NALAIYA THIRAN

IBM

PROJECT REPORT

FERTILIZERS RECOMMENDATION SYSTEM FOR DISEASE PREDICTION

Presented by

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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.

1.2 Purpose

To Detect and recognize the plant diseases and to recommend fertilizer, it is necessary to provide symptoms in identifying the disease at its earliest. Hence the authors proposed and implemented new fertilizers Recommendation System for crop disease prediction.

2. LITERATURE SURVEY

2.1 Existing Problem

Adequate mineral nutrition is central to crop production. However, it can also exert considerable influence on disease development. Fertilizer application can increase or decrease development of diseases caused by different pathogens, and the mechanisms responsible are complex, including effects of nutrients on plant growth, plant resistance mechanisms and direct effects on the pathogen. The effects of mineral nutrition on plant disease and the mechanisms responsible for those effects have been dealt with comprehensively elsewhere. In India, around 40% of land is kept and grown using reliable irrigation technologies, while the rest relies on the monsoon environment for water. Irrigation decreases reliance on the monsoon, increases food security, and boosts agricultural production.

Most research articles use humidity, moisture, and temperature sensors near the plant's root, with an external device handling all of the data provided by the sensors and transmitting it directly to an external display or an Android application. The application was created to measure the approximate values of temperature, humidity and moisture sensors that were programmed into a microcontroller to manage the amount of water.

2.2 References

2.2.1 Agro based crop and fertilizer recommendation system using machine learning

Preethi G, Rathi Priya V, Sanjula S M, Lalitha S D, Vijaya Bindhu B

DESCRIPTION:

India being an agriculture country, its economy predominantly depends on agriculture yield growth and agroindustry products. Data Mining is an emerging research field in crop yield analysis. Yield prediction is a very important issue in agricultural. Any farmer is interested in knowing how much yield he is about to expect. Analyze the various related attributes like location, pH value from which alkalinity of the soil is determined. Along with it, percentage of nutrients like Nitrogen (N),

Phosphorous (P), and Potassium (K) Location is used along with the use of thirdparty applications like APIs for weather and temperature, type of soil, nutrient value of the soil in that region, amount of rainfall in the region, soil composition can be determined. All these attributes of data will be analyzed, train the data with various suitable machine learning algorithms for creating a model. The system comes with a model to be precise and accurate in predicting crop yield and deliver the end user with proper recommendations about required fertilizer ratio based on atmospheric and soil parameters of the land which enhance to increase the crop yield and increase farmer revenue.

ADVANTAGES:

Helps to predict the crops that can be recommended suitable for the soil.

DISADVANTAGES:

This application is not available in local languages

2.2.2 Crop and Fertilizer Recommendation and Disease diagnosis system using Machine Learning and Internet of Things

Taranjeet singh , Saurabh Anand , Anmol Sehgal , Siddhesh mahajan , Prof. Pranoti Kavimandan

DESCRIPTION:

The Agriculture sector is the backbone of our country. It provides a living for the vast majority of India's inhabitants, but it only accounts for 15% of the country's GDP. In comparison to other countries, our country's crop yield is quite poor. This could be one of the reasons for India's increased suicide rate among marginal farmers. Another cause for this is that farmers do not plan their crops properly. Another reason for this situation is that farmers frequently make incorrect crop selection decisions, such as planting in the wrong season or picking a crop that would not yield much for the particular soil. Incorrect crop selection will always result in a lower yield. It is difficult to survive if the family is entirely dependent on this revenue. In this paper, we offer a model that addresses these concerns. The suggested methodology allows for crop selection based on economic and environmental factors, intending to boost crop yields to satisfy the country's growing food demand.

The proposed model predicts the crop yield by studying factors such as rainfall, temperature, humidity, soil nutrients, ph value of the soil. The model assists farmers in maintaining soil nutrient levels. In addition to that, the app will enable farmers to identify diseases in their plants.

ADVANTAGES:

It detects many diseases in crops and recommends appropriate treatments to help them recover.

DISADVANTAGES:

Accuracy is less.

2.2.3 Leaf Disease Detection And Fertilizer Suggestion

Indumathi.R, Saagari.N, Thejuswini.V, Swarnareka.R

DESCRIPTION:

The field of agriculture is in a great threat this includes the diseases that attack the plant leaf. Our system finds the area of leaf that has been affected and also the disease that attacked the leaf. This is achieved by using Image Processing; there are systems that predict the diseases in the leaf. Our system uses K-Medoid clustering and Random Forest algorithm to produce more accuracy in the detection of disease in the leaf. The image is first pre-processed and then the clustering method is applied to find the affected area of the leaf. This is then processed to fetch 13 characters like Mean, SD, Entropy, RMS, Variance, Smoothness, Kurtosis, Skewness, IDM, Contrast, Correlation, Energy and Homogeneity through this we will measure the accuracy and find the disease

ADVANTAGES:

Efficient in finding the disease accurately.

DISADVANTAGES:

Accuracy of only about 80%

2.2.4 Plant Disease Detection and Fertilizer Suggestion

Aksham Gupta, Sarthak Pruthi. DivyanjanaNikam, Prof. Dr. Shilpa Paygude

DESCRIPTION:

The field of agriculture is in a great threat this includes the diseases that attack the plant leaf. Our system finds the area of leaf that has been affected and also the disease that attacked the leaf. This is achieved by using Image Processing; there are systems that predict the diseases in the leaf. Our system uses K-Medoid clustering and Random Forest algorithm to produce more accuracy in the detection of disease in the leaf. The image is first pre-processed and then the clustering method is applied to find the affected area of the leaf. This is then processed to fetch 13 characters like Mean, SD, Entropy, RMS, Variance, Smoothness, Kurtosis, Skewness, IDM, Contrast, Correlation, Energy and Homogeneity through this we will measure the accuracy and find the disease.

ADVANTAGES:

Successfully interprets various Diseases.

DISADVANTAGES:

It is limited to just one crop

2.2.5 Soil Based Fertilizer Recommendation System for Crop Disease Prediction System.

Dr.P. PandiSelvi, P. Poornima

DESCRIPTION:

Agriculture is the main aspect for the economic development of a country. Agriculture is the heart and life of most Indians. But in recent days, the field was going down due to various natural calamities. In order to overcome the problem, various issues in this field need to be addressed. The soil type, fertilizer recommendation, diseases in plants and leaves. All these features need to be considered. Our proposed system was organized in such a way, to analyze the soil type, diseases in the leaves and finally to recommend the appropriate fertilizer to the farmers, that may be of great help to them.

Plant disease, especially on leaves, is one of the major factors that reduce the yield in both quality and quantity of the food crops. Finding the leaf disease is an important role to preserve agriculture. Smart analysis and Comprehensive prediction model in agriculture helps the farmer to yield right crop at the right time. The main benefits of the proposed system are as follows: Yield right crop at the right time, Balancing the crop production, control plant disease, Economic growth, and planning to reduce the crop scarcity. Hence to Detect and recognize the plant diseases and to recommend fertilizer it is necessary to provide symptoms in identifying the disease at its earliest. Hence , the authors proposed and implemented new fertilizers Recommendation System for crop disease prediction.

ADVANTAGES:

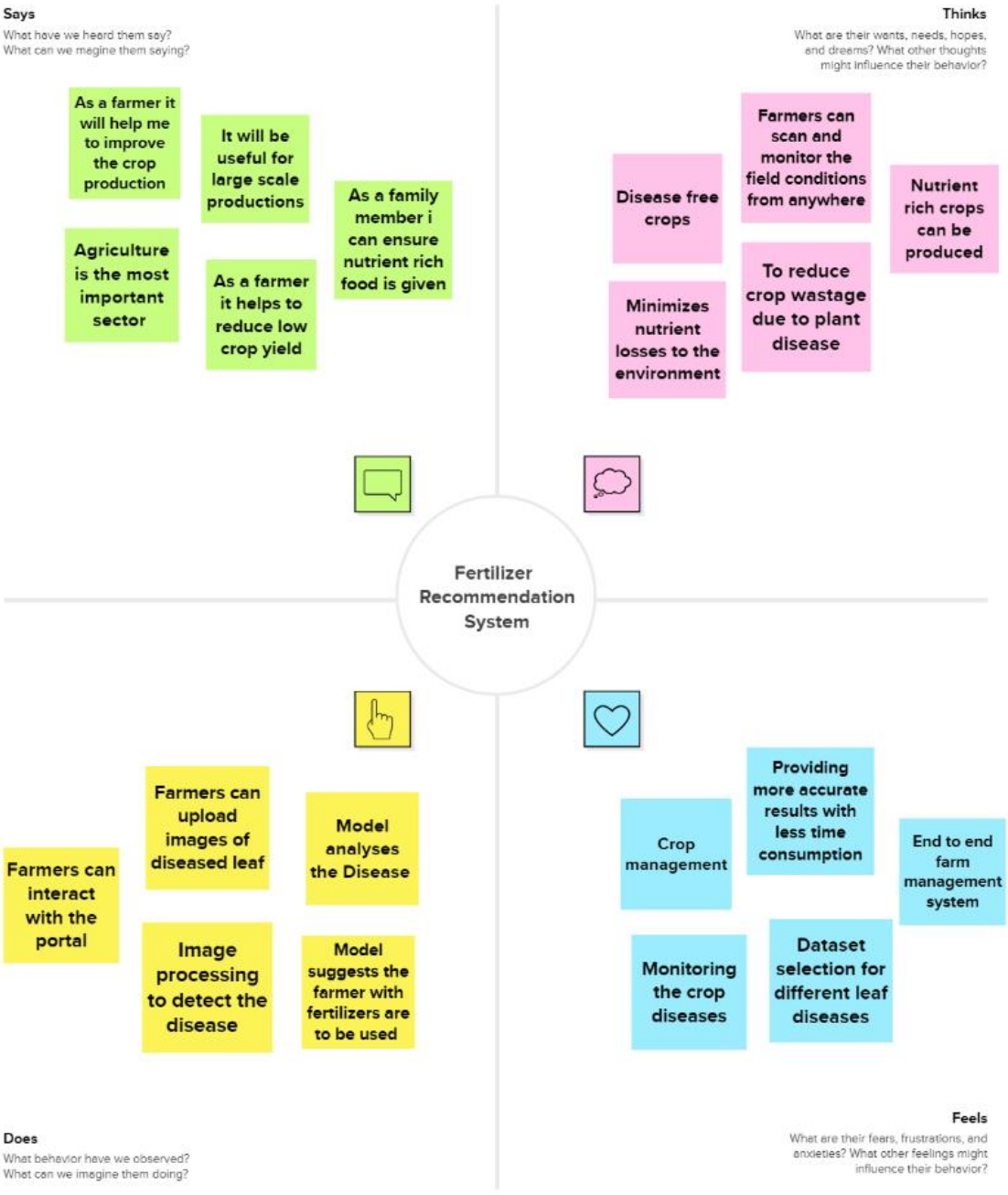
Helps the farmer to yield right crop at the right time

DISADVANTAGES:

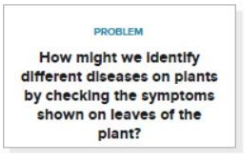
Limited to specific crops

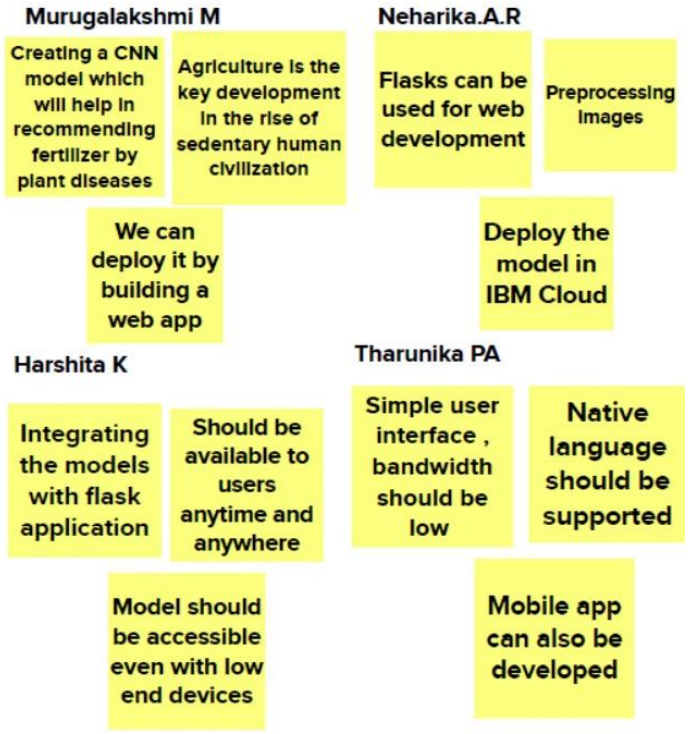
3. IDEATION & PROPOSED SOLUTION

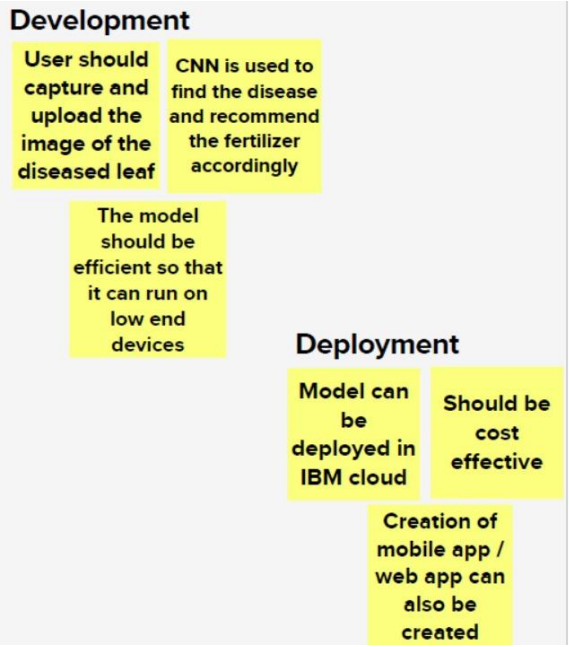
3.1 Empathy Map Canvas

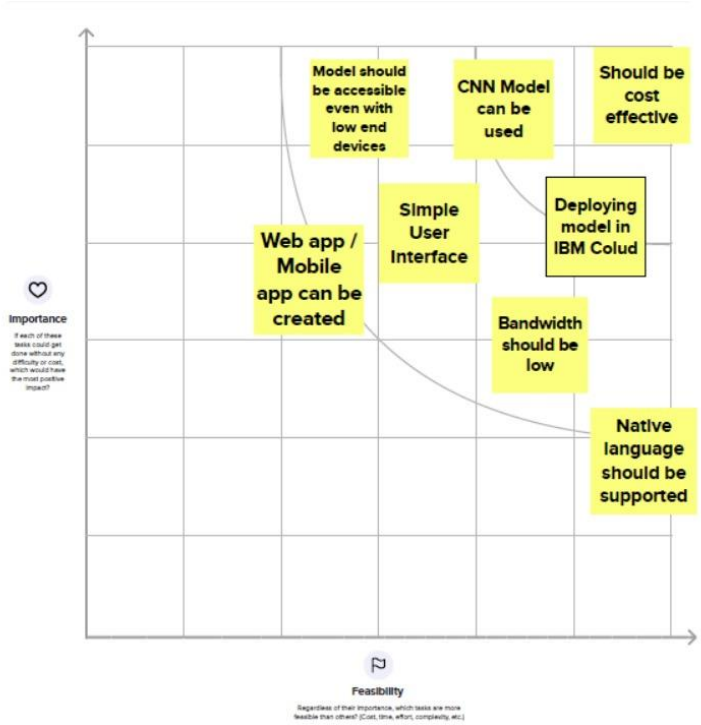


3.2 Ideation & Brainstorming









3.3 Proposed Solution

3.3.1 Problem Statement

Agriculture and related industries have already suffered harm as a result of the Covid19 outbreak. Local ecosystems have experienced significant disturbance, but global supply chains have completely collapsed. The crisis will soon be over, but one of its most lasting effects will be the acceleration of digital technology adoption and the growth of mechanization throughout the value chains. Data science along with AI and ML (machine learning and artificial intelligence) will be used more and more in this situation. AI/ML technologies are largely responsible for the concept of "smart farming," which is improving agriculture's profitability and sustainability. Crop and water management, pest and disease detection, crop health monitoring and yield estimation, as well as cultivation and harvesting by intelligent tractors, can all benefit from these technologies.

3.3.2 Solution description

The proposed solution of leaf disease detection with preventive measures in that, the leaf images of apple, corn, and peach are taken. Image processing techniques namely, Image preprocessing, and image augmentation classification are applied to leaf image dataset. The process of preprocessing 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. 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. However, the augmented leaf images are created to maintain the balanced quality and size of images in the healthy and unhealthy leaf datasets. The key purpose of this project is to classify leaf diseases from image datasets using a convolutional neural network (CNN). The two deep learning approaches: VGG19 and created new CNN architectures are used to identify the various diseases in the apple, corn, and peach leaves. After training the model is integrated with the flask application.

The final outcome of this project is as follows:

• A web Application will be built.

• Farmers can interact with the portal.

• Farmers can upload images of the diseased leaf.

• Model analyses the Disease and suggests the farmer with fertilizers are to be used.

3.3.3. Novelty

By identifying the photos, this application can suggest a proper fertilizer for plant illnesses.

3.3.4 Social Impact

Consumers Farming is a significant industry that affects a nation's economic development in agriculture. In a nation like India, the majority of people rely on agriculture as their primary source of income. So that farmers may more easily cultivate their land and increase their productivity, numerous new technologies, including Deep Learning and Machine Learning, are being incorporated into the agricultural sector.

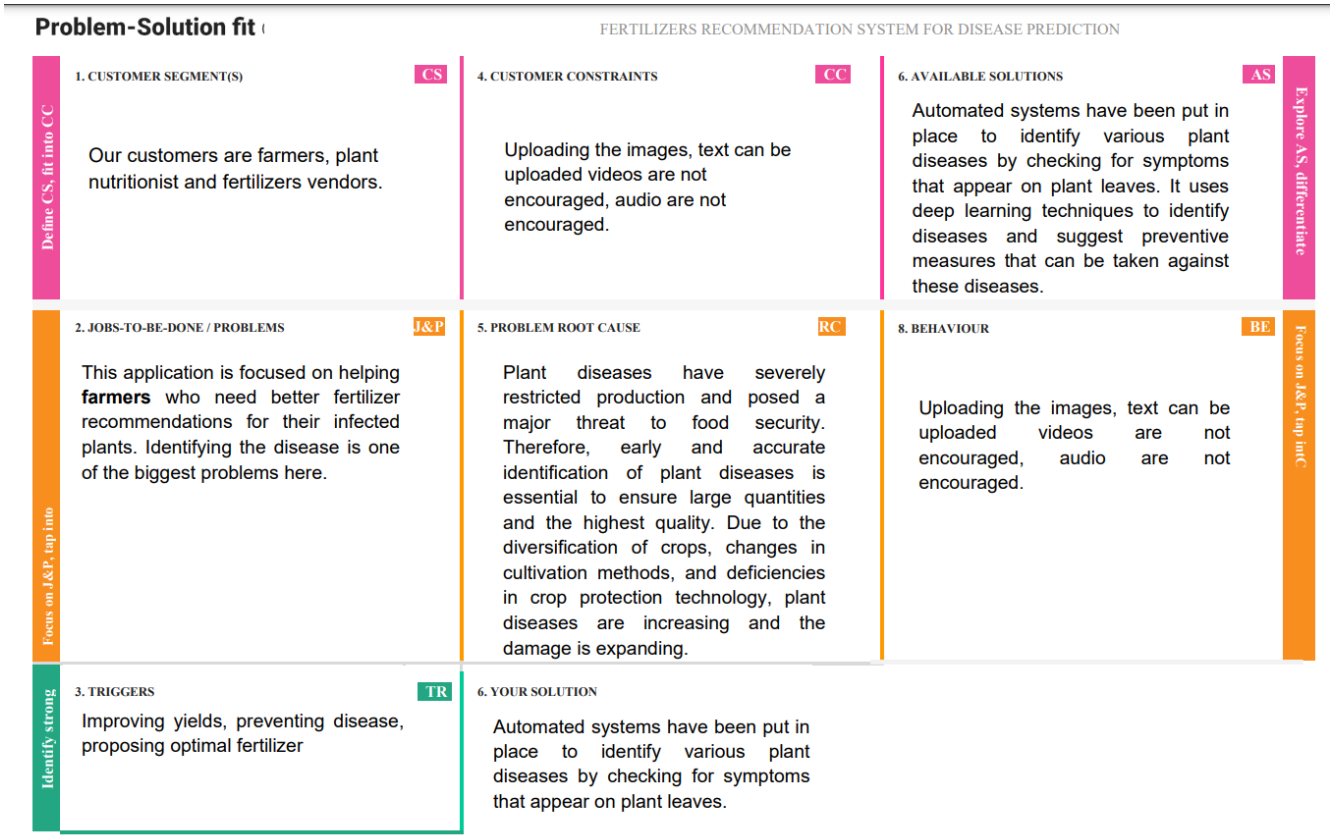
3.3.5 Business Model

The application is recommended based on farmer’s necessities.

3.3.6 Scalability of the Solution

By smoothly integrating online purchases of agricultural fertilizers, this application could be improved.

3.4 Problem Solution fit



4. REQUIREMENT ANALYSIS

4.1 Functional Requirements (FR):

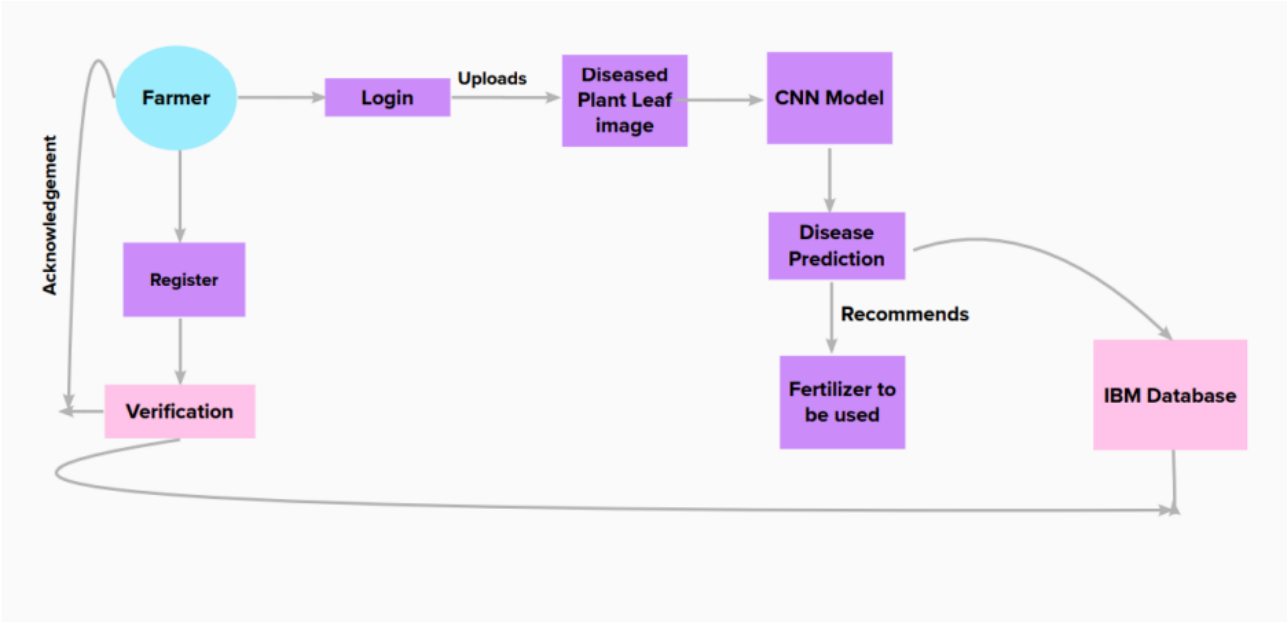
S.No	Functional requirements	Sub requirements(Story/subtask)
1	User registration	Registration through form Registration through Gmail
2	User confirmation	Confirmation via OTP Confirmation via Email
3	Capturing image	Capture the image of the leaf And check the parameter of the captured image
4	Image Pre - processing	Preprocessing the image to help with leaf disease prediction
5	Leaf identification	Identify the leaf and predict the disease in leaf.
6	Image description	Suggesting the best fertilizer for the disease.

4.2 Non Functional Requirements (NFR):

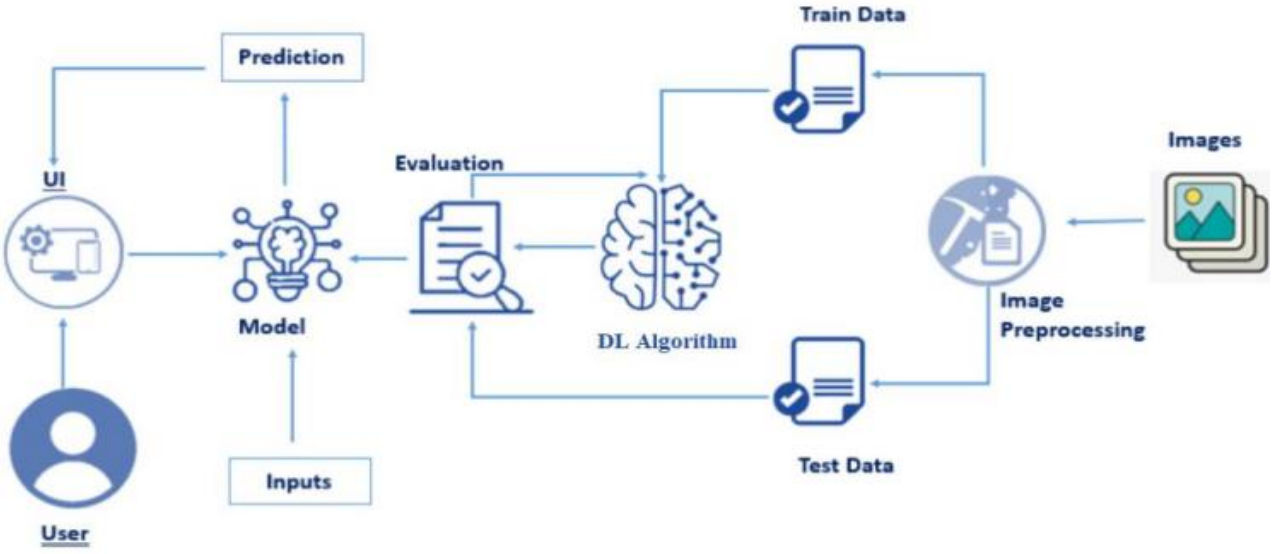
S No	Non-functional requirements	Description
1	Usability	Datasets of all the leaf is used to detecting the disease that present in the leaf
2	Security	The information belongs to the user and leaf are secured highly
3	Reliability	Helps framers and agriculture experts, they simply have to upload an image to get the fertilizer recommendation.
4	Performance	The performance is based on the quality of the leaf used for disease in the plant
5	Availability	It is available for all user to predict the disease in the plant

5. PROJECT DESIGN

5.1 Data Flow Diagram:



5.2 Solution and Technical Architecture:



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Farmer (Web user)		USN-1	As a user, I can retrieve useful information about the images.	I can visualize the change in the input image due to image pre-processing.	High	Sprint-1
		USN-2	As a user, I can able to predict fruit disease using this model.	I can get the prediction of fruit disease.	High	Sprint-2
		USN-3	As a user, I can able to predict vegetable disease using this model.	I can get the prediction of vegetable disease.	High	Sprint-2
	Dashboard	USN-4	As a user, I can see a webpage for a fertilizer recommendation system for disease prediction.	I can access the dashboard and the UI elements in the dashboard.	High	Sprint-3
		USN-5	As a user, I can save information about fertilizers and crops on IBM Cloud	I can upload the model to the IBM cloud.	High	Sprint-4

6. PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation:

SPRINT PLANNING:

The performance of Artificial Intelligence (AI) models is being improved and increased in modern technology. Based Crop Yield Disease Prediction System would assist farmers in protecting their crops from a variety of diseases by identifying them during the process of taking an image at the plant and providing the afflicted disease's name to a machine learning algorithm.

The best answer for the farmer will be provided in this project milestone, and he or she may find it on their own by using a web application with a completely user friendly and straightforward user interface. Additionally, we intend to add a useful Module that is a fertilizer prescription for a certain disease to the process. It can propose both artificial and natural fertilizer in a similar way.

ESTIMATION:

1. Planning is a crucial role in project management because it allows team members to schedule their time on the project.

2. This activity demonstrates how the team members assigned and completed various tasks.

3. In Project we can Split into the Four Step of Phrases are,

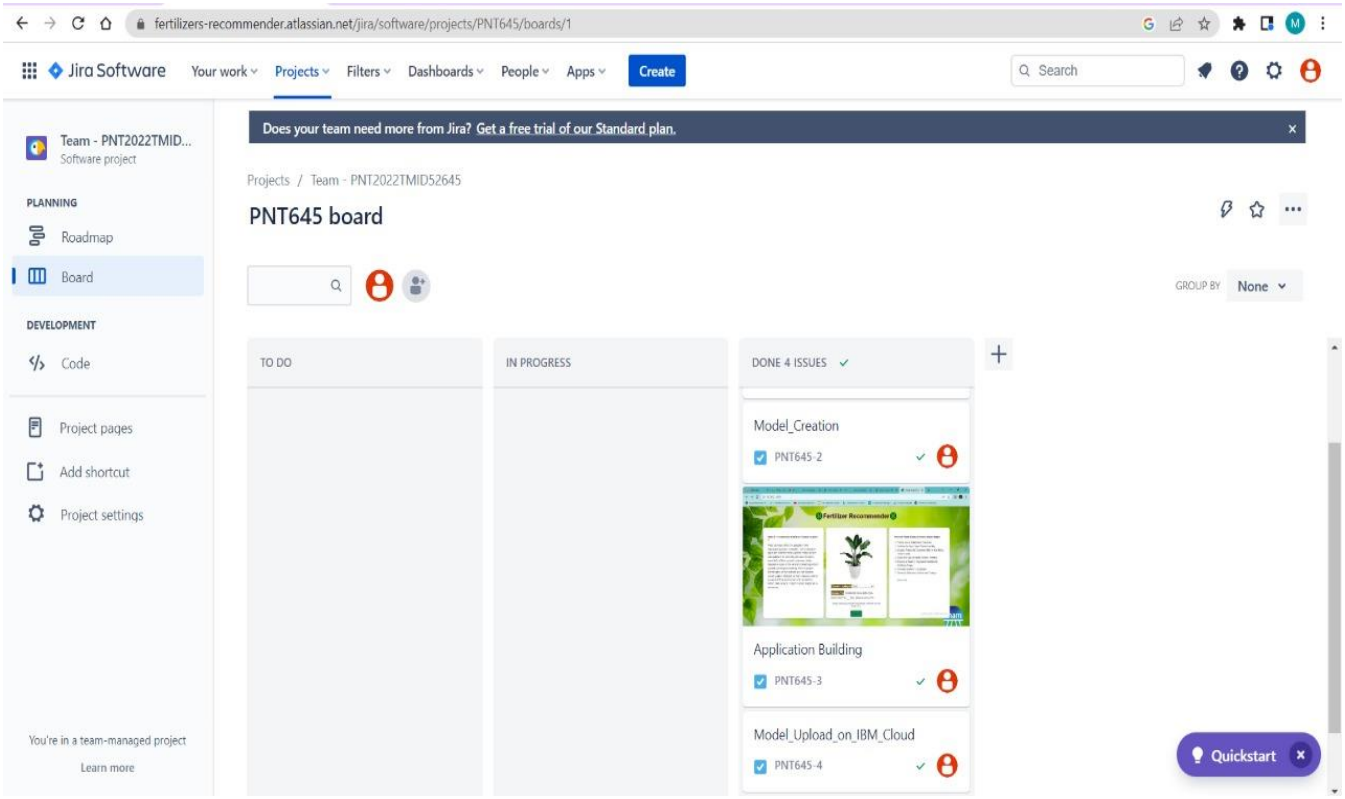
- Phrase 1: Information Collection and Requirement Analysis
- Phrase 2: Project Planning and Developing Modules
- Phrase 3: Implementing the High Accuracy Deep Learning Algorithm to Perform
- Phrase 4: Deploying the Model on Cloud and Testing the Model and UI Performance

6.2 Sprint Delivery Schedule

Sprint	Functional Requirement	User Story Number	User Story/Task	Priority	Team Members
Sprint -1	Image Processing	USN-1	As a user I can retrieve useful information about the images.	Low	Tharunika PA Harshita K
Sprint -2	Model building for Fruit disease prediction	USN-2	As a user I can able to predict fruit disease using this model.	Medium	Murugalakshmi M Neharika A.R
Sprint-2	Model building for Vegetable disease prediction	USN-3	As a user I can able to predict vegetable disease using this model	Medium	Murugalakshmi M Neharika A.R
Sprint-3	Application Building	USN-4	As a user I can see a webpage for a fertilizer recommendation system for disease prediction	High	Tharunika PA Harshita K
Sprint-4	Train the model on IBM cloud	USN-5	As a user I can save the information about the fertilizers and crops on IBM Cloud	High	Murugalakshmi M Neharika A.R

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End date	Story points (completed as on planned date)	Sprint Release Date
Sprint-1	20	6 days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA:



7. CODING & SOLUTIONING

7.1 Feature 1[Manual prediction]:

```
[1] import numpy as np
    import pandas as pd
    import matplotlib.pyplot as plt
    import os
```

```
import keras
from keras.preprocessing import image
import tensorflow
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.utils import img_to_array
from tensorflow.keras.models import load_model
from keras.applications.vgg19 import VGG19,preprocess_input,decode_predictions
```

```
[10] from keras.layers import Dense,Flatten
     from keras.models import Model
     from keras.applications.vgg19 import VGG19
     import keras
```

```
base_model=VGG19(input_shape=(256,256,3),include_top=False)
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vgg19/vgg19_weights_tf_dim_ordering_tf_kernels_notop.h5
80134624/80134624 [==============================] - 0s 0us/step
```

```
for layer in base_model.layers:
  layer.trainable=False
```

```
base_model.summary()
```

```
Model: "vgg19"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_1 (InputLayer)        [(None, 256, 256, 3)]     0

 block1_conv1 (Conv2D)       (None, 256, 256, 64)      1792

 block1_conv2 (Conv2D)       (None, 256, 256, 64)      36928

 block1_pool (MaxPooling2D)  (None, 128, 128, 64)      0

 block2_conv1 (Conv2D)       (None, 128, 128, 128)     73856

 block2_conv2 (Conv2D)       (None, 128, 128, 128)     147584

 block2_pool (MaxPooling2D)  (None, 64, 64, 128)       0

 block3_conv1 (Conv2D)       (None, 64, 64, 256)       295168

 block3_conv2 (Conv2D)       (None, 64, 64, 256)       590080

 block3_conv3 (Conv2D)       (None, 64, 64, 256)       590080
```

```
block3_conv4 (Conv2D)       (None, 64, 64, 256)       590080
block3_pool (MaxPooling2D)  (None, 32, 32, 256)       0
block4_conv1 (Conv2D)       (None, 32, 32, 512)       1180160
block4_conv2 (Conv2D)       (None, 32, 32, 512)       2359808
block4_conv3 (Conv2D)       (None, 32, 32, 512)       2359808
block4_conv4 (Conv2D)       (None, 32, 32, 512)       2359808
block4_pool (MaxPooling2D)  (None, 16, 16, 512)       0
block5_conv1 (Conv2D)       (None, 16, 16, 512)       2359808
block5_conv2 (Conv2D)       (None, 16, 16, 512)       2359808
block5_conv3 (Conv2D)       (None, 16, 16, 512)       2359808
block5_conv4 (Conv2D)       (None, 16, 16, 512)       2359808
block5_pool (MaxPooling2D)  (None, 8, 8, 512)         0
=================================================================
Total params: 20,024,384
Trainable params: 0
Non-trainable params: 20,024,384
_________________________________________________________________
```

[14]
```
X=Flatten()(base_model.output)
X=Dense(units=6,activation='softmax')(X)

model=Model(base_model.input,X)
```

[16]
```
model.compile(optimizer='adam',loss=keras.losses.categorical_crossentropy,metrics=['accuracy'])
```

[17]
```
from keras.callbacks import ModelCheckpoint,EarlyStopping

es=EarlyStopping(monitor='val_accuracy',min_delta=0.01,patience=3,verbose=1)

mc=ModelCheckpoint(filepath='best_model.h5',monitor='val_accuracy',min_delta=0.01,patience=3,verbose=1,save_best_only=True)


cb=[es,mc]
```

```
model.summary()
```

```
model.fit_generator(train,steps_per_epoch=16,epochs=50,verbose=1,callbacks=cb,validation_data=val,validation_steps=16)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `
  """Entry point for launching an IPython kernel.
Epoch 1/50
16/16 [==============================] - ETA: 0s - loss: 4.7898 - accuracy: 0.6934
Epoch 1: val_accuracy improved from -inf to 0.90430, saving model to best_model.h5
16/16 [==============================] - 799s 51s/step - loss: 4.7898 - accuracy: 0.6934 - val_loss: 1.1782 - val_accuracy: 0.9043
Epoch 2/50
16/16 [==============================] - ETA: 0s - loss: 1.2273 - accuracy: 0.9043
Epoch 2: val_accuracy improved from 0.90430 to 0.97266, saving model to best_model.h5
16/16 [==============================] - 781s 50s/step - loss: 1.2273 - accuracy: 0.9043 - val_loss: 0.4871 - val_accuracy: 0.9727
Epoch 3/50
16/16 [==============================] - ETA: 0s - loss: 0.8745 - accuracy: 0.9336
Epoch 3: val_accuracy did not improve from 0.97266
16/16 [==============================] - 790s 51s/step - loss: 0.8745 - accuracy: 0.9336 - val_loss: 0.3597 - val_accuracy: 0.9707
Epoch 4/50
16/16 [==============================] - ETA: 0s - loss: 0.6920 - accuracy: 0.9551
Epoch 4: val_accuracy did not improve from 0.97266
16/16 [==============================] - 784s 50s/step - loss: 0.6920 - accuracy: 0.9551 - val_loss: 0.2227 - val_accuracy: 0.9727
Epoch 5/50
16/16 [==============================] - ETA: 0s - loss: 0.5757 - accuracy: 0.9549
Epoch 5: val_accuracy did not improve from 0.97266
16/16 [==============================] - 761s 49s/step - loss: 0.5757 - accuracy: 0.9549 - val_loss: 0.3777 - val_accuracy: 0.9688
Epoch 5: early stopping
<keras.callbacks.History at 0x7f1afaaf9910>
```

```
[22] from keras.preprocessing import image
     import tensorflow
     # from tensorflow.keras.preprocessing.image import img_to_array
     from tensorflow.keras.utils import img_to_array
     from tensorflow.keras.models import load_model
     import numpy as np
```

```
[23] model1=load_model('/content/best_model.h5')
```

```
[24] imge=tensorflow.keras.utils.load_img('/content/drive/MyDrive/peach_healthy.JPG',target_size=(256,256))
```

```
x=img_to_array(imge)
im=preprocess_input(x)
image1=np.expand_dims(im,axis=0)
```

```
[26] pred=np.argmax(model1.predict(image1))
```

```
1/1 [==============================] - 3s 3s/step
```

```
[27] if pred==0:
       print("Apple_black_rot")
     elif pred==1:
       print("Apple_healthy")
     elif pred==2:
       print("Corn(maize)_healthy")
     elif pred==3:
       print("Corn(maize)_Northen_Leaf_Blight")
     elif pred==4:
       print("Peach_Bacterial_spot")
     else:
       print("Peach_healthy")

     Peach_healthy
```

7.2 Feature 1[Python Code]:

```
from flask import Flask, render_template, request
from keras.models import load_model
from keras.preprocessing import image
from keras.applications.vgg19 import VGG19,preprocess_input,decode_predictions
import tensorflow
import numpy as np
```

Initialize the flask app and load the model:

```
app = Flask(__name__)

def predict_label(img_path):

    model = load_model('best_model.h5')

    model.make_predict_function()
    i = tensorflow.keras.utils.load_img(img_path, target_size=(256,256))
    i = tensorflow.keras.utils.img_to_array(i)
    i = i.reshape(1, 256,256,3)
    pred=np.argmax(model.predict(i))
    return pred

def predict_label1(img_path):

    model = load_model('veg.h5')

    model.make_predict_function()
    i = tensorflow.keras.utils.load_img(img_path, target_size=(256,256))
    i = tensorflow.keras.utils.img_to_array(i)
    i = i.reshape(1, 256,256,3)
    pred=np.argmax(model.predict(i))
    return pred
```

```
# routes
@app.route("/", methods=['GET', 'POST'])
def main():
    return render_template("index.html")

@app.route("/about")
def about_page():
    return "Please subscribe  Artificial Intelligence Hub..!!!"
```

Pre process the frame and run:

```
@app.route("/submit", methods = ['GET', 'POST'])
def get_output():
    if request.method == 'POST':
        img = request.files['image']
        plant= request.form['plant']
        img_path = "static/" + img.filename
        img.save(img_path)
        if(plant =='vegetable'):
            p = predict_label1(img_path)
            print(p)
            return render_template("submit1.html", prediction = p, img_path = img_path)
        if(plant =='fruit'):
            p = predict_label(img_path)
            print(p)
            return render_template("submit.html", prediction = p, img_path = img_path)
```

```
if __name__ =='__main__':
    #app.debug = True
    app.run(debug = True)
```

8. TESTING

8.1 Test Cases

Date	19-Nov-22
Team ID	PNT2022TMID52645
Project Name	Fertilizer Recommendation System
Maximum Marks	4 marks

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation	BUG ID	Executed By
HomePage_TC_001	Functional	Home Page	Verify user is able to see the home page or not		1.Enter URL and click go 2.Verify whether the user is able to see the home page.	Enter URL and click go	User able to see the home page	Working as expected	Pass	Nil			Tharunika P A.
HomePage_TC_002	UI	Home Page	Verify the UI elements in Home page		1.Enter URL and click go 2.Verify the UI elements in Home page	Enter URL and click go	Application should show below UI elements: Dropdown list, uploaded file button, predict page	Working as expected	Pass	Nil			Neharika A R
ResultPage_TC_003	Functional	Result Page	Verify user is able to redirect to Result page or not		1.Enter URL and click go 2.Click on submit button 3.Verify whether the user to redirect to result page or not.	Click on submit button and redirect to result page	User should navigate to Result page	Working as expected	Pass	Nil			Murugalakshmi M
HomePage_TC_004	Functional	Home page	Verify user is able to select the dropdown value or not		1.Enter URL and click go 2.Click on submit button 3.Verify whether the user to redirect to result page or not. 4.Verify user is able to select the dropdown value or not.	Fruit or vegitable	Application should show the user to choose fruit or vegitable option in the dropdown list	Working as expected	Pass	Nil			Harshita K
HomePage_TC_005	Functional	Home page	Verify user is able to upload the image or not		1.Enter URL and click go 2.Click on Submit button 3.Verify whether the user to redirect to result page or not. 4.Verify user is able to select dropdown value or not. 5.Verify user is able to upload the images or not	Images to upload	Application should shows the uploaded image.	Working as expected	Pass	Nil			Murugalakshmi M
HomePage_TC_006	Functional	Home page	Verify whether the image is predicted correctly or not		1.Enter URL and click go 2.Click on Submit button 3.Verify whether the user to redirect to result page or not. 4.Verify user is able to select dropdown value or not. 5.Verify user is able to upload the images or not. 6.Verify whether the image is predicted correctly or not	Click on submit button	Application shows the predicted output.	Working as expected	Pass	Nil			Tharunika P A.

8.2 User Acceptance Testing

Purpose of Document:

The purpose of this document is to briefly explain the test coverage and open issues of the Fertilizers Recommendation System project at the time of the release to User Acceptance Testing (UAT).

Defect Analysis:

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	0	0	1	0	1
Duplicate	1	2	3	2	8
External	2	3	0	0	5
Fixed	4	4	4	4	16
Not Reproduced	0	0	0	1	1
Skipped	0	0	0	0	2
Won't Fix	0	0	0	0	8
Totals	7	10	7	7	31

Test case Analysis:

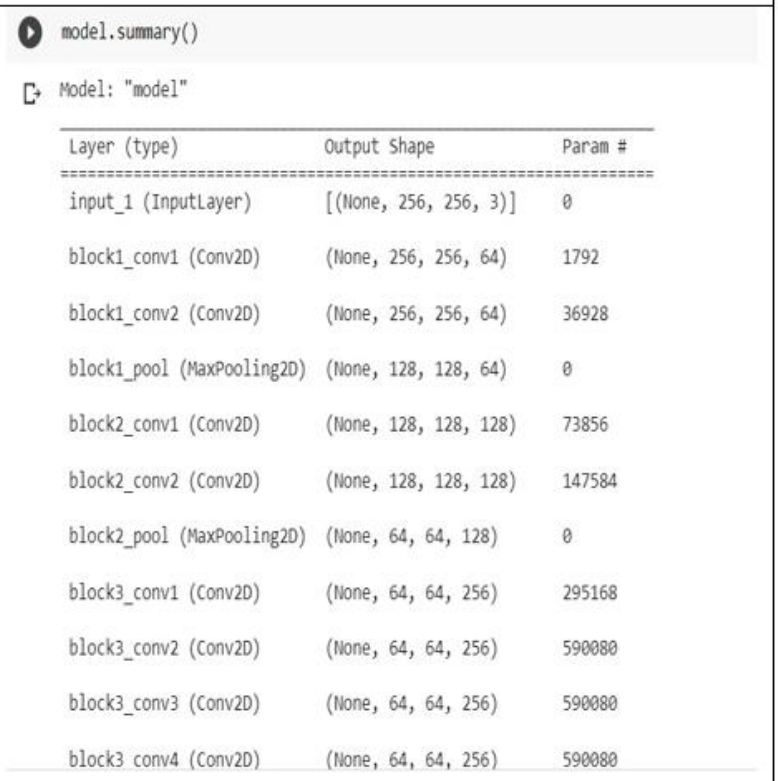
This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	1	0	0	1
Client Application	1	0	0	1
Security	1	0	0	1
Outsource Shipping	1	0	0	1
Exception Reporting	1	0	0	1
Final Report Output	1	0	0	1
Version Control	1	0	0	1

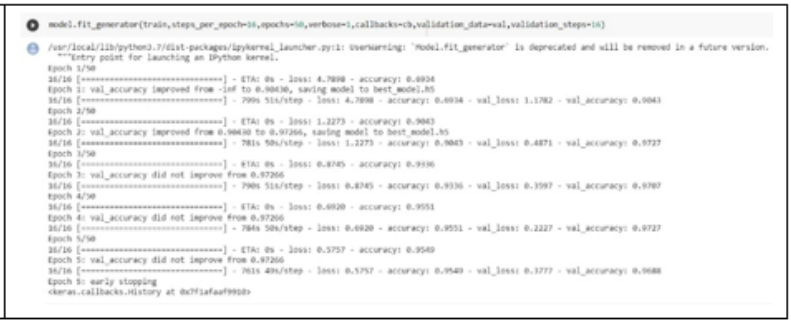
9. RESULTS

9.1 Performance Metrics

Project team shall fill the following information in model performance testing template.

<table>
<tr><th>S.No</th><th>Parameter</th><th>Values</th><th>Screenshot</th></tr>
<tr><td>1.</td><td>Model Summary</td><td>-</td><td>


</td></tr>
<tr><td>2.</td><td>Accuracy</td><td>Training Accuracy – 95%

Validation Accuracy – 96%</td><td>

</td></tr>
</table>

Model Accuracy:

```
model.fit_generator(train,steps_per_epoch=16,epochs=50,verbose=1,callbacks=cb,validation_data=val,validation_steps=16)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version.
  """Entry point for launching an IPython kernel.
Epoch 1/50
16/16 [==============================] - ETA: 0s - loss: 4.7898 - accuracy: 0.6934
Epoch 1: val_accuracy improved from -inf to 0.90430, saving model to best_model.h5
16/16 [==============================] - 799s 51s/step - loss: 4.7898 - accuracy: 0.6934 - val_loss: 1.1782 - val_accuracy: 0.9043
Epoch 2/50
16/16 [==============================] - ETA: 0s - loss: 1.2273 - accuracy: 0.9043
Epoch 2: val_accuracy improved from 0.90430 to 0.97266, saving model to best_model.h5
16/16 [==============================] - 781s 50s/step - loss: 1.2273 - accuracy: 0.9043 - val_loss: 0.4871 - val_accuracy: 0.9727
Epoch 3/50
16/16 [==============================] - ETA: 0s - loss: 0.8745 - accuracy: 0.9336
Epoch 3: val_accuracy did not improve from 0.97266
16/16 [==============================] - 790s 51s/step - loss: 0.8745 - accuracy: 0.9336 - val_loss: 0.3597 - val_accuracy: 0.9707
Epoch 4/50
16/16 [==============================] - ETA: 0s - loss: 0.6920 - accuracy: 0.9551
Epoch 4: val_accuracy did not improve from 0.97266
16/16 [==============================] - 784s 50s/step - loss: 0.6920 - accuracy: 0.9551 - val_loss: 0.2227 - val_accuracy: 0.9727
Epoch 5/50
16/16 [==============================] - ETA: 0s - loss: 0.5757 - accuracy: 0.9549
Epoch 5: val_accuracy did not improve from 0.97266
16/16 [==============================] - 761s 49s/step - loss: 0.5757 - accuracy: 0.9549 - val_loss: 0.3777 - val_accuracy: 0.9688
Epoch 5: early stopping
<keras.callbacks.History at 0x7f1afaaf9910>
```

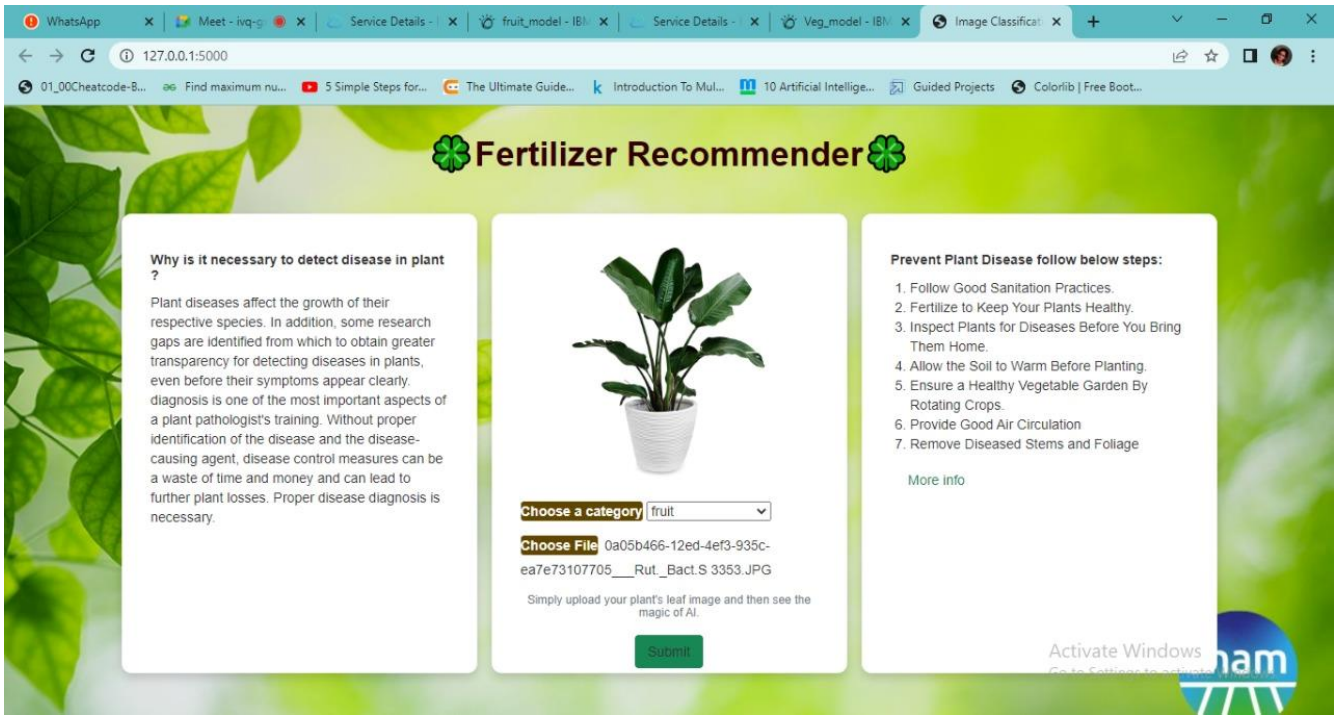
on

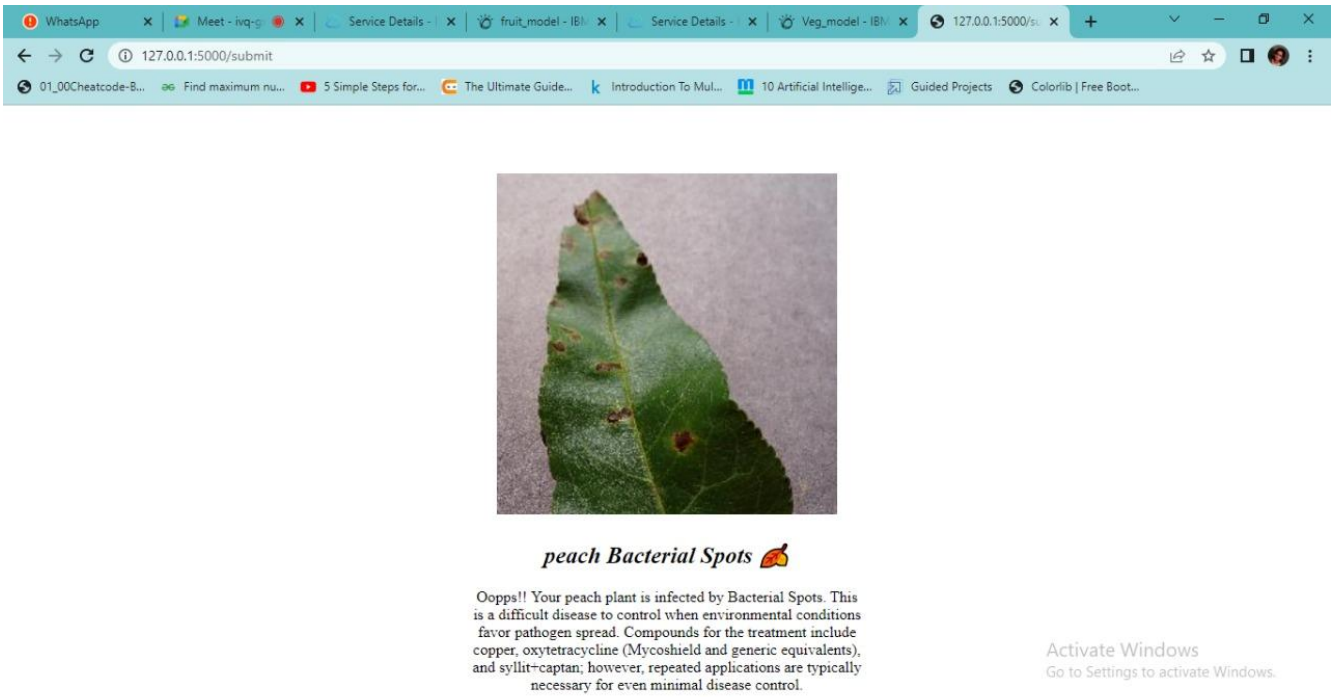
the

n's

OUTPUT

HomePage





10. ADVANTAGES AND DISADVANTAGES

10.1 Advantages

The proposed model could predict the disease just from the image of a particular plant.

- Easy to use UI.
- Model has some good accuracy in detecting the plant just by taking the input(leaf).
- These kind of web applications can be used in the agricultural sector as well as for small house hold plants as well.

10.2 Disadvantages

- Prediction is limited to few plants as we haven't trained all the plants.

11. CONCLUSION

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.
- Usage of such applications could help the farmers to necessary precautions so that they don't face any loss as such.

12. FUTURE SCOPE

As of now we have just built the web application which apparently takes the input as an image and then predict the out in the near future we can develop an application which computer vision and AI techniques to predict the infection once you keep the camera near the plant or leaf this could make our project even more usable.

This can be also done in Mobile applications like android, ios. It helps in many ways to improve the agriculture in cultivation of crops and predict the correct fertilizers to the crops.

13. APPENDIX

Source Code:

app.py

```
from flask import Flask, render_template, request
from keras.models import load_model
from keras.preprocessing import image
from keras.applications.vgg19 import VGG19,preprocess_input,decode_predictions
import tensorflow
import numpy as np

app = Flask(__name__)

@app.route('/',methods=['GET','POST'])
def home():
```

```
pages={'summer':['AC','Refrigerator'],'winter':['heater'],'preservation':['Refrigerator'
],'fresh':['Refrigerator','AC'],'Entertainment':['TV'],'Microwave':['Oven']}

    if request.method=='POST':
        prod=request.form.get('product')

        if 'summer' in prod:
            return render_template("home.html",app=pages['summer'])

        if 'winter' in prod:
            return render_template("home.html",app=pages['winter'])

        if 'preservation' in prod:
            return render_template("home.html",app=pages['preservation'])

        if 'fresh' in prod:
            return render_template("home.html",app=pages['fresh'])
        if 'Microwave' in prod:
            return render_template("home.html",app=pages['Microwave'])
        if 'Entertainment' in prod:
            return render_template("home.html",app=pages['Entertainment'])
    return render_template("home.html")

@app.route('/fridge1',methods=['GET','POST'])
def fridge1():
    return render_template('index.html',appliance="fridge")
```

```
@app.route('/fridge2',methods=['GET','POST'])
def fridge2():
    return render_template('prodhaier.html',appliance="fridge")

@app.route('/fridge3',methods=['GET','POST'])
def fridge3():
    return render_template('prodpan.html',appliance="fridge")

@app.route('/o1',methods=['GET','POST'])
def o1():
    return render_template('prodhaier.html',appliance="Oven")

@app.route('/AC',methods=['GET','POST'])
def AC():
    return render_template('prodhaier.html',appliance="AC")

@app.route('/t1',methods=['GET','POST'])
def t1():
    return render_template('index.html',appliance="TV")


@app.route('/t2',methods=['GET','POST'])
def t2():
    return render_template('prodhaier.html',appliance="TV")
```

```
@app.route('/t3',methods=['GET','POST'])
def t3():
    return render_template('prodpan.html',appliance="TV")
if __name__ =='__main__':
        #app.debug = True
        app.run(debug = True)
```

home.html

```
<!DOCTYPE html>
<html lang="en">
    <head>
        <meta charset="UTF-8">
        <meta name="viewport" content="width=device-width,initial-scale=1.0">
        <meta http-equiv="X-UA-Compatible" content="ie-edge">
        <title>What's the weather like?</title>
        <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/bulma/0.6.2/css/bulma.css"/>
        <link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/font-awesome/4.7.0/css/font-awesome.min.css">
    </head>

    <body>
        <section class="hero is-primary">
            <div class="hero-body">
                <div class="container">
                    <h1 class="title">Smart appliances</h1>
                </div>
```

```
        </div>
    </section>
    <section class="section">
        <div class="container">
            <div class="columns">
                <div class="column is-offset-4 is-4">
                    <form action="/" method="POST">
                        <div class="field has-addons">
                            <div class="control is-expanded">
                                <input class="input" name="product" type="text" placeholder="Search for...">
                            </div>
                            <div class="control">
                                <button type="submit" class="button is-info">
                                    <span id="search" class="fa fa-search" style="float:right;width:30px;color:white;height: 20px;"></span>
                                </button>

                            </div>

                        </div>
                    </form>
                </div>
            </div>
        </div>
    </section>
```

```
<section class="section">
    <div class="container">
        <div class="columns">
            <div class="column is-offset-4 is-4">
                <h3>Results</h3>
                {%  for ap in app %}
                    {% if ap == "Refrigerator" %}
                        <li><a href="/fridge1">1</a></li>
                        <li><a href="/fridge2">2</a></li>
                        <li><a href="/fridge3">3</a></li>
                    {% endif %}
                    {% if ap == "Oven" %}
                        <li><a href="/o1">4</a></li>
                    {% endif %}
                    {% if ap == "AC" %}
                        <li><a href="/AC">5</a></li>
                    {% endif %}
                    {% if ap == "TV" %}
                        <li><a href="/t1">6</a></li>
                        <li><a href="/t2">7</a></li>
                        <li><a href="/t3">8</a></li>
                    {% endif %}
                {% endfor %}
            </div>
        </div>
    </div>
</section>
```

```
        <footer class="footer"></footer>
    </body>
</html>
```

index.html

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="utf-8">
    <title>Smart Appliance - Online Shop Website Template</title>
    <meta content="width=device-width, initial-scale=1.0" name="viewport">
    <meta content="Free HTML Templates" name="keywords">
    <meta content="Free HTML Templates" name="description">

    <!-- Favicon -->
    <link href="img/favicon.ico" rel="icon">

    <!-- Google Web Fonts -->
    <link rel="preconnect" href="https://fonts.gstatic.com">
    <link
href="https://fonts.googleapis.com/css2?family=Roboto:wght@400;500;700&disp
lay=swap" rel="stylesheet">

    <!-- Font Awesome -->
    <link                              href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/5.10.0/css/all.min.css" rel="stylesheet">
```

```
    <!-- Libraries Stylesheet -->
    <link href="lib/animate/animate.min.css" rel="stylesheet">
    <link href="lib/owlcarousel/assets/owl.carousel.min.css" rel="stylesheet">

    <!-- Customized Bootstrap Stylesheet -->
    <link href="../static/css/style.css" rel="stylesheet">
</head>

<body>
    <!-- Topbar Start -->
    <div class="container-fluid">
        <div class="row bg-secondary py-1 px-xl-5">
            <div class="col-lg-6 d-none d-lg-block">
                <div class="d-inline-flex align-items-center h-100">
                    <a class="text-body mr-3" href="">About</a>
                    <a class="text-body mr-3" href="">Contact</a>
                    <a class="text-body mr-3" href="">Help</a>
                    <a class="text-body mr-3" href="">FAQs</a>
                </div>
            </div>
            <div class="col-lg-6 text-center text-lg-right">
                <div class="d-inline-flex align-items-center">

            </div>
                <div class="d-inline-flex align-items-center d-block d-lg-none">
                    <a href="" class="btn px-0 ml-2">
```

```
                <i class="fas fa-heart text-dark"></i>
                <span class="badge text-dark border border-dark rounded-circle" style="padding-bottom: 2px;">0</span>
            </a>
            <a href="" class="btn px-0 ml-2">
                <i class="fas fa-shopping-cart text-dark"></i>
                <span class="badge text-dark border border-dark rounded-circle" style="padding-bottom: 2px;">0</span>
            </a>
        </div>
    </div>
</div>
<div class="row align-items-center bg-light py-3 px-xl-5 d-none d-lg-flex">
    <div class="col-lg-4">
        <a href="" class="text-decoration-none">
            <span class="h1 text-uppercase text-primary bg-dark px-2">Smart</span>
            <span class="h1 text-uppercase text-dark bg-primary px-2 ml-n1">Appliance</span>
        </a>
    </div>
    <div class="col-lg-4 col-6 text-left">
        <form action="">
            <div class="input-group">
                <input type="text" class="form-control" placeholder="Search for products">
                <div class="input-group-append">
```

```
                        <span class="input-group-text bg-transparent text-primary">
                            <i class="fa fa-search"></i>
                        </span>
                    </div>
                </div>
            </form>
        </div>
        <div class="col-lg-4 col-6 text-right">
            <p class="m-0">Customer Service</p>
            <h5 class="m-0">+012 345 6789</h5>
        </div>
    </div>
</div>
<!-- Topbar End -->


<!-- Navbar Start -->
<div class="container-fluid bg-dark mb-30">
    <div class="row px-xl-5">
        <div class="col-lg-3 d-none d-lg-block">
            <a class="btn d-flex align-items-center justify-content-between bg-primary w-100" data-toggle="collapse" href="#navbar-vertical" style="height: 65px; padding: 0 30px;">
                <h6 class="text-dark m-0"><i class="fa fa-bars mr-2"></i>Categories</h6>
                <i class="fa fa-angle-down text-dark"></i>
            </a>
```

```
<nav class="collapse position-absolute navbar navbar-vertical navbar-light align-items-start p-0 bg-light" id="navbar-vertical" style="width: calc(100% - 30px); z-index: 999;">
    <div class="navbar-nav w-100">
      <div class="nav-item dropdown dropright">
        <a href="#" class="nav-link dropdown-toggle" data-toggle="dropdown">LCD TV <i class="fa fa-angle-right float-right mt-1"></i></a>

      </div>
      <a href="" class="nav-item nav-link">Washing Machine</a>
      <a href="" class="nav-item nav-link">Refrigerator</a>


    </div>
  </nav>
</div>
<div class="col-lg-9">
  <nav class="navbar navbar-expand-lg bg-dark navbar-dark py-3 py-lg-0 px-0">
    <a href="" class="text-decoration-none d-block d-lg-none">
      <span class="h1 text-uppercase text-dark bg-light px-2">Smart</span>
      <span class="h1 text-uppercase text-light bg-primary px-2 ml-n1">Appliance</span>
    </a>
```

```
<button type="button" class="navbar-toggler" data-toggle="collapse" data-target="#navbarCollapse">
  <span class="navbar-toggler-icon"></span>
</button>
<div class="collapse navbar-collapse justify-content-between" id="navbarCollapse">
  <div class="navbar-nav mr-auto py-0">
    <a href="index.html" class="nav-item nav-link active">Home</a>
    <a href="prodhaier.html" class="nav-item nav-link">Brand-1</a>
    <a href="prodpan.html" class="nav-item nav-link">Brand-2</a>
    <div class="nav-item dropdown">
      <a href="#" class="nav-link dropdown-toggle" data-toggle="dropdown">Pages <i class="fa fa-angle-down mt-1"></i></a>
      <div class="dropdown-menu bg-primary rounded-0 border-0 m-0">
        <a href="cart.html" class="dropdown-item">Shopping Cart</a>
        <a href="checkout.html" class="dropdown-item">Checkout</a>
      </div>
    </div>
    <a href="contact.html" class="nav-item nav-link">Contact</a>
  </div>
  <div class="navbar-nav ml-auto py-0 d-none d-lg-block">
    <a href="" class="btn px-0">
      <i class="fas fa-heart text-primary"></i>
```

```
                    <span class="badge text-secondary border border-secondary rounded-circle" style="padding-bottom: 2px;">0</span>
                    </a>
                    <a href="" class="btn px-0 ml-3">
                        <i class="fas fa-shopping-cart text-primary"></i>
                        <span class="badge text-secondary border border-secondary rounded-circle" style="padding-bottom: 2px;">0</span>
                    </a>
                </div>
            </div>
        </nav>
    </div>
</div>
<!-- Navbar End -->


<!-- Carousel Start -->
<div class="container-fluid mb-3">
    <div class="row px-xl-5">
        <div class="col-lg-8">
            <div id="header-carousel" class="carousel slide carousel-fade mb-30 mb-lg-0" data-ride="carousel">
                <ol class="carousel-indicators">
                    <li data-target="#header-carousel" data-slide-to="0" class="active"></li>
                    <li data-target="#header-carousel" data-slide-to="1"></li>
```

```
            <li data-target="#header-carousel" data-slide-to="2"></li>
        </ol>
        <div class="carousel-inner">
            <div class="carousel-item position-relative active" style="height: 430px;">
                <img class="position-absolute w-100 h-100" src="../static/img/carousel-1.jpg" style="object-fit: cover;">
                <div class="carousel-caption d-flex flex-column align-items-center justify-content-center">
                    <div class="p-3" style="max-width: 700px;">
                        <h1 class="display-4 text-white mb-3 animate__animated animate__fadeInDown">ALL Brands</h1>
                        <p class="mx-md-5 px-5 animate__animated animate__bounceIn">Home entertainment has never been so
exciting, with advanced technologies that keep evolving. </p>
                        <a class="btn btn-outline-light py-2 px-4 mt-3 animate__animated animate__fadeInUp" href="#">Shop Now</a>
                    </div>
                </div>
            </div>
            <div class="carousel-item position-relative" style="height: 430px;">
                <img class="position-absolute w-100 h-100" src="../static/img/carousel-2.jpg" style="object-fit: cover;">
                <div class="carousel-caption d-flex flex-column align-items-center justify-content-center">
                    <div class="p-3" style="max-width: 700px;">
```

```
                    <h1 class="display-4 text-white mb-3 animate__animated animate__fadeInDown"></h1>
                    <p class="mx-md-5 px-5 animate__animated animate__bounceIn">We’re here to
help you find the TV that suits what you love to watch and how you love
to watch it.</p>
                    <a class="btn btn-outline-light py-2 px-4 mt-3 animate__animated animate__fadeInUp" href="#">Shop Now</a>
                </div>
            </div>
        </div>
        <div class="carousel-item position-relative" style="height: 430px;">
            <img class="position-absolute w-100 h-100" src="../static/img/carousel-3.jpeg" style="object-fit: cover;">
            <div class="carousel-caption d-flex flex-column align-items-center justify-content-center">
                <div class="p-3" style="max-width: 700px;">
                    <h1 class="display-4 text-white mb-3 animate__animated animate__fadeInDown"></h1>
                    <p class="mx-md-5 px-5 animate__animated animate__bounceIn">Smart Appliances is a Leading distributor of Top Global Brands.</p>
                    <a class="btn btn-outline-light py-2 px-4 mt-3 animate__animated animate__fadeInUp" href="#">Shop Now</a>
                </div>
            </div>
        </div>
```

```
            </div>
        </div>
    </div>
    <div class="col-lg-4">
        <div class="product-offer mb-30" style="height: 200px;">
            <img class="img-fluid" src="../static/img/offer-1.jpg" alt="">
            <div class="offer-text">
                <h6 class="text-white text-uppercase">Save 20%</h6>
                <h3 class="text-white mb-3">Special Offer</h3>
                <a href="" class="btn btn-primary">Shop Now</a>
            </div>
        </div>
        <div class="product-offer mb-30" style="height: 200px;">
            <img class="img-fluid" src="../static/img/offer-2.jpg" alt="">
            <div class="offer-text">
                <h6 class="text-white text-uppercase">Save 20%</h6>
                <h3 class="text-white mb-3">Special Offer</h3>
                <a href="" class="btn btn-primary">Shop Now</a>
            </div>
        </div>
    </div>
</div>
<!-- Carousel End -->


<!-- Featured Start -->
```

```
<div class="container-fluid pt-5">
    <div class="row px-xl-5 pb-3">
        <div class="col-lg-3 col-md-6 col-sm-12 pb-1">
            <div class="d-flex align-items-center bg-light mb-4" style="padding: 30px;">
                <h1 class="fa fa-check text-primary m-0 mr-3"></h1>
                <h5 class="font-weight-semi-bold m-0">Quality Product</h5>
            </div>
        </div>
        <div class="col-lg-3 col-md-6 col-sm-12 pb-1">
            <div class="d-flex align-items-center bg-light mb-4" style="padding: 30px;">
                <h1 class="fa fa-shipping-fast text-primary m-0 mr-2"></h1>
                <h5 class="font-weight-semi-bold m-0">Free Shipping</h5>
            </div>
        </div>
        <div class="col-lg-3 col-md-6 col-sm-12 pb-1">
            <div class="d-flex align-items-center bg-light mb-4" style="padding: 30px;">
                <h1 class="fas fa-exchange-alt text-primary m-0 mr-3"></h1>
                <h5 class="font-weight-semi-bold m-0">14-Day Return</h5>
            </div>
        </div>
        <div class="col-lg-3 col-md-6 col-sm-12 pb-1">
            <div class="d-flex align-items-center bg-light mb-4" style="padding: 30px;">
                <h1 class="fa fa-phone-volume text-primary m-0 mr-3"></h1>
```

```
                <h5 class="font-weight-semi-bold m-0">24/7 Support</h5>
            </div>
        </div>
    </div>
    <!-- Featured End -->
    <!-- Products Start -->
    <div class="container-fluid pt-5 pb-3">
        <h2 class="section-title position-relative text-uppercase mx-xl-5 mb-4"><span class="bg-secondary pr-3">Featured Products</span></h2>
        <div class="row px-xl-5">
            <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
                <div class="product-item bg-light mb-4">
                    <div class="product-img position-relative overflow-hidden">
                        <img class="img-fluid w-100" src="../static/img/product-1.jpeg" alt="">
                        <div class="product-action">
                            <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                            <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                            <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                            <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                        </div>
                    </div>
```

```
                <div class="text-center py-4">
                    <a class="h6 text-decoration-none text-truncate" href="">LED TV</a>
                    <h6>SAMSUNG</h6>
                    <div class="d-flex align-items-center justify-content-center mt-2">

                        <h5>$10000.00</h5><h6 class="text-muted ml-2"><del>$15000.00</del></h6>
                    </div>
                    <div class="d-flex align-items-center justify-content-center mb-1">
                        <small class="fa fa-star text-primary mr-1"></small>
                        <small class="fa fa-star text-primary mr-1"></small>
                        <small class="fa fa-star text-primary mr-1"></small>
                        <small class="fa fa-star text-primary mr-1"></small>
                        <small class="fa fa-star text-primary mr-1"></small>
                        <small>(99)</small>
                    </div>
                </div>
            </div>
        </div>
        <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
            <div class="product-item bg-light mb-4">
                <div class="product-img position-relative overflow-hidden">
                    <img class="img-fluid w-100" src="../static/img/product-2.jpg" alt="">
                    <div class="product-action">
```

```
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                  </div>
                </div>
                <div class="text-center py-4">
                  <a class="h6 text-decoration-none text-truncate" href="">Washing Machine</a>
                  <h6> SAMSUNG</h6>
                  <div class="d-flex align-items-center justify-content-center mt-2">
                    <h5>$20000.00</h5><h6 class="text-muted ml-2"><del>$35000.00</del></h6>
                  </div>
                  <div class="d-flex align-items-center justify-content-center mb-1">
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star-half-alt text-primary mr-1"></small>
                    <small class="far fa-star text-primary mr-1"></small>
                    <small>(99)</small>
                  </div>
                </div>
```

```
            </div>
        </div>
        <div class="col-lg-3 col-md-4 col-sm-6 pb-1" id="fridge">
            <div class="product-item bg-light mb-4">
                <div class="product-img position-relative overflow-hidden">
                    <img class="img-fluid w-100" src="../static/img/product-3.jpg" alt="">
                    <div class="product-action">
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                    </div>
                </div>
                <div class="text-center py-4" >
                    {% if appliance == "fridge" %}
                        <div style="background-color:gold;"><a class="h6 text-decoration-none text-truncate" href="">SAMSUNG 198 L Direct Cool </a></div>

                    {% else %}
                    <div><a class="h6 text-decoration-none text-truncate" href="">SAMSUNG 198 L Direct Cool </a></div>
                    {% endif %}
```

```
                <h6>SAMSUNG</h6>
                <div class="d-flex align-items-center justify-content-center mt-2">
                  <h5>$40000.00</h5><h6 class="text-muted ml-2"><del>$50000.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="fa fa-star-half-alt text-primary mr-1"></small>
                  <small class="far fa-star text-primary mr-1"></small>
                  <small>(99)</small>
                </div>
              </div>
            </div>
          </div>
          <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
            <div class="product-item bg-light mb-4">
              <div class="product-img position-relative overflow-hidden">
                <img class="img-fluid w-100" src="../static/img/product-4.jpg" alt="">
                <div class="product-action">
                  <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                  <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
```

```
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                </div>
            </div>
            <div class="text-center py-4">
                {% if appliance == "TV" %}
                <div style="background-color:rgb(255, 0, 85);"><a class="h6 text-decoration-none text-truncate" href="">SAMSUNG Ultra HD LED Smart TV </a></div>

            {% else %}
            <div><a class="h6 text-decoration-none text-truncate" href="">SAMSUNG Ultra HD LED Smart TV </a></div>
            {% endif %}

                <h6>SAMSUNG</h6>
                <div class="d-flex align-items-center justify-content-center mt-2">
                    <h5>$30000.00</h5><h6 class="text-muted ml-2"><del>$44990.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="far fa-star text-primary mr-1"></small>
```

```
                    <small class="far fa-star text-primary mr-1"></small>
                    <small>(99)</small>
                </div>
            </div>
        </div>
        <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
            <div class="product-item bg-light mb-4">
                <div class="product-img position-relative overflow-hidden">
                    <img class="img-fluid w-100" src="../static/img/product-5.jpg" alt="">
                    <div class="product-action">
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                    </div>
                </div>
                <div class="text-center py-4">
                    <a class="h6 text-decoration-none text-truncate" href="">
15 Place Setting Dishwasher</a>
<h6>SAMSUNG<h6>
                    <div class="d-flex align-items-center justify-content-center mt-2">
```

```
                    <h5>$15999.00</h5><h6 class="text-muted ml-2"><del>$20000.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small>(99)</small>
                </div>
            </div>
        </div>
    </div>
    <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
        <div class="product-item bg-light mb-4">
            <div class="product-img position-relative overflow-hidden">
                <img class="img-fluid w-100" src="../static/img/product-6.jfif" alt="">
                <div class="product-action">
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
```

```
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                </div>
            </div>
            <div class="text-center py-4">
                <a class="h6 text-decoration-none text-truncate" href="">Whirlpool Whitemagic Classic</a>
                <h6>SAMSUNG</h6>
                <div class="d-flex align-items-center justify-content-center mt-2">
                    <h5>$30000.00</h5><h6 class="text-muted ml-2"><del>$40999.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star-half-alt text-primary mr-1"></small>
                    <small>(99)</small>
                </div>
            </div>
        </div>
    </div>
    <div class="col-lg-3 col-md-4 col-sm-6 pb-1" id="fridge">
        <div class="product-item bg-light mb-4">
            <div class="product-img position-relative overflow-hidden">
```

```
                <img class="img-fluid w-100" src="../static/img/product-7.jpg" alt="">
                <div class="product-action">
                  <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                  <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                  <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                  <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                </div>
              </div>
              <div class="text-center py-4">
                {% if appliance == "fridge" %}
                  <div style="background-color:gold;"><a class="h6 text-decoration-none text-truncate" href="" >Double Door Refrigerator</a></div>

                {% else %}
                <div><a class="h6 text-decoration-none text-truncate" href="" >Double Door Refrigerator</a></div>
                {% endif %}
                <h6></h6>
                <h6>SAMSUNG</h6>
                <div class="d-flex align-items-center justify-content-center mt-2">
                  <h5>$19999.00</h5><h6 class="text-muted ml-2"><del>$25000.00</del></h6>
```

```
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star-half-alt text-primary mr-1"></small>
                    <small class="far fa-star text-primary mr-1"></small>
                    <small>(99)</small>
                </div>
            </div>
        </div>
    </div>
    <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
        <div class="product-item bg-light mb-4">
            <div class="product-img position-relative overflow-hidden">
                <img class="img-fluid w-100" src="../static/img/product-8.jpg" alt="">
                <div class="product-action">
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                </div>
```

```
            </div>
             <div class="text-center py-4">
                <a class="h6 text-decoration-none text-truncate" href="">20 litres Microwave Oven </a>
                <h6></h6>
                <h6>SAMSUNG </h6>
                <div class="d-flex align-items-center justify-content-center mt-2">
                   <h5>$6790.00</h5><h6 class="text-muted ml-2"><del>$10000.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                   <small class="fa fa-star text-primary mr-1"></small>
                   <small class="fa fa-star text-primary mr-1"></small>
                   <small class="fa fa-star text-primary mr-1"></small>
                   <small class="far fa-star text-primary mr-1"></small>
                   <small class="far fa-star text-primary mr-1"></small>
                   <small>(99)</small>
                </div>
             </div>
          </div>
       </div>
       <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
          <div class="product-item bg-light mb-4">
             <div class="product-img position-relative overflow-hidden">
                <img class="img-fluid w-100" src="../static/img/product-9.jpg" alt="">
                <div class="product-action">
```

```
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                </div>
            </div>
            <div class="text-center py-4">
                {% if appliance == "TV" %}
                <div style="background-color:rgb(255, 0, 85);"><a class="h6 text-decoration-none text-truncate" href="">32 Smart Full </a></div>

            {% else %}
            <div><a class="h6 text-decoration-none text-truncate" href="">32 Smart Full </a></div>
            {% endif %}

 <h6>HD TV Features |</h6>
<h6>SAMSUNG</h6>
                <div class="d-flex align-items-center justify-content-center mt-2">
                    <h5>$17000.00</h5><h6 class="text-muted ml-2"><del>$22000.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
```

```
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="far fa-star text-primary mr-1"></small>
                    <small class="far fa-star text-primary mr-1"></small>
                    <small>(99)</small>
                </div>
            </div>
        </div>
        <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
            <div class="product-item bg-light mb-4">
                <div class="product-img position-relative overflow-hidden">
                    <img class="img-fluid w-100" src="../static/img/product-10.jpg" alt="">
                    <div class="product-action">
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                    </div>
                </div>
                <div class="text-center py-4">
```

```
                <a class="h6 text-decoration-none text-truncate" href="">7 kg Top
</a>
                <h6>Fully Automatic Top Load </h6>
                <h6>SAMSUNG</h6>
                <div class="d-flex align-items-center justify-content-center mt-2">
                  <h5>$40000.00</h5><h6 class="text-muted ml-
2"><del>$49999.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="far fa-star text-primary mr-1"></small>
                  <small class="far fa-star text-primary mr-1"></small>
                  <small>(99)</small>
                </div>
              </div>
            </div>
          </div>
          <div class="col-lg-3 col-md-4 col-sm-6 pb-1" id="fridge">
            <div class="product-item bg-light mb-4">
              <div class="product-img position-relative overflow-hidden">
                <img class="img-fluid w-100" src="../static/img/product-11.jpg"
alt="">
                <div class="product-action">
                  <a class="btn btn-outline-dark btn-square" href=""><i class="fa
fa-shopping-cart"></i></a>
```

```
                    <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                    <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                </div>
            </div>
            <div class="text-center py-4">
                {% if appliance == "fridge" %}
                <div style="background-color:gold;"><a class="h6 text-decoration-none text-truncate" href="">Under Counter Refrigerator</a></div>

                {% else %}
                <div><a class="h6 text-decoration-none text-truncate" href="">Under Counter Refrigerator</a></div>
                {% endif %}

                <h6> 2.4 Cubic Feet</h6>
                <h6>SAMSUNG</h6>
                <div class="d-flex align-items-center justify-content-center mt-2">
                    <h5>$15000.00</h5><h6 class="text-muted ml-2"><del>$20000.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="fa fa-star text-primary mr-1"></small>
```

```
                    <small class="fa fa-star text-primary mr-1"></small>
                    <small class="far fa-star text-primary mr-1"></small>
                    <small class="far fa-star text-primary mr-1"></small>
                    <small>(99)</small>
                </div>
            </div>
        </div>
        <div class="col-lg-3 col-md-4 col-sm-6 pb-1">
            <div class="product-item bg-light mb-4">
                <div class="product-img position-relative overflow-hidden">
                    <img class="img-fluid w-100" src="../static/img/product-12.jpg" alt="">
                    <div class="product-action">
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-shopping-cart"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="far fa-heart"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-sync-alt"></i></a>
                        <a class="btn btn-outline-dark btn-square" href=""><i class="fa fa-search"></i></a>
                    </div>
                </div>
                <div class="text-center py-4">
                 <br></br>
```

```
                <a class="h6 text-decoration-none text-truncate" href="">20 Litres
</a>
                <h6>Solo Microwave Oven</h6>
                <h6>SAMSUNG </h6>

                <div class="d-flex align-items-center justify-content-center mt-2">
                  <h5>$21000.00</h5><h6 class="text-muted ml-
2"><del>$29000.00</del></h6>
                </div>
                <div class="d-flex align-items-center justify-content-center mb-1">
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="fa fa-star text-primary mr-1"></small>
                  <small class="far fa-star text-primary mr-1"></small>
                  <small class="far fa-star text-primary mr-1"></small>
                  <small>(99)</small>
                </div>
              </div>
            </div>
          </div>
        </div>
    <!-- Products End -->
```

```
<!-- Footer Start -->
    <div class="container-fluid bg-dark text-secondary mt-5 pt-5">
        <div class="row px-xl-5 pt-5">
            <div class="col-lg-4 col-md-12 mb-5 pr-3 pr-xl-5">
                <h5 class="text-secondary text-uppercase mb-4">Get In Touch</h5>
                <p class="mb-4">No dolore ipsum accusam no lorem. Invidunt sed clita kasd clita et et dolor sed dolor. Rebum tempor no vero est magna amet no</p>
                <p class="mb-2"><i class="fa fa-map-marker-alt text-primary mr-3"></i>123 Street, New York, USA</p>
                <p class="mb-2"><i class="fa fa-envelope text-primary mr-3"></i>info@example.com</p>
                <p class="mb-0"><i class="fa fa-phone-alt text-primary mr-3"></i>+012 345 67890</p>
            </div>
            <div class="col-lg-8 col-md-12">
                <div class="row">
                    <div class="col-md-4 mb-5">
                        <h5 class="text-secondary text-uppercase mb-4">Quick Shop</h5>
                        <div class="d-flex flex-column justify-content-start">
                            <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Home</a>
                            <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Our Shop</a>
                            <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Shop Detail</a>
                            <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Shopping Cart</a>
```

```
                    <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Checkout</a>
                    <a class="text-secondary" href="#"><i class="fa fa-angle-right mr-2"></i>Contact Us</a>
                </div>
            </div>
            <div class="col-md-4 mb-5">
                <h5 class="text-secondary text-uppercase mb-4">My Account</h5>
                <div class="d-flex flex-column justify-content-start">
                    <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Home</a>
                    <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Our Shop</a>
                    <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Shop Detail</a>
                    <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Shopping Cart</a>
                    <a class="text-secondary mb-2" href="#"><i class="fa fa-angle-right mr-2"></i>Checkout</a>
                    <a class="text-secondary" href="#"><i class="fa fa-angle-right mr-2"></i>Contact Us</a>
                </div>
            </div>
            <div class="col-md-4 mb-5">
                <h5 class="text-secondary text-uppercase mb-4">Newsletter</h5>
                <p>Duo stet tempor ipsum sit amet magna ipsum tempor est</p>
                <form action="">
```

```
                    <div class="input-group">
                      <input type="text" class="form-control" placeholder="Your Email Address">
                      <div class="input-group-append">
                        <button class="btn btn-primary">Sign Up</button>
                      </div>
                    </div>
                  </form>
                  <h6 class="text-secondary text-uppercase mt-4 mb-3">Follow Us</h6>
                  <div class="d-flex">
                    <a class="btn btn-primary btn-square mr-2" href="#"><i class="fab fa-twitter"></i></a>
                    <a class="btn btn-primary btn-square mr-2" href="#"><i class="fab fa-facebook-f"></i></a>
                    <a class="btn btn-primary btn-square mr-2" href="#"><i class="fab fa-linkedin-in"></i></a>
                    <a class="btn btn-primary btn-square" href="#"><i class="fab fa-instagram"></i></a>
                  </div>
                </div>
              </div>
            </div>
          </div>
          <div class="row border-top mx-xl-5 py-4" style="border-color: rgba(256, 256, 256, .1) !important;">
            <div class="col-md-6 px-xl-0">
```

```
            <p class="mb-md-0 text-center text-md-left text-secondary">
                &copy; <a class="text-primary" href="#">Domain</a>. All Rights Reserved. Designed
                by
                <a class="text-primary" href="https://htmlcodex.com">HTML Codex</a>
            </p>
        </div>
        <div class="col-md-6 px-xl-0 text-center text-md-right">
            <img class="img-fluid" src="../static/img/payments.png" alt="">
        </div>
    </div>
</div>
<!-- Footer End -->


<!-- Back to Top -->
<a href="#" class="btn btn-primary back-to-top"><i class="fa fa-angle-double-up"></i></a>


<!-- JavaScript Libraries -->
<script src="https://code.jquery.com/jquery-3.4.1.min.js"></script>
<script src="https://stackpath.bootstrapcdn.com/bootstrap/4.4.1/js/bootstrap.bundle.min.js"></script>
<script src="../static/lib/easing/easing.min.js"></script>
```

```
    <script src="../static/lib/owlcarousel/owl.carousel.min.js"></script>

    <!-- Contact Javascript File -->
    <script src="../static/mail/jqBootstrapValidation.min.js"></script>
    <script src="../static/mail/contact.js"></script>

    <!-- Template Javascript -->
    <script src="../static/js/main.js"></script>
</body>

</html>
```

GITHUB LINK

https://github.com/IBM-EPBL/IBM-Project-48448-1660807377

VIDEO DEMO LINK

https://drive.google.com/file/d/1Ss5M1VHnQiLXKV_dlwnqPpunkxVc_0RD/view?usp=share_link