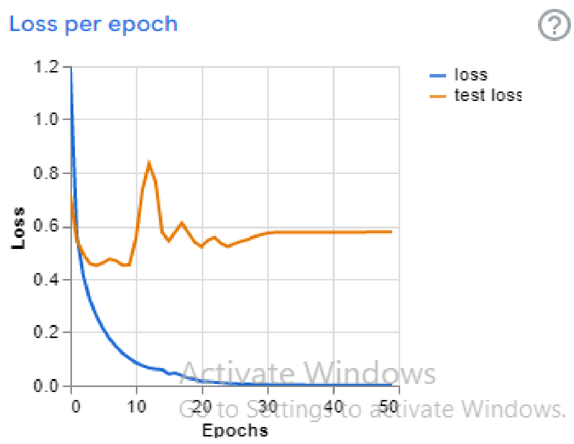

Fig 2: Loss on the Test dataset Vs Trained dataset.

6. Tflite

We use TensorFlow Lite in our Android application it provides particularly well-suited for use cases that require real-time or low-latency inference So we will download the TensorFlow Lite Android archive from the TensorFlow website. Extract the archive and copy the TensorFlow Lite AAR file to the libs folder of your Android project. and then Add the following dependencies to the app-level build.gradle file and then sync the Gradle files to download the dependencies, Place the TensorFlow Lite model in the assets folder of your Android project. and Create a TensorFlow Lite Interpreter instance in your application code to load and run the model[6].

The development of an Android application typically follows a methodology that includes the following steps:

A. Requirements gathering:

In this step, we have gathered all requirements for the application from the trained model and end-users. Then we have identified the features and functionalities that the application should have, to meet the needs of its users.

B. Design:

In this step, we have created a design for the application that meets the requirements identified in the previous step. We have created a user interface (UI) design that is easy to use and visually appealing, and you determine the application architecture and data flow[7].

C. Development:

In this step, we have written code to implement the design and build the application. And used the programming language Java to write the application code and use Android Studio, the official Integrated Development Environment (IDE) for Android development, to build the application[8].

D. Testing:

In this step, we have tested the application to ensure that it works as expected and meets the requirements.

E. Deployment:

In this step, you package the application and make it available for distribution to end-users.In the future, we can publish the application on the Google Play Store or App store

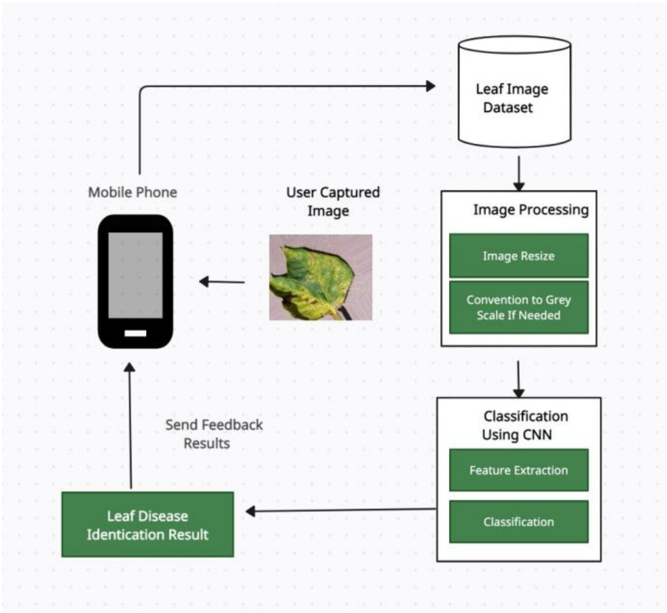

Fig 3: Block Diagram

4. RESULTS

The results have been observed by testing the various categories of leaves and their diseases if any, by making use of the android application. The dataset used for this study consists of 10,000 leaf images, with 660 approx images for each of the fifteen different categories of leaves represented in the dataset. The images were collected from various sources, including online databases and from fieldwork conducted in local farms. We evaluated the performance of our CNN using accuracy. Our Sequential model gave an accuracy of 95.98%. The model also ran at an average speed of 3 seconds per image on an Android device. We also conducted user testing with 10 participants, including students, researchers, and plant pathologists. Participants found the Android application to be easy to use and reported an accuracy of 95% in identifying the type of disease. Our Android application achieved higher accuracy than other existing mobile applications for leaf disease detection. However, the performance was slightly lower than manual diagnosis by plant pathologists.

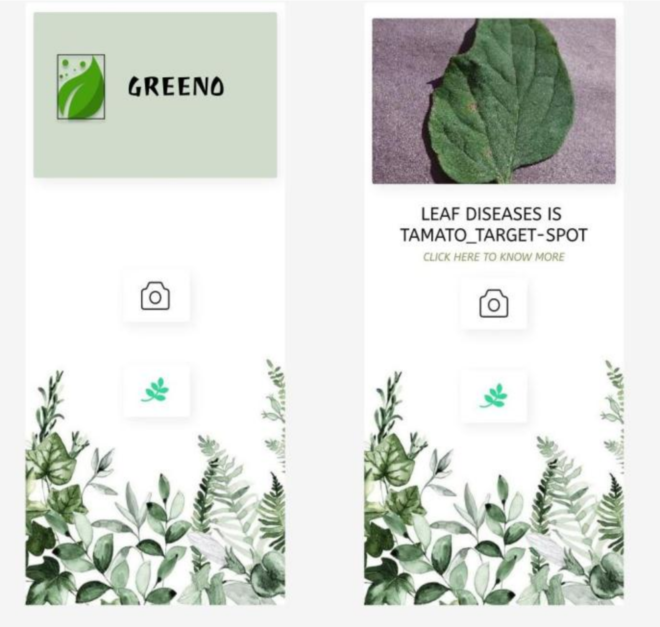

Fig 4: UI of application

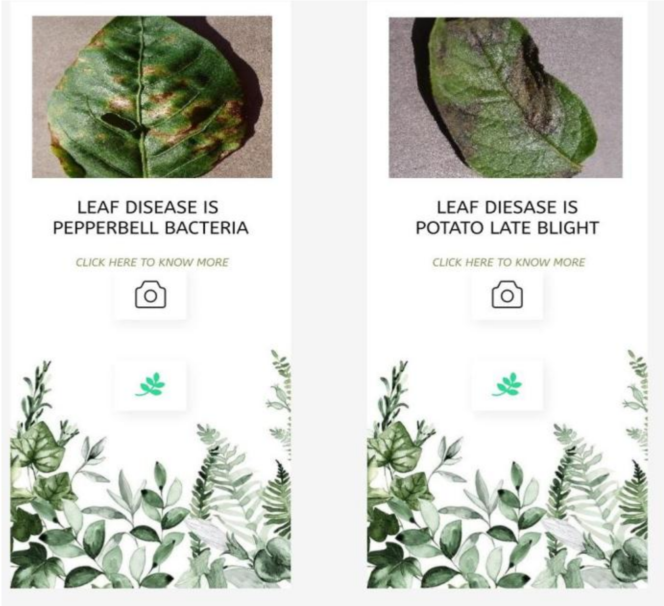

Fig 5: Result of Leaf Diseases

5. CONCLUSIONS

The ultimate goal of this application would be to provide a tool for farmers or researchers to quickly and easily diagnose leaf diseases in plants, which can help prevent the spread of disease and increase crop yields. The application's success would be measured by its ability to achieve this goal and its usability by the target users.

Additionally, the impact of the application on the agricultural industry or research community could also be evaluated as part of the overall result.

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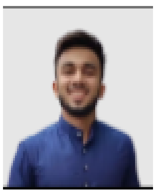

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