e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:06/June-2021 Impact Factor- 5.354 www.irjmets.com

# PLANT DISEASE RECOGNITION SYSTEM WITH DEEP LEARNING MODEL HOSTED ON CLOUD

**Dhiraj Salunke[*1], Rutuja Awate[*2], Mukesh Parekar[*3], Sarita Karale[*4], Madhuri Dharanguttikar[*5]**

[*1,2,3,4]Student, Department Of Computer Engineering Skn Sinhgad Institute Of Technology And Science, Lonavala, Maharashtra, India.

[*5]Professor, Department Of Computer Engineering Skn Sinhgad Institute Of Technology And Science, Lonavala, Maharashtra, India.

## ABSTRACT

Implementing a smart system capable of capturing images of plant leaves of some plants and processing them on a cloud-hosted compute engine capable of performing deep learning technique for classifying them into 39 different groups or classes of disease of some plants by processing data generated from the captured image. Data processed by the cloud-hosted engine is needed to be an array of square shape. The image will be cropped from the app's front-end, transferred over *HTTP* and processed at compute cloud, and sent a response with some metadata. The app is authenticated with google, email and capable of store data at firestore[3]. Firestore will record the history of predictions performed by compute-cloud using deep learning techniques built using the TensorFlow framework by google. The TensorFlow[2] model was implemented using transfer learning with the base model as an Inception_v3 [2] with 299x299 of input shape. The model is hosted in AWS compute cloud with the help of Django.

**Keywords:** Cloud, Deep Learning, HTTP, Inception_V3, Tensorflow, Transfer Learning, Django.

## I. INTRODUCTION

With an expanding network of internet connectivity like never before, it's becoming more feasible to bring smart technologies to technologically abandoned industries like agriculture. Previously it was quite difficult to implement cloud-based technologies in remote areas. Without any professional help to the farmers on the field, it used to be difficult to detect the deficiencies, diseases and pests on the crop for the farmers.

That's where our smart system steps in to help the farmers by providing the capability to click the image or choosing the image from the gallery from the application or provided to the user. This image is then processed onto the cloud platform provided by AWS[5]. The result contains data on the disease on the crop, the confidence of the model about prediction, timestamp of result, and measure taken by the user to the given disease.

The user then has the option to save this data to fire store to keep its record. This data is displayed in a different tab from where it is possible to see all history with some cosmetic sugar applied to UI.

## II. METHODOLOGY

**Defining requirements**

- **Development requirements:**

Android SDK, Flutter SDK, Firebase SDK, AWS cloud, Tensorflow SDK, Django, Python.

Android SDK is used as a dependency for Flutter SDK while Flutter is used as a frontend development framework for various platforms[4]. Firebase SDK is used for developing authentication logic and database platforms[3]. AWS is used as a backend compute engine[5]. Tensorflow is used for building deep learning models[2]. and Django is a backend framework used to host the model.

- **Production requirements**

Smartphone, AWS EC2 instance, Firebase project, Hello Farmer app.

Smartphone to run an app called Hello Farmer as the frontend of the project. EC2 is a Cloud instance of the computer to host the deep learning model. The Firebase project is for authentication and database backend.

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## III. MODELING AND ANALYSIS

The complete architecture of the system can be represented as a diagram given below. This is an oversimplification of the system to better understand the working of the app.[1]

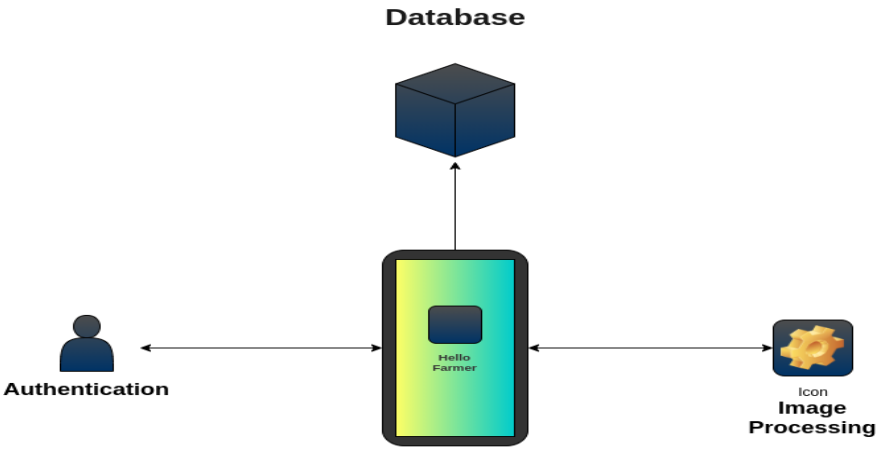



**Figure 1:** Relation diagram of different components of the app.

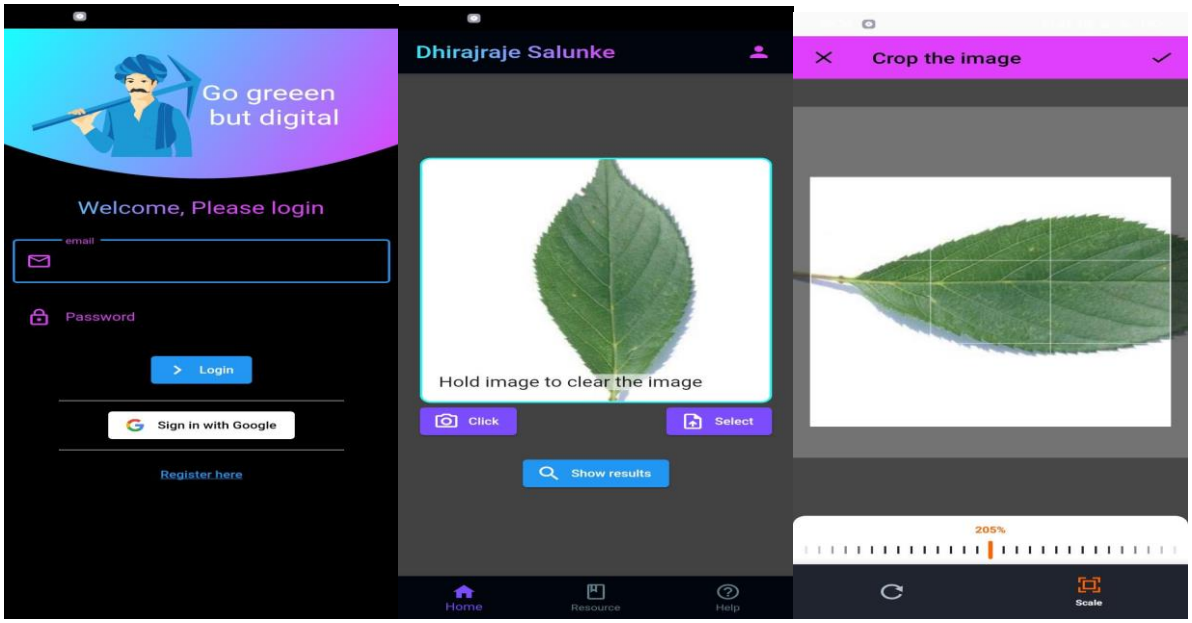
The system's data flow begins when the user clicks an image or chooses an image from a gallery. In this step, the user generates the data to be processed to generate the results. This image then cropped in a square shape so that it would be compatible to be processed by deep learning model.

This image then can be uploaded to the backend server over the HTTP where it is subjected to a deep learning model which predicts the class of the disease and returns the response in the JSON format containing the class of disease, the confidence of the model regarding the prediction made timestamp for recording purpose, and the measure to be taken.

In the next step, the results from the server are displayed and the user has given the choice to sync this data to the firebase firestore database. This data is then forever visible to the user's resource screen. This data is colour coded concerning the confidence of the model.

## IV. RESULTS AND DISCUSSION

We have deployed a deep learning model to AWS's highly available infrastructure[], and on the other hand, we have achieved 89.9*% accuracy while validating the deep learning model.[2] Also with the firebases stream driven environment, we have able to simulate offline like performance in our app whether it is for authentication or database events.[1] following are some screenshots of the working app.



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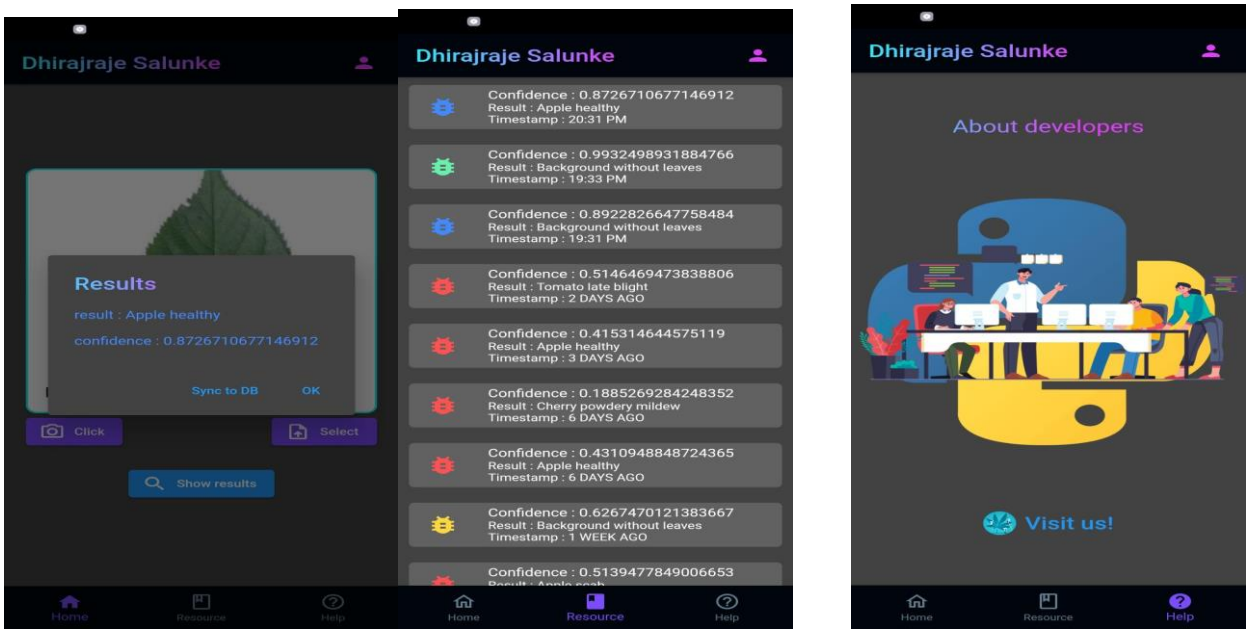


**Figure 2:** Working screenshots of the app

## V. CONCLUSION

With the help of a deep learning framework by google called Tensorflow, and a cross-platform app development framework called Flutter we have implemented a smart disease recognition system capable of using AWS's cloud infrastructure as a backend for deep learning processes. The system now can predict 39 different classes of diseases for different plants whose dataset was taken from Kaggle.

## VI. REFERENCES

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