Fertilizers Recommendation System For Disease Prediction

TEAM ID:PNT2022TMID10695

TEAM MEMBERS,

1.SARGUNAN .P

2.SATHYA .S

3.SURYA .K.K

4. VENUKRISHNA .P

5. SRIRAM .R.S

INTRODUCTION

1.1 Project Overview

In today's world agriculture is very important for life and helps to save the natural resources around as. Doing agriculture is the very hard in current scenario because of many natural disasters are happening every day. Most of the plants are affected by many diseases due to pollution in water, air, soil. Identifying the disease is one of the huge hurtles in agriculture. Most of the plants are affected by leaf disease and it's hard to find to correct fertilizer to cure. The main objective of this project is to identify the disease in the plants and cure it in the early stage of the infection. 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.

LITERATURE SURVEY

2.1 Existing problem

- The use of excess insecticides and fertilizers in farming poses a risk to human health. It is necessary to control them to ensure healthy crop production.
- Many techniques are used to identify the pest, suggest medications, and do soil nutrient analysis techniques separately.
- This paper applies the dual operator, Transition Probability Function (TPF) to process the pest's image discretely and continuously for applying the recommended insecticide.
- The mathematical model with the objective function is derived in this paper. The existing system major aspects in farming: pest identification and insecticide recommendation using machine vision. The soil nutrient analysis uses a soil NPK sensor with the recommendation of fertilizers according to the obtained nutrient values.
- On-spot results are obtained, and the time required for insecticide recommendation is within 50 s, and for fertilizer recommendation, it is within 80s.
- Successful identification of five pests, namely aphids, bollworms, leaf folder, leaf miner, and green stink bug, was done with more than 70% accuracy.

2.2 References

[1] S. Pudumalar, E. Ramanujam, R.H. Rajashree, C. Kavya, T. Kiruthika, J. Nisha, Crop recommendation system for precision agriculture, in: Proceedings of the Eighth International Conference on Advanced Computing (ICoAC), IEEE, 2017, pp. 32–36.

[2] S. Varjani, G. Kumar, E.R. Rene, Developments in biochar application for pesticide remediation: current knowledge and future research directions, J. Environ. Manag. 232 (2019) 505–513.

[3] P.S. Moschella, R.P. Laane, S. B¨ ack, H. Behrendt, G. Bendoricchio, S. Georgiou, W. Windhorst, Group report: methodologies to support implementation of the Water Framework Directive. Managing European Coasts, Springer, Berlin, Heidelberg, 2005, pp. 137–152.

[4] P.C. Abhilash, N. Singh, Pesticide use and application: an Indian scenario, J. Hazard. Mater. 165 (1–3) (2009) 1–12.

[5] L. Rani, K. Thapa, N. Kanojia, N. Sharma, S. Singh, A.S. Grewal, J. Kaushal, An extensive review on the consequences of chemical pesticides on human health and environment, J. Clean. Prod. 283 (2021), 124657.

[6] I.C. Yadav, N.L. Devi, J.H. Syed, Z. Cheng, J. Li, G. Zhang, K.C. Jones, Current status of persistent organic pesticides residues in air, water, and soil, and their possible effect on neighboring countries: a comprehensive review of India, Sci. Total Environ. 511 (2015) 123–137.

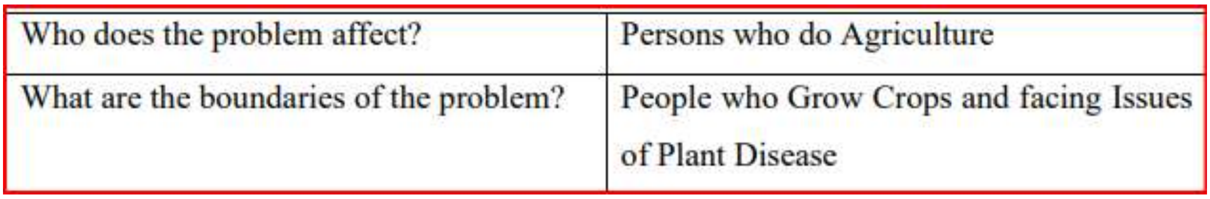
[7] J. Lacasta, F.J. Lopez-Pellicer, B. Espejo-García, J. Nogueras-Iso, F.J. ZarazagaSoria, Agricultural recommendation system for crop protection, Comput. Electron. Agric. 152 (2018) 82–89.

[8] J. Qian, C. Shi, S. Wang, Y. Song, B. Fan, X. Wu, Cloud-based system for rational use of pesticide to guarantee the source safety of traceable vegetables, Food Control 87 (2018) 192–202.

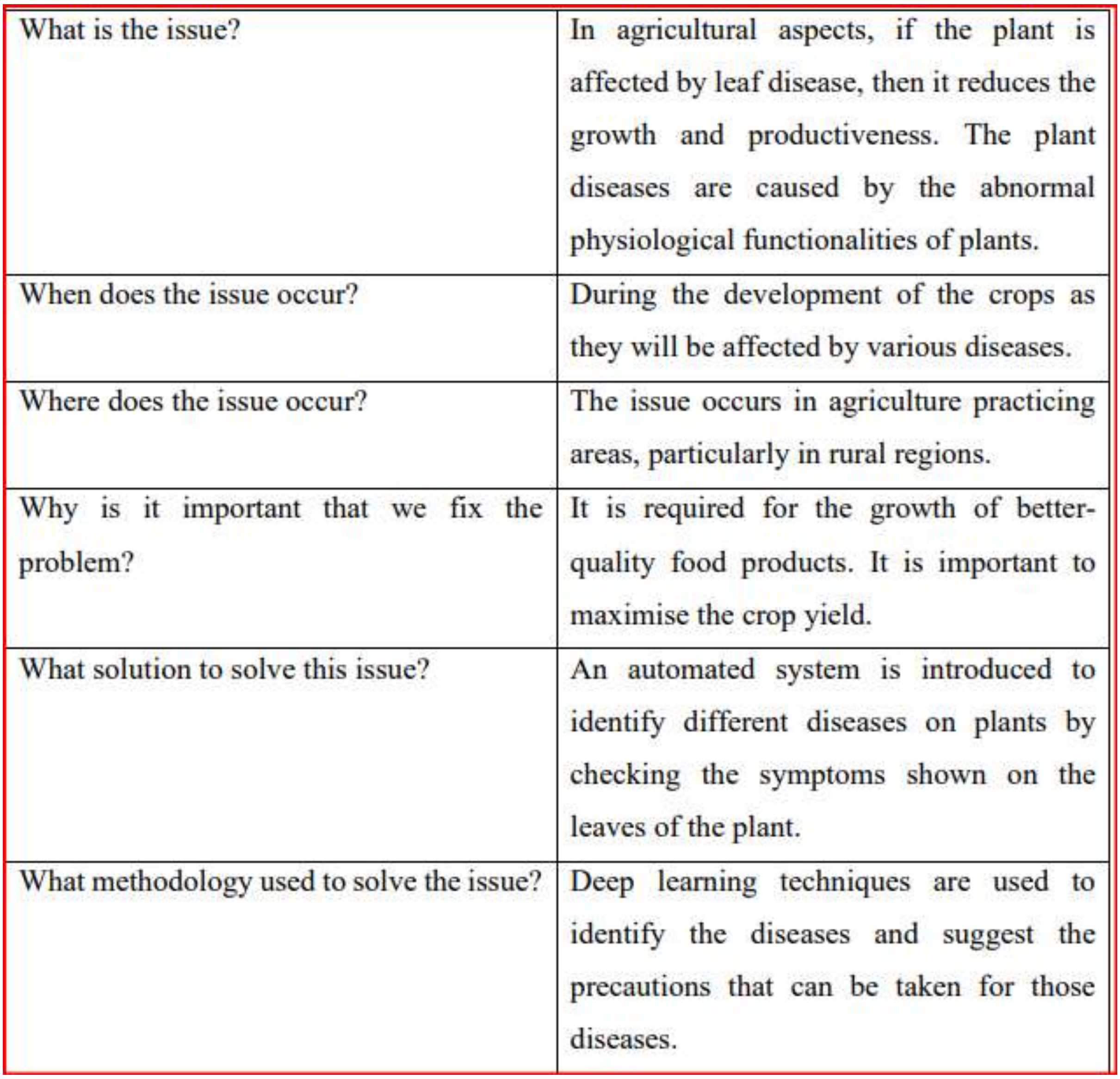
2.3 Problem Statement Definition

Mr. Narasimma Rao is a 65-year-old man. He had an own farming land and do Agriculture for past 30 Years, in this 30 Years he Faced a problem in Choosing Fertilizers and Controlling of Plant Disease.

- Narasimma Rao wants to know the better recommendation for fertilizers for plants with the disease.
- He has faced huge losses for a long time.
- This problem is usually faced by most farmers.
- Mr. Narasimma Rao needs to know the result immediately.



Who does the problem affect?	Persons who do Agriculture
What are the boundaries of the problem?	People who Grow Crops and facing Issues of Plant Disease

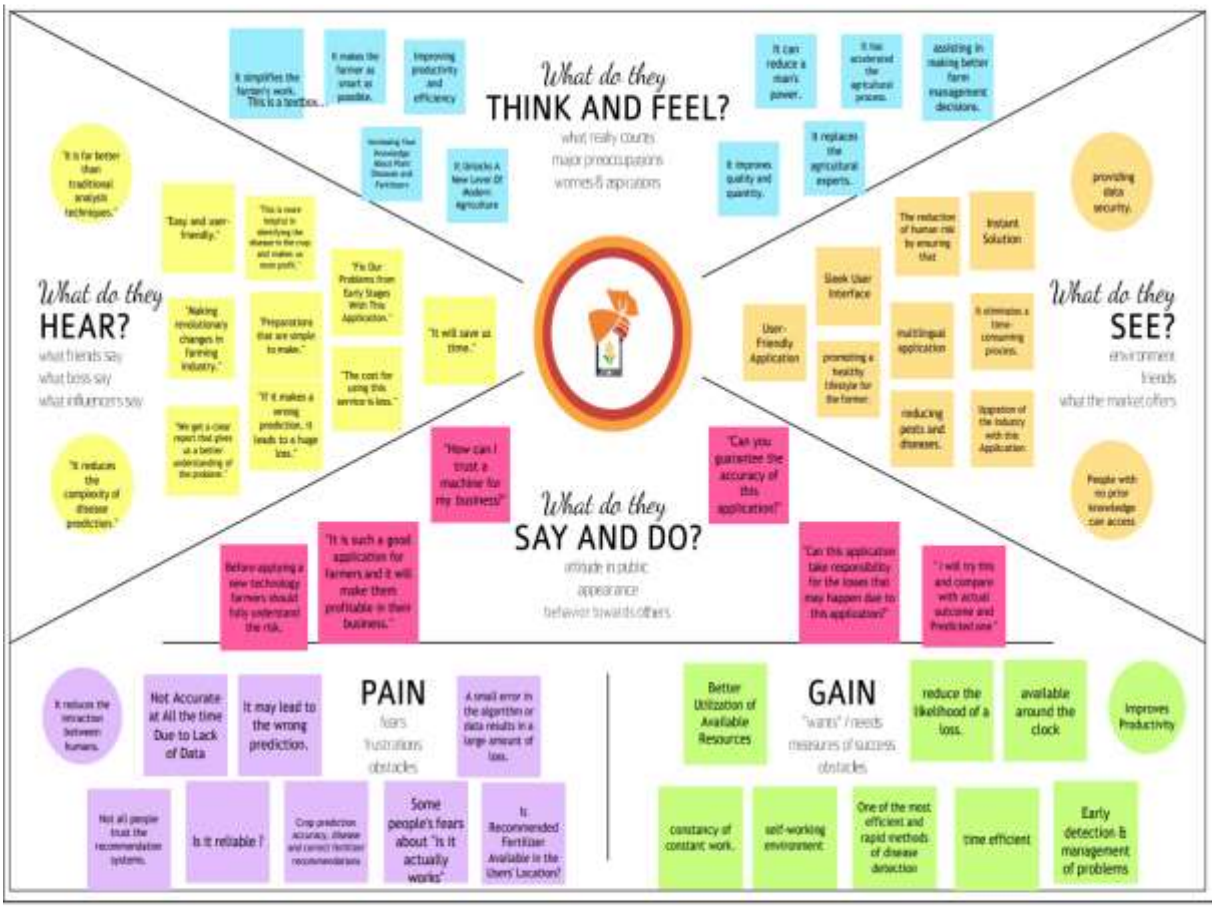


What is the issue?	In agricultural aspects, if the plant is affected by leaf disease, then it reduces the growth and productiveness. The plant diseases are caused by the abnormal physiological functionalities of plants.
When does the issue occur?	During the development of the crops as they will be affected by various diseases.
Where does the issue occur?	The issue occurs in agriculture practicing areas, particularly in rural regions.
Why is it important that we fix the problem?	It is required for the growth of better-quality food products. It is important to maximise the crop yield.
What solution to solve this issue?	An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant.
What methodology used to solve the issue?	Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases.

IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

Agriculture is the main aspect of the economic development of a country. Agriculture is the heart and life of most Indians. By understanding their feelings and problems, we can create a better product and contribute to their lives. For our project, we are getting surveys from farmers to understand what they truly require and desire.

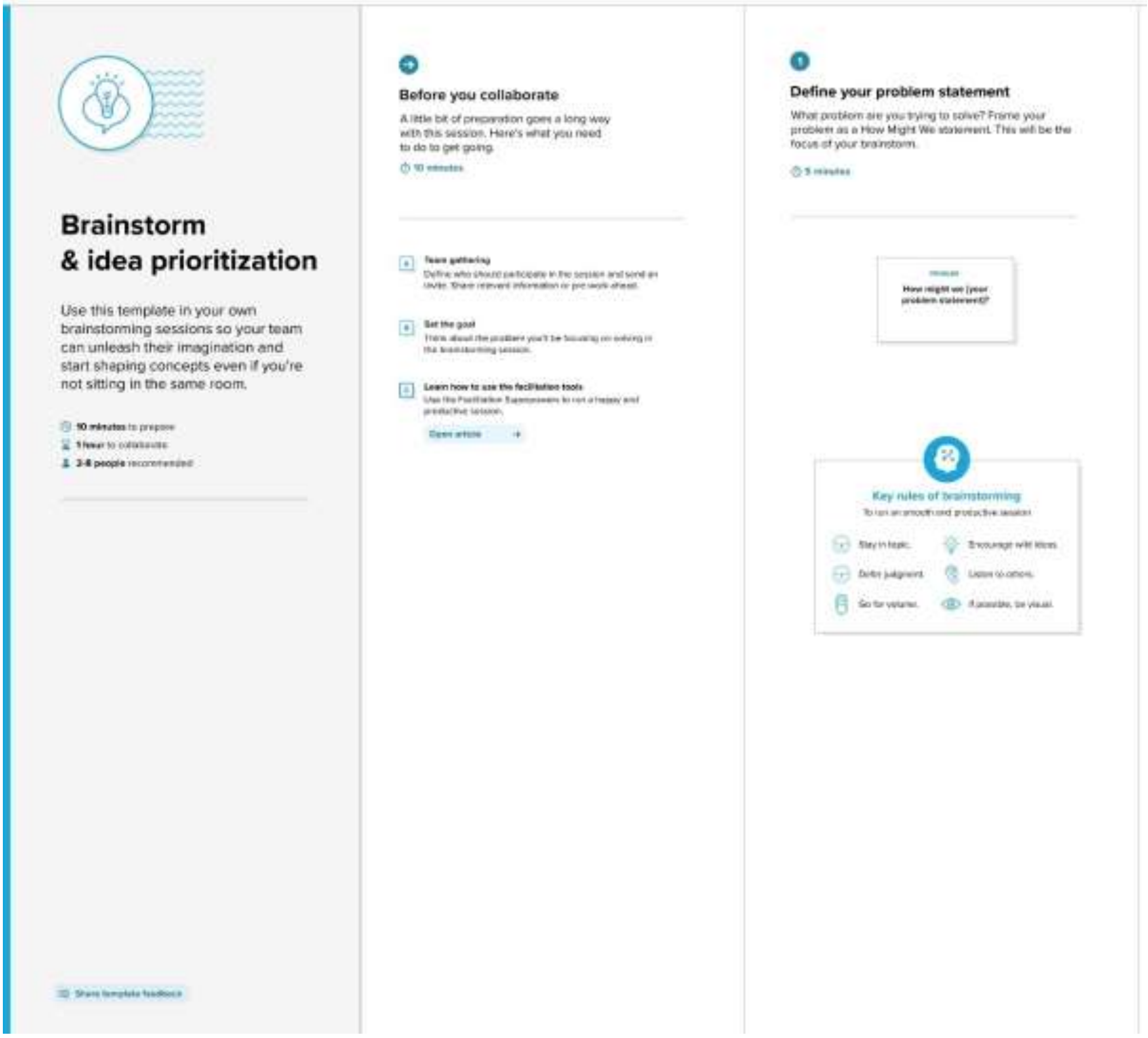

What do they THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
It simplifies the farmer's work. This is a textbox...
It makes the farmer as smart as possible.
Improving productivity and efficiency
Increasing Their Knowledge About Plant Diseases and Fertilizers
It Unlocks A New Level Of Modern Agriculture
It can reduce a man's power.
It has accelerated the agricultural process.
assisting in making better farm management decisions.
It improves quality and quantity.
It replaces the agricultural experts.
What do they HEAR?
what friends say
what boss say
what influencers say
"It is far better than traditional analysis techniques."
"Easy and user-friendly."
"This is more helpful in identifying the disease in the crop and makes us more profit."
"Fix Our Problems from Early Stages With This Application."
"Making revolutionary changes in farming industry."
"Preparations that are simple to make."
"It will save us time."
"The cost for using this service is less."
"If it makes a wrong prediction, it leads to a huge loss."
"We get a clear report that gives us a better understanding of the problem."
"It reduces the complexity of disease prediction."
What do they SEE?
environment
friends
what the market offers
providing data security.
The reduction of human risk by ensuring that
Instant Solution
Sleek User Interface
User-Friendly Application
multilingual application
It eliminates a time-consuming process.
promoting a healthy lifestyle for the farmer.
reducing pests and diseases.
Upgradation of the Industry with this Application
People with no prior knowledge can access
What do they SAY AND DO?
attitude in public
appearance
behavior towards others
"How can I trust a machine for my business?"
"Can you guarantee the accuracy of this application?"
Before applying a new technology farmers should fully understand the risk.
"It is such a good application for farmers and it will make them profitable in their business."
"Can this application take responsibility for the losses that may happen due to this application?"
" I will try this and compare with actual outcome and Predicted one"
PAIN
fears
frustrations
obstacles
It reduces the interaction between humans.
Not Accurate at All the time Due to Lack of Data
It may lead to the wrong prediction.
A small error in the algorithm or data results in a large amount of loss.
Not all people trust the recommendation systems.
Is it reliable ?
Crop prediction accuracy, disease and correct fertilizer recommendations
Some people's fears about "Is it actually works"
Is Recommended Fertilizer Available in the Users' Location?
GAIN
"wants" / needs
measures of success
obstacles
Better Utilization of Available Resources
reduce the likelihood of a loss.
available around the clock
Improves Productivity
constancy of constant work.
self-working environment
One of the most efficient and rapid methods of disease detection
time efficient
Early detection & management of problems

3.2 Ideation & Brainstorming

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

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

Reference:
https://app.mural.co/invitation/mural/sriranjani2206gmailcom4908/1664174945462?sender=



Brainstorm & idea prioritization

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

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

Share template feedback

Before you collaborate

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

10 minutes

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

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

C Learn how to use the facilitation tools
Use the Facilitation Superpowers to run a happy and productive session.

Open article →

1 Define your problem statement

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

5 minutes

PROBLEM
How might we [your problem statement]?

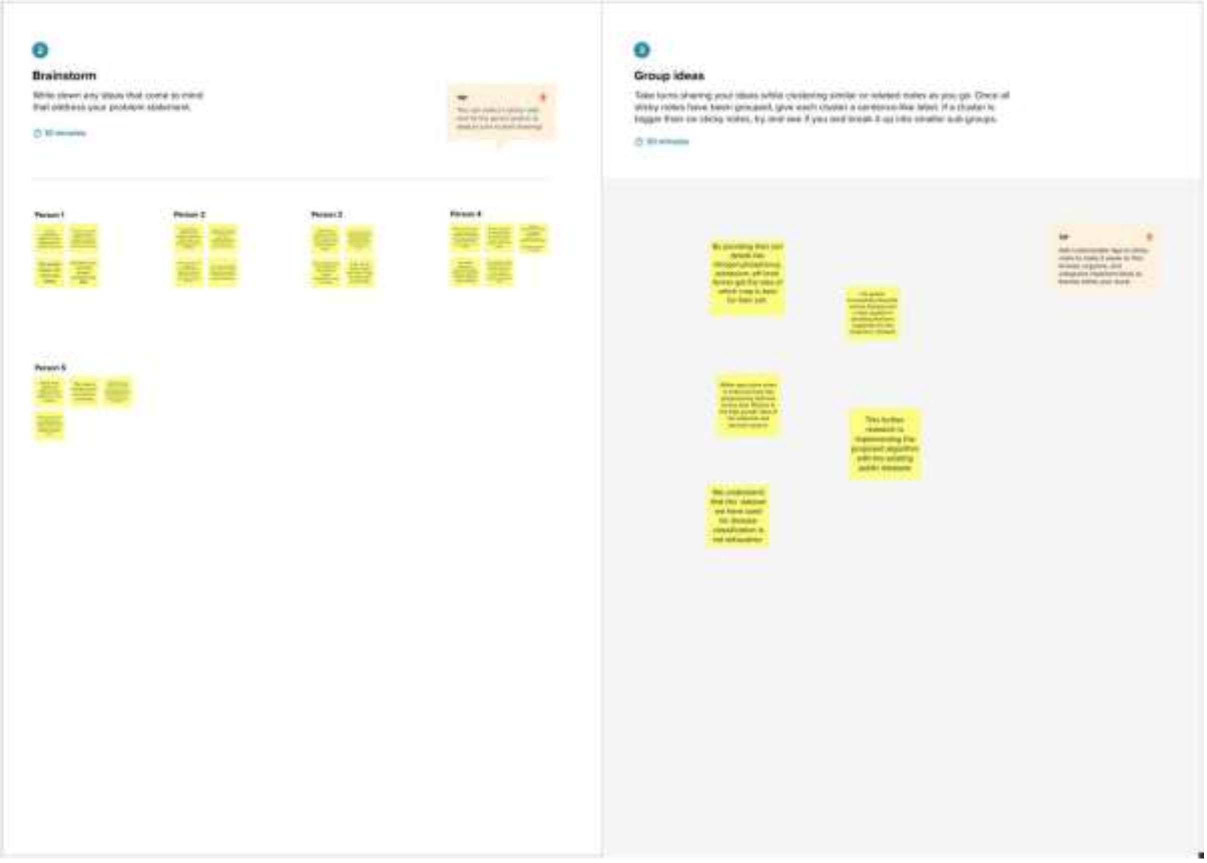
Key rules of brainstorming
To run an smooth and productive session

Stay in topic.
Encourage wild ideas.
Defer judgment.
Listen to others.
Go for volume.
If possible, be visual.

u94 40b5d16c624a2349c74839&key=4efe01b8-deea-4f7d-836e-42a3c658fd09

Step-1: Team Gathering, Collaboration and Select the Problem Statemen

Step-2: Brainstorm, Idea Listing and Grouping



2
Brainstorm
Write down any ideas that come to mind that address your problem statement.
10 minutes
Person 1
Person 2
Person 3
Person 4
Person 5
3
Group ideas
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.
20 minutes

By providing their soil details like nitrogen/phosphorus, potassium, pH level farmer get the idea of which crop is best for their soil.

This further research is implementing the proposed algorithm with the existing public datasets

We understand that the dataset we have used for disease classification is not exhaustive

3.3 Proposed Solution

Applications of Artificial Intelligence, is being used to implement the proposed system. Crop recommendation is going to recommend you the best crop you can grow in your land as per the soil nutrition value and along with as per the climate in that region. And recommending the best fertilizer for every particular crop is also a challenging task. And the other and most important issue is when a plant gets caught by heterogeneous diseases that effect on less amount of agriculture production and compromises with quality as well. To overcome all these issues this recommendation has been proposed . Nowadays a lot of research and work is being implemented in the smart and modern agriculture domain. Crop recommendation is characterized by a soil database comprised of Nitrogen, Phosphorus, potassium. The ensembles technique is used to build a recommendation model that combines the prediction of multiple machine learning. Models to recommend the right crop based on soil value and the best fertilizer to use.

3.4 Problem Solution fit

1.Customer Segment:

Farmer Are The First Customer For This Application. Farmer Can Easily Use This Application And Get Suggestion For Fertilizer To Used Correctly.

2.Jobs To Be Done /Problems:

This application focuses on helping for the farmer who needs a better recommendation of fertilizer on the infected plants .identifying the disease is one of the biggest problem here

3.Triggers:

Seeing their crops are being infected by disease and facing huge loss in quatity and quality

4.Emotion:

Before: losing self-confidence ,distress

After: gaining self-confidence.relief

5. Available solution :

People are judge the disease in plants by Identifying through the change of leaf's quality

6.customer constraints :

Availability of good networks.

Capturing the image in a required pixels to get a accurate prediction of disease in the plant.

7.Behaviour:

Directly:

Farmer can easily identify the disease by the application and they don't need my extra knowledge on the disease prediction

8.channels of behaviour :

Online :

Basic knowledge on the plant and fertilizer

Offline :

People try to identify the disease by the quality of the leaf’s

9. problem root cause :

Various disease on the plants can lead to reducing the quality and quantity of the crops productivity. The insects on the plants can spread the disease

10.solution:

Using the fertilizer is one solution for disease in the plants. Our application use the images of the infected plant by identifying the disease and suggest the good fertilizer for the disease.

REQUIREMENT ANALYSIS

4.1 Functional requirement

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Uploading the images	Drag and drop feature Browse through device folders
FR-4	Image Pre-processing	Uploaded images are pre-processed using the pre-processing model deployed IBM cloud.
FR-5	Disease Prediction	Disease prediction model is trained with a large dataset and deployed in the IBM cloud to predict the disease by analysing the uploaded images.
FR-6	Fertilizer Recommendation	Based on the disease predicted by the model the fertilizer required to cure the disease is suggested to the user
FR-7	Report Generation	The fertilizer to be used and the amount and other details are specified in the report which can be downloaded by the user.

4.2 Non-Functional requirements

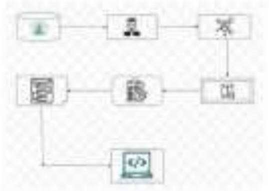
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	The website is designed to be responsive and user-friendly so that it can be used on any device and by anyone.
NFR-2	Security	The user details are confidential and the user account is verified with the email id provided to ensure security.
NFR-3	Reliability	As the deployment is done in a cloud environment the model and the website are highly reliable with efficient and accurate outputs.
NFR-4	Performance	As the models are deployed in the IBM cloud the performance will be efficient.
NFR-5	Availability	The website will be hosted so that it is available for a large number of people.
NFR-6	Scalability	As the models are deployed in the IBM cloud they can easily be scaled for large inputs and to handle many requests.

PROJECT DESIGN

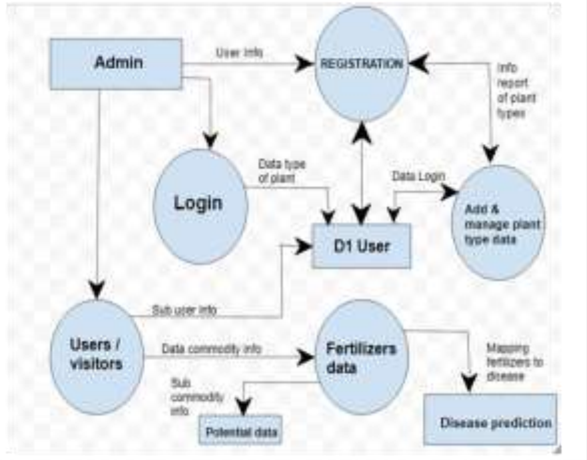
5.1 Data Flow Diagrams

Example: (Simplified)



- Download the dataset.
- Classify the dataset into train and test sets.
- Add the neural network layers.
- Load the trained images and fit the model.
- Test the model.
- Save the model and its dependencies.
- Build a Web application using a flask that integrates with the model built.

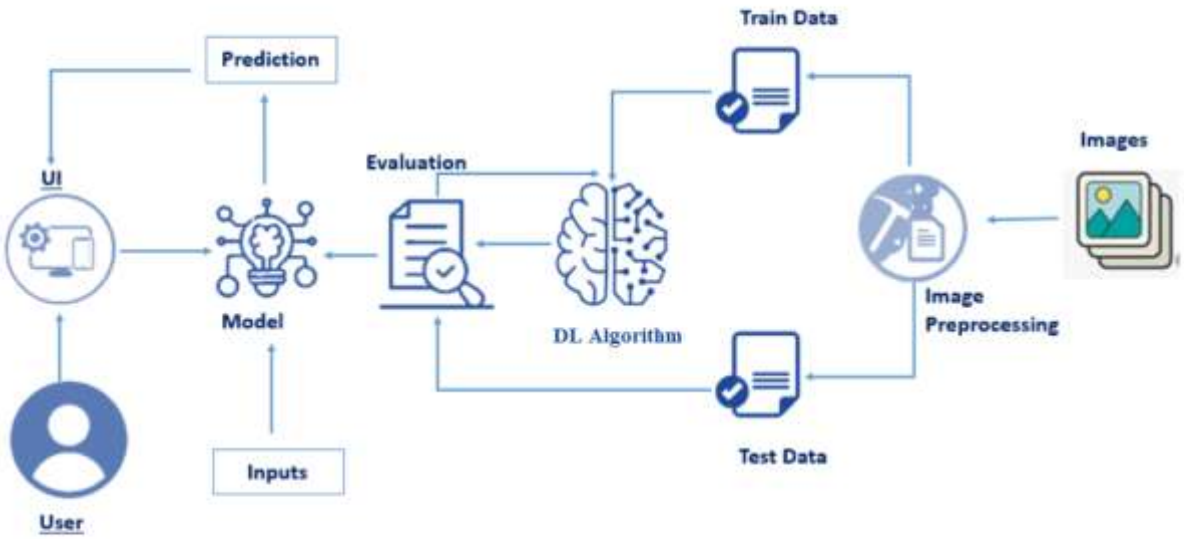
Example: DFD Level 0 (Industry Standard)



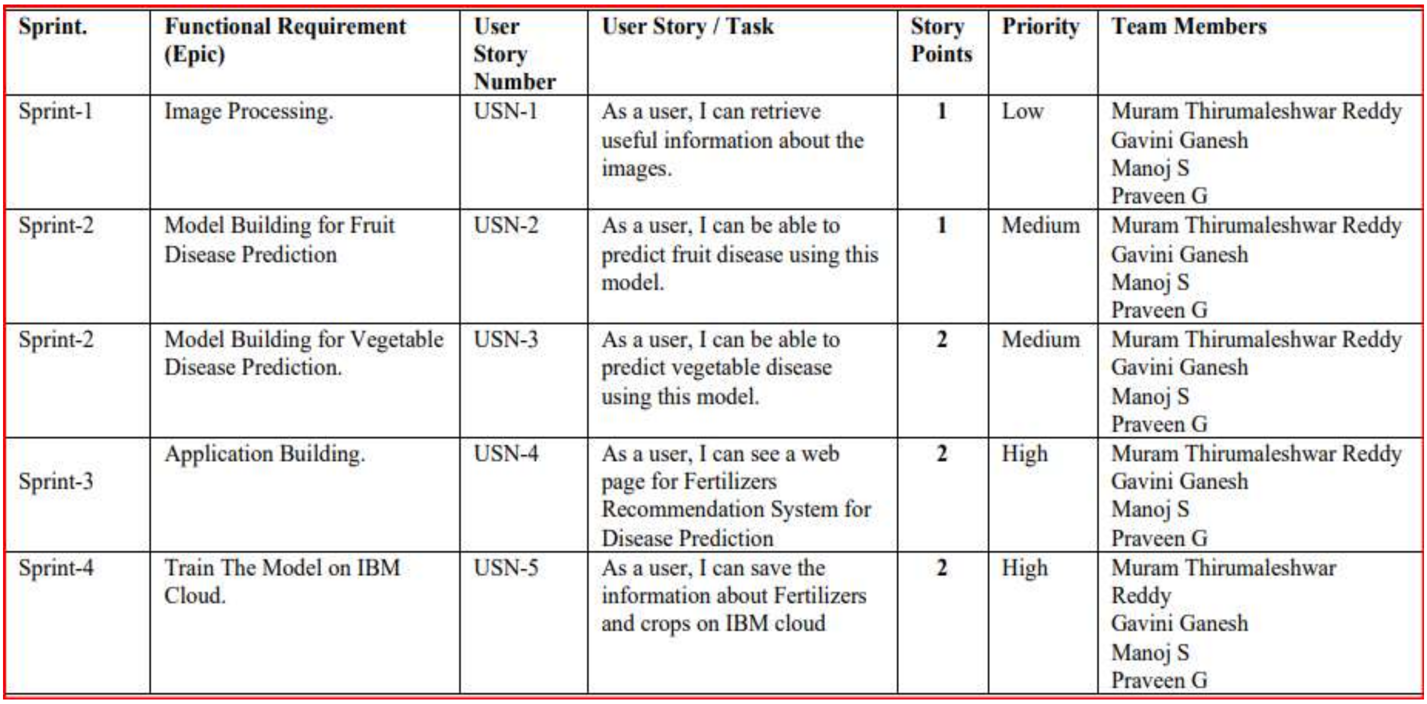
User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application via mobile/desktop.	I can register & access the dashboard with login credentials.	Low	Sprint-2
		USN-4	As a user, I can register for the application through Google service/cloud.	Valid Google account to be linked and verified.	Medium	Sprint-1

5.2 Solution & Technical Architecture



5.3 User Stories

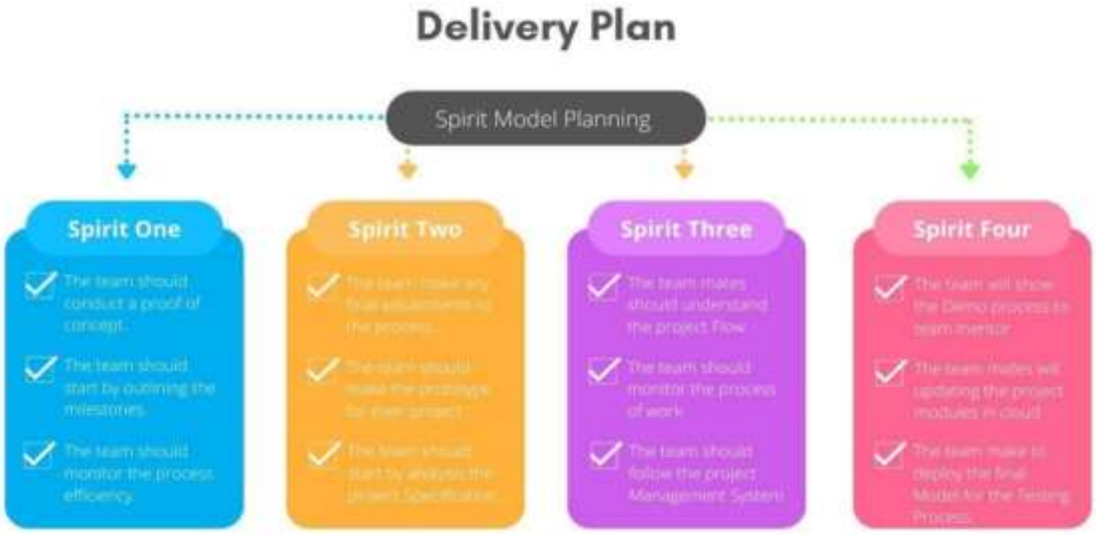


Sprint.	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Image Processing.	USN-1	As a user, I can retrieve useful information about the images.	1	Low	Muram Thirumaleshwar Reddy Gavini Ganesh Manoj S Praveen G
Sprint-2	Model Building for Fruit Disease Prediction	USN-2	As a user, I can be able to predict fruit disease using this model.	1	Medium	Muram Thirumaleshwar Reddy Gavini Ganesh Manoj S Praveen G
Sprint-2	Model Building for Vegetable Disease Prediction.	USN-3	As a user, I can be able to predict vegetable disease using this model.	2	Medium	Muram Thirumaleshwar Reddy Gavini Ganesh Manoj S Praveen G
Sprint-3	Application Building.	USN-4	As a user, I can see a web page for Fertilizers Recommendation System for Disease Prediction	2	High	Muram Thirumaleshwar Reddy Gavini Ganesh Manoj S Praveen G
Sprint-4	Train The Model on IBM Cloud.	USN-5	As a user, I can save the information about Fertilizers and crops on IBM cloud	2	High	Muram Thirumaleshwar Reddy Gavini Ganesh Manoj S Praveen G

PROJECT PLANNING & SCHEDULING

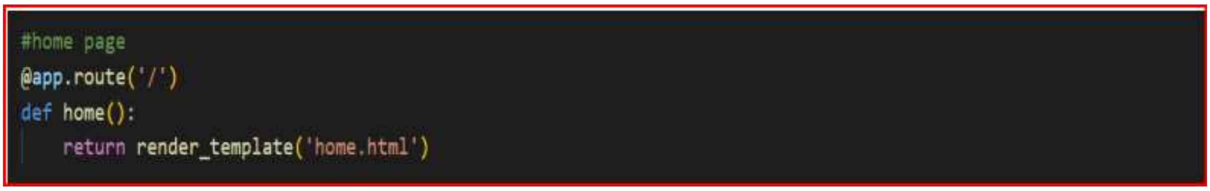
6.1 Sprint Planning & Estimation

The delivery plan of project deliverables is a strategic element for every Project Manager. The goal of every project is, in fact, to produce a result that serves a specific purpose. With the word „purpose “, we can mean the most disparate goals: a software program, a chair, a building, a translation, etc. In Project Spirit Delivery Planning is one of the processes of Completing the project and Show Casing the Time Line of the Project Planning. This Delivery plan help to understanding the process and Work Flow of the Project working by the Team Mates. Every Single Modules are assigned to the team mates to show case their work and contribution of developing the Project


Delivery Plan
Spirit Model Planning
Spirit One
The team should conduct a proof of concept.
The team should start by outlining the milestones
The team should monitor the process efficiency.
Spirit Two
The team make any final adjustments to the process.
The team should make the prototype for their project.
The team should start by analysis the project Specification
Spirit Three
The team mates should understand the project Flow
The team should monitor the process of work
The team should follow the project Management System
Spirit Four
The team will show the Demo process to team mentor
The team mates will updating the project modules in cloud
The team make to deploy the final Model for the Testing Process

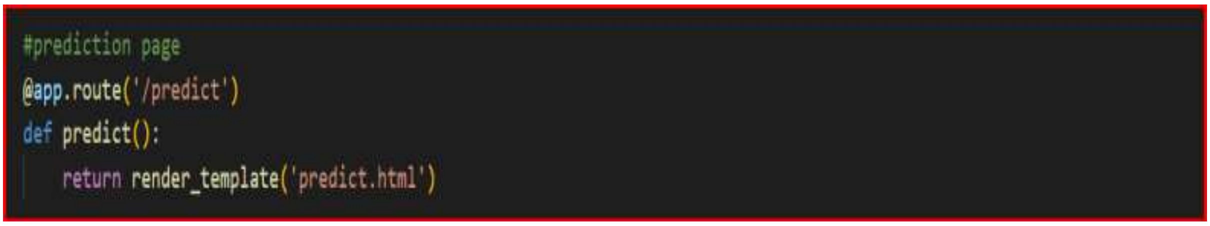
CODING & SOLUTIONING

7.1 HOME PAGE



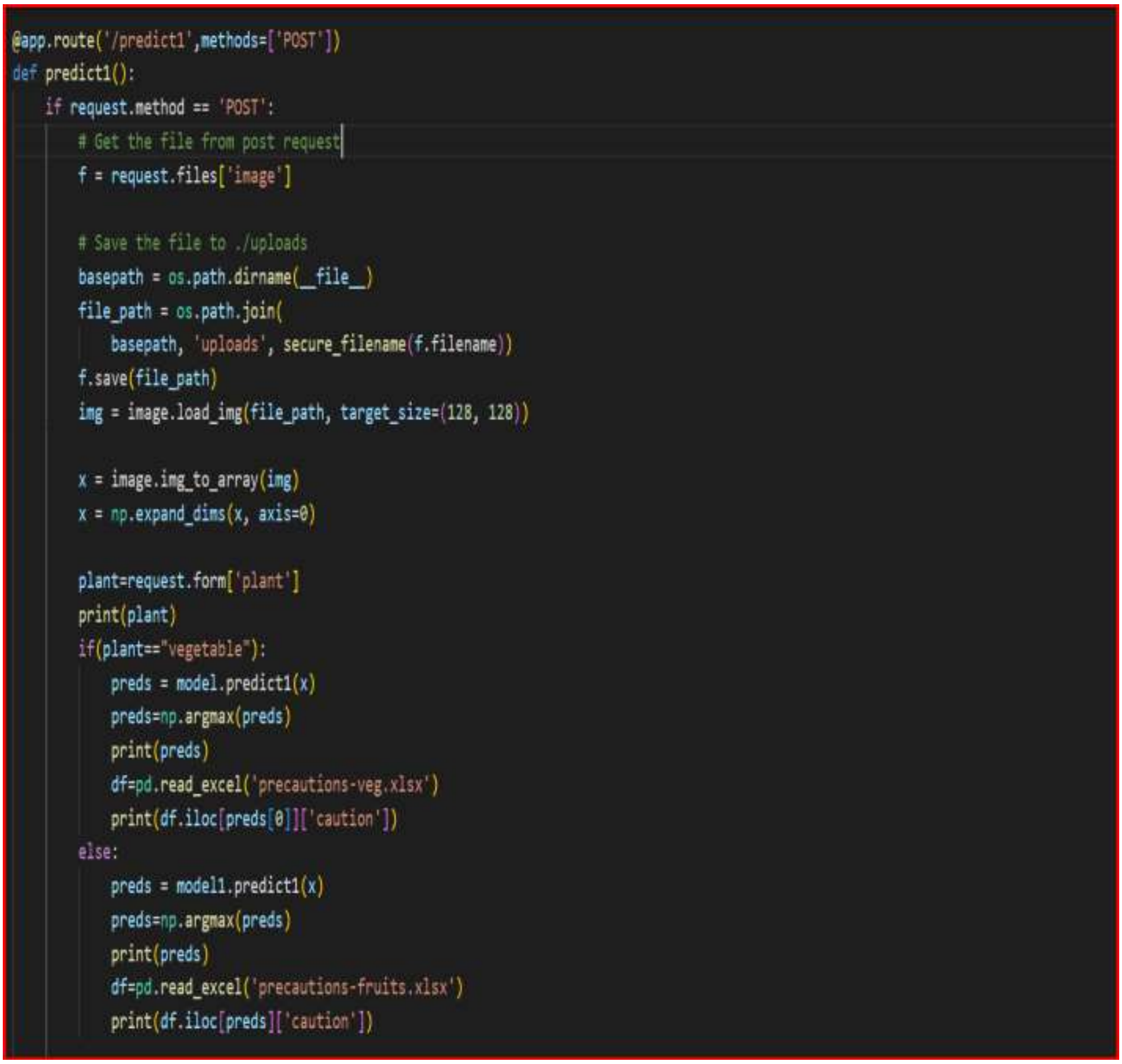
```
#home page
@app.route('/')
def home():
    return render_template('home.html')
```

7.2 PREDICTION PAGE



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

7.3 PREDICTING DISEASE & GIVING PRECAUTIONS



```
@app.route('/predict1',methods=['POST'])
def predict1():
    if request.method == 'POST':
        # Get the file from post request
        f = request.files['image']

        # Save the file to ./uploads
        basepath = os.path.dirname(__file__)
        file_path = os.path.join(
            basepath, 'uploads', secure_filename(f.filename))
        f.save(file_path)
        img = image.load_img(file_path, target_size=(128, 128))

        x = image.img_to_array(img)
        x = np.expand_dims(x, axis=0)

        plant=request.form['plant']
        print(plant)
        if(plant=="vegetable"):
            preds = model.predict1(x)
            preds=np.argmax(preds)
            print(preds)
            df=pd.read_excel('precautions-veg.xlsx')
            print(df.iloc[preds[0]]['caution'])
        else:
            preds = model1.predict1(x)
            preds=np.argmax(preds)
            print(preds)
            df=pd.read_excel('precautions-fruits.xlsx')
            print(df.iloc[preds]['caution'])
```

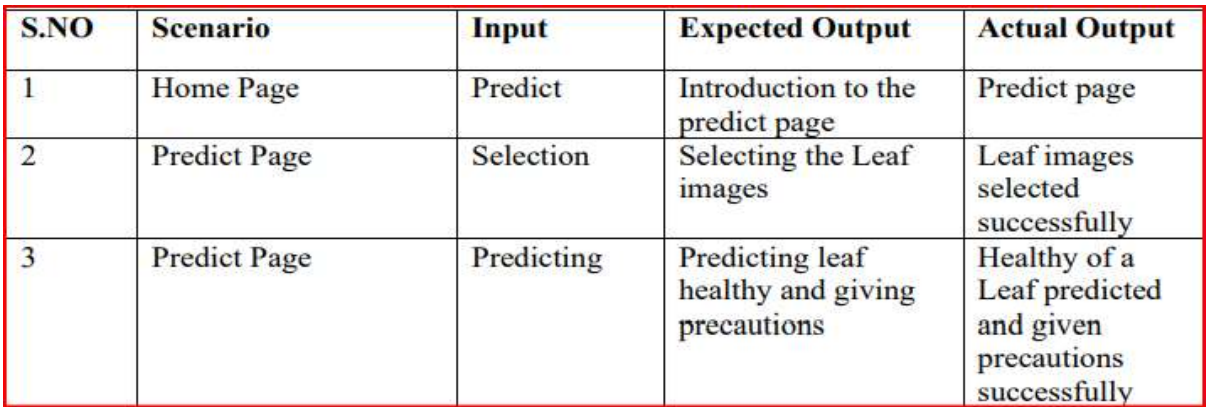
TESTING

8.1 TEST CASES

A test case has components that describe input, action and an expected response, in order to determine if a feature of an application is working correctly. A test case is a set of instructions on "HOW" to validate a particular test objective/target, which when followed will tell us if the expected behaviour of the system is satisfied or not.

Characteristics of a good test case:

- Accurate: Exacts the purpose.
- Economical: No unnecessary steps or words.
- Traceable: Capable of being traced to requirements.
- Repeatable: Can be used to perform the test over and over.
- Reusable: Can be reused if necessary.



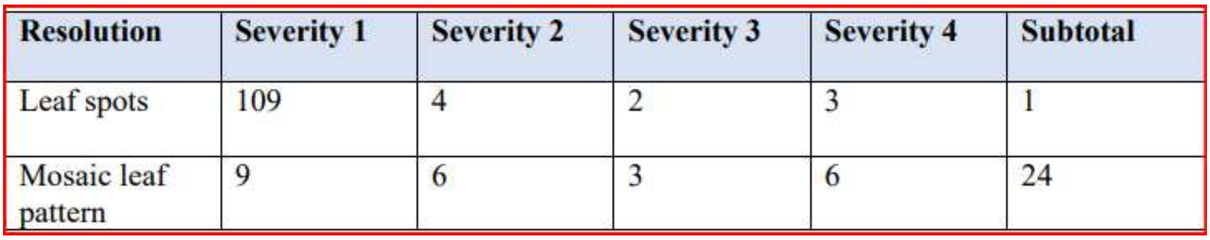
S.NO	Scenario	Input	Expected Output	Actual Output
1	Home Page	Predict	Introduction to the predict page	Predict page
2	Predict Page	Selection	Selecting the Leaf images	Leaf images selected successfully
3	Predict Page	Predicting	Predicting leaf healthy and giving precautions	Healthy of a Leaf predicted and given precautions successfully

8.2 User Acceptance Testing

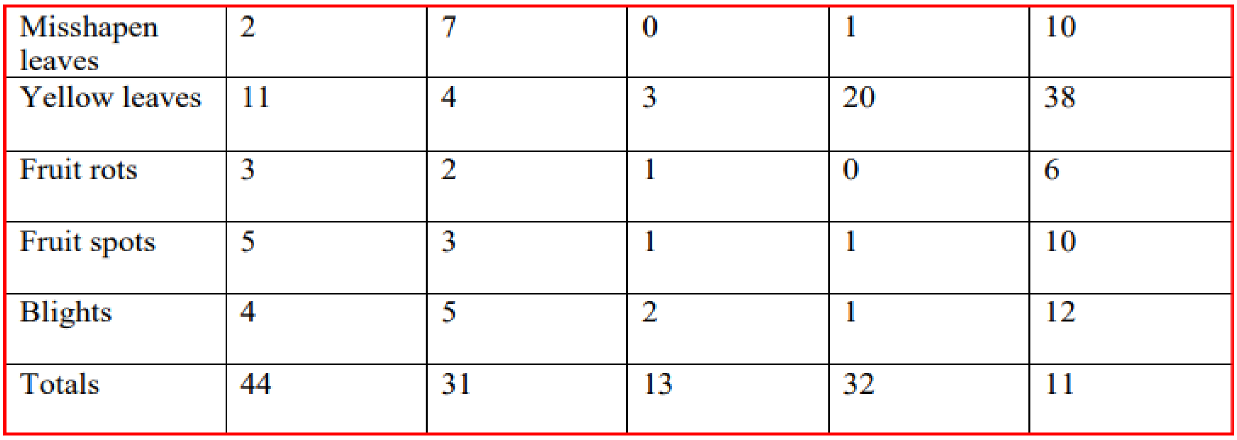
8.2.1 Purpose Of The Document:

The purpose of this document is to briefly explain the test coverage and open issues of the [Fertilizer Recommendation system for plant disease prediction] project at the time of the release to User Acceptance Testing (UAT).

8.2.2 Defect Analysis:

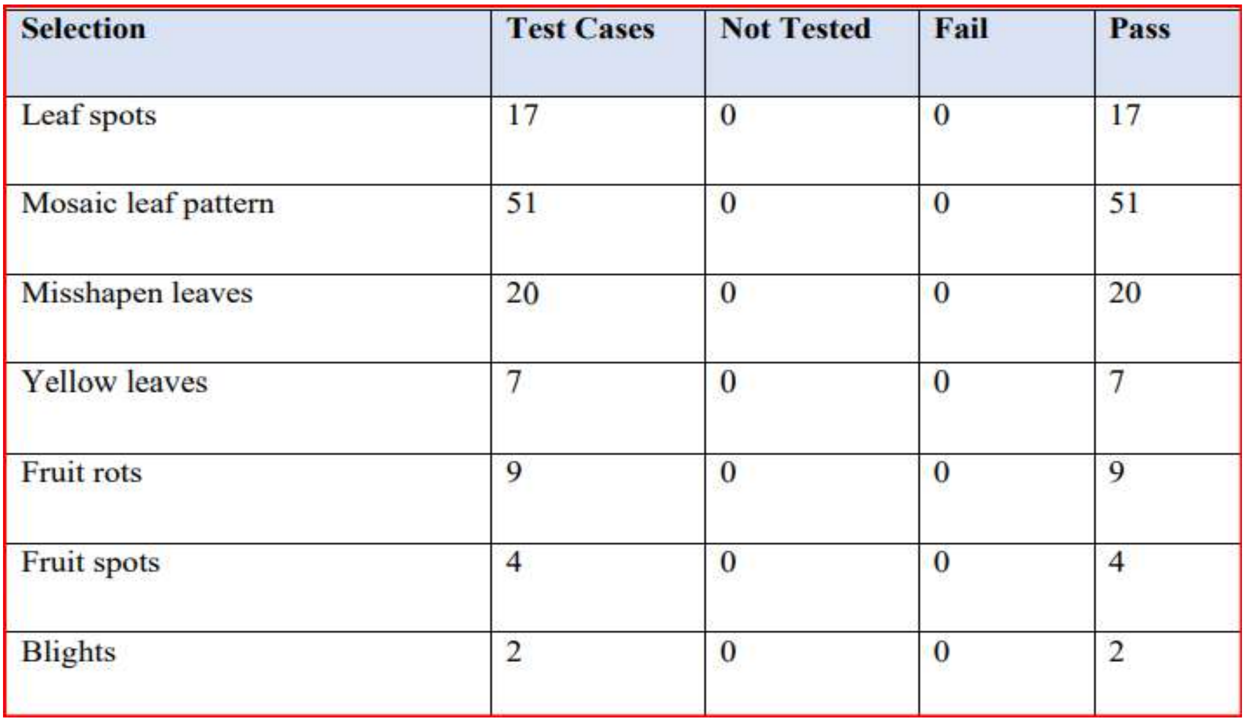


Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
Leaf spots	109	4	2	3	1
Mosaic leaf pattern	9	6	3	6	24



Misshapen leaves	2	7	0	1	10
Yellow leaves	11	4	3	20	38
Fruit rots	3	2	1	0	6
Fruit spots	5	3	1	1	10
Blights	4	5	2	1	12
Totals	44	31	13	32	11

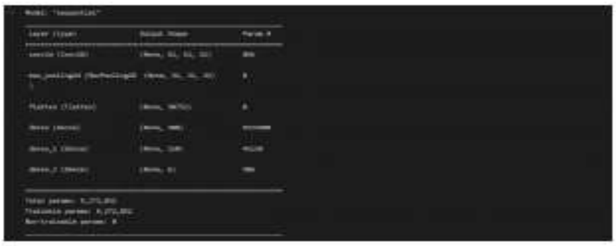
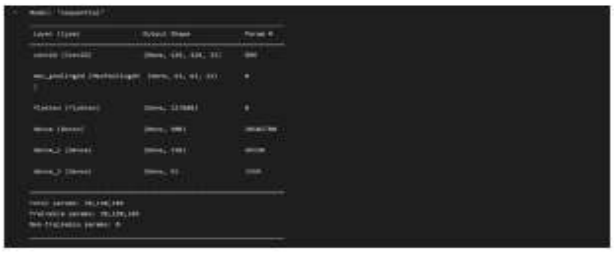
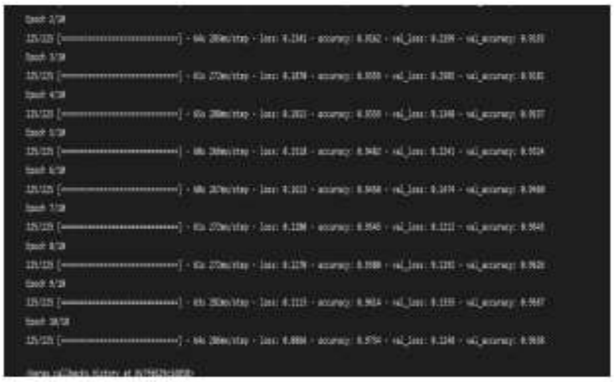
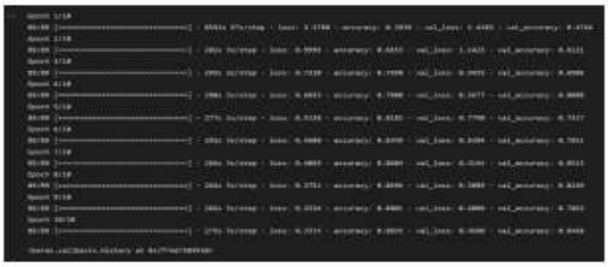
8.2.3 Test Case Analysis:



Selection	Test Cases	Not Tested	Fail	Pass
Leaf spots	17	0	0	17
Mosaic leaf pattern	51	0	0	51
Misshapen leaves	20	0	0	20
Yellow leaves	7	0	0	7
Fruit rots	9	0	0	9
Fruit spots	4	0	0	4
Blights	2	0	0	2

9. RESULTS

9.1 PERFORMANCE METRICS

S. No.	Parameter	Values	Screenshot
1.	Model Summary of Fruit	Training the dataset of Vegetable images by using the CNN models to predict the disease of the given leaves.	
2.	Model Summary for Vegetable	Training the dataset of Vegetable images by using the CNN models to predict the disease of the given leaves.	
2.	Accuracy for Fruit	Training Accuracy - 0.9734 Validation Accuracy - 0.9638	
3.	Accuracy for Vegetable	Training Accuracy - 0.8835 Validation Accuracy - 0.8448	

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Prediction of disease of a plant using leaf images in early stages.
- Giving the precautions to the plants according to the plant condition.
- Recommends the fertilizers for the particular disease.
- It doesn’t required any chemical to test the disease.
- Simple way to predict the disease by taking Images.

DISADVANTAGES:

- It predicts the disease for the plants which are given in the Dataset only.
- It cannot predict the disease for the plants which are not present in the Dataset.
- Sometimes it may predict the wrong fertilizers which leads to loss.

CONCLUSION

Different approaches and models of Deep Learning methods were explored and used in this project so that it can detect and classify plant diseases correctly through image processing of leaves of the plants. The procedure starts from collecting the images used for training, testing and validation to image pre-processing and augmentation and finally comparison of different pretrained models over their accuracy. Finally, at the end, our model detects and distinguishes between a healthy plant and different diseases and provides suitable remedies so as to cure the disease. This paper proposed and developed a system which uses plant leaf images to detect different types of disease in tomato crops, and also provides appropriate fertilizer suggestions.

FUTURE SCOPE

The system successfully interprets various Diseases and is also capable of providing fertilizers suggestion for the respective disease. Furthermore, this system can be made more robust by incorporating more image dataset with wider variations like more than one leaf in a single image. An App could also be developed for the project which could make the work of the farmers easier. They could directly upload image on the app and it would tell the disease and the cure then and there. This would reduce the time and efforts. This project is limited to just one crop for now but in the future more crops and even flowers dataset can be added so that it is helpful for every agricultural need. Newer models can also be added and tried with time which may result in better accuracy and would make the model even faster.

APPENDIX

Source Code GitHub & Project Demo Link

```
from keras.preprocessing.image import ImageDataGenerator

train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)

test_datagen=ImageDataGenerator(rescale=1


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')

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'


from keras.models import Sequential

from keras.layers import Dense

from keras.layers import Convolution2D

from keras.layers import MaxPooling2D

from keras.layers import Flatten


from keras.preprocessing.image import ImageDataGenerator

train_datagen=ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)

test_datagen=ImageDataGenerator(rescale=1)


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')
```

```
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')


model=Sequential()
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(units=300,kernel_initializer='uniform',activation='relu'))


model.add(Dense(units=150,kernel_initializer='uniform',activation='relu'))
model.add(Dense(units=75,kernel_initializer='uniform',activation='relu'))
model.add(Dense(units=9,kernel_initializer='uniform',activation='softmax'))
model.compile(loss='categorical_crossentropy',optimizer="adam",metrics=["accuracy"])
model.fit(x_train,steps_per_epoch=89,epochs=20,validation_data=x_test,validation_steps=27)


model.save('fruit.h5')


model.summary()


from keras.preprocessing import image
from tensorflow.keras.preprocessing.image import img_to_array
from tensorflow.keras.preprocessing import image
from tensorflow.keras.models import load_model
import numpy as nps


model=load_model('fruit.h5')
```

```
img=image.load_img('/content/Dataset Plant Disease/fruit-dataset/fruit-dataset/test/Apple___healthy/011d02f3-5c3c-4484-a384-b1a0a0dbdec1___RS_HL 7544.JPG',grayscale=False,target_size=(128,128))

img

x=image.img_to_array(img)
x=nps.expand_dims(x,axis=0)

pred=(model.predict(x) > 0.5).astype("int32")

pred

import requests
from tensorflow.keras.preprocessing import image

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

app= Flask(__name__)
model = load_model("fruit.h5")
```

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

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

@app.route('/predict',methods=['POST'])
def predict():
  if request.method=='POST':
    f= request.files['images']
    basepath=os.path.dirname(__file__)
    file_path==os.path.join(
        basepath, 'uploads',secure_filename(f.filename))
    f.save(file_path)
    img=image.load_img(file_path, target_size=(128,128))
    x=image.img_to_array(img)
    x=np.expand_dims(x, axis=0)
    plant=request.form['plant']
    print(plant)
    if(plant=="fruit"):
      preds=model.predict_classess(x)
      print(preds)
      df=pd.read_excel('precautions-veg.xlsx')
      print (df.iloc[preds[0]]['cautions'])
    else:
      pred=model1.predict_classes(x)
      df=pd.read_excel('precautions-fruits.xlsx')
      print(df.iloc[preds[0]]['caution'])
      return df.iloc[preds[0]]['caution']

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

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-23904-1659933223

DEMO VIDEO LINK:

https://drive.google.com/file/d/1aOi98J3erKXhUqPkw_36fs3KpsTjDZqP/view?usp=drivesdk