

FRUIT DISEASE DETECTOR

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering.

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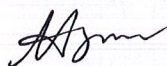


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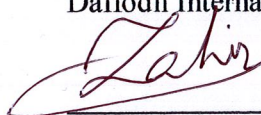


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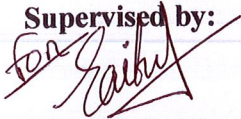
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DECLARATION

We hereby declare that this project has been done by us under the supervision of Fahad Faisal, Assistant Professor, Department of CSE, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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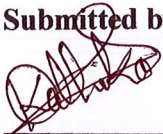
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ABSTRACT

Bangladesh is a developing country as well as productive also. We have a large amount of tropical fruit. Our most cultivated fruits are mango, banana, apple, orange, jackfruit, etc. But the fact is that the lack of technology, farmers are unable to find out the damages and causes of fruit properly. Sometimes, unknown about the percentages of specific fruit that are causing other fruit damage. For example, if a mango is affected by bacteria then this is harmful to other mangoes. Because other mangoes can be affected by the same bacteria. That's why uncertainty farmers have to count a huge amount of loss. We take an initiative to help the farmers as far we can. In this app, we have developed an image processing concept. Our application is based on the Android phones. The app will store two types of fruit. One is the fresh fruit section and another is the damage fruit section. After picking the fresh fruit and damage fruit the comparison is started. By this process, the damaged area is detected. For making awareness of farmer we have added a percentage of the damaged area. As a result, he can predict his farming quality and apply the criteria for decreasing the damage. So all on average this application can make a good impact for the farmer In Sha Allah.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Though the cultivation of fruit in our country is better because of prolific soil. About 1.6% of fields are used to cultivate fruits. There are 70 types of fruits are grown in these fields. Bangladesh exports fruits in 40 countries. But it's so small amount of exported fruits. Our farmer can't get the proper advantages. Bangladesh is a developing country, not a developed one. So the facilities for the farmer for farming is not lesser than the developed country. On the other hand, though day by day we are familiar with technology rural people can't get the opportunity. In fact, they are unfamiliar with the internet. Considering sometimes, the number of fruits is damaging for contacting the only one damage fruit. If the farmer can identify the only fruit after ensuring the percentage of damage, a huge amount of fruit can be saved. Consideration of this fact we developed an idea/solution that is more helpful for the cultivators as well as for human beings.

1.2 Motivation

Our concern as a motivation for this project is a step to protect the thousands of fresh fruits those contact in affected fruit. Whether it's difficult for the farmer to check and identify the fresh and damage fruit. For this, they often face a number of difficulties and losses. That can impact their livelihood as well as their earning. As a result, a range of people can face problems while buying those fruits. Our project application can detect those damage fruits. By detecting those damaged fruits, the financial losses of farmers are being decreased.

1.3 Objectives

- Protect thousands of fruits by detecting one affected fruit.
- Name of the diseases.
- Provide solution against those diseases.
- Give useful information protecting from those diseases.

1.4 Expected Outcome

- This Android application is a way to detect fruit disease from thousands of fruits.

- After detecting the fruit disease farmers can take proper step.
- Using the application farmers can get solution to reduce the disease.
- Applying solution they can get financial benefit.

1.5 Report Layout

Basically, every report follows three-step:

- First: Initial matter
- Second: Test
- Third: Back matter

Initial matter fills up with title page, approval page, abstract summary, Acknowledgement, table contents, list of tables, list of figures, other lists and the Preface, etc. Initial pages are designed as a sequence that whatever is in the content. Consideration of this we have sequenced our report as follows:

Chapter 2, In this chapter we fix the content of discussion of the background circumstances of our project. We also mention the challenges that we have faced, adding related work and the future scope of our project

Chapter 3, we have mentioned the requirements of the project. Like business process modeling, use case diagram and design requirements.

Chapter 4, mentioned two design parts of our project, detailed about the front end and the back end design.

Chapter 5, Implementation of the whole project and testing the application section of the project whether the application is working or not.

Chapter 6, In the end, discussing the conclusion and future scope for the development of our project. Finally, all report references which are related to our work ensure the information in the report is correct.

CHAPTER 2

BACKGROUND

2.1 Introduction

At present, our country's growth is increasing based on technologies. Smart devices are becoming cheaper day by day. From this point of view, smart devices are readily available for all people. Our project makes the scope to those people who are cultivating fruits. The project output is an Android application. By using this application anyone can detect the disease and getting the way of cure from it.

2.2 Related Works

Related works are those works, projects, and researches which is related to our work. Here, we are going to show the works, projects, and researches

Intra-Class Recognition of Fruits Using DCNN for Commercial Trace Back-System

Intra-class acknowledgment of fruit utilizing image processing and Computer Vision strategies is viewed as trying undertaking because of likenesses between different sorts of fruits grown from the ground natural changes. Essentially sub-sort of similar fruits shows many likenesses between one another. Thus, it's a more troublesome assignment to recognize than when various sorts with the same shade of fruits are included. It makes confuses among preparing and test sets. In this research work, the research team made a better solution to recognize those fruits in the best way.

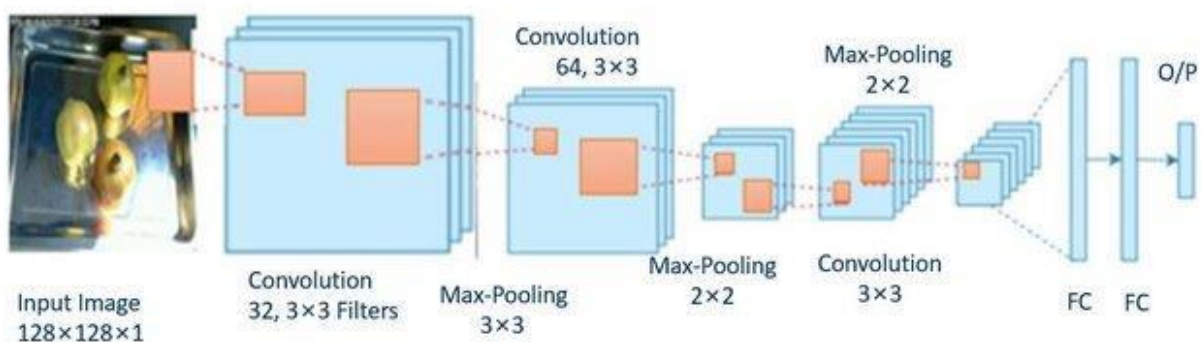


Figure 2.2.1: CNN that is proposed [1]

A Robust Algorithm for Fruits Recognition System

Fruit Name	Minimum			Maximum		
	R	G	B	R	G	B
Red Apple	159	79	77	232	155	130
Green Apple	125	140	67	200	220	120
Strawberry	210	102	90	254	170	130
Banana	215	208	160	251	240	200
Lemon	110	148	17	252.8	218	129
Water Melon	116	68	68	150	183	115

Figure 2.2.2: Minimum and Maximum values of each fruits. [2]

The research paper's work is based on classifying fruits. But difficulties of color and shapes of fruits in here only eight fruits can be classified out of selected 187 fruits. The process is based on fruit's shape, colors, and 2D formation. This system is built on the k-Nearest Neighbor (KNN) algorithm as the classifier. Using the values of R(red, G(green), B(black), a 2D form is created.

Adapted Approach for Fruit Disease Identification using Images

Diseases are affecting the fruit economy and making slow the growth of this economic structure. So, it must be to identify the diseases of the fruits to make a proper solution for decreasing financial disadvantages. In this research paper, the k-means clustering is used to identify those diseases by clustering fruits. The test case is here an apple where the author finds out three types of apple diseases namely apple scab, apple blotch, and apple rot.

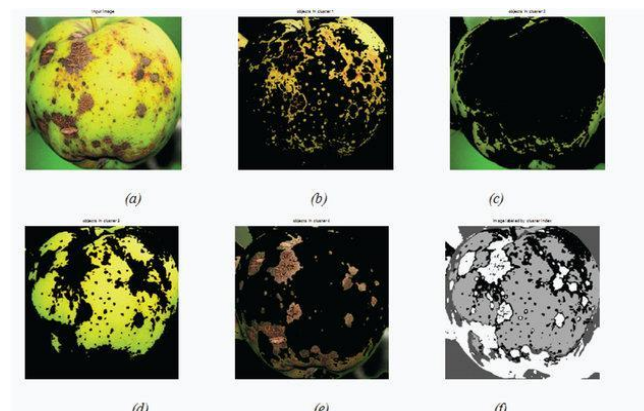


Figure 2.2.3: K-Means clustering for an apple fruit that is infected with apple scab disease: (a) the infected fruit image, (b) first cluster, (c) second cluster, (d) third cluster, and (e) fourth cluster, respectively, (f) single gray-scale image colored based on their cluster index [3]

Automatic Classification for Fruits' Types and Identification of Rotten Ones Using k-NN and SVM

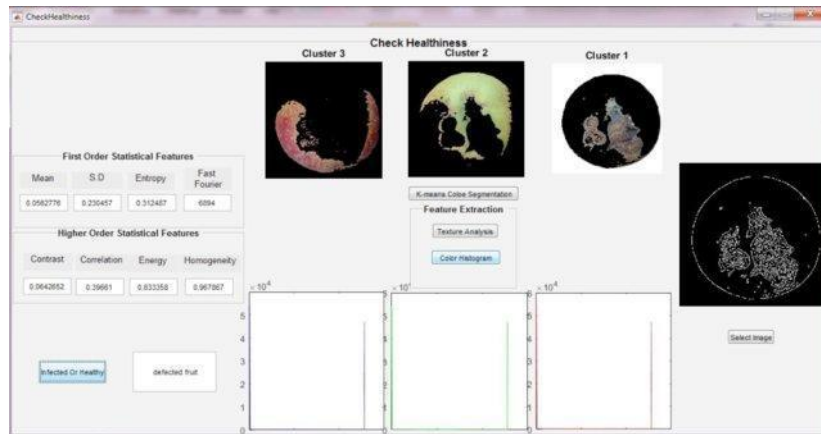


Fig 2.2.4: Interface of the system [4]

In this paper, the developed system can identify fruits and recognize them from different fruits. The algorithm is used based on colors and texture features of fruits. This can identify the diseases of fruits. The calculations separate the RGB values and the first statistical order and the second measurable of the Gray Level Co-occurrence Matrix (GLCM) values. The segments are Fine, Medium, Coarse, Cosine, Cubic, and Weighted K-Nearest Neighbors algorithms are applied among seasonal fruits i.e. banana, apple, strawberry, and the images were taken from a mobile phone. The accuracy percentages of each are 96.3%, 93.8%, 25%, 83.8%, 90% and 95% respectively.

Development of a Controlled Vocabulary and Software Application to Analyze Fruit Shape Variation in Tomato and Other Plant Species

The domestication and improvement of fruit-bearing crops resulted in a huge range of fruit shape. To facilitate constant terminology pertaining to form, a controlled vocabulary focusing in particular on fruit shape developments was evolved. Mathematical equations have been installed for the attributes in order for that goal, quantitative measurements of fruit shape may be conducted. The controlled vocabulary and equations were incorporated into a new advanced software program application, a tomato analyzer, which conducts semiautomatic phenotype measurements.

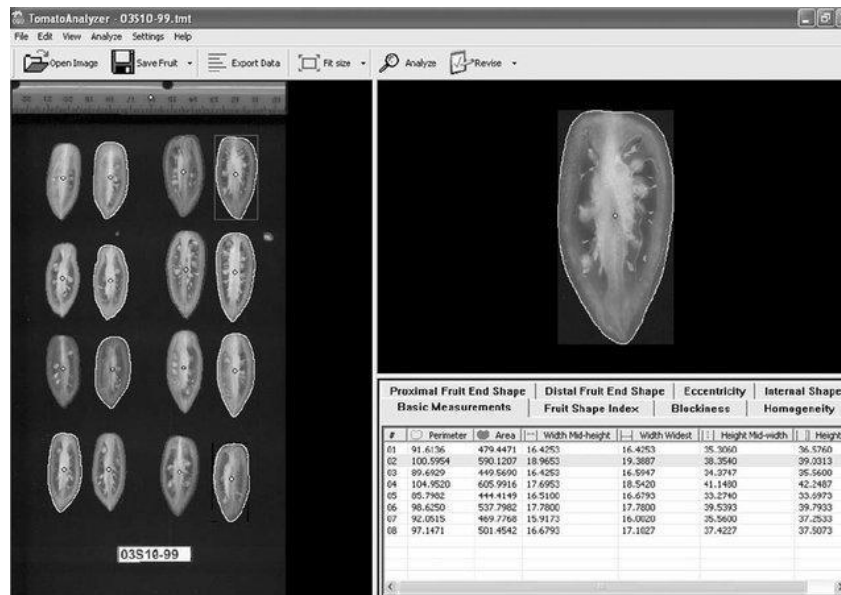


Figure 2.2.5: Tomato Analyzer application. [5]

Image recognizer

Using this application we can detect the image and recognize the image which it is. The features of this application are extracted text, logo detection, image attributes, label detection and much more. The latest version of this application is 1.0.2 which was last updated on 9 October 2017

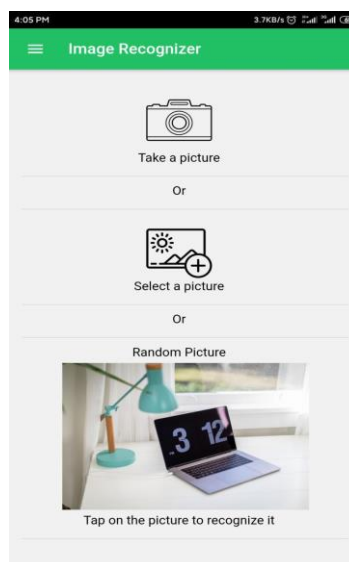


Figure 2.2.6: Image recognizer front page

2.3 Comparative Studies

“Fruit Damage detector” is an android application that is a useful and efficient application for every single cultivator who wants to make a better position even less loss. This application ensures the quality control of the fruit. An android phone is enough to access the advantages of using this

application. Cultivator just need to capture the images and select them by using the application. By using this procedure they don't need to sort them manually. If any auto motion system can be developed based on this application then no need to capture those images manually too.

2.4 Scope of the Problem

We observed that there were many solutions in comparing the image. But for Android devices it is rare. We found the amount around 5% to 10% that's why we had planned to design an application for Android devices. We build the application with OpenCV and Android Studio. Using image processing there is much paper related to fruit plants and the implementation is web-based. We also observed those papers and became a success to make a solution and step to make the application based on the Android platform. Basically, this is our most common problem and we serve it over and may get a specific solution.

2.5 Challenges

Every work has some difficulties and overcoming those difficulties is called challenges. We also have faced difficulties. Our first thought was about making the user-friendly application and accessible for the target customer(cultivator). Lack of technical habituation several people may consider it difficult. As a result, they may be unwilling to use the application. Based on that fact we have tried to make the application as simple as possible. Another issue is, the application is mostly used in the rural areas and their Internet connection may be slow or not suitable for high speed based applications. Keeping inside this concept of worst-case our this application development is work properly with the less usage of the data connection.

On the other hand, we also faced many working challenges like,

- Collecting the proper image data
- Fruit disease identification
- Data training
- User should have Android device

CHAPTER 3

REQUIREMENT SPECIFICATIONS

3.1 Business Process Modeling

There are two main layers in our project. One is user layer and another is Application layer. In user layer, user scans the fruits. In Application layer, the scanned fruit is detected as fresh fruits or affected fruits. If the fruit is affected by any disease then the system will give the solution and some information about that disease.

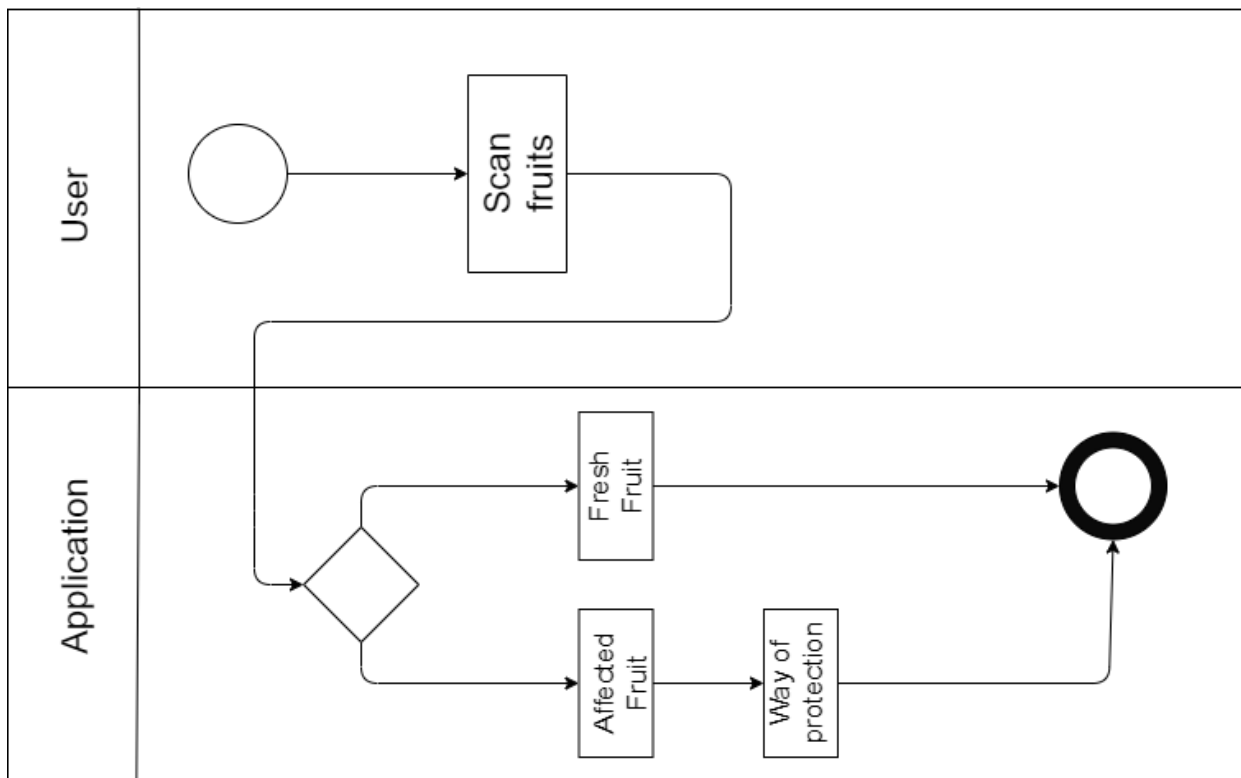


Figure 3.1.1: Business Process Model

3.2 Requirement Collection and Analysis

This Android application is the consideration of the rural people as a user. So our instrumentation is based on that consideration. So it must be user-friendly and more efficient for them.

Here below is the requirement requires:

Hardware configuration required:

- Computer System for doing the project.
- Android Smartphone for a farmer or an organization who weekly visit all the farming area.

Software configuration required:

- Operating System: Android.
- Tools: Android Studio, Tensorflow Lite.

Other requirements required following:

- User-friendly
- Less internet but working
- Satisfactory output
- Efficient

3.3 Use Case Modeling and Description

User must be registered to the app then he/she should log in to access user portal. After getting permission to access the user portal he/she can see his profile, monthly result of scanned fruits and can check the fruits. After going to check the fruit page he/she must pick the damaged image. Finally, the result comes out.

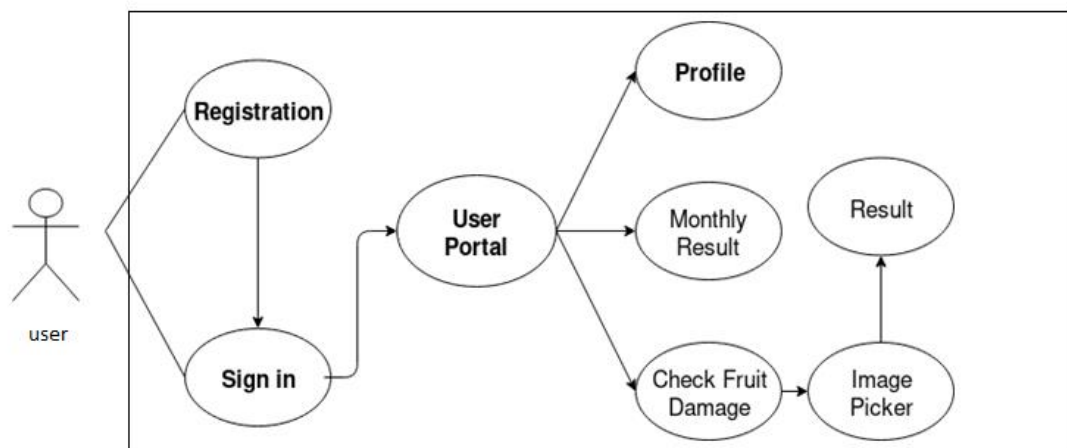


Figure 3.3.1: Use case diagram

3.4 Flow Chart

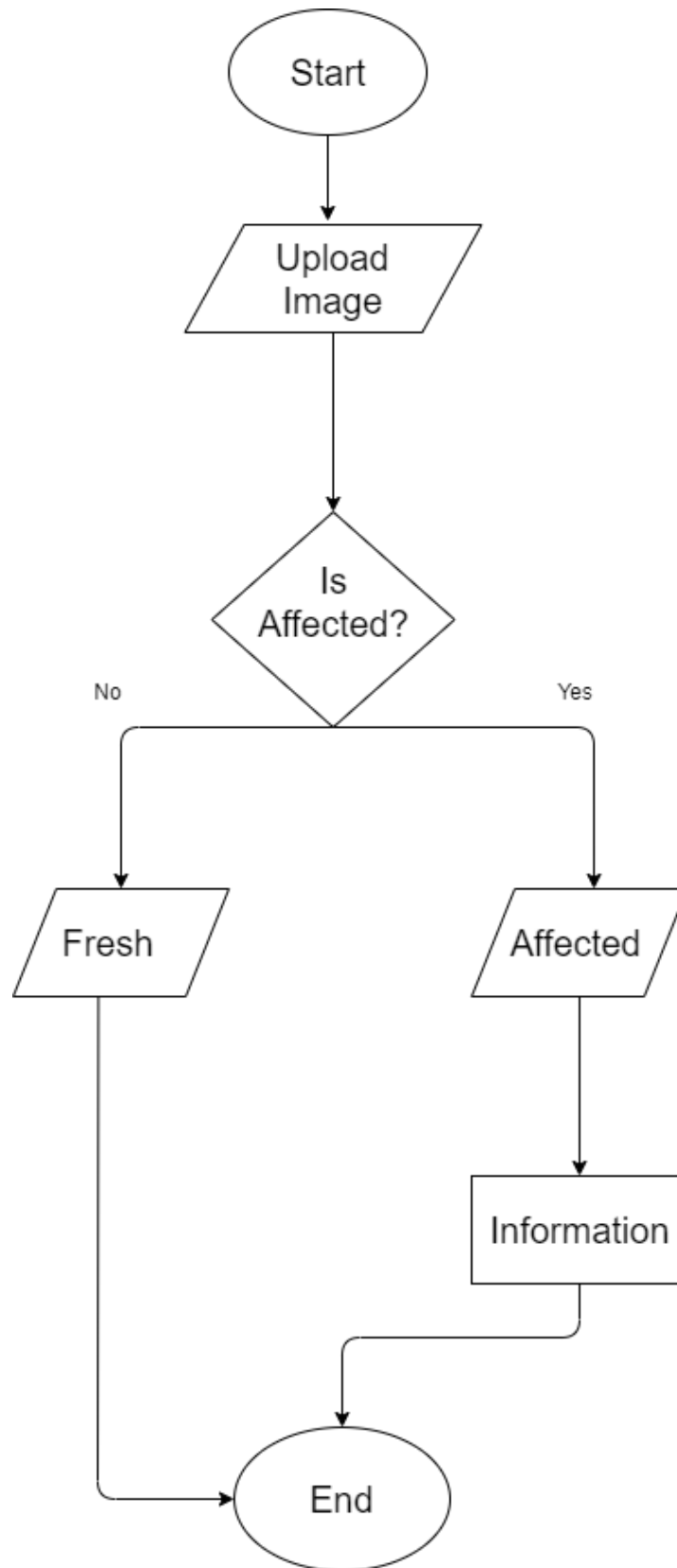


Figure 3.4.1: Flow chart of detecting damage percentage.

3.5 Design Requirements

We need some implementation for our project to run the application as we want to get success in our application. For implementing the application successfully the following requirements are needed.

- Android Phone is mandatory
- Install the Fruit Damage Detector application.
- The targeted fruit image must be needed.
- The image needs to be saved in the device storage.
- Fresh fruit image is needed to compare
- Image must be clear

CHAPTER 4

DESIGN SPECIFICATION

4.1 Front-end Design

Front-end is the client-side from where the user can interact with the application. The user interface makes this attractive to the users. Based on the user interface design, user can able to handle the application. Sometimes it's easy for the users and sometimes it's complicated.

4.1.1 Starting Page

After launching the application the landing page is opened. There's a warm welcome from the "Food Disease Identifier". There are two buttons. One is for opening camera to capture picture directly from application. Another button works for selecting image from Gallery.

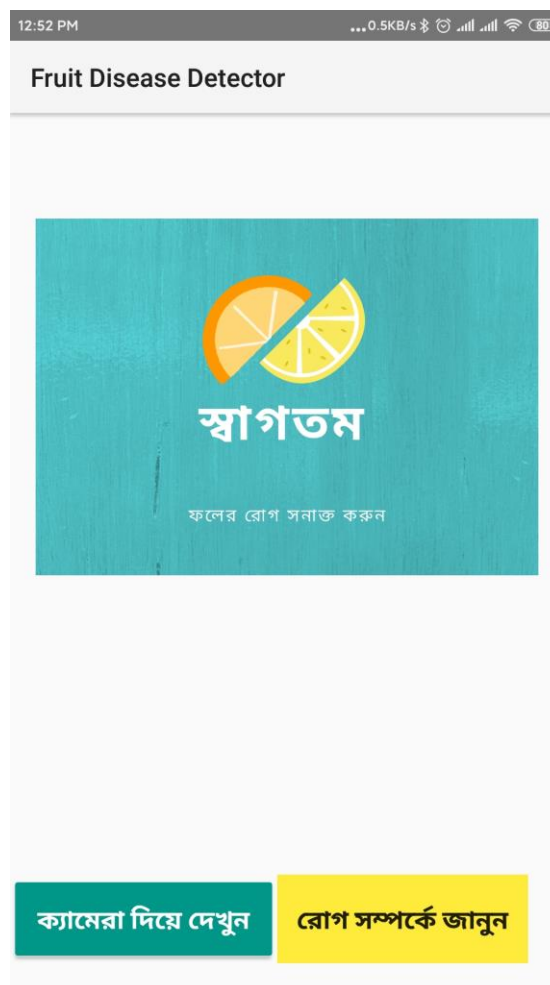


Figure 4.1.1: Landing Page of the Application

4.1.2 Result's Page:

In this page the scanned fruit is shown and also the name of the disease. There's also a button to go next activity for knowing more about the disease.



Figure 4.1.2 Result Page Using Camera

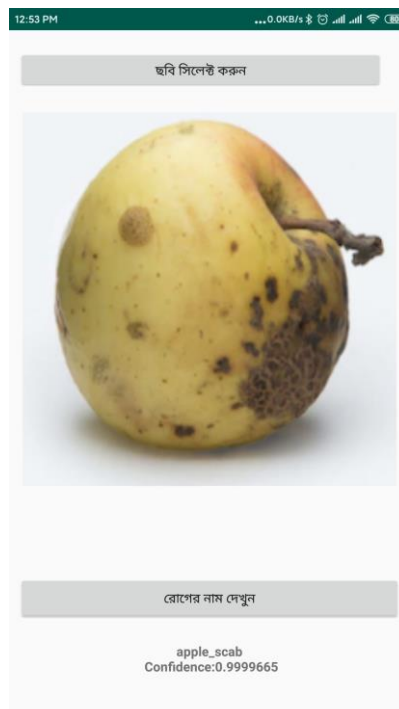


Figure 4.1.3: Result Page Using Image Picker

4.1.3 Information Page:

Here, the information is shown based on the disease name. From the information we can know about the disease and controlling way of it.



Figure 4.1.4: Information Page

4.2 Back-end Design

In the back-end, we use Extensible Markup Language (XML) for designing UI. Java for building up function and interacting with UI. Using python language for making training system/

4.3 Implementation Requirements

- Tensorflow Lite
- Google Colab
- Android Studio
- Android Device
- Image Data

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Introduction

Here, we are discussing about our project's implementation, architecture and output. We use TensorFlow to train our model data and TensorFlow lite converter to convert the model data in mobile devices.

5.2 Implementation of Front-end Design

For front-end design, we use the XML programming language to design layout. Using the linear layout for the main layout. We also use:

- Image View
- Text View
- Button

5.3 Implementation of Back-end

We use python programming language to train our images. TensorFlow lite is used for processing images and integrated the trained data in Android Application. We take two type of data set. One is called training data to train the data set and another is validation data set which is compared with training data set and give the result of accuracy.

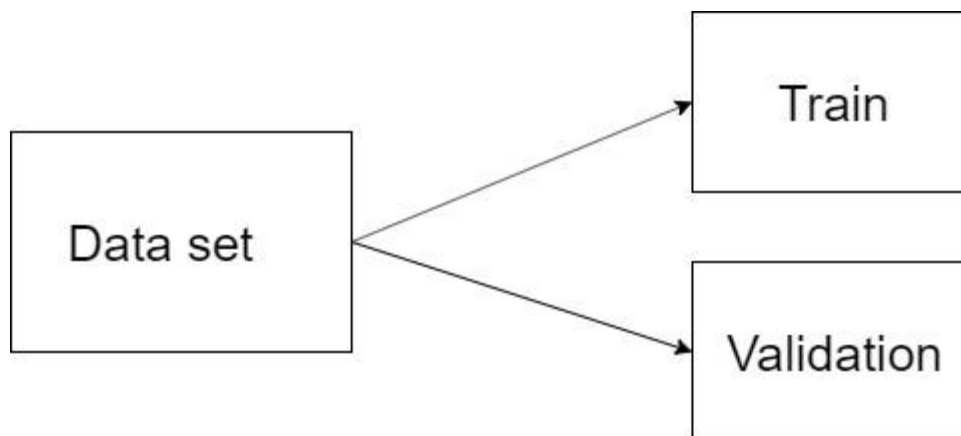


Figure 5.3.1: Dataset for training

5.4 Implementation of Interaction

Two layers are in this case. User can upload the image from Gallery using image picker or capture using camera API. After uploading the image, it's compared with the trained dataset and give the

result based on accuracy.

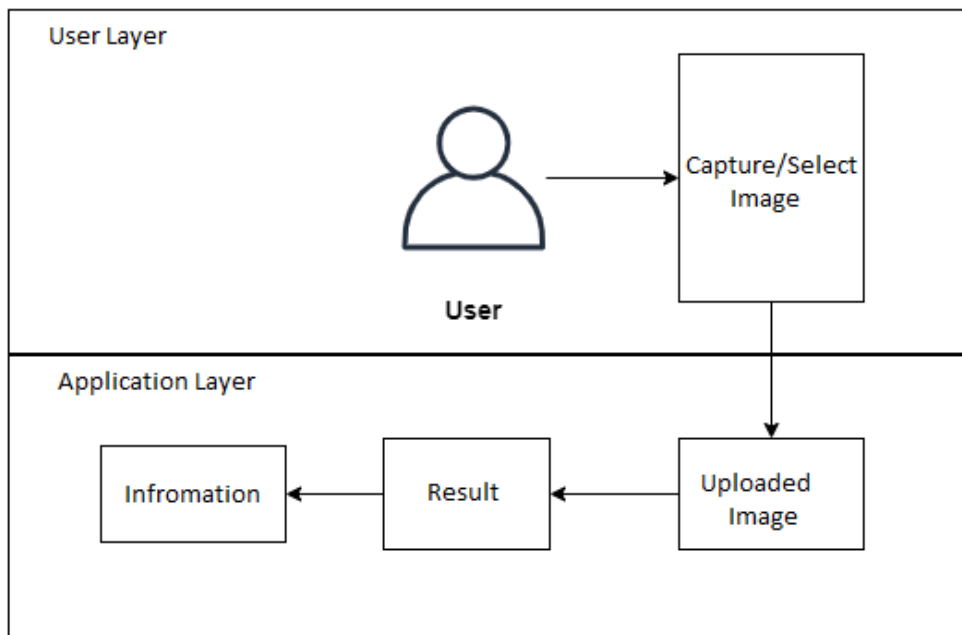


Figure 5.4.1: Implementation of Interaction

5.5 System Architecture

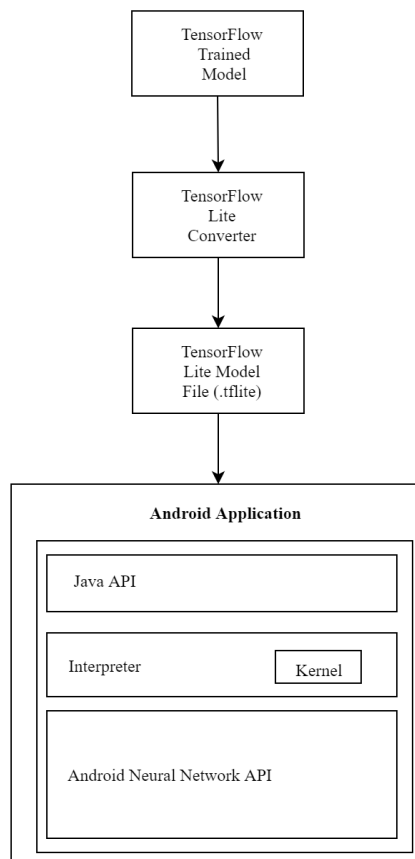


Figure 5.5.1: System Architecture

5.6 Testing Implementation

After finishing trained we got a result of accuracy. Based on this accuracy result the developed system can detect the fruit's disease accurately. Also we got the validation result.

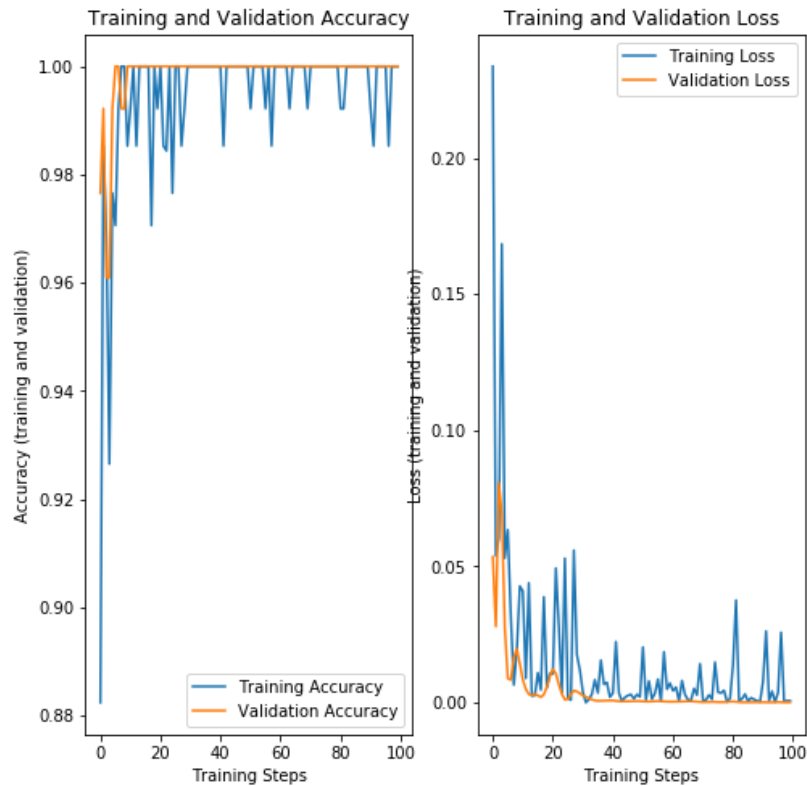


Figure 5.6.1: Accuracy Result

5.7 Result of Implementation

After implementing our project system we got an outcome. We successfully trained the data for apple scab and green mould. Then got the perfect validation for them.

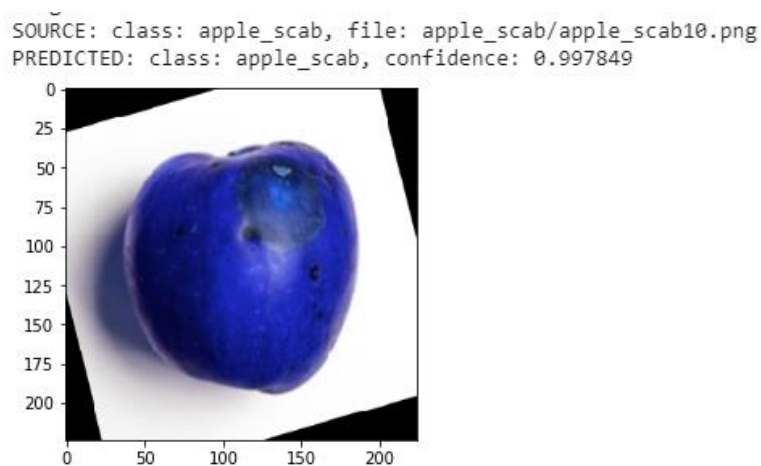
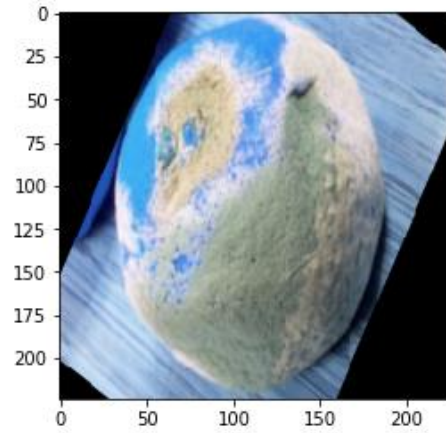


Figure 5.6.2: Validation Result of Apple Scab

SOURCE: class: green_mould, file: green_mould/green_mould60.png
PREDICTED: class: green_mould, confidence: 0.999988



<Figure size 432x288 with 0 Axes>

Figure 5.6.3: Validation Result of Green Mould

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 Discussion and Conclusion

This application is for those farmers who are farming fruits and those fruit's lovers who love fruits. Our target is to maintain fruit quality by detecting them. The application is based on Bangla language so they can easily use it. As our most of the fruits are seasonal. So, it's difficult for us to collect them. We tried to make this success using the dataset of apple scab and green mould. Also added the information of apple scab and green mould which can be a helping hand for them. The application of our project language is Bangla so that it's very easy to read instruction and understanding our application software.

As it's for Android smartphone, there's more things remains to develop. We try to make it as more user friendly as we can. By using our application the users can detect different type of diseases and get the solution. Information are included so that, they can know about the disease in detailed and take proper step about it.

6.3 Scope and Further Developments

Whereas our developed application is for the rural people but it's on the primary stage, the application has more development scope. In the future, the camera feature can be added for the live results. Scope for dragging the image and mark the area of damage that will show the percentage of damage. Here AI can be used. The application can be more user-friendly by clicking the current image and show output quickly. Now, this application is working on Android and only works for basic operation. In the future, our development will be added to this type of feature using AI and fully AI-based Applications.

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CHAPTER 1 Introduction 1.1 Introduction Though the cultivation of fruit in our country is better because of prolific soil. But the farmer can't get the proper advantages. Bangladesh is a developing country, not a developed one. So the facilities for the farmer for farming is not lesser than the developed country. On the other hand, though day by day we are familiar with technology rural people can't get the opportunity. In fact, they are unfamiliar with the internet. Considering sometimes, the number of fruits is damaging for contacting the only one damage fruit. If the farmer can identify the only fruit after ensuring the percentage of damage, a huge amount of fruit can be saved. Consideration of this fact we developed an idea/solution that is more helpful for the cultivators as well as for human beings. 1.2 Motivation Our concern as a motivation for this project is a step to protect the thousands of fresh fruits those contact in damaged fruit. Whether it's difficult for the farmer to check and identify the fresh and damage fruit. For this, they often face a number of difficulties and losses. That can impact their livelihood as well as their earning. As a result, a range of people can face problems while buying those fruits. Our project application can detect those damage fruits. By detecting those damaged fruits, the financial losses of farmers are being decreased. 1.3 Objectives • Protect thousands of fruits by detecting one damage fruit. • Get the percentage of damage area so that farmers can apply criteria to decrease damage. • Take the proper steps to protect those fruits in the future from the same disease. • Get monthly report of damaged fruits. 1.4 Expected Outcome • This Android application is a way to detect damaged fruit from thousands of fruits that are contacted with each other. • By detecting the damaged area a damage percentage is shown. That can help the farmers to apply criteria to decrease the damage. • To get an expected outcome application must need fresh and damage fruit images. The developed idea is a better solution as well as a step for the cultivator to make their difficulties easier. In this Android application, two types of images are stored for detecting the damage and show the percentage. This can be a helping hand of the cultivator. 1.5 Report Layout Basically,