

Fertilizer Recommendation System for Plant Disease Prediction

PROJECT REPORT

Submitted by

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In

COMPUTER SCIENCE AND ENGINEERING



**KAMARAJ COLLEGE OF ENGINEERING AND TECHNOLOGY,
VIRUDHUNAGAR.**

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1. INTRODUCTION

1.1 PROJECT OVERVIEW:

Agriculture is the most important sector in today's life. Most plants are affected by a wide variety of bacterial and fungal diseases. Diseases on plants placed a major constraint on the production and a major threat to food security. Hence, early and accurate identification of plant diseases is essential to ensure high quantity and best quality. In recent years, the number of diseases on plants and the degree of harm caused has increased due to the variation in pathogen varieties, changes in cultivation methods, and inadequate plant protection techniques. An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases. Detection and recognition of plant diseases using deep learning are very efficient in providing symptoms of identifying diseases at its earliest. Plant pathologists can analyze the digital images using digital image processing for diagnosis of plant diseases. Application of computer vision and image processing strategies simply assist farmers in all of the regions of agriculture. Generally, the plant diseases are caused by the abnormal physiological functionalities of plants. Therefore, the characteristic symptoms are generated based on the differentiation between normal physiological functionalities and abnormal physiological functionalities of the plants. Mostly, the plant leaf diseases are caused by Pathogens which are positioned on the stems of the plants. These different symptoms and diseases of leaves are predicted by different methods in image processing. These different methods include different fundamental processes like segmentation, feature extraction and classification and so on. Mostly, the prediction and diagnosis of leaf diseases are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves.

1.2 PURPOSE:

An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM:

Punith Shah proposed that the basis on the crop and region of farming we will recommend the fertilizer and its uses to boost the yield productivity for farmers. Sometimes due to unwanted excess of rainfall or the pest attack can cause disease to crops. We will use the image classification technique where the user can upload the picture of the affected plant/crop and the system will figure out the type of disease which will be done using Support Vector Machine (SVM) or using the neural network techniques. And this disease detection will suggest that how that plant/crop can be cure or prevent.

2.2 REFERENCES:

- Crop Prediction and Disease Detection System - Sambhav Bhansali, Punit Shah, Jinay Shah, Priyal Vyas, Poonam Thakre.
- Fertilizers Recommendation System for Disease Prediction In Tree Leave - R.Neela, P.Nithya.
- Soil based fertilizer Recommendation system for crop disease prediction – Dr.P.Pandiselvi, P.Poornima.

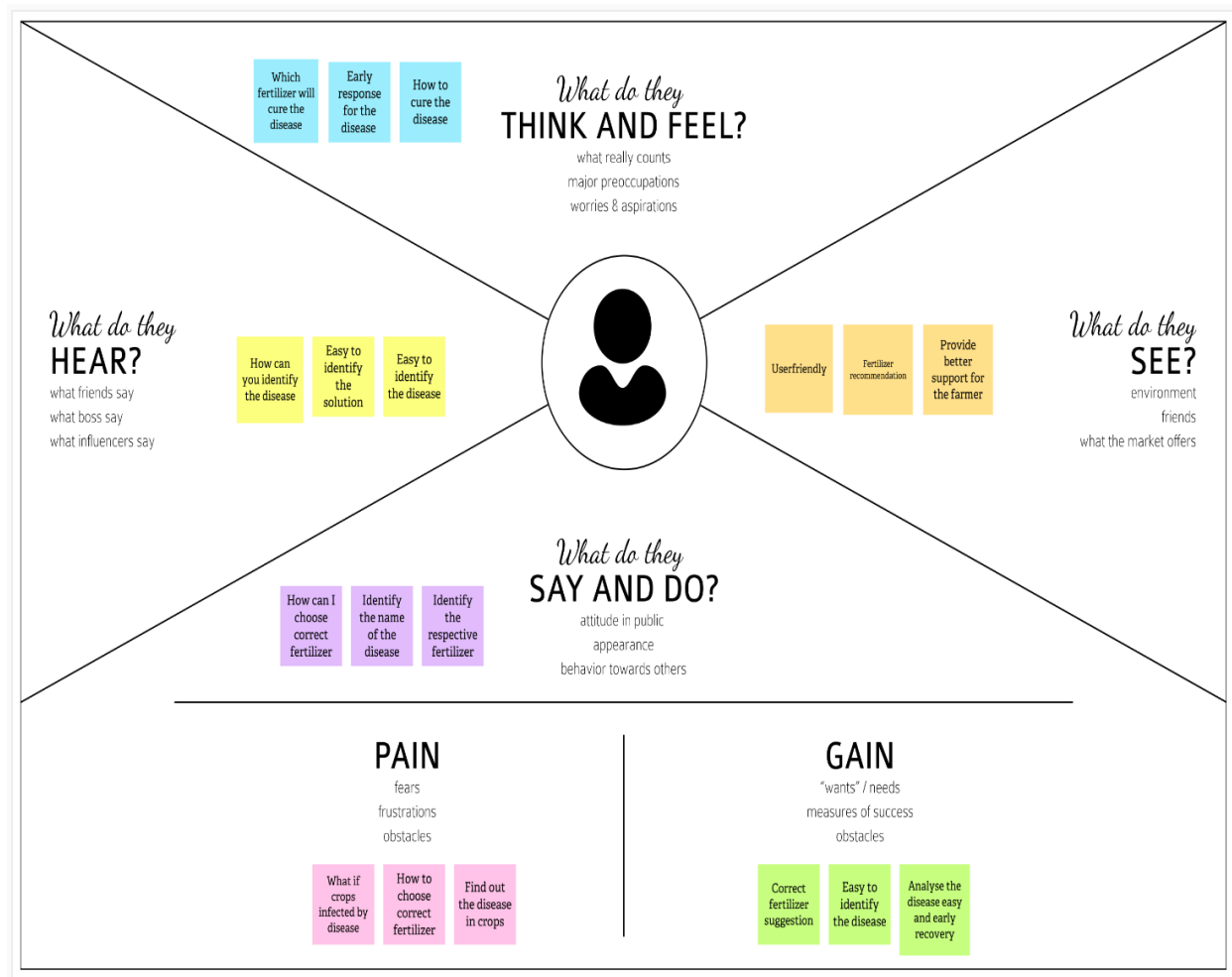
2.3 PROBLEM STATEMENT DEFINITION:

Agriculture is the most important sector in today's life. Most plants are affected by a wide variety of bacterial and fungal diseases. Diseases on plants placed a major constraint on the production and a major threat to food security. Hence, early and accurate identification of plant diseases is essential to ensure high quantity and best quality. In recent years, the number of diseases on plants and the degree of harm caused has increased due to the variation in pathogen varieties, changes in cultivation methods, and inadequate plant protection techniques. An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases. The farmer who is trying to cultivating the crops for huge profit and very control in using fertilizer on the crops. He is trying to use the recent technologies to avoid disease in crops and trying increase the quantity and quality of crops. But he is unaware of the existing technology that can help me a lot to predict the disease and I don't know to use the correct fertilizer for disease. Because he don't want to spoil the soil quality and crops quality which

makes him feel that he is not capable of cultivating the crops and maintaining the quality of land and producing good quality of crops.

3. IDEATION AND PROPOSED SOLUTION


3.1 EMPATHY MAP CANVAS:



3.2 IDEATION & BRAINSTORMING:




Step 1: Team Gathering, Collaboration and Select the Problem Statement


Template



Brainstorm & idea prioritization


Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

 10 minutes to prepare
 1 hour to collaborate
 2-8 people recommended



Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

 10 minutes

A

Team gathering

Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B


Set the goal

Think about the problem you'll be focusing on solving in the brainstorming session.

C

Learn how to use the facilitation tools


Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) 

1


Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

 5 minutes


PROBLEM


How might we [your problem statement]?





Key rules of brainstorming


To run a smooth and productive session


 Stay in topic.

 Encourage wild ideas.

 Defer judgment.

 Listen to others.

 Go for volume.

 If possible, be visual.

Step 2: Brainstorm, Idea listing and Grouping

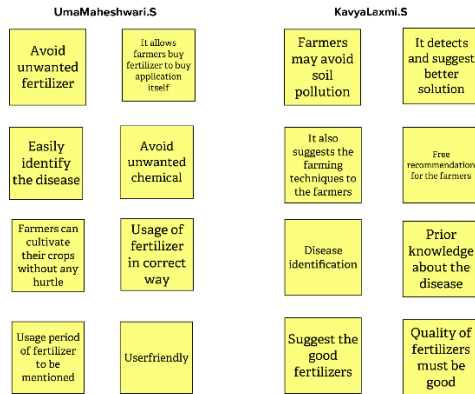
2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP
You can select a sticky note and fill the pencil (switch to sketch) icon to start drawing!



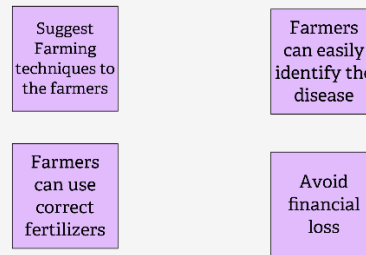
3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

TIP
Add customizable tags to sticky notes to make it easier to find, browse, unpin, and categorize important ideas on themes within your mural.



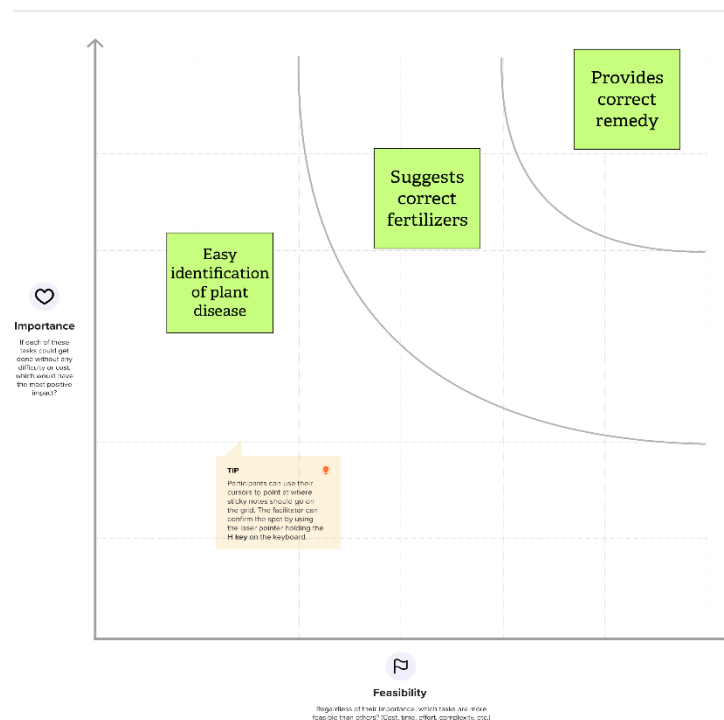
Step 3: Idea Prioritization

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes



5

After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

- Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.
- Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

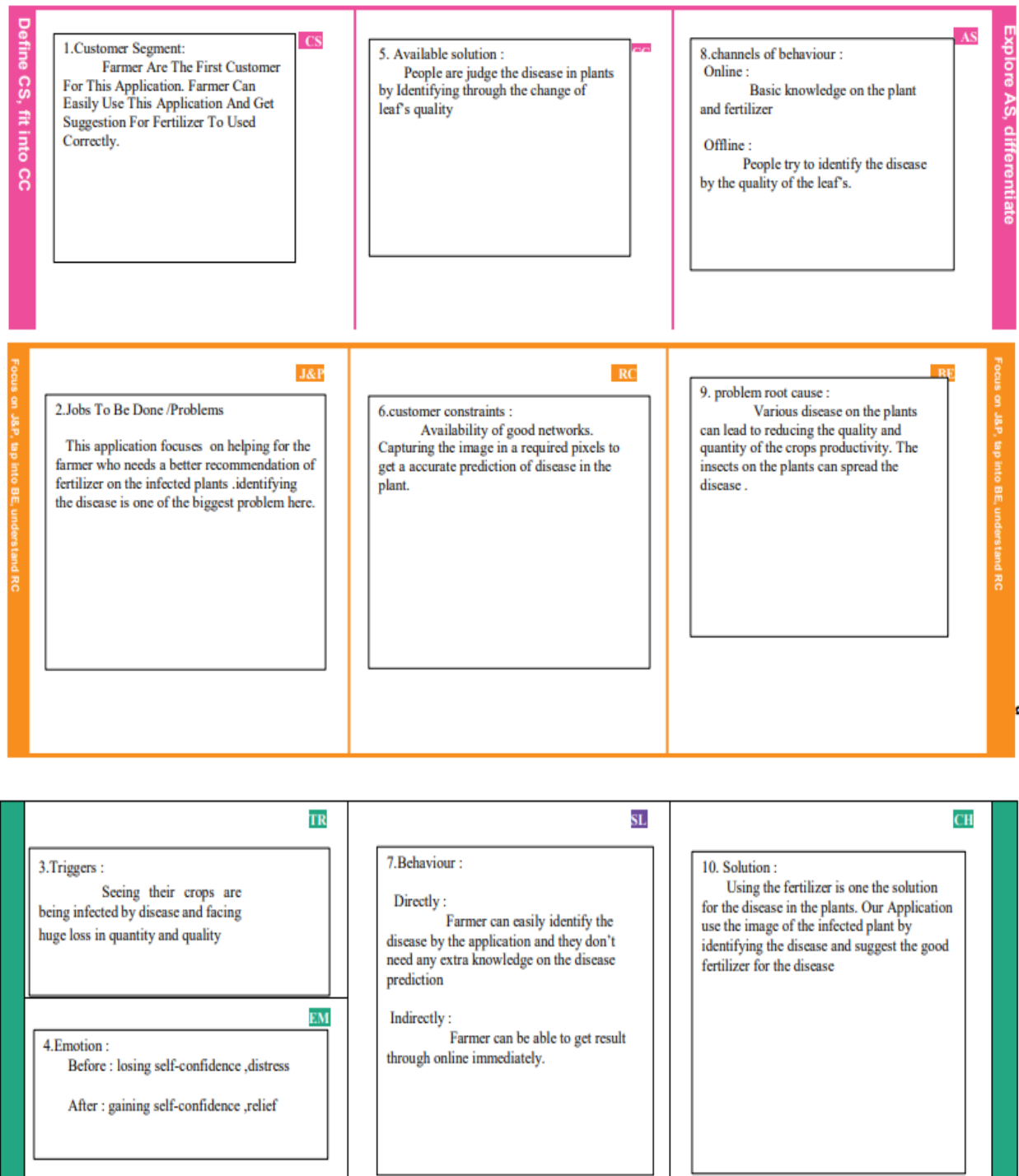
- Strategy blueprint**
Define the components of a new idea or strategy.
[Open the template →](#)
- Customer experience journey map**
Understand customer needs, motivations, and obstacles for an experience.
[Open the template →](#)
- Strengths, weaknesses, opportunities & threats**
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
[Open the template →](#)

[Share template feedback](#)

3.3 PROPOSED SOLUTION:

S.No	Parameter	Description
1.	Problem statement (problem to be solved)	Disease in plants reduced the quantity and quality of the plants productivity. Identifying the disease in plant is hard to find.
2.	Idea/solution description	One of the solution of the problem is to identifying the disease in early stage and using the correct fertilizer.
3.	Novelty / uniqueness	This application can suggest good fertilizer for the disease in the plant by recognizing the images.
4.	Social impact/customer satisfaction	It helps the farmer by identifying the disease in the early stage and increase the quality and quantity of crops in efficient way.
5.	Business model(revenue model)	The application is recommends to farmer in subscription basis.
6.	Scalability of the solution	This application can be improved by introducing online purchases of crops, fertilizer easily

3.4 PROBLEM SOLUTION FIT:



4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS:

Following are the functional requirements of the proposed system,

Fr.no	Functional requirement	Sub requirement (story/subtask)
Fr-1	User registration	Registration through form Registration through Gmail
Fr-2	User confirmation	Confirmation via OTP Confirmation via Email
Fr-3	Capturing image	Capture the image of the leaf And check the parameter of the captured image .
Fr-4	Image processing	Upload the image for the prediction of the disease in the leaf.
Fr-5	Leaf identification	Identify the leaf and predict the disease in leaf.
Fr-6	Image description	Suggesting the best fertilizer for the disease.

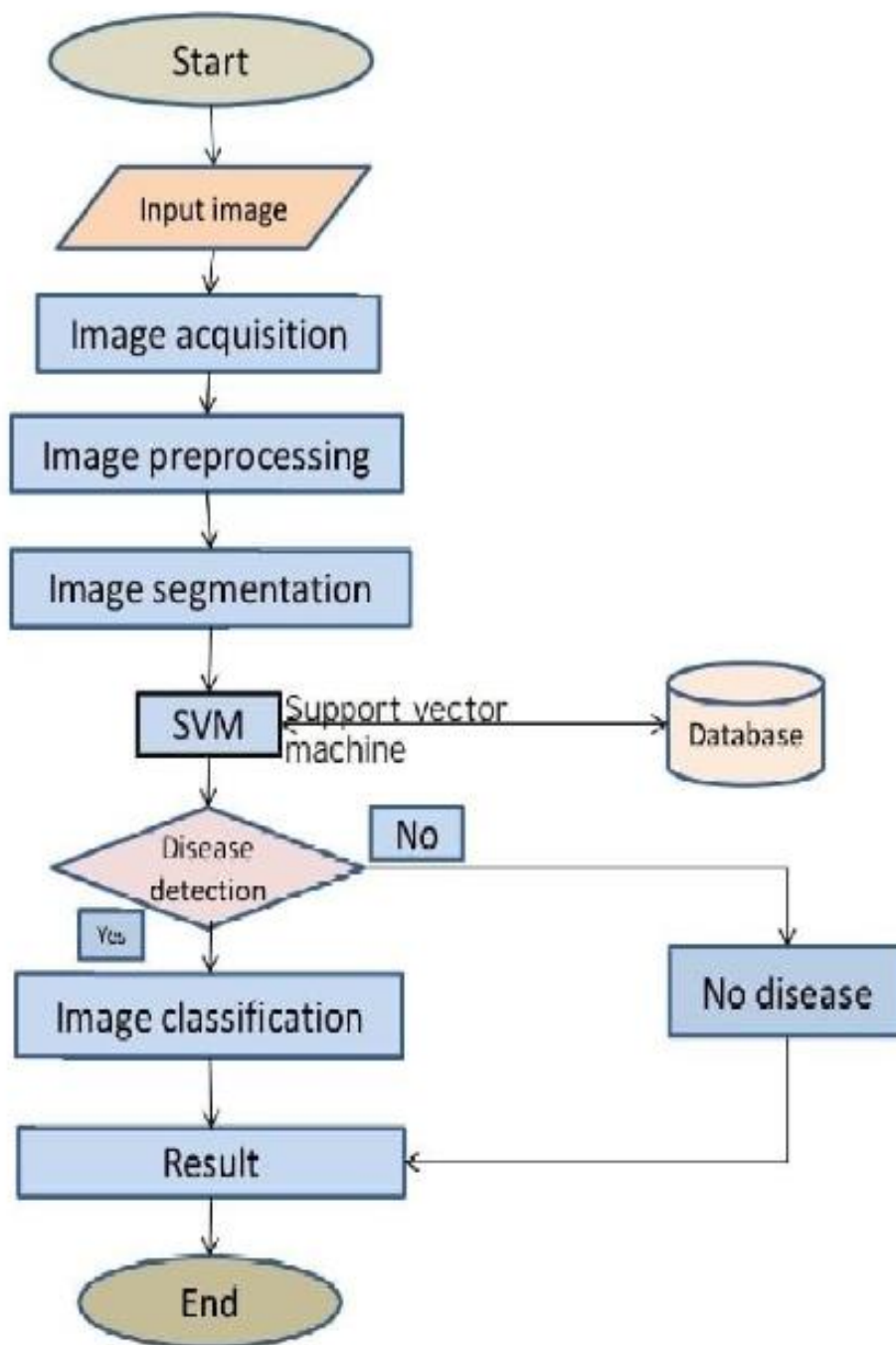
4.2 NON FUNCTIONAL REQUIREMENTS:

Following are the non functional requirements of the proposed system,

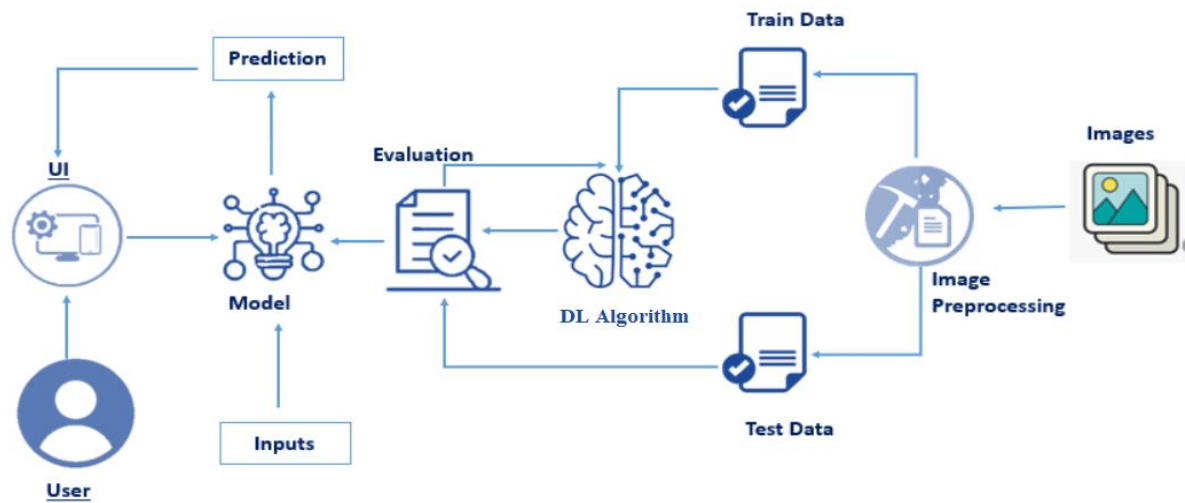
NFr.no	Non-functional requirement	Description
Nfr-1	Usability	Datasets of all the leaf is used to detecting the disease that present in the leaf.
Nfr-2	Security	The information belongs to the user and leaf are secured highly.
Nfr-3	Reliability	The leaf quality is important for the predicting the disease in leaf.
Nfr-4	Performance	The performance is based on the quality of the leaf used for disease prediction
Nfr-5	Availability	It is available for all user to predict the disease in the plant
Nfr-6	Scalability	Increasing the prediction of the disease in the leaf

5 PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS:



5.2 SOLUTION & TECHNICAL ARCHITECTURE:



5.3 USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard					
Customer (Web user)						

Customer Care Executive						
Administrator						

6 PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points (Total)	Priority	Team Members
Sprint1	Model Creation and Training (Fruits)	FRSFDP-44	Create a model which can classify diseased fruit plants from given images. I also need to test the model and deploy it on IBM Cloud	8	High	Uma
	Model Creation and Training (Vegetables)	FRSFDP-45	Create a model which can classify diseased vegetable plants from given images	2	Medium	Kavya
Sprint2	Model Creation and Training (Vegetables)	FRSFDP-46	Create a model which can classify diseased vegetable plants from given images and train on IBM Cloud	6	High	Uma
	Registration	FRSFDP-47	As a user, I can register by entering my email, password, and confirming my password via OAuth API	3	High	Kavya
	Upload page	FRSFDP-48	As a user, I will be redirected to a page where I can upload my pictures of crops	4	High	Uma
	Suggestion results	FRSFDP-49	As a user, I can view the results and then obtain the suggestions provided by the ML Model	4	High	Kavya
	Base Flask App	FRSFDP-50	A base Flask web app must be created as an interface for the ML model.	2	High	Uma

Sprint3	Login	FRSFDP-51	As a user/admin/shopkeeper ,I can log into the application by entering email & password	2	High	Kavya
	User Dashboard	FRSFDP-52	As a user, I can view the previous results and history	3	Medium	Uma
	Integration	FRSFDP-53	Integrate Flask, CNN model with Cloudant DB	5	Medium	Uma
	Containerization	FRSFDP-54	Containerize Flask app using Docker	2	Low	Kavya
Sprint4	Dashboard (Admin)	FRSFDP-55	As an admin, I can view other user details and uploads for other purposes	2	Medium	Uma
	Dashboard (Shopkeeper)	FRSFDP-56	As a shopkeeper, I can enter fertilizer products and then update the details	2	Low	Uma
	Containerization	FRSFDP57	Create and deploy Helmcharts using Docker Image made before	2	Low	Kavya
	Logout	FRSFDP58	After finishing the process then logout	2	Low	Uma

6.2 SPRINT DELIVERY SCHEDULE:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint EndDate (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	10	6 Days	24 Oct 2022	29 Oct 2022	10	30 Oct 2022
Sprint-2	15	6 Days	31 Oct 2022	05 Nov 2022	15	06 Nov 2022
Sprint-3	15	6 Days	07 Nov 2022	12 Nov 2022	15	13 Nov 2022
Sprint-4	12	6 Days	14 Nov 2022	19 Nov 2022	10	20 Nov 2022

7 CODING & SOLUTIONING

7.1 FEATURE 1:

Index.html:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <!-- basic -->
  <meta charset="utf-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <!-- mobile metas -->
  <meta name="viewport" content="width=device-width, initial-scale=1">
  <meta name="viewport" content="initial-scale=1, maximum-scale=1">
  <!-- site metas -->
  <title>IBM</title>
  <meta name="keywords" content="">
  <meta name="description" content="">
  <meta name="author" content="">
  <!-- favicon -->
  <link rel="icon"
href="C:\Users\uma25\project\flask\static\images\favicon.png"
type="image/gif" />
  <!-- bootstrap css -->
  <link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\bootstrap.min.css">
  <!-- style css -->
  <link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\style.css">
  <!-- Responsive-->
```

```
<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\responsive.css">

<!-- Scrollbar Custom CSS -->

<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\jquery.mCustomScrollbar.min.css
">

<!-- Tweaks for older IEs-->

<link rel="stylesheet" href="https://netdna.bootstrapcdn.com/font-
awesome/4.0.3/css/font-awesome.css">

<link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/fancybox/2.1.5/jquery.fancybox.mi
n.css" media="screen">

<!--[if lt IE 9]>

<script
src="https://oss.maxcdn.com/html5shiv/3.7.3/html5shiv.min.js"></script>

<script
src="https://oss.maxcdn.com/respond/1.4.2/respond.min.js"></script><![endif]-
->

</head>

<!-- body -->

<body class="main-layout">

  <!-- loader -->

  <div class="loader_bg">

    <div class="loader"></div>

  </div>

  <!-- end loader -->

  <!-- header -->

  <header>

    <!-- header inner -->

    <div class="header-top">
```



```
<div class="header">
  <div class="container-fluid">
    <div class="row">
      <div class="col-xl-2 col-lg-4 col-md-4 col-sm-3 col logo_section">
        <div class="full">
          <div class="center-desk">
            <div class="logo">
              <a href="index.html"></a>
            </div>
          </div>
        </div>
      </div>
      <div class="col-xl-10 col-lg-8 col-md-8 col-sm-9">
        <div class="menu-area">
          <div class="limit-box">
            <nav class="main-menu ">
              <ul class="menu-area-main">
                <li class="active"> <a href="index.html">Home</a> </li>
                <li> <a href="#about">About</a> </li>
                <li> <a href="predict.html">Predict</a> </li>
              </ul>
            </nav>
          </div>
        </div>
      </div>
    </div>
  </div>
</div>
```

```

</div>
</div>
<!-- end header inner -->
<!-- end header -->
<section class="slider_section">
<div id="myCarousel" class="carousel slide" data-ride="carousel">
<ol class="carousel-indicators">
<li data-target="#myCarousel" data-slide-to="0" class="active"></li>
<li data-target="#myCarousel" data-slide-to="1"></li>
</ol>
<div class="carousel-inner">
<div class="carousel-item active">
<div class="container-fluid padding_dd">
<div class="carousel-caption">
<div class="row">
<div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
<div class="text-bg">
<h1 style="font-size: 50px;">Fertilizers Recommendation System
For Disease Prediction In Plants</h1>
<form class="Vegetable">
</div>
</div>
<div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
<div class="images_box">
<figure></figure>
</div>
</div>

```

```
</div>
</div>
</div>
</div>
<div class="carousel-item">
  <div class="container-fluid padding_dd">
    <div class="carousel-caption">
      <div class="row">
        <div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
          <div class="text-bg">
            <h2 style="font-size: 35px;">It is used to predict diseases in
plants and to suggest fertilizers which would be required to eradicate the disease
and to fight off the disease in the future too.</h2>
          </div>
        </div>
        <div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
          <div class="images_box">
            <figure></figure>
          </div>
        </div>
      </div>
    </div>
  </div>
</div>
</div>
</div>
</div>
</div>
```

```
<a class="carousel-control-prev" href="#myCarousel" role="button" data-
slide="prev">
```

```
<span class="carousel-control-prev-icon" aria-hidden="true"></span>
```

```
<span class="sr-only">Previous</span>
```

```
</a>
```

```
<a class="carousel-control-next" href="#myCarousel" role="button" data-
slide="next">
```

```
<span class="carousel-control-next-icon" aria-hidden="true"></span>
```

```
<span class="sr-only">Next</span>
```

```
</a>
```

```
</div>
```

```
</section>
```

```
</div>
```

```
</header>
```

```
<!-- about -->
```

```
<div id="about" class="about">
```

```
<div class="container-fluid">
```

```
<div class="row">
```

```
<div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
```

```
<div class="about-box">
```

```
<h2>About us</h2>
```

<p>Agriculture is the most important sector in today's life. Most plants are affected by a wide variety of bacterial and fungal diseases. Diseases on plants placed a major constraint on the production and a major threat to food security. Hence, early and accurate identification of plant diseases is essential to ensure high quantity and best quality. In recent years, the number of diseases on plants and the degree of harm caused has increased due to the variation in pathogen varieties, changes in cultivation methods, and inadequate plant protection techniques.

An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning

techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases. </p>

</div>

</div>

<div class="col-xl-6 col-lg-6 col-md-6 col-sm-12 padding_rl">

<div class="about-box_img">

<figure></figure>

</div>

</div>

</div>

</div>

</div>

<!-- end abouts -->

<!-- end vegetable -->

<!-- Javascript files-->

<script
src="C:\Users\uma25\project\flask\static\js\jquery.min.js"></script>

<script
src="C:\Users\uma25\project\flask\static\js\popper.min.js"></script>

<script
src="C:\Users\uma25\project\flask\static\js\bootstrap.bundle.min.js"></script>

<script src="C:\Users\uma25\project\flask\static\js\jquery-3.0.0.min.js"></script>

<script src="C:\Users\uma25\project\flask\static\js\plugin.js"></script>

<!-- sidebar -->

<script
src="C:\Users\uma25\project\flask\static\js\jquery.mCustomScrollbar.concat.min.js"></script>

<script src="C:\Users\uma25\project\flask\static\js\custom.js"></script>

```
<script
src="https://cdnjs.cloudflare.com/ajax/libs/fancybox/2.1.5/jquery.fancybox.min.js
"></script>

</body>

</html>
```

Predict.html:

```
<!DOCTYPE html>

<html lang="en">

<head>

  <!-- basic -->

  <meta charset="utf-8">

  <meta http-equiv="X-UA-Compatible" content="IE=edge">

  <!-- mobile metas -->

  <meta name="viewport" content="width=device-width, initial-scale=1">

  <meta name="viewport" content="initial-scale=1, maximum-scale=1">

  <!-- site metas -->

  <title>IBM</title>

  <meta name="keywords" content="">

  <meta name="description" content="">

  <meta name="author" content="">

  <!-- favicon -->

  <link rel="icon"
href="C:\Users\uma25\project\flask\static\images\favicon.png"
type="image/gif" />

  <!-- bootstrap css -->

  <link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\bootstrap.min.css">
```

```
<!-- style css -->

<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\style.css">

<!-- Responsive-->

<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\responsive.css">

<!-- Scrollbar Custom CSS -->

<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\jquery.mCustomScrollbar.min.css
">

<!-- Tweaks for older IEs-->

<link rel="stylesheet" href="https://netdna.bootstrapcdn.com/font-
awesome/4.0.3/css/font-awesome.css">

<link href="{{ url_for('static', filename='css/final.css') }}" rel="stylesheet">

<link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/fancybox/2.1.5/jquery.fancybox.mi
n.css" media="screen">

<!--[if lt IE 9]>

<script
src="https://oss.maxcdn.com/html5shiv/3.7.3/html5shiv.min.js"></script>

<script
src="https://oss.maxcdn.com/respond/1.4.2/respond.min.js"></script><![endif]-
->

</head>

<body>

    <!-- predict -->

<div id="predict" class="vegetable">

    <div class="container">

        <div class="row">

            <div class="col-md-12">

                <div class="titlepage">
```

```

        <h2> Plant Disease <strong class="llo">Prediction</strong> </h2>
    </div>
</div>
</div>
<div class="row">
    <div class="col-xl-5 col-lg-5 col-md-5 col-sm-12 ">
        <h4 style="color: green;"><b>Drop the image to get the
prediction!!!...</b></h4>
        <div class="vegetable_shop">
            <form action="" id="upload-file" method="post"
enctype="multipart/form-data">
                <h5 style="color: red;"><b>Choose Category</b></h5>
                <select name="plant">
                    <option value="fruit" name="fruit">Fruits</option>
                    <option value="vegetable" name="vegetable">Vegetables</option>
                </select>
                <br><br>
                <input id="imageUpload" type="file" name="image" value="CHOOSE"
accept="image/jpeg, image/jpg, image/png"
onchange="document.getElementById('output').src=window.URL.createObject
URL(this.files[0])">
                <br><br>
                <img src="" id="output">
                <br><br>
                <button type="button" class="btn btn-info btn-lg " id="btn-predict"
style="background: #28272c;">Predict</button>
            </form>
            <!--drop down,file upload,button-->
        </div>
    </div>

```



```
</div>
<div class="loader" style="display:none;"></div>
    <h3>
        <span id="result" style="font-size:17px; "> </span>
    </h3>
<div class="col-xl-7 col-lg-7 col-md-7 col-sm-12 ">
    <div class="vegetable_img">
        <right>
            <figure></figure>
        </right>
    </div>
</div>
</div>
</div>
<!-- Javascript files-->
<script src="C:\Users\uma25\project\flask\static\js\jquery.min.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\popper.min.js"></script>
<script
src="C:\Users\uma25\project\flask\static\js\bootstrap.bundle.min.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\jquery-
3.0.0.min.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\plugin.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\main.js"></script>
<!-- sidebar -->
<script
src="C:\Users\uma25\project\flask\static\js\jquery.mCustomScrollbar.concat.mi
n.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\custom.js"></script>
```

```
<script
src="https://cdnjs.cloudflare.com/ajax/libs/fancybox/2.1.5/jquery.fancybox.min.js
"></script>

</body>

</html>
```

7.2 FEATURE 2:

App.py :

```
import requests

from tensorflow.keras.preprocessing import image
from tensorflow.keras.models import load_model

import numpy as np
import pandas as pd
import tensorflow as tf

from flask import Flask, request, render_template, redirect, url_for
import os

from werkzeug.utils import secure_filename

from tensorflow.python.keras.backend import set_session

app=Flask(__name__)

model=load_model('vegetable.h5')
model1=load_model('fruit.h5')

#homepage
@app.route('/')
def home():
    return render_template('index.html')
```

```
#prediction page
@app.route('/prediction')
def prediction():
    return render_template('predict.html')

@app.route('/predict',methods=['POST'])
def predict():
    if request.method=='POST':
        f=request.files['image']
        basepath=os.path.dirname(__file__)
        file_path=os.path.join(basepath,'uploads',secure_filename(f.filename))
        f.save(file_path)
        img=image.load_img(file_path,target_size=(128,128))
        x=image.img_to_array(img)
        x=np.expand_dims(x,axis=0)
        plant=request.form['plant']
        print(plant)
        if(plant=="vegetable"):
            preds = model.predict(x)
            preds=np.argmax(preds)
            print(preds)
            df=pd.read_excel('precautions_veg.xlsx')
            print(df.iloc[preds]['caution'])
        else:
            preds = model1.predict(x)
            preds=np.argmax(preds)
            df=pd.read_excel('precautions_fruits.xlsx')
```

```

    print(df.iloc[preds]['caution'])

    return df.iloc[preds]['caution']

if __name__ == "__main__":
    app.run(debug=False)

```

8 TESTING

8.1 TEST CASES:

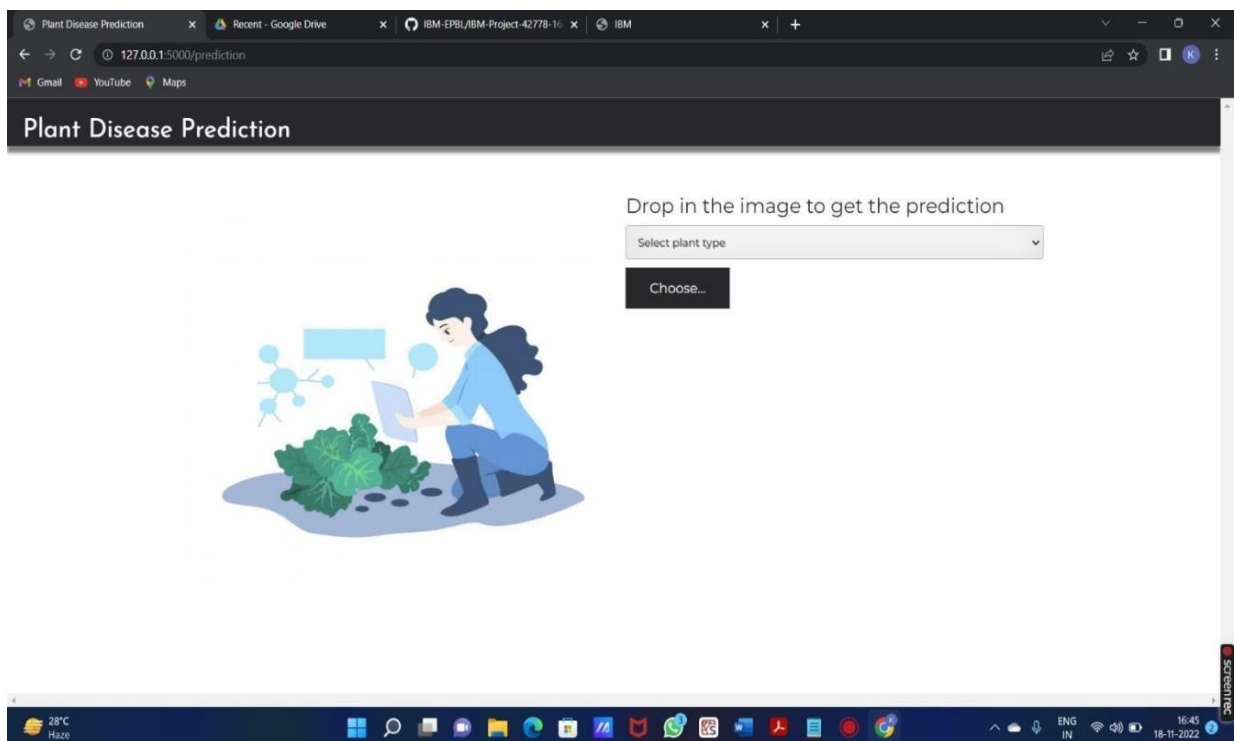
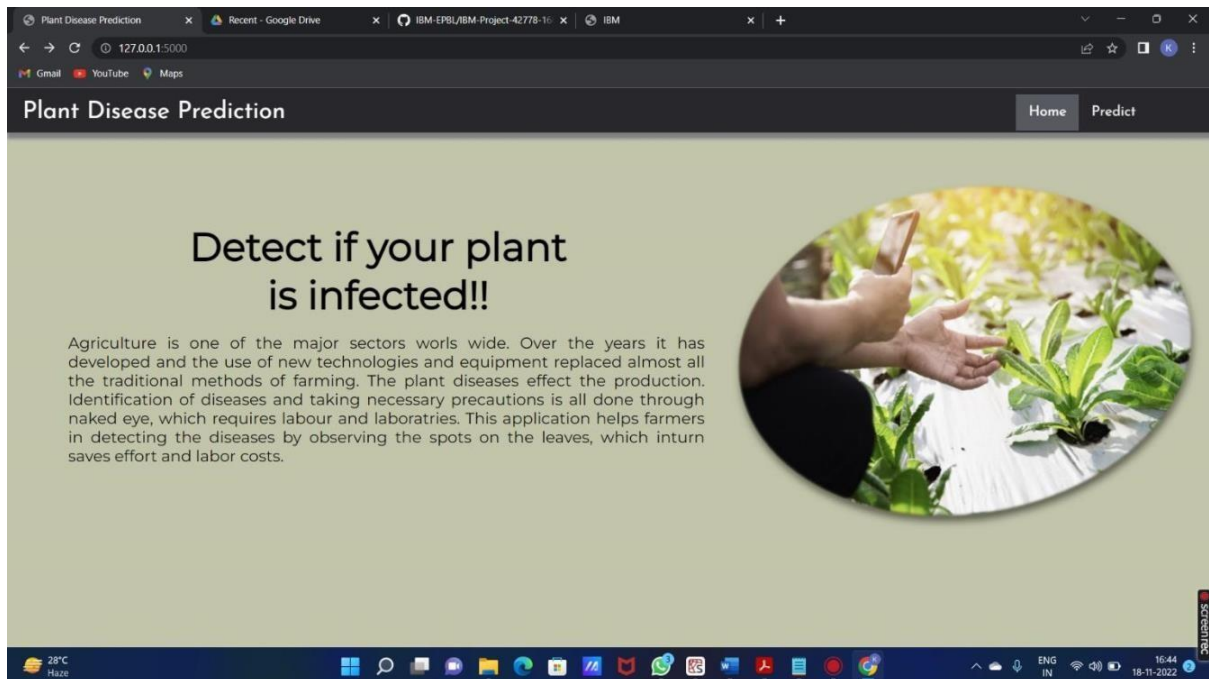
SECTION	TOTAL CASES	NOT TESTED	FAIL	PASS
Leaf spots	17	0	0	17
Mosaic Leaf Pattern	51	0	0	51
Misshapen Leaves	20	0	0	20
Yellow Leaves	7	0	0	7
Fruit Rots	9	0	0	9
Fruit Spots	4	0	0	4
Blights	2	0	0	2

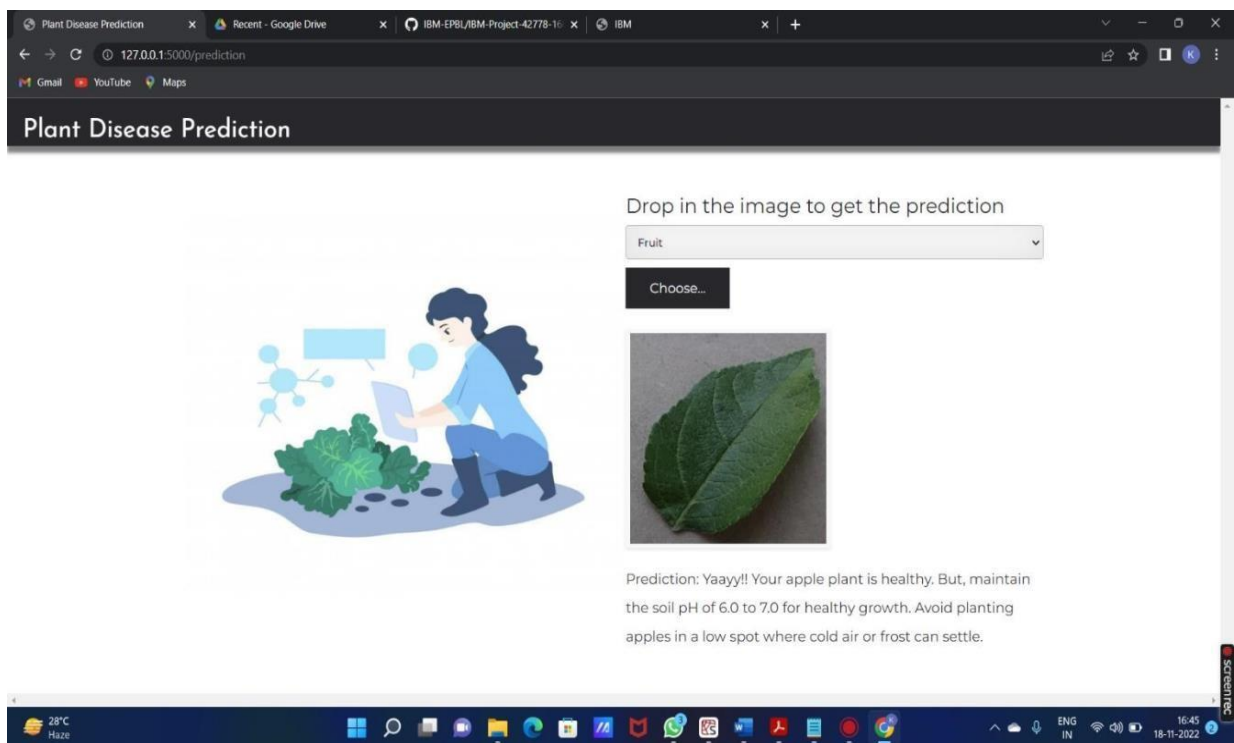
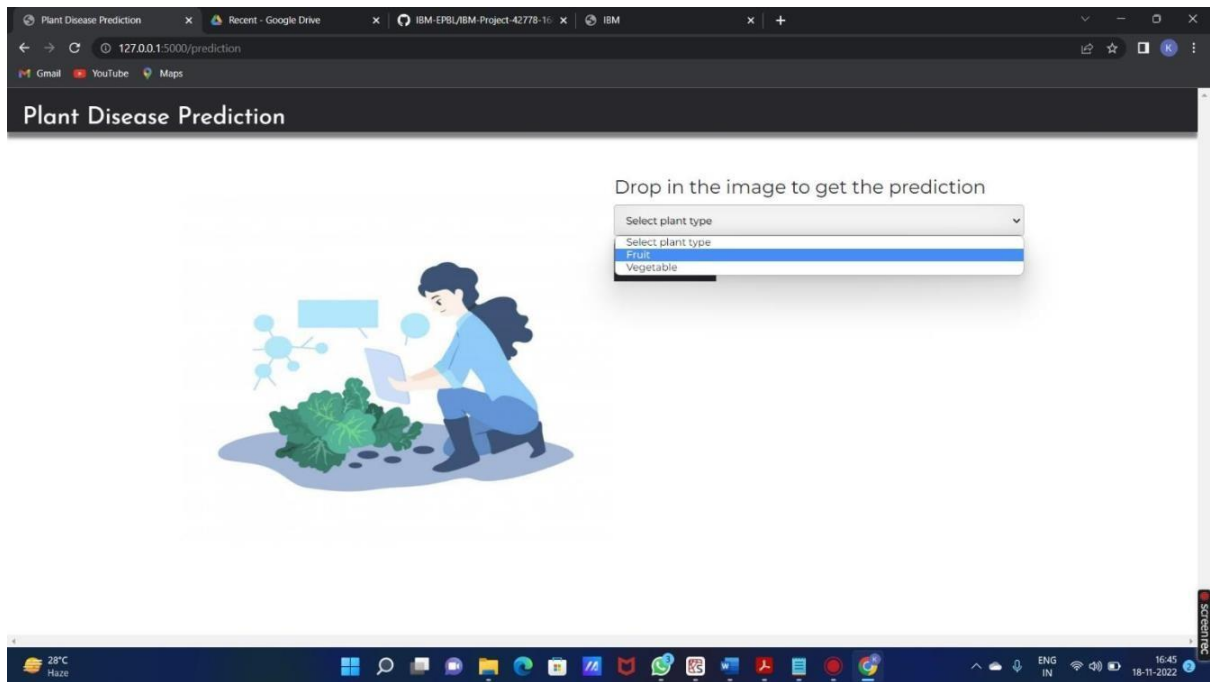
8.2 USER ACCEPTANCE TESTING:

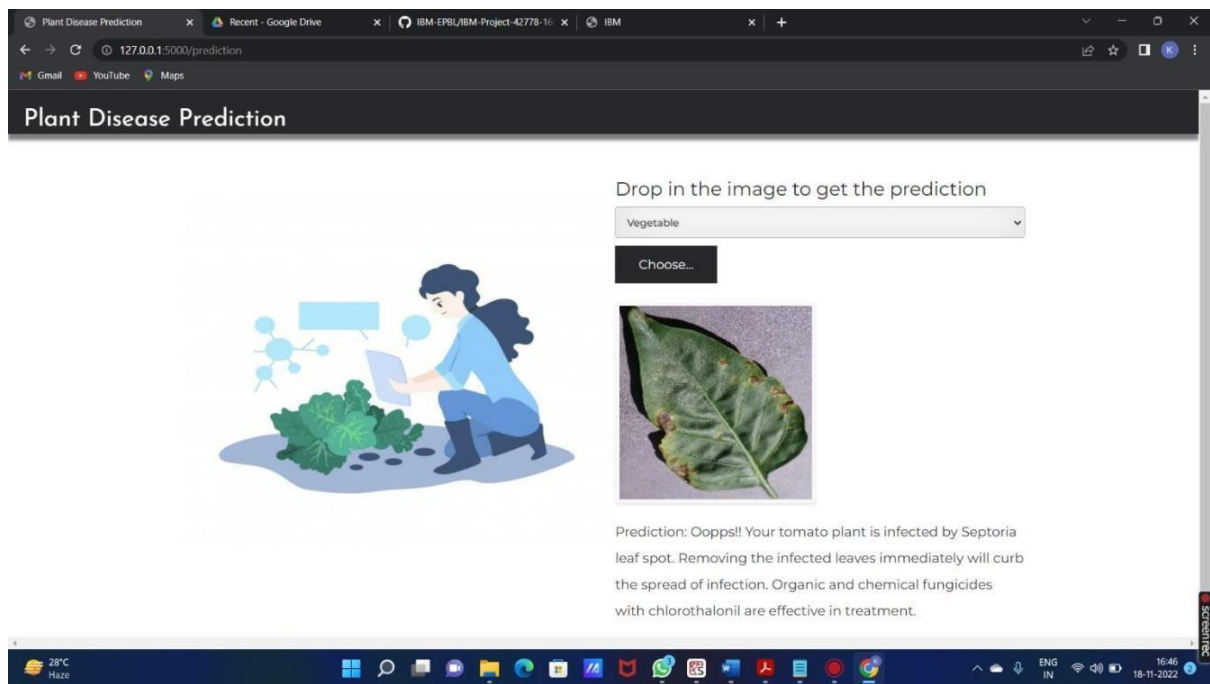
RESOLUTION	SEVERITY1	SEVERITY2	SEVERITY3	SEVERITY4	SUBTOTAL
Leaf spots	1 0	4	2	3	19
Mosaic LeafPattern	9	6	3	6	24
MisshapenLeaves	2	7	0	1	10
Yellow Leaves	1 1	4	3	20	38
Fruit Rots	3	2	1	0	6
Fruit Spots	5	3	1	1	10
Blights	4	5	2	1	12
Totals	4 4	31	13	32	119

9 RESULTS

9.1 PERFORMANCE METRICS:







10 ADVANTAGES & DISADVANTAGES:

List of advantages:

- The proposed model here produces very high accuracy of classification.
- Very large datasets can also be trained and tested.
- Images of very high can be resized within the proposed itself.

List of disadvantages:

- For training and testing, the proposed model requires very high computational time.
- The neural network architecture used in this project work has high complexity.

11 CONCLUSION:

The model proposed here involves image classification of fruit datasets and vegetable datasets. The following points are observed during model testing and training:

- The accuracy of classification increased by increasing the number of epochs.
- For different batch sizes, different classification accuracies are obtained.
- The accuracies are increased by increasing more convolution layers.

- The accuracy of classification also increased by varying dense layers.
- Different accuracies are obtained by varying the size of kernel used in the convolution layer output.
- Accuracies are different while varying the size of the train and test datasets.

12 FUTURE SCOPE:

The proposed model in this project work can be extended to image recognition. The entire model can be converted to application software using python to exe software. The real time image classification, image recognition and video processing are possible with help OpenCV python library. This project work can be extended for security applications such as figure print recognition, iris recognition and face recognition.

13 APPENDIX

13.1 SOURCE CODE:

Index.html:

```
<!DOCTYPE html>

<html lang="en">

<head>

  <!-- basic -->

  <meta charset="utf-8">

  <meta http-equiv="X-UA-Compatible" content="IE=edge">

  <!-- mobile metas -->

  <meta name="viewport" content="width=device-width, initial-scale=1">

  <meta name="viewport" content="initial-scale=1, maximum-scale=1">

  <!-- site metas -->

  <title>IBM</title>

  <meta name="keywords" content="">

  <meta name="description" content="">

  <meta name="author" content="">
```



```
<!-- fevicon -->

<link rel="icon"
href="C:\Users\uma25\project\flask\static\images\fevicon.png"
type="image/gif" />

<!-- bootstrap css -->

<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\bootstrap.min.css">

<!-- style css -->

<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\style.css">

<!-- Responsive-->

<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\responsive.css">

<!-- Scrollbar Custom CSS -->

<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\jquery.mCustomScrollbar.min.css
">

<!-- Tweaks for older IEs-->

<link rel="stylesheet" href="https://netdna.bootstrapcdn.com/font-
awesome/4.0.3/css/font-awesome.css">

<link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/fancybox/2.1.5/jquery.fancybox.mi
n.css" media="screen">

<!--[if lt IE 9]>

<script
src="https://oss.maxcdn.com/html5shiv/3.7.3/html5shiv.min.js"></script>

<script
src="https://oss.maxcdn.com/respond/1.4.2/respond.min.js"></script><![endif]-
->

</head>

<!-- body -->
```

```
<body class="main-layout">
  <!-- loader -->
  <div class="loader_bg">
    <div class="loader"></div>
  </div>
  <!-- end loader -->
  <!-- header -->
  <header>
    <!-- header inner -->
    <div class="header-top">
      <div class="header">
        <div class="container-fluid">
          <div class="row">
            <div class="col-xl-2 col-lg-4 col-md-4 col-sm-3 col logo_section">
              <div class="full">
                <div class="center-desk">
                  <div class="logo">
                    <a href="index.html"></a>
                  </div>
                </div>
              </div>
            </div>
            <div class="col-xl-10 col-lg-8 col-md-8 col-sm-9">
              <div class="menu-area">
                <div class="limit-box">
                  <nav class="main-menu ">
```

```
<ul class="menu-area-main">
  <li class="active"> <a href="index.html">Home</a> </li>
  <li> <a href="#about">About</a> </li>
  <li> <a href="predict.html">Predict</a> </li>
</ul>
</nav>
</div>
</div>
</div>
</div>
</div>
</div>
</div>
</div>
</div>
<!-- end header inner -->
<!-- end header -->
<section class="slider_section">
  <div id="myCarousel" class="carousel slide" data-ride="carousel">
    <ol class="carousel-indicators">
      <li data-target="#myCarousel" data-slide-to="0" class="active"></li>
      <li data-target="#myCarousel" data-slide-to="1"></li>
    </ol>
    <div class="carousel-inner">
      <div class="carousel-item active">
        <div class="container-fluid padding_dd">
          <div class="carousel-caption">
            <div class="row">
              <div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
```

```

    <div class="text-bg">
        <h1 style="font-size: 50px;">Fertilizers Recommendation System
For Disease Prediction In Plants</h1>
        <form class="Vegetable">
    </div>
</div>
<div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
    <div class="images_box">
        <figure></figure>
    </div>
</div>
</div>
</div>
</div>
</div>
</div>
<div class="carousel-item">
    <div class="container-fluid padding_dd">
        <div class="carousel-caption">
            <div class="row">
                <div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
                    <div class="text-bg">
                        <h2 style="font-size: 35px;">It is used to predict diseases in
plants and to suggest fertilizers which would be required to eradicate the disease
and to fight off the disease in the future too.</h2>
                    </div>
                </div>
            </div>
        </div>
    </div>
    <div class="images_box">

```

```
<figure></figure>
</div>
</div>
</div>
</div>
</div>
</div>
</div>
</div>
</div>
<a class="carousel-control-prev" href="#myCarousel" role="button" data-
slide="prev">
  <span class="carousel-control-prev-icon" aria-hidden="true"></span>
  <span class="sr-only">Previous</span>
</a>
<a class="carousel-control-next" href="#myCarousel" role="button" data-
slide="next">
  <span class="carousel-control-next-icon" aria-hidden="true"></span>
  <span class="sr-only">Next</span>
</a>
</div>
</section>
</div>
</header>
<!-- about -->
<div id="about" class="about">
  <div class="container-fluid">
```

```

<div class="row">
  <div class="col-xl-6 col-lg-6 col-md-6 col-sm-12">
    <div class="about-box">
      <h2>About us</h2>
      <p>Agriculture is the most important sector in today's life. Most plants
are affected by a wide variety of bacterial and fungal diseases. Diseases on
plants placed a major constraint on the production and a major threat to food
security. Hence, early and accurate identification of plant diseases is essential to
ensure high quantity and best quality. In recent years, the number of diseases on
plants and the degree of harm caused has increased due to the variation in
pathogen varieties, changes in cultivation methods, and inadequate plant
protection techniques.

An automated system is introduced to identify different diseases on plants by
checking the symptoms shown on the leaves of the plant. Deep learning
techniques are used to identify the diseases and suggest the precautions that can
be taken for those diseases. </p>
    </div>
  </div>
  <div class="col-xl-6 col-lg-6 col-md-6 col-sm-12 padding_rl">
    <div class="about-box_img">
      <figure></figure>
    </div>
  </div>
</div>
<!-- end abouts -->
<!-- end vegetable -->
  <!-- Javascript files-->

```

```
<script
src="C:\Users\uma25\project\flask\static\js\jquery.min.js"></script>

<script
src="C:\Users\uma25\project\flask\static\js\popper.min.js"></script>

<script
src="C:\Users\uma25\project\flask\static\js\bootstrap.bundle.min.js"></script>

<script src="C:\Users\uma25\project\flask\static\js\jquery-
3.0.0.min.js"></script>

<script src="C:\Users\uma25\project\flask\static\js\plugin.js"></script>

<!-- sidebar -->

<script
src="C:\Users\uma25\project\flask\static\js\jquery.mCustomScrollbar.concat.mi
n.js"></script>

<script src="C:\Users\uma25\project\flask\static\js\custom.js"></script>

<script
src="https://cdnjs.cloudflare.com/ajax/libs/fancybox/2.1.5/jquery.fancybox.min.js
"></script>

</body>

</html>
```

Predict.html:

```
<!DOCTYPE html>

<html lang="en">

<head>

<!-- basic -->

<meta charset="utf-8">

<meta http-equiv="X-UA-Compatible" content="IE=edge">

<!-- mobile metas -->

<meta name="viewport" content="width=device-width, initial-scale=1">
```

```
<meta name="viewport" content="initial-scale=1, maximum-scale=1">
<!-- site metas -->
<title>IBM</title>
<meta name="keywords" content="">
<meta name="description" content="">
<meta name="author" content="">
<!-- fevicon -->
<link rel="icon"
href="C:\Users\uma25\project\flask\static\images\fevicon.png"
type="image/gif" />
<!-- bootstrap css -->
<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\bootstrap.min.css">
<!-- style css -->
<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\style.css">
<!-- Responsive-->
<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\responsive.css">
<!-- Scrollbar Custom CSS -->
<link rel="stylesheet"
href="C:\Users\uma25\project\flask\static\css\jquery.mCustomScrollbar.min.css"
">
<!-- Tweaks for older IEs-->
<link rel="stylesheet" href="https://netdna.bootstrapcdn.com/font-
awesome/4.0.3/css/font-awesome.css">
<link href="{ { url_for('static', filename='css/final.css') } }" rel="stylesheet">
<link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/fancybox/2.1.5/jquery.fancybox.mi
n.css" media="screen">
<!--[if lt IE 9]>
```



```

<script
src="https://oss.maxcdn.com/html5shiv/3.7.3/html5shiv.min.js"></script>

<script
src="https://oss.maxcdn.com/respond/1.4.2/respond.min.js"></script><![endif]-
->

</head>

<body>

    <!-- predict -->

<div id="predict" class="vegetable">

    <div class="container">

        <div class="row">

            <div class="col-md-12">

                <div class="titlepage">

                    <h2> Plant Disease <strong class="llo">Prediction</strong> </h2>

                </div>

            </div>

        </div>

        <div class="row">

            <div class="col-xl-5 col-lg-5 col-md-5 col-sm-12 ">

                <h4 style="color: green;"><b>Drop the image to get the
prediction!!!...</b></h4>

                <div class="vegetable_shop">

                    <form action="" id="upload-file" method="post"
enctype="multipart/form-data">

                        <h5 style="color: red;"><b>Choose Category</b></h5>

                        <select name="plant">

                            <option value="fruit" name="fruit">Fruits</option>

                            <option value="vegetable" name="vegetable">Vegetables</option>

                        </select>

```

```

        <br><br>

        <input id="imageUpload" type="file" name="image" value="CHOOSE"
accept="image/jpeg, image/jpg, image/png"
onchange="document.getElementById('output').src=window.URL.createObject
URL(this.files[0])">

        <br><br>

        <img src="" id="output">

        <br><br>

        <button type="button" class="btn btn-info btn-lg " id="btn-predict"
style="background: #28272c;">Predict</button>

    </form>

    <!--drop down,file upload,button-->

</div>
</div>
<div class="loader" style="display:none;"></div>

        <h3>

                <span id="result" style="font-size:17px; "> </span>

        </h3>

<div class="col-xl-7 col-lg-7 col-md-7 col-sm-12 ">
    <div class="vegetable_img">
        <right>
            <figure></figure>
        </right>
    </div>
</div>
</div>
<!-- Javascript files-->

```

```

<script src="C:\Users\uma25\project\flask\static\js\jquery.min.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\popper.min.js"></script>
<script
src="C:\Users\uma25\project\flask\static\js\bootstrap.bundle.min.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\jquery-
3.0.0.min.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\plugin.js"></script>
<script src="C:\Users\uma25\project\flask\static\js\main.js"></script>
<!-- sidebar -->

<script
src="C:\Users\uma25\project\flask\static\js\jquery.mCustomScrollbar.concat.mi
n.js"></script>

<script src="C:\Users\uma25\project\flask\static\js\custom.js"></script>

<script
src="https://cdnjs.cloudflare.com/ajax/libs/fancybox/2.1.5/jquery.fancybox.min.js
"></script>

</body>
</html>

```

App.py :

```

import requests
from tensorflow.keras.preprocessing import image
from tensorflow.keras.models import load_model
import numpy as np
import pandas as pd
import tensorflow as tf
from flask import Flask, request, render_template, redirect, url_for
import os
from werkzeug.utils import secure_filename

```

```
from tensorflow.python.keras.backend import set_session

app=Flask(__name__)

model=load_model('vegetable.h5')
model1=load_model('fruit.h5')

#homepage
@app.route('/')
def home():
    return render_template('index.html')

#prediction page
@app.route('/prediction')
def prediction():
    return render_template('predict.html')

@app.route('/predict',methods=['POST'])
def predict():
    if request.method=='POST':
        f=request.files['image']
        basepath=os.path.dirname(__file__)
        file_path=os.path.join(basepath,'uploads',secure_filename(f.filename))
        f.save(file_path)
        img=image.load_img(file_path,target_size=(128,128))
        x=image.img_to_array(img)
        x=np.expand_dims(x,axis=0)
```

```
plant=request.form['plant']
print(plant)
if(plant=="vegetable"):
    preds = model.predict(x)
    preds=np.argmax(preds)
    print(preds)
    df=pd.read_excel('precautions_veg.xlsx')
    print(df.iloc[preds]['caution'])
else:
    preds = model1.predict(x)
    preds=np.argmax(preds)
    df=pd.read_excel('precautions_fruits.xlsx')
    print(df.iloc[preds]['caution'])
    return df.iloc[preds]['caution']
if __name__ == "__main__":
    app.run(debug=False)
```

13.2 GITHUB & PROJECT DEMO LINK:

a) GITHUB LINK:

<https://github.com/IBM-EPBL/IBM-Project-25215-1659955012>

b) PROJECT DEMO LINK:

https://youtu.be/_5bTOyX_dyY