

# **NALAIYA THIRAN PROGRAM**

## **FERTILLIZER RECOMMENDATION SYSTEM**

### **FOR DISEASE PREDICTION**

### **PROJECT REPORT**

#### **SUBMITTED 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**

It allows us to predict which crops would be appropriate for a given climate. Using the weather and disease related data sets, the crop quality can also be improved. Prediction algorithms help us to classify the data based on the disease, and data extracted from the classifier is used to predict soil and crop.

# **2. LITERATURE SURVEY**

## **2.1. EXISTING PROBLEM**

The growth of crops which will earn them most profit. It will help in maintaining nutrients content in the soil. Both quantity and quality will be increased. The prediction of crop yield is based on the soil data and proper implementation of algorithms have proved that higher crop is achieved. the soil is based on soil type, land type, nutrients along with temperature and electrical conductivity of soil. Alternate crops also can be grown for the particular season as requested by the farmers.

## **2.2 REFERENCES**

- Gosai, Dhruvi, Chintal Raval, Rikin Nayak, Hardik Jayswal, and Axat Patel. "Crop Recommendation System using Machine Learning." (2021).
- Bondre, D. A., & Mahagaonkar, S. (2019). Prediction of crop yield and fertilizer

recommendation using machine learning algorithms. *International Journal of Engineering Applied Sciences and Technology*, 4(5), 371-376.

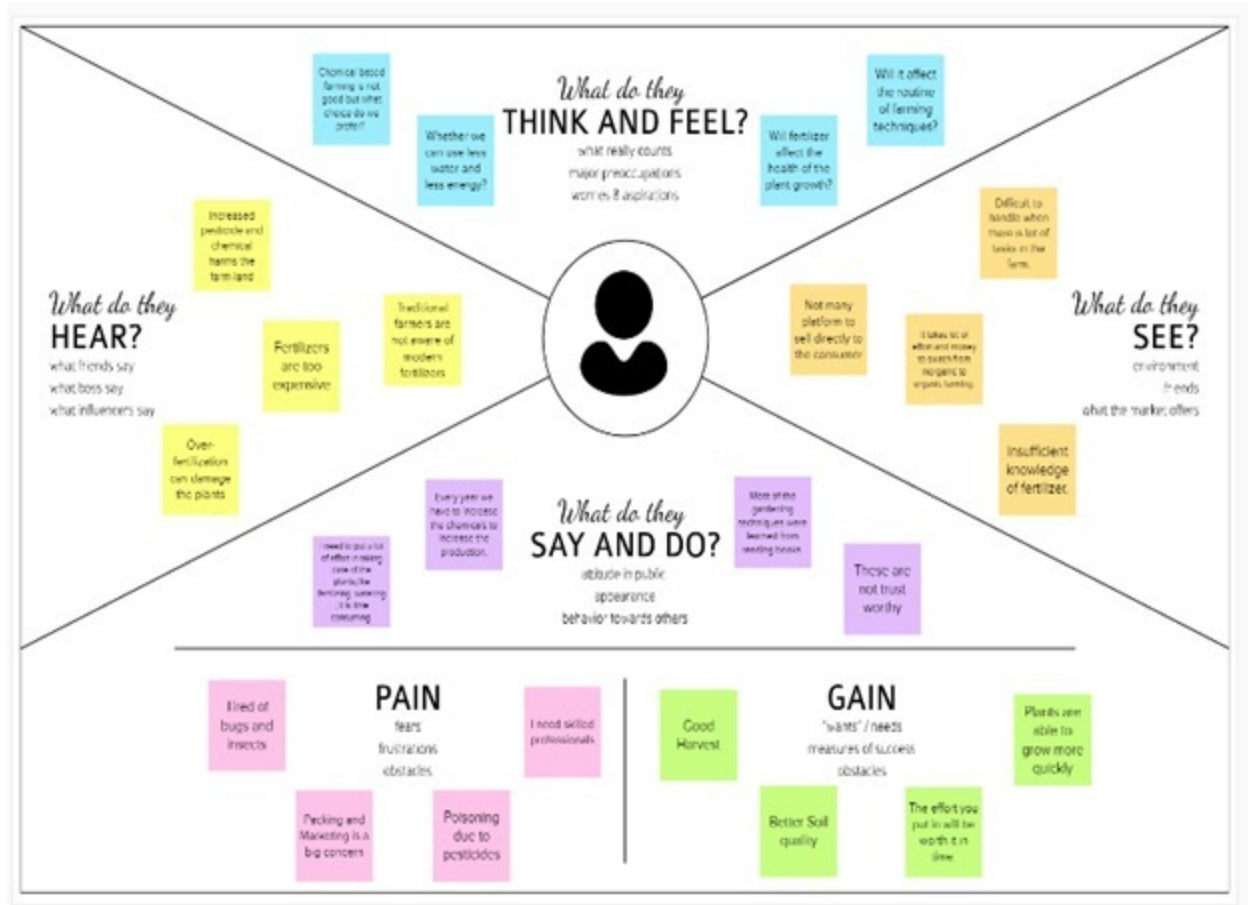
- Archana, K., and K. G. Saranya. "Crop Yield Prediction, Forecasting and Fertilizer Recommendation using Voting Based Ensemble Classifier." *SSRG Int. J. Comput. Sci. Eng* 7 (2020): 1-4.
- Neela, R., & Nithya, P. (2019). Fertilizers Recommendation System For Disease Prediction In Tree Leaves. *International Journal Of Scientific & Technology Research*, ISSN, (2277-8616).
- Mane, Vijay, Akash Gajbhiye, Chinmay Deshmukh, and Kunal Gaikwad. "Krishi Mitra: Crop and Fertilizer Recommendations System Using Machine Learning Algorithm." In *Pervasive Computing and Social Networking*, pp. 309-317. Springer, Singapore, 2023.
- Chougule, A., Jha, V. K., & Mukhopadhyay, D. (2019). Crop suitability and fertilizers recommendation using data mining techniques. In *Progress in Advanced Computing and Intelligent Engineering* (pp. 205-213). Springer, Singapore.

## **2.3 PROBLEM STATEMENT DEFINITION**

The Agriculture industry is extremely vital and crucial for economic and social development and jobs. In India, the agricultural sector provides a living for almost 48% of the population. As per the 2019-2020 economic survey, an Indian farmer's median wage in 16 states is Rupees 2500. Most of the Indian population depends on agriculture for their livelihood. Agriculture gives an opportunity of employment to the village people to develop a country like India on large scale and give a push in the economic sector. The majority of farmers face the problem of planting an inappropriate crop for their land based on a conventional or non-scientific approach. This is a challenging task for a country like India, where agriculture feeds approximately 42% of the population. And the outcomes for the farmer of choosing the wrong crop for land is moving towards metro city for livelihoods, suicide, quitting the agriculture and give land on lease to industrialist or use for the non-agriculture purpose. The outcome of wrong crop selection is less yield and less profit.

### 3. IDEATION AND PROPOSED SOLUTION

#### 3.1 EMPATHY MAP CANVAS



### 3.2 IDEATION AND BRAINSTORMING



### 3.3 PROPOSED SOLUTION

**Problem Statement:** Most of the plants are affected by variety of bacterial and fungal diseases. This will result in the reduces the growth and productiveness of the plant

**Idea / Solution Description:** The solution of the problem is to identifying the diseases of the crops by using image processing and then it provides the correct fertilizers to the farmers.

**Novelty / Uniqueness:** Capturing the image of the crop will be in required picture to identify the disease of the crop and suggest related fertilizers to the farmers.

**Social Impact / Customer Satisfaction:** It identifies the diseases of the crops by using image processing and will provide the solution within a minute and also increases the quality and quantity of the crops.

**Business Model:** The application is recommended to farmers in subscription basis

**Scalability:** Application can be improved by introducing online purchases of crops,

fertilizers with door delivery and online payment

### 3.4 PROBLEM SOLUTION FIT

Project Title: Fertilizer Recommendation System for Disease Prediction			Project Design Phase-I - Solution Fit Template			Team ID: PNT2022TMID19767		
Define CS, fit into CC	<b>1. CUSTOMER SEGMENT(S)</b> <small>Who is your customer? (a. Working parents of 3-5 y.o. kids)</small>	<b>CS</b>	<b>6. CUSTOMER CONSTRAINTS</b> <small>What constraints prevent your customers from taking action to solve their chosen problem? (a. Spending power, budget, no cash, network connection, available devices)</small>	<b>CC</b>	<b>5. AVAILABLE SOLUTIONS</b> <small>Which solutions are available to the customer when they face the problem? (a. Need to get the job done? What have they tried in the past? What price is worth to these solutions? What is an alternative to digital technology)</small>	<b>AS</b>	Explore AS, differentiate	
	Farmers are the customer for this application. This application is easy to use for the customer and then it suggests the correct fertilizers to the customer.		<ul style="list-style-type: none"><li>It supports in all the devices.</li><li>Capturing the image of the crop will be in required picture to identify the disease of the crop.</li></ul>		<ul style="list-style-type: none"><li>This application finds the disease in crops by identifying quality of leaves</li><li>It supports in mobile, desktop etc.,</li></ul>			
Focus on J&P, map into BE, understand RC	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> <small>Which jobs to be done (or problems) do you address for your customer? There could be more than one, explore different jobs.</small>	<b>J&amp;P</b>	<b>9. PROBLEM ROOT CAUSE</b> <small>What is the real reason that this problem exists? What is the back story behind the need to do this job? (a. Customer's have to do it because of the change in requirements)</small>	<b>RC</b>	<b>7. BEHAVIOUR</b> <small>What does your customer do to address the problem and get the job done? (a. Directly related: find the right solar panel installer, calculate rough and benefits indirectly associated: customers spend less time on volunteering work (a. Example))</small>	<b>BE</b>	Focus on BE, map into RC, understand RC	
	This application is used to identify the diseases of the crop and it will recommend the correct fertilizer for their crops		Existing need to put a lot of effort in taking care of the plants, like fertilizing, watering, it is time consuming		It will improve Soil quality, Good Harvest and save lot of money.			
Identify strong TR & EM	<b>3. TRIGGERS</b> <small>What event?</small>	<b>TR</b>	<b>10. YOUR SOLUTION</b> <small>If you are working on an existing business, write down your current solution flow, list the current, and think how much it fits real life. If you are working on a new business proposition, how long it took until you felt the current and coming up with a solution that fits within customer limitations, solve a problem and enables customer behavior.</small>	<b>SE</b>	<b>8. CHANNELS of BEHAVIOUR</b> <b>8.1 ONLINE</b> <small>What kind of actions do customers take online? Connect online channels from 7?</small>	<b>CH</b>	Identify strong TR & EM	
	Customers will feel that this application will improve the quality and quantity of the crops, but also feel that it is too expensive.		<ul style="list-style-type: none"><li>Using the recommended fertilizer in the disease-affected crop is one of our solutions for our application.</li><li>It will provide the solution within a minute</li></ul>		<b>8.2 OFFLINE</b> <small>What kind of actions do customers take offline? Connect offline channels from 7 and use them for customer development.</small>			
	<b>4. EMOTIONS: BEFORE / AFTER</b> <small>How do customers feel when they face a problem at a job and afterwards? (a. Not, because of feedback, is correct - see 9 to your communication strategy &amp; design)</small>	<b>EM</b>						
	Before: Poisoning due to pesticides and loss of money After: The effort you put in will be worth it in time.				Online: Need skilled professionals and basic knowledge of the crops and fertilizers. Offline: Most of the gardening techniques were learned from reading books			

## 4. REQUIREMENT ANALYSIS

### 4.1 FUNCTIONAL REQUIREMENTS

- User Registration
- User Confirmation
- User Details
- Uploading data
- Image processing
- Solution description

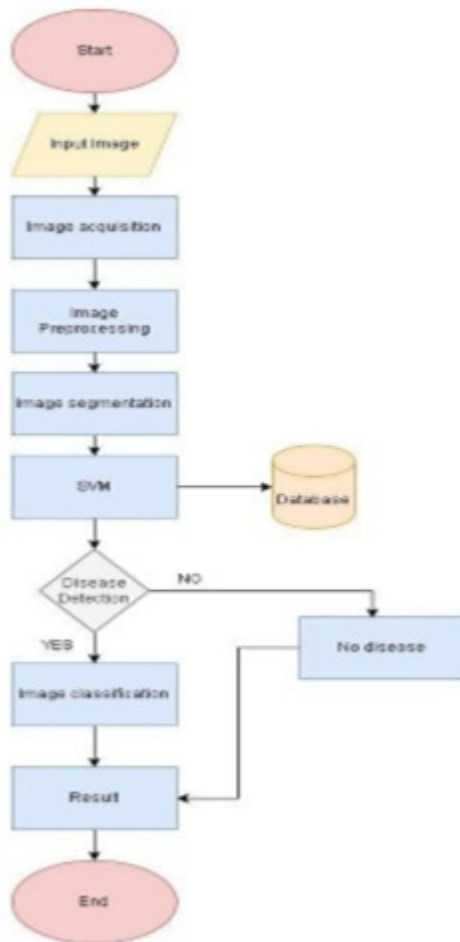


## **4.2 NON-FUNCTIONAL REQUIREMENTS**

- Usability
- Security
- Performance
- Availability
- Scalability
- Reliability

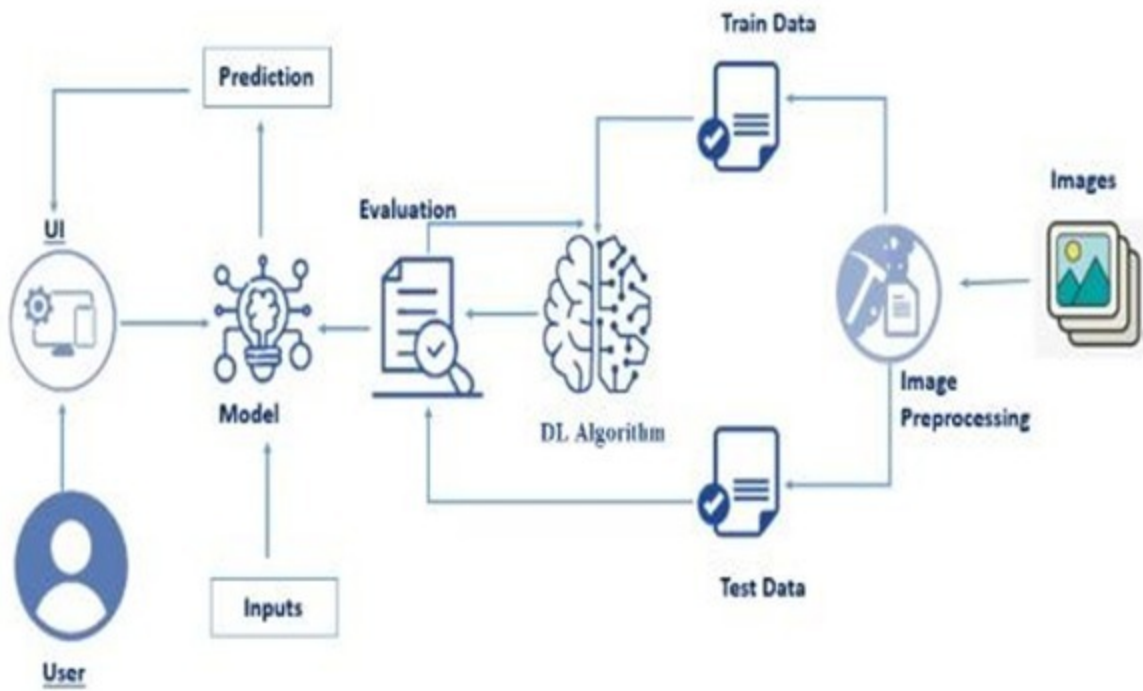
## **5. PROJECT DESIGN**

### **5.1 DATA FLOW DIAGRAMS**



## 5.2 SOLUTION AND TECHNICAL ARCHITECTURE

We are planning to create an application which will be instructing the user to recommend the fertilizer for the prediction of diseases. To do this process without any errors, we will be training our model with more reliable training and testing dataset.



### 5.3 USER STORIES

<b>1 Phases</b> High-level steps you need to accomplish from start to finish	Obtaining Information	Seedbed preparation and purchase of seedlings	Sowing the seedlings using fertilizers	Feeding the seedlings and harvesting crops and storage
<b>2 Steps</b> Detailed actions you need to take to perform	Best plants for the season Economic need Soil Condition	Irrigation Required Preparing the soil Purchase seed for best choice	Find the best time to sowing the seed Plan the amount of yield Adding extra fertilizer for strengthening	Check for unwanted infection Check if the plants are hydrated enough store them remaining Sell them off
<b>3 Feelings</b> What you might be thinking and feeling at the moment	<div><div>👍</div><div>The yield should be great for the season</div><div>Quality information</div><div>Information on demand</div></div> <div><div>👎</div><div>There shouldn't be any unforeseen weather</div></div>	<div><div>The quality of the seeds should be good</div></div>	<div><div>Enough fertilizers might ensure great yield</div><div>There shouldn't be any weeds inocorrectly</div></div>	<div><div>If there is great then yield will be good</div><div>Good Harvest = Happy Farmer</div><div>There shouldn't be any weeds infection</div></div>
<b>4 Pain points</b> Problems you user runs into	<div>Reservations in taking the right information</div>	<div>Incorrect irrigation</div>	<div>Wind drift and late inocorrect</div>	<div>Presence of rodent</div> <div>Risk of harvest loss</div>
<b>5 Opportunities</b> Potential improvements or enhancements to the experience	<div>Good Weather and Right information</div>	<div>Right amount of irrigation and good weeds produce great yield</div>		<div>No sign of rodents or fungi</div> <div>Great yield and harvest</div>

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
	Login	USN-2	As a user, I can log into the application by entering email & password	I can login using my E-mail ID accounts or user credentials	High	Sprint-1
	Dashboard	USN-3	As a user, I can view the page of the application where i can upload my images and the fertilizer should be recommended.	I can access my account/ dashboard.	High	Sprint-2
Customer (Web user)	Registration	USN-4	As a user, I can login to web dashboard just like website dashboard	I can register using my username and password	High	Sprint-3
	Login	USN-5	As a user, I can login to my web dashboard with the login credentials	I can login using my User credentials	High	Sprint-3
	Dashboard	USN-6	As a user, I can view the web application where i can upload my images for getting the suggestion of the fertilizer	I can access my account/ dashboard	High	Sprint-4
		USN-7	As a user, the fertilizer recommended to me is in high accurate.	I can access my account/ dashboard	High	Sprint-4

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Administrator	Login	USN-8	As a admin, I can login to the website using my login credentials.	I can login to the website using my login credentials.	High	Sprint-5
	Dashboard	USN-9	As a admin, I can view the dashboard of the application.	I can access my dashboard	High	Sprint-5

## 6.2 SPRINT DELIVERY SCHEDULE

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points (Total)	Priority	Team members
Sprint-1	Model Creation and Training (Fruits)		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	Swetha C Nalina M Subanandhana R Renuka R
	Model Creation and Training (Vegetables)		Create a model which can classify diseased vegetable plants from given images	2	High	Swetha C Nalina M Subanandhana R Renuka R

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points (Total)	Priority	Team Members
Sprint-2	Model Creation and Training (Vegetables)		Create a model which can classify diseased vegetable plants from given images and train on IBM Cloud	6	High	Swetha C Nalina M Subanandhana R Renuka R
	Registration	USN-1	As a user, I can register by entering my email, password, and confirming my password or via OAuth API	3	Medium	Swetha C Nalina M Subanandhana R Renuka R
	Upload page	USN-2	As a user, I will be redirected to a page where I can upload my pictures of crops	4	High	Swetha C Nalina M Subanandhana R Renuka R
	Suggestion results	USN-3	As a user, I can view the results and then obtain the suggestions provided by the ML model	4	High	Swetha C Nalina M Subanandhana R Renuka R
	Base Flask App		A base Flask web app must be created as an interface for the ML model	2	High	Swetha C Nalina M Subanandhana R Renuka R
Sprint-3	Login	USN-4	As a user/admin/shopkeeper, I can log into the application by entering email & password	2	High	Swetha C Nalina M Subanandhana R Renuka R
	User Dashboard	USN-5	As a user, I can view the previous results and history	3	Medium	Swetha C Nalina M Subanandhana R Renuka R
	Integration		Integrate Flask, CNN model with Cloudant DB	5	Medium	Swetha C Nalina M Subanandhana R Renuka R
	Containerization		Containerize Flask app using Docker	2	Low	Swetha C Nalina M Subanandhana R Renuka R

Sprint-4	Dashboard (Admin)	USN-6	As an admin, I can view other user details and uploads for other purposes	2	Medium	Swetha C Nalina M Subanandhana R Renuka R
	Dashboard (Shopkeeper)	USN-7	As a shopkeeper, I can enter fertilizer products and then update the details if any	2	Low	Swetha C Nalina M Subanandhana R Renuka R
	Containerization		Create and deploy Helm charts using Docker Image made before	2	Low	Swetha C Nalina M Subanandhana R Renuka R

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (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 AND SOLUTIONING

### 7.1 FEATURE 1

```
from google.colab import drive
drive.mount('/content/drive')

Mounted at /content/drive

!unzip '/content/drive/MyDrive/Dataset.zip'

Streaming output truncated to the last 5000 lines.
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8914e04-4e33-4189-bfa9-f547e5f696d1__GCREC_Bact.Sp 317
3.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8a64b79-e21e-4158-9d9d-47bd6e44fba0__GCREC_Bact.Sp 359
4.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8a90b81-eb30-461d-80ba-4fa9c93f379d__GCREC_Bact.Sp 375
7.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8b6f17a-5189-47ae-904f-be4a09dc9ead__UF_GRC_BS_Lab Leaf
9009.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8d2baf6-87de-43e5-bd40-48dfe33841d3__GCREC_Bact.Sp 574
7.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8d3c759-4242-42c0-9be5-b3177f2664be__GCREC_Bact.Sp 595
3.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8d99dae-78a8-46f4-b7ad-600e0685d592__GCREC_Bact.Sp 613
6.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8db4770-1ba3-4648-8a8f-05bfc2d6e49__GCREC_Bact.Sp 612
3.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d8e40874-f16d-43e2-9922-97a973861a0c__UF_GRC_BS_Lab Leaf
8728.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d903df67-fe54-4892-be62-1db1a8bbe6d2__GCREC_Bact.Sp 594
2.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d90c232c-8940-4931-8b77-346b7fecf992__GCREC_Bact.Sp 372
9.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d917a80d-e9b2-4c64-85ba-60014b11c757__GCREC_Bact.Sp 358
8.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d91864c6-22e4-4dea-b10f-e64061a300a3__GCREC_Bact.Sp 357
2.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Bacterial_spot/d9461bb6-7502-4f29-80eb-e691b7f5619f__GCREC_Bact.Sp 629
3.JPG
```

```
55.JPG
Inflating: Dataset Plant Disease/Veg-dataset/Veg-dataset/train_set/Tomato__Septoria_leaf_spot/fffee500-8469-4c0f-a17d-d95c5516b446__Matt.S.CG 621
0.JPG

In [ ]: test_dir=r'/content/Dataset_Plant_Disease/fruit-dataset/fruit-dataset/test'

In [ ]: import tensorflow as tf
        from tensorflow import keras
        from tensorflow.keras.preprocessing.image import ImageDataGenerator

In [ ]: train_datagen=ImageDataGenerator(rescale=1./255, zoom_range=0.2, horizontal_flip=True, vertical_flip=False)

In [ ]: test_datagen=ImageDataGenerator(rescale=1./255)

In [ ]: x_train=train_datagen.flow_from_directory(r'/content/Dataset_Plant_Disease/fruit-dataset/fruit-dataset/train', target_size=(128,128), class_mode='catego

Found 5384 images belonging to 6 classes.

In [ ]: x_test=test_datagen.flow_from_directory(r'/content/Dataset_Plant_Disease/fruit-dataset/fruit-dataset/test', target_size=(128,128), class_mode='categoric

Found 1686 images belonging to 6 classes.

In [ ]: from tensorflow.keras.models import Sequential
        from tensorflow.keras.layers import Dense, Convolution2D, MaxPooling2D, Flatten

In [ ]: model=Sequential()

In [ ]: model.add(Convolution2D(32,(3,3), input_shape=(128,128,3), activation='relu'))
```

```
Follow-up x Course x IBM Clo x Obtain x IBM x IBM-61 x IBM-Pro x My Drive x Project x Project x + - Update
github.com/IBM-EPBL/IBM-Project-6137-1658823980/blob/main/Project%20Development%20Phase/Sprint%202/Testing%20model/testing_model_fruit.ip...

In [ ]: model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))

In [ ]: model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.summary()

Model: "sequential"
Layer (type) Output Shape Param #
-----
conv2d (Conv2D) (None, 126, 126, 32) 896
max_pooling2d (MaxPooling2D) (None, 63, 63, 32) 0
flatten (Flatten) (None, 127008) 0
-----
Total params: 896
Trainable params: 896
Non-trainable params: 0

In [ ]: 32*(3*3*3+1)
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))

In [ ]: model.add(Dense(6,activation='softmax'))
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
len(x_train)

Out[ ]: 225

In [20]: model.fit(x_train,steps_per_epoch=len(x_train),validation_data=x_test,validation_steps=len(x_test),epochs=10)
```

```
Follow-up x Course x IBM Clo x Obtain x IBM x IBM-61 x IBM-Pro x My Drive x Project x Project x + - Update
github.com/IBM-EPBL/IBM-Project-6137-1658823980/blob/main/Project%20Development%20Phase/Sprint%202/Testing%20model/testing_model_fruit.ip...

225/225 [=====] - 164s 727ms/step - loss: 0.0940 - accuracy: 0.9716 - val_loss: 0.0990 - val_accuracy: 0.9656
Epoch 8/10
225/225 [=====] - 163s 725ms/step - loss: 0.0523 - accuracy: 0.9811 - val_loss: 0.1073 - val_accuracy: 0.9686
Epoch 9/10
225/225 [=====] - 161s 715ms/step - loss: 0.0499 - accuracy: 0.9807 - val_loss: 0.1402 - val_accuracy: 0.9680
Epoch 10/10
225/225 [=====] - 164s 727ms/step - loss: 0.0653 - accuracy: 0.9801 - val_loss: 0.1073 - val_accuracy: 0.9680

Out[20]:

In [21]: model.save('fruitdata.h5')

In [22]: import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image

In [23]: model=load_model('fruitdata.h5')

In [24]: test_datagen_1=ImageDataGenerator(rescale=1)
test_generator_1=test_datagen_1.flow_from_directory(
    test_dir,
    target_size=(128,128),
    batch_size=20,
    class_mode='categorical'
)

Found 1686 images belonging to 6 classes.

In [25]: import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image


In [26]: img=image.load_img(r"/content/Dataset_Plant_Disease/fruit-dataset/fruit-dataset/test/Peach___healthy/5a40aaba-8352-4bd0-bfec-b9fcf89a891b_Rutg._HL 3
```



github.com/IBM-EPBL/IBM-Project-6137-1658823980/blob/main/Project%20Development%20Phase/Sprint%202/Testing%20model/testing\_model\_fruit.ip...

In [27]:  
img

Out[27]:



In [28]:

```
img=image.load_img(r"/content/Dataset_Plant_Disease/fruit-dataset/fruit-dataset/test/Peach___healthy/5a40aaba-8352-4bd0-bfec-b9fcf89a891b__Rutg._HL 3
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
y=np.argmax(model.predict(x),axis=1)
index=['Apple___Black_rot','Peach___healthy','Corn_(maize)___Northern_Leaf_Blight','Corn_(maize)___healthy','Peach___Bacterial_spot','Apple___healthy']
index[y[0]]
```

1/1 [=====] - 0s 169ms/step

Out[28]: 'Peach\_\_\_healthy'

In [29]:

```
model.evaluate(test_generator_1,steps=50)
```

50/50 [=====] - 8s 149ms/step - loss: 1223.7683 - accuracy: 0.5820

Out[29]: [1223.768310546875, 0.5820000171661377]

Windows taskbar: 23:34 19-11-2022

## 7.2 FEATURE 2

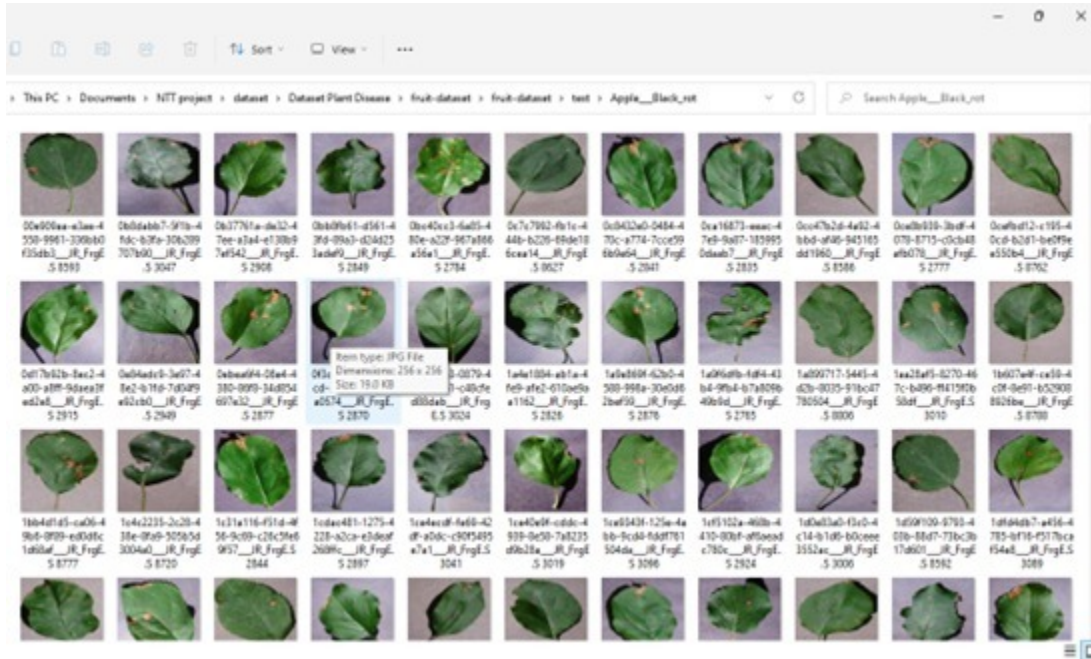
github.com/IBM-EPBL/IBM-Project-6137-1658823980/blob/main/Project%20Development%20Phase/Sprint%203/Python%20code/plant\_disease.py.py

```
34 from keras.preprocessing.image import ImageDataGenerator
35 train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
36 test_datagen=ImageDataGenerator(rescale=1)
37
38 x_train=train_datagen.flow_from_directory('/content/Dataset_Plant_Disease/Veg-dataset/Veg-dataset/train_set',target_size=(128,128),batch_size=2,class_mode='categorical')
39 x_test=test_datagen.flow_from_directory('/content/Dataset_Plant_Disease/Veg-dataset/Veg-dataset/test_set',target_size=(128,128),batch_size=2,class_mode='categorical')
40
41 from keras.models import Sequential
42 from keras.layers import Dense
43 from keras.layers import Convolution2D
44 from keras.layers import MaxPooling2D
45 from keras.layers import Flatten
46
47 from keras.preprocessing.image import ImageDataGenerator
48 train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
49 test_datagen=ImageDataGenerator(rescale=1)
50
51 x_train=train_datagen.flow_from_directory('/content/Dataset_Plant_Disease/Veg-dataset/Veg-dataset/train_set',target_size=(128,128),batch_size=16,class_mode='categorical')
52 x_test=test_datagen.flow_from_directory('/content/Dataset_Plant_Disease/Veg-dataset/Veg-dataset/test_set',target_size=(128,128),batch_size=16,class_mode='categorical')
53
54 model=Sequential()
55 model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
56 model.add(MaxPooling2D(pool_size=(2,2)))
57 model.add(Flatten())
58 model.add(Dense(units=300,kernel_initializer='uniform',activation='relu'))
59
60 model.add(Dense(units=150,kernel_initializer='uniform',activation='relu'))
61 model.add(Dense(units=75,kernel_initializer='uniform',activation='relu'))
62 model.add(Dense(units=9,kernel_initializer='uniform',activation='softmax'))
63 model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
64 model.fit(x_train,steps_per_epoch=89,epochs=20,validation_data=x_test,validation_steps=27)
65
66 model.save('fruit.h5')
```

Windows taskbar: 23:38 19-11-2022

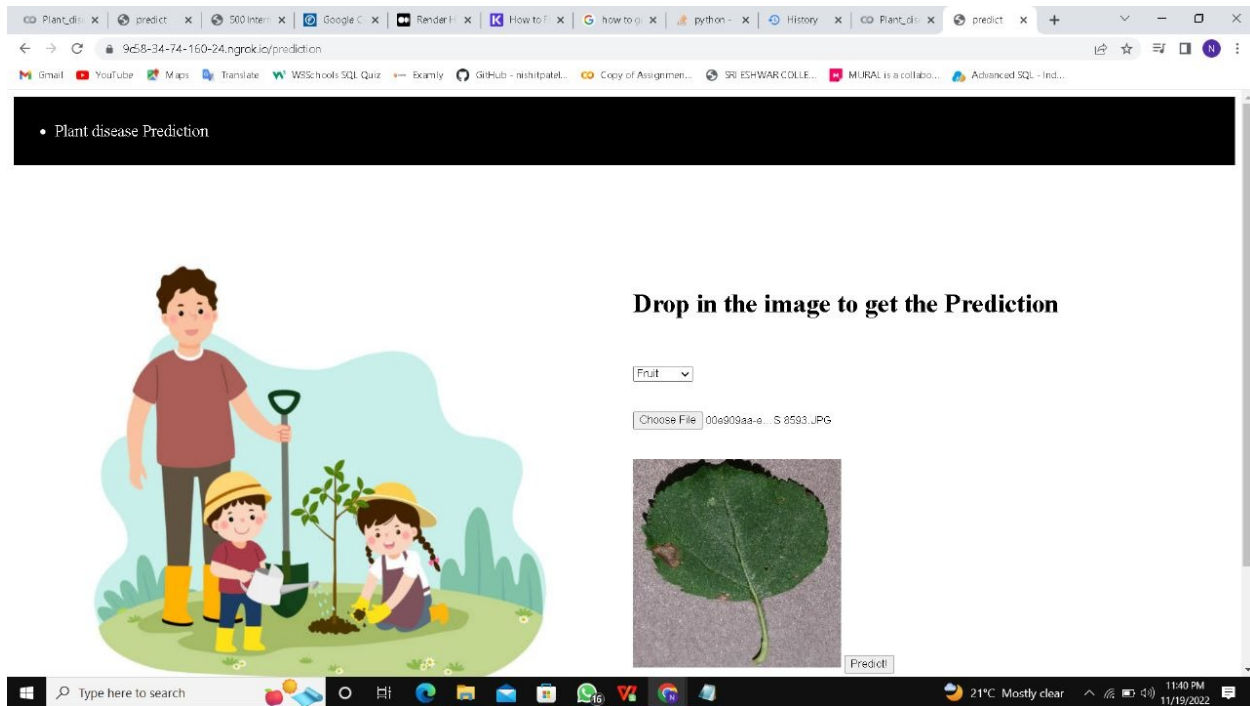
## 8. TESTING

### 8.1 TESTCASES



### 8.2 USER ACCEPTANCE TESTING





## 10. ADVANTAGES

- They are quick in providing plant nutrients and restoring soil fertility.
- They are portable and easy to transport.
- Plants easily absorb fertilizers.
- Fertilizers improve and increase the productivity of many crops such as wheat, maize, and rice.

## 11. CONCLUSION

Generally chemical fertilizers and pesticides are effective and convenient in use for production and disease management of plants but they are potential threat for the health and environment of soil, plant as well as humans.

## 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 Open CV

python library. This project work can be extended for security applications such as figure print recognition, iris recognition and face recognition.

### **13. APPENDIX**

**GITHUB link**

[\*\*https://github.com/IBM-EPBL/IBM-Project-6137-1658823980\*\*](https://github.com/IBM-EPBL/IBM-Project-6137-1658823980)