FERTILIZERS RECOMMENDATION SYSTEM FOR DISEASE PREDICTION

PROJECT REPORT

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

In our proposed project, we present an automated system to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Plant leaf image is fed into the system using which the diseases on the plant are identified.The image can be uploaded by the user .Deep learning techniques are used to identify the diseases and the recommended components for the best fertilizer is shown to the user.The two datasets namely fruit and vegetable datasets are collected.The collected datasets which contains 15 classes are trained and tested using deep learning.All the python code are written in python flask and the code are tested.We have two features i.e to upload the image of the leaf and to recommend the fertilizer based on the disease predicted.

1.2 PURPOSE

The purpose of this system is as follows:
- Yield right crop at the right time
- Balancing the crop production
- control plant disease
- Economic growth
- planning to reduce the crop scarcity

2. LITERATURE SURVEY

2.1. EXISTING PROBLEM

There are many fertilizer recommendation systems for disease prediction out on the web, most of them charge users after the limit of usage. We have carefully analyzed and proposed a model to predict plant disease with high accuracy and suitable fertilizer is recommented , the input image fed is automatically resized by the system and the website built is open-source and easily accessible to all users.

2.2. REFERENCES

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[9] Automatic Detection of Citrus Fruit and Leaves Diseases Using Deep Neural Network Model ASAD KHATTAK, MUHAMMAD USAMA ASGHAR, ULFAT BATOOL, MUHAMMAD ZUBAIR ASGHAR, HAYAT ULLAH, MABROOK AL-RAKHAMI, (Member, IEEE), AND ABDU GUMAEI.

[10] Detection and Analysis of Behavior Trajectory for Sea Cucumbers Based on Deep Learning JUAN LI ,CHEN XU , LINGXU JIANG, YING XIAO, LIMIAO DENG, AND ZHONGZHI HAN J. Li, C. Xu, L. Jiang, Y. Xiao, L. Deng, and Z. Han, "Detection and Analysis of Behavior Trajectory for Sea Cucumbers Based on Deep Learning," in IEEE Access, vol. 8, pp. 18832-18840, 2020, DOI: 10.1109/ACCESS.2019.2962823.

2.3. PROBLEM STATEMENT DEFINITION

Agriculture is the heart and life of most Indians. But in recent days, the field was going down due to various natural calamities. Most plants are affected by a wide variety of bacterial and fungal diseases. 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.Hence, early and accurate identification of plant diseases is essential to ensure high quantity and best quality. Smart analysis and Comprehensive prediction models in agriculture helps the farmer to yield the right crop at the right time.Artificial neural network is used to train these images and build a deep learning model. The Convolutional Neural Networks (CNN) is a deep learning algorithm that is highly suitable for image recognition and those tasks involving processing of pixel data. Convolutional neural networks (CNNs) are very effective in detecting plant disease from the image of the leaf that is uploaded in ways that help in automatic extraction of distinct features and make CNN the most suitable approach for recommending the

fertilizer for the infected plant.Our aim in the proposed work is to deploy the CNN model effectively and produce a good result with better accuracy.The main objective is to predict the plant disease from the uploaded leaf image and then recommending the fertilizer components for the effective growth of the plant.Web application is created where the user can upload an image of an infected leaf . This image is analyzed by the model and the detected result is returned to the UI.

3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users. Empathy mapping is a simple workshop activity that can be done with stakeholders, marketing and sales, product development, or creative teams to build empathy for end users. For teams involved in the design and engineering of products, services, or experiences, an empathy mapping session is a great exercise for groups to "get inside the heads" of users.
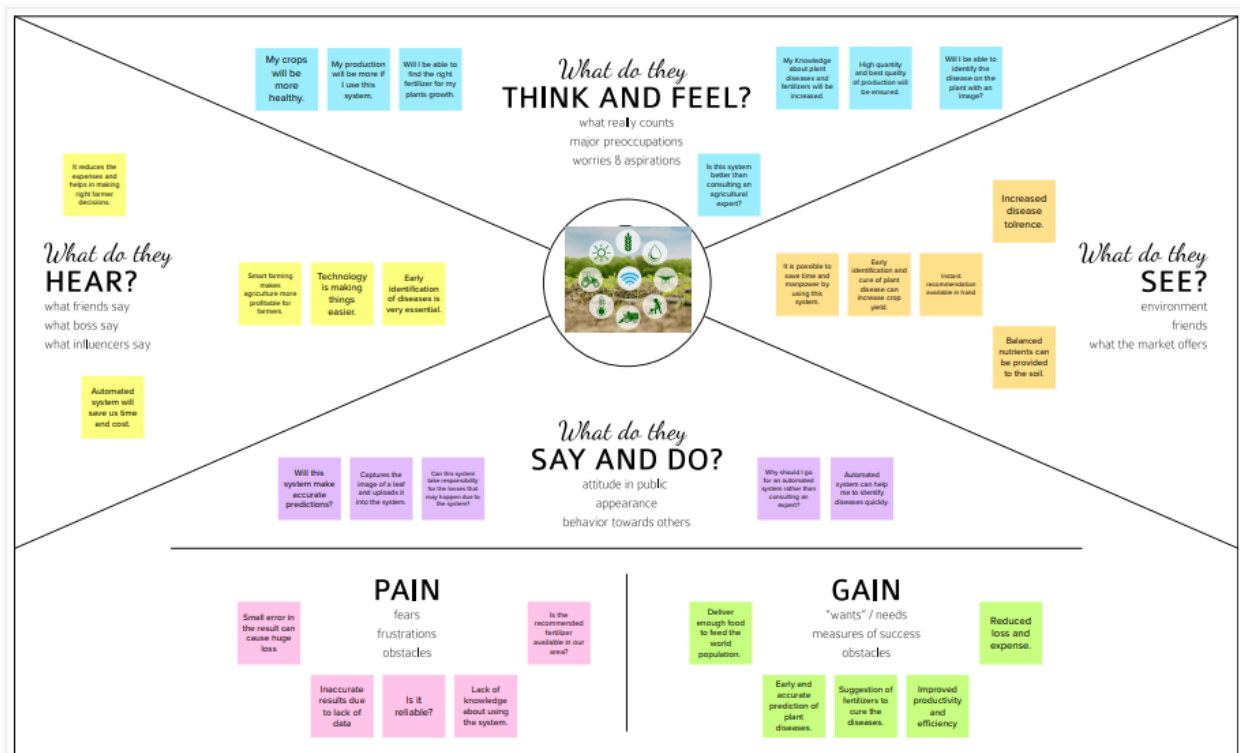
3.2. IDEATION AND BRAINSTORMING

Ideation essentially refers to the whole creative process of coming up with and communicating new ideas. Ideation is innovative thinking, typically aimed at solving a problem or providing a more efficient means of doing or accomplishing something.

Ideation is often closely related to the practice of brainstorming, a specific technique that is utilized to generate new ideas. A principal difference between ideation and brainstorming is that ideation is commonly more thought of as being an individual pursuit, while brainstorming is almost always a group activity.

3.3. PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Agriculture is the heart and life of most Indians. But in recent days, the field was going down due to various natural calamities. Most plants are affected by a wide variety of bacterial and fungal diseases. 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. Hence, early and accurate identification of plant diseases is essential to ensure high quantity and best quality. Smart analysis and Comprehensive prediction models in agriculture helps the farmer to yield the right crop at the right time.
2.	Idea/ Solution description	In our proposed project, we present an automated system to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Image of a leaf of the plant is fed into the system using which the diseases on the plant are identified. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases.
3.	Novelty/ Uniqueness	We make use of deep learning techniques such as CNN to predict the plant disease using the image of the leaf of the plant. The number of models developed for fertilizer recommendation is limited and the proposed model serves as the promising aspect in the planning of crops.
4.	Social Impact/Customer Satisfaction	The proposed work enhances agricultural production and productivity by offering smart technology which will recommend fertilizers for crops and soil respectively. The farmers can use this technology anytime and anywhere. This will help in raising the living standard of farmers and will boost their economic growth.
5.	Business Model (Revenue Model)	As the fertilizers are being recommended at the early stage, loss can be minimized and the yield can be increased. Since we provide recommendations there is no need for expert advice or recommendation. This will save cost and time for the users.
6.	Scalability of the solution.	This system can be accessed online without paying. It can be accessed via any browser of your choice. It can predict plant diseases with high accuracy.

3.4. PROBLEM SOLUTION FIT

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why.

Purpose:

- Solve complex problems in a way that fits the state of your customers.
- Succeed faster and increase your solution adoption by tapping into existing mediums and
- channels of behaviour.
- Sharpen your communication and marketing strategy with the right triggers and messaging.
- Increase touchpoints with your company by finding the right problem-behaviour fit and building
- trust by solving frequent annoyances, or urgent or costly problems.
- Understand the existing situation in order to improve it for your target group.

Project Title: Fertilizers Recommendation System For Disease Prediction

Project Design Phase-I - Solution Fit

Team ID: PNT2022TMID27490

Define CS, fit into CC	**1. CUSTOMER SEGMENT(S)** `CS` 1. Farmer 2. Common People 3. Seller 4. Buyer 5. Agricultural experts 6. Industrial People	**6. CUSTOMER CONSTRAINTS** `CC` 1. Internet facility 2. Available Devices 3. Electricity 4. Knowledge about the system	**5. AVAILABLE SOLUTIONS** `AS` The existing method for plant disease detection is simply naked eye observation by experts through which identification and detection of plant diseases is done. Disease detection using the computer vision approach can detect the existence of the disease once the disease has already appeared.	**Explore AS, differentiate**
Focus on J&P, tap into BE, understand RC	**2. JOBS-TO-BE-DONE / PROBLEMS** `J&P` Diseases on plants placed a major constraint on the production and a major threat to food security. Finding the leaf disease is an important role to preserve agriculture. Hence, early and accurate identification of plant diseases is essential to ensure high quantity and best quality.	**9. PROBLEM ROOT CAUSE** `RC` Infectious plant diseases are mainly caused by biotic and abiotic factors. Biotic factors includes pathogenic organisms such as fungi, bacteria, viruses, protozoa, as well as insects. Environmental conditions like temperature,humidity and pollution in air, soil are the abiotic factors.	**7. BEHAVIOUR** `BE` 1. Go to the website. 2. Upload the picture of a leaf of the infected plant. 3. Get to know about the disease and use the recommended fertilizers to cure the infected plants.	**Focus on J&P, tap into BE, understand RC**
Identify strong TR & EM	**3. TRIGGERS** `TR` 1. Identification of crop condition. 2. Pest Control. 3. Sudden outbreak of plant disease. 4. Reduced crop yield and impact on crop quality **4. EMOTIONS: BEFORE / AFTER** `EM` **Before:** 1. Time consuming. 2. Wastage of capital and resources. 3. Over usage of manpower. **After:** Rise in production. Healthy crop yield. Early prevention of disease.	**10. YOUR SOLUTION** `SL` An automated system to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Image of a leaf of the plant is fed into the system using which the diseases on the plant are identified. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases.	**8. CHANNELS of BEHAVIOUR** `CH` **8.1 ONLINE** Go the web application and upload the picture of a leaf of the infected plant. **8.2 OFFLINE** Use the recommended fertilizers in the right amount to cure the predicted disease.	**Identify strong TR & EM**

4. REQUIREMENT ANALYSIS

4.1. FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed solution

FR No	Functional Requirement(EPIC)	Sub Requirement (Story / Sub-Task)
FR-1	User Input	User needs to upload the image of a leaf of the infected plant.
FR-2	Feature Extraction	The required features to make the predictions are extracted from the uploaded image to yield the best result.
FR-3	Model Prediction	Pre-processed image is then fed into the pretrained model and disease is predicted by the model.
FR-4	Result Display	The disease identified by the model is then displayed to the user through the application's user interface
FR-5	Recommendation	Fertilizers that could cure the identified disease are suggested to 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	An easy-to-use interface with guidelines for a smooth user experience.
NFR-2	Security	Providing secure service without any malicious attacks.
NFR-3	Reliability	The system provides accurate results and recommendations using the best ML model.
NFR-4	Performance	The application is capable of producing results within a few seconds and it is highly responsive.
NFR-5	Availability	Users with good internet service can access the application from anywhere at any time.
NFR-6	Scalability	Application can handle a growing number of users and load, without compromising on performance and causing disruptions to user experience.

5. PROJECT DESIGN

5.1. DATA FLOW DIAGRAM

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.
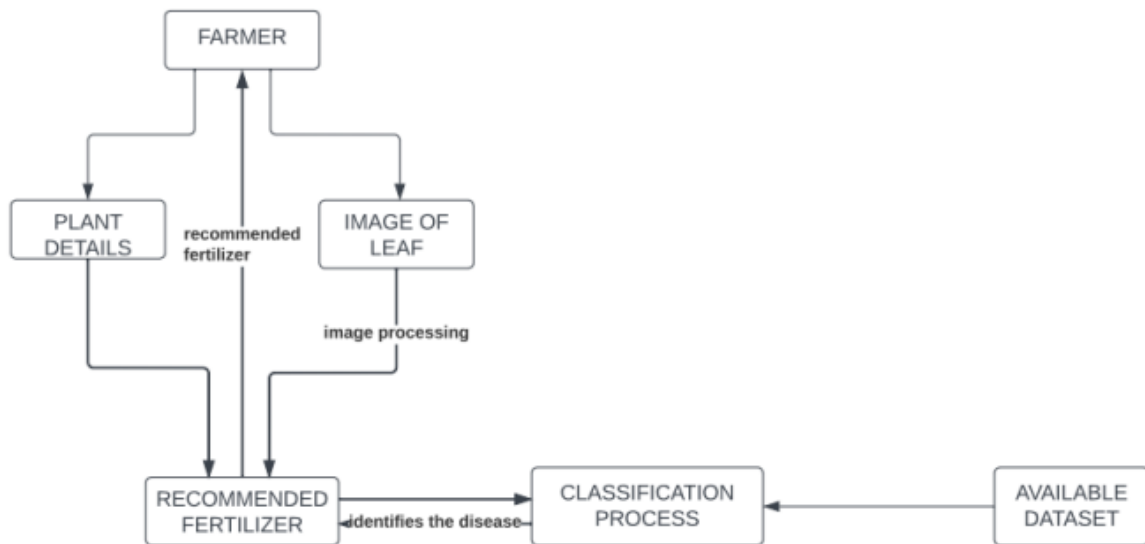
5.2. SOLUTION AND TECHNICAL ARCHITECTURE

Solution Architecture

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

• Find the best tech solution to solve existing business problems.

• Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.

• Define features, development phases, and solution requirements.

• Provide specifications according to which the solution is defined, managed, and delivered.
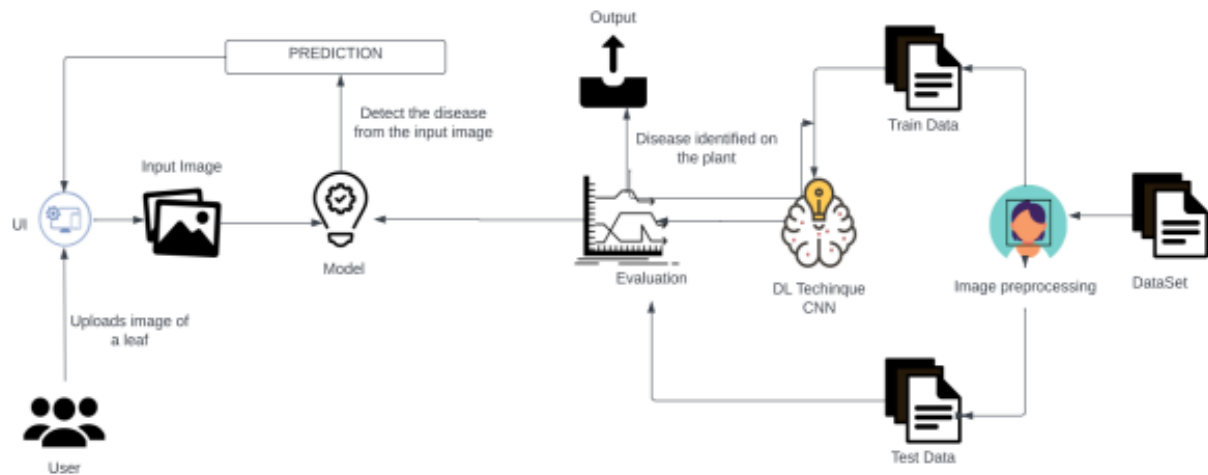
Technical Architecture

Technical architecture which is also often referred to as application architecture includes the major components of the system, their relationships, and the contracts that define the interactions between the components. The goal of technical architects is to achieve all the business needs with an application that is optimized for both performance and security.
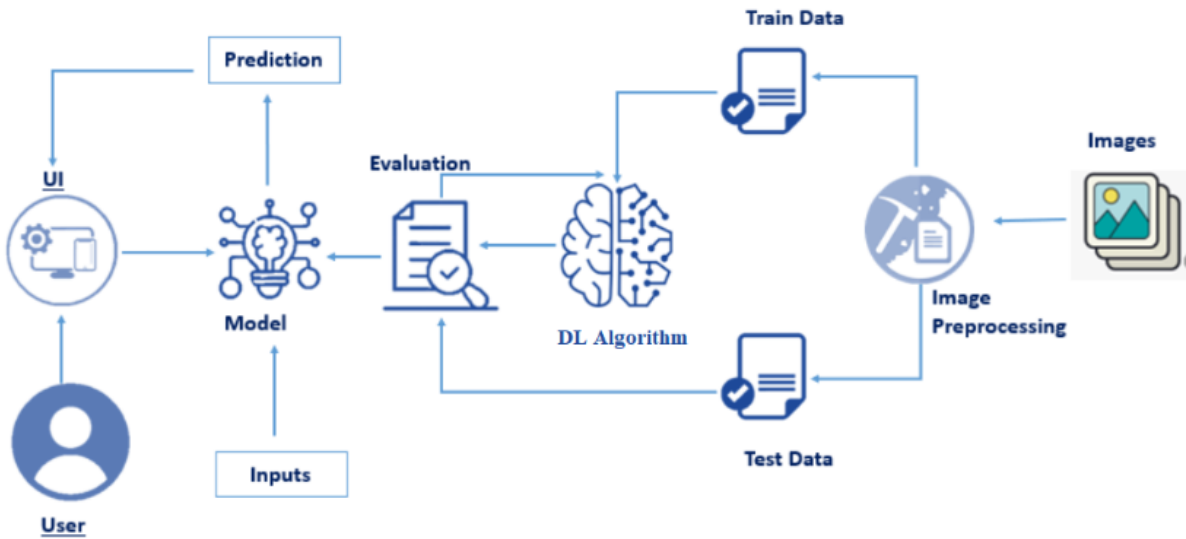
5.3. USER STORIES

User Type	Functional Requirement (EPIC)	User Story Number	User Story/Task	Acceptance criteria	Priority	Release
Customer (Web User)	Login	USN-1	As a user,I can visit the website by typing the URL of the website	I can access the page	High	Sprint-3
	Dashboard	USN-2	As a user, I can upload the infected image for the fertilizer recommendation	I can access the dashboard	High	Sprint-2
		USN-3	As a user, I can get the fertilizer recommendation	I can get my best fertilizer	High	Sprint-3

Administrator	Database upgrade	USN-4	As an administrator, I can add the new fertilizer to the database	I can access the database	High	Sprint-1

6. PROJECT PLANNING & SCHEDULING

6.1. SPRINT PLANNING AND ESTIMATION

Sprint	Functional requirements (Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-1	Dashboard	USN-1	As a user, I can visit the website by entering the URL of the website.	1	Medium	Padmapriya
Sprint-1		USN-2	As a user, I can navigate into the website.	1	Low	Meghaa Rhenith
Sprint-2	Input	USN-3	As a user, I will upload the image of a leaf to predict the disease	2	High	Lakshmi Priya
Sprint-3	Result	USN-4	As a user, I can see the output.	3	High	Sneha
Sprint-3		USN-5	As a user, I can get recommendations	2	High	Lakshmi Priya

			about the fertilizer to use.			
Sprint-4	Backend	USN-6	As an admin, I can add new fertilizers into the database	1	Low	Meghaa Rhenith

6.2. SPRINT DELIVERY SCHEDULE

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	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

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

6.3. REPORTS FROM JIRA

Backlog

❯ **Backlog** (6 issues)

🔖 FRSFPDP-1	As a user, I can visit the website by entering the URL of the website.
🔖 FRSFPDP-2	As a user, I can navigate into the website.
🔖 FRSFPDP-3	As a user, I will upload the image of a leaf to predict the disease.
🔖 FRSFPDP-4	As a user, I can see the output.
🔖 FRSFPDP-5	As a user, I can get recommendations about the fertilizer to use.
🔖 FRSFPDP-6	As an admin, I can add new fertilizers into the database.

+ Create issue

Sprint 1 and 2

Sprint 1 board

Sprint 1 Insights - Burndown Chart

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.
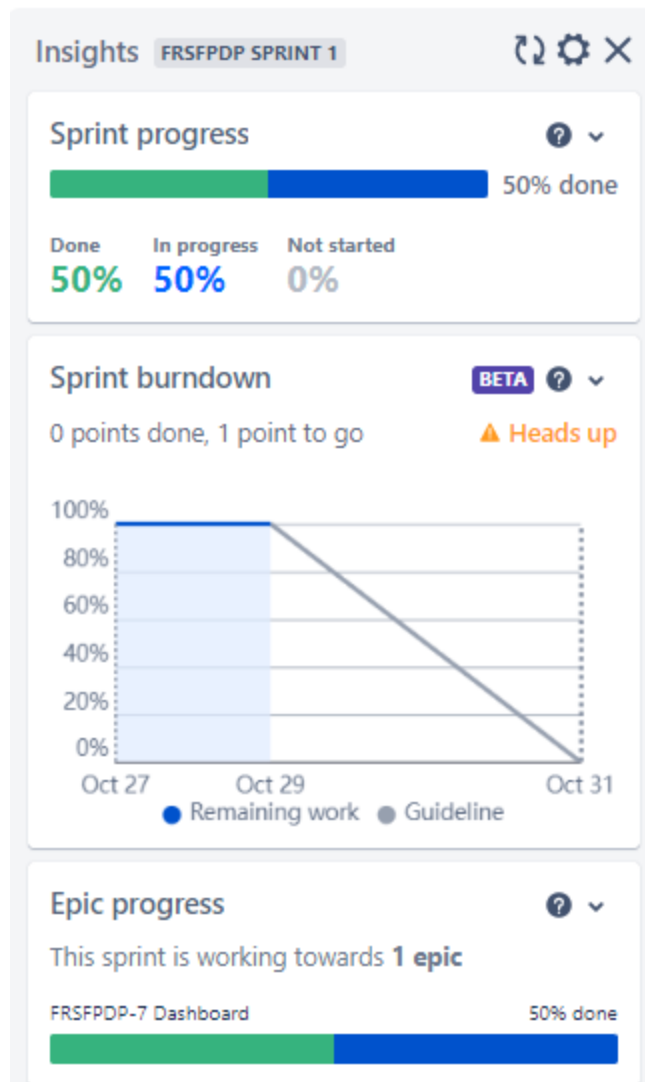
Sprint 3 and 4

FRSFPDP Sprint 3 7 Nov – 12 Nov (2 issues)   5 0 0   Start sprint •••

☐ FRSFPDP-4 As a user, I can see the output. RESULT   3   TO DO∨ 👤

☐ FRSFPDP-5 As a user, I can get recommendations about the fertilizer to use. RESULT   2   TO DO∨ L

+ Create issue

FRSFPDP Sprint 4 14 Nov – 19 Nov (1 issue)   1 0 0   Start sprint •••

☐ FRSFPDP-6 As an admin, I can add new fertilizers into the database. BACKEND   1   TO DO∨ P

+ Create issue

7. CODING AND SOLUTIONING

7.1. FEATURE-1 MODEL BUILDING

Neural networks are used to classify these images and build a deep learning model. The Convolutional Neural Networks (CNN) is a deep learning algorithm that is highly suitable for image recognition and those tasks involving processing of pixel data. It is the most crucial aspect that makes algorithm training possible. In deep learning projects, we need a training data set. It is the actual data set used to train the model for performing various actions. Keras is a deep learning API written in Python, running on top of the machine learning platform TensorFlow. It was developed with a focus on enabling fast experimentation. Being able to go from idea to result as fast as possible is key to doing good research. The proposed system consist of two models namely Vegetable and fruit model. The Vegetable model has 9 classes and the Fruit model consists of 6 classes for the prediction of plant disease .The required libraries are imported which are essential for the model to run. The dataset for this model is imported from the Keras module. The data is split into train and test.The trained dataset is used to train the model and the validation dataset is used to predict the plant disease.

7.2. FEATURE-2 WEB APP

HTML, CSS and JavaScript are used to create the web pages for the front end. An html page that takes in image files as input using form and submits to the back end is created. A flask app is created using python flask, where it receives the image files from the templates, html pages and the prediction operation is done over this image. Later the predicted output is sent to the result page.

8 TESTING

8.1 TEST CASES

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)
HomePage_TC_OO1	Functional	Home Page	Verify the URL entered and allow the user	Proper network connection	1.Enter URL and click go 2.The home page will be displayed	URL of the website	Proper display of the home page	Working as expected	Pass		Y
DiagnosisPage_TC_OO2	Functional	Diagnosis	Allows the user to upload the image of infected leaf	The plant's picture should be readily discernible.	1.Enter URL and click go 2.Click on dignosis button 3.Select the type of plant to be detected 4.Upload the image of the leaf 5.Click on the dignosis button	URL of the website	Application should show below UI elements: a.Drop down icon to select the plant type b.Space to upload the image c.Diagnosis button	Working as expected	Pass		Y
ResultPage_TC_OO3	Non-Functional	Result	Predict the disease of the plant based on the image uploaded	Image of the plant should be uploaded	1.Upload the image 2.Click on dignosis	Folder of infected plant images	Application should show below details: 1.Crop name 2.Disease name 3.Image description 4.Preventive measures 5.Recommended fertilizer components	Working as expected	Fail	The recommended fertilizer components are not available in my area	Y
FeedbackPage_TC_OO4	Functional	Feedback	Check if the feedback is submitted to the database		1.Enter the following elements: a.Name b.Phone number c.e-Mail id d.Feedback message 2.Click on the submit button	name:smpl phone number:9479903145 e-mail id:smpl@gmail.com message:This app really hepled me a lot to increase the yield	Application should show a pop up with a thank you message	Working as expected	Pass		Y

+

8.2 USER ACCEPTANCE TEST

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	13	2	1	3	19
Duplicate	4	0	2	0	6
External	3	2	1	0	6
Fixed	12	3	2	14	31
Not Reproduced	0	2	0	0	2
Skipped	0	0	1	1	2
Won't Fix	0	4	2	1	7
Totals	32	13	9	19	73

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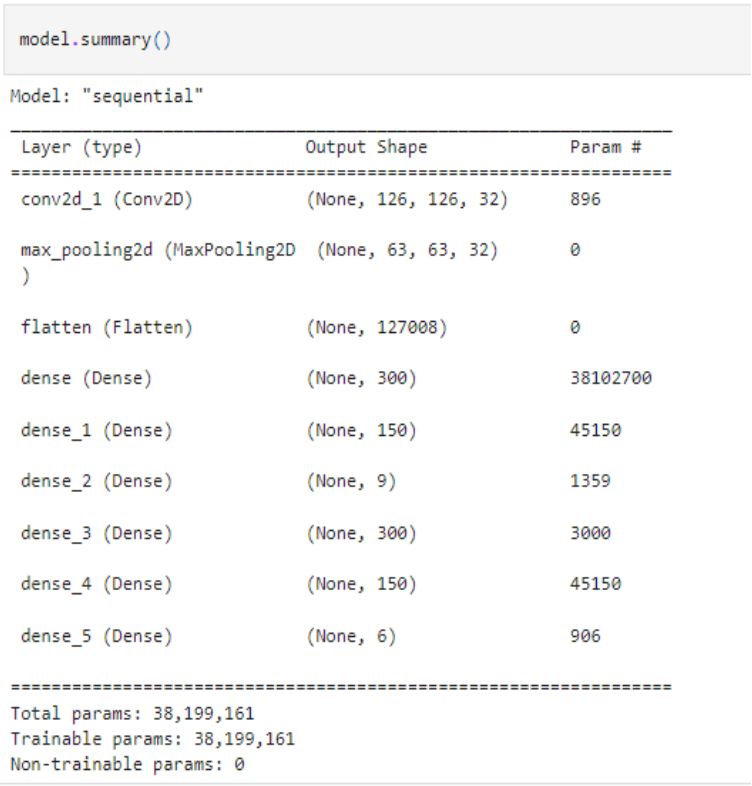
This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Client Application	30	0	0	30
Image	15	0	0	15
Prediction	5	0	0	5
Exception Reporting	8	0	0	8
Final Report Output	5	0	0	5
Version Control	3	0	0	3

9. RESULTS

9.1 PERFORMANCE METRICS

Vegetables:

S.No.	Parameter	Values	Screenshot
| 1. | Model Summary | - | ```text
model.summary()

Model: "sequential"
_____
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_1 (Conv2D)           (None, 126, 126, 32)      896

 max_pooling2d (MaxPooling2D  (None, 63, 63, 32)       0
 )

 flatten (Flatten)           (None, 127008)            0

 dense (Dense)               (None, 300)               38102700

 dense_1 (Dense)             (None, 150)               45150

 dense_2 (Dense)             (None, 9)                 1359

 dense_3 (Dense)             (None, 300)               3000

 dense_4 (Dense)             (None, 150)               45150

 dense_5 (Dense)             (None, 6)                 906

=================================================================
Total params: 38,199,161
Trainable params: 38,199,161
Non-trainable params: 0
``` |

| 2. | Accuracy | Training Accuracy - 87.65

Validation Accuracy - 53.2 | `model.fit(x_train, steps_per_epoch=len(x_train),validation_data=x_test,validation_steps=len(x_test),epochs=10)`

Epoch 1/10
356/356 [==============================] - 294s 821ms/step - loss: 1.4784 - accuracy: 0.4540 - val_loss: 1.2836 - val_accuracy: 0.7147
Epoch 2/10
356/356 [==============================] - 290s 815ms/step - loss: 1.0785 - accuracy: 0.5955 - val_loss: 1.8063 - val_accuracy: 0.5680
Epoch 3/10
356/356 [==============================] - 289s 809ms/step - loss: 0.8824 - accuracy: 0.6930 - val_loss: 1.8846 - val_accuracy: 0.3880
Epoch 4/10
356/356 [==============================] - 290s 813ms/step - loss: 0.7073 - accuracy: 0.7643 - val_loss: 1.9312 - val_accuracy: 0.3573
Epoch 5/10
356/356 [==============================] - 289s 812ms/step - loss: 0.5931 - accuracy: 0.7980 - val_loss: 1.2552 - val_accuracy: 0.5560
Epoch 6/10
356/356 [==============================] - 289s 812ms/step - loss: 0.5508 - accuracy: 0.8188 - val_loss: 2.1893 - val_accuracy: 0.4853
Epoch 7/10
356/356 [==============================] - 289s 810ms/step - loss: 0.4766 - accuracy: 0.8378 - val_loss: 1.4635 - val_accuracy: 0.7560
Epoch 8/10
356/356 [==============================] - 289s 812ms/step - loss: 0.4310 - accuracy: 0.8588 - val_loss: 2.5084 - val_accuracy: 0.4227
Epoch 9/10
356/356 [==============================] - 293s 823ms/step - loss: 0.4152 - accuracy: 0.8646 - val_loss: 1.8773 - val_accuracy: 0.5547
Epoch 10/10
356/356 [==============================] - 293s 822ms/step - loss: 0.3686 - accuracy: 0.8765 - val_loss: 2.6036 - val_accuracy: 0.5320 |

Fruits:

S.No	Parameter	Values	Screenshot
1.	Model Summary	–	Model: "sequential" Layer (type) Output Shape Param # === conv2d_1 (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 [49]: `model.add(Dense(300,activation='relu'))` `model.add(Dense(150,activation='relu'))` In [50]: `model.add(Dense(6, activation = 'softmax'))`

| 2. | Accuracy | Training Accuracy - 94.69

Validation Accuracy - 63.52 | (see code output below) |

```
model.fit(x_train, steps_per_epoch=len(x_train),validation_data=x_test,validation_steps=len(x_test),epochs=10)

Epoch 1/10
169/169 [==============================] - 144s 852ms/step - loss: 0.5092 - accuracy: 0.7923 - val_loss: 0.9665 - val_accuracy: 0.6145
Epoch 2/10
169/169 [==============================] - 142s 841ms/step - loss: 0.3892 - accuracy: 0.8568 - val_loss: 1.7423 - val_accuracy: 0.5747
Epoch 3/10
169/169 [==============================] - 142s 838ms/step - loss: 0.3450 - accuracy: 0.8845 - val_loss: 1.7142 - val_accuracy: 0.6139
Epoch 4/10
169/169 [==============================] - 142s 842ms/step - loss: 0.3118 - accuracy: 0.8982 - val_loss: 2.0814 - val_accuracy: 0.5623
Epoch 5/10
169/169 [==============================] - 145s 856ms/step - loss: 0.2226 - accuracy: 0.9266 - val_loss: 3.4725 - val_accuracy: 0.5261
Epoch 6/10
169/169 [==============================] - 144s 853ms/step - loss: 0.1762 - accuracy: 0.9408 - val_loss: 2.4493 - val_accuracy: 0.5765
Epoch 7/10
169/169 [==============================] - 144s 852ms/step - loss: 0.1802 - accuracy: 0.9422 - val_loss: 2.6436 - val_accuracy: 0.5706
Epoch 8/10
169/169 [==============================] - 146s 864ms/step - loss: 0.1448 - accuracy: 0.9497 - val_loss: 2.4450 - val_accuracy: 0.5356
Epoch 9/10
169/169 [==============================] - 149s 881ms/step - loss: 0.1307 - accuracy: 0.9569 - val_loss: 2.7819 - val_accuracy: 0.5919
Epoch 10/10
169/169 [==============================] - 148s 876ms/step - loss: 0.1575 - accuracy: 0.9469 - val_loss: 2.3024 - val_accuracy: 0.6352
```

10. ADVANTAGES & DISADVANTAGES

Advantages

1. It is open-source and can be accessed by anyone.

2. Saves cost and time for the users.

3. No need for expert advice and recommendations.

4. Early disease prediction minimizes loss and increases yield.

5. Image size is automatically resized.

Disadvantages

1. Requires high computational time for training and testing.

2. The system build is complex and holds difficulty.

3. The accuracy is not guaranteed and there is a risk of errors.

11. CONCLUSION

The model proposed here involves predicting the plant disease based on processing the image of the affected sample and recommends suitable fertilizer components and it also suggests preventive measures for it.With the use of this model farmers will be able to get details regarding required fertilizers from the image of the infected plant leaves uploaded. This Proposed system will give fast and accurate results. This is used for improved crop production with reduction in cost of fertilizer and thus improves the agriculture sector. Our system makes appropriate fertilization recommendations for the soil in the most economical way.

12. FUTURE SCOPE

In the future we can further extend our project to detect the disease that affects the various other parts of the plant such as stems ,roots and fruits.This prediction of plant disease can also be done using various other factors such as soil type,geographical location,humidity. Also, various segmentation algorithms can be implemented to improve accuracy. We can also develop this web application into a software application.

13. APPENDIX

Source code

app.py

```python
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, Markup, redirect, url_for

from disease import disease_dic

import os

from werkzeug.utils import secure_filename

from tensorflow.python.keras.backend import set_session


app = Flask(__name__)


#Loading the models
vmodel = load_model("vegetable.h5")

fmodel = load_model("fruit.h5")


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

```python
#Prediction page

@app.route('/prediction')

def prediction():

    return render_template('plants.html')


#Feedback Page

@app.route('/feedback')

def feedback():

    return render_template('contact.html')


#About Page

@app.route('/about')

def about():

    return render_template('about.html')


@app.route('/predict',methods=['POST'])

def predict():

    if request.method == 'POST':

        f = request.files['image']

        basepath = os.path.dirname(__file__)

        file_path = os.path.join(

            basepath, 'uploads', secure_filename(f.filename))

        f.save(file_path)

        img = image.load_img(file_path, target_size=(128, 128))

        x = image.img_to_array(img)

        x = np.expand_dims(x, axis=0)
```

```python
        plant=request.form['plants']

        print(plant)

        if(plant=="fruit"):

            preds = np.argmax(fmodel.predict(x),axis=1)

            print(preds[0])

            fruit_index = ['Apple___Black_rot', 'Apple___healthy',
'Corn_(maize)___Northern_Leaf_Blight', 'Corn_(maize)___healthy', 'Peach___Bacterial_spot',
'Peach___healthy']

            pred = fruit_index[preds[0]]

        else:

            preds = np.argmax(vmodel.predict(x),axis=1)

            print(preds[0])

            veg_index = ['Pepper,_bell___Bacterial_spot', 'Pepper,_bell___healthy',
'Potato___Early_blight', 'Potato___Late_blight', 'Potato___healthy', 'Tomato___Bacterial_spot',
'Tomato___Late_blight', 'Tomato___Leaf_Mold', 'Tomato___Septoria_leaf_spot']

            pred = veg_index[preds[0]]

        prediction = Markup(str(disease_dic[pred]))

        return render_template("results.html", disease=prediction, img=img)


if __name__=="__main__":

    app.run(debug=False)
```

disease.py
```python
disease_dic = {
    'Pepper,_bell___Bacterial_spot': """ <centre><b>Crop</b>: Pepper <br/>Disease: Bacterial
Spot<br/>
        <br/> Cause of disease:
        <br/><br/> 1. Bacterial spot is caused by several species of gram-negative bacteria in the
genus Xanthomonas.
```


 2. In culture, these bacteria produce yellow, mucoid colonies. A "mass" of bacteria can be observed oozing from a lesion by making a cross-sectional cut through a leaf lesion, placing the tissue in a droplet of water, placing a cover-slip over the sample, and examining it with a microscope (~200X)..

 How to prevent/cure the disease

1. The primary management strategy of bacterial spot begins with use of certified pathogen-free seed and disease-free transplants.

2. The bacteria do not survive well once host material has decayed, so crop rotation is recommended. Once the bacteria are introduced into a field or greenhouse, the disease is very difficult to control.

3. Pepper plants are routinely sprayed with copper-containing bactericides to maintain a "protective" cover on the foliage and fruit.

The FERTILIZER components that are suggested

  copper and pyrethrins
Sulphur
""",

'Pepper,_bell___healthy': """ Crop: Pepper
Disease: No disease

 Don't worry. Your crop is healthy. Keep it up !!!""",

'Potato___healthy': """ Crop: Potato
Disease: No disease

 Don't worry. Your crop is healthy. Keep it up !!!""",

'Potato___Early_blight': """ Crop: Potato
Disease: Early Blight

 Cause of disease:

 1. Early blight (EB) is a disease of potato caused by the fungus Alternaria solani. It is found wherever potatoes are grown.

 2. The disease primarily affects leaves and stems, but under favorable weather conditions, and if left uncontrolled, can result in considerable defoliation and enhance the chance for tuber infection. Premature defoliation may lead to considerable reduction in yield.

 3. Primary infection is difficult to predict since EB is less dependent upon specific weather conditions than late blight.

 How to prevent/cure the disease

1. Plant only diseasefree, certified seed.

2. Follow a complete and regular foliar fungicide spray program.

3. Practice good killing techniques to lessen tuber infections.

4. Allow tubers to mature before digging, dig when vines are dry, not wet, and avoid excessive wounding of potatoes during harvesting and handling.

The FERTILIZER components that are suggested

 Azox ystrobin
Boscalid
Chlorothalonil
Famoxadone/cymoxanil
Fenamidone
 Iprodione
 Mancozeb
 Pyraclostrobin
"""』

'Potato___Late_blight': """ Crop: Potato
Disease: Late Blight

Late blight is a potentially devastating disease of potato, infecting leaves, stems and fruits of plants. The disease spreads quickly in fields and can result in total crop failure if untreated. Late blight of potato was responsible for the Irish potato famine of the late 1840s.

 Cause of disease:

 1. Late blight is caused by the oomycete Phytophthora infestans. Oomycetes are fungus-like organisms also called water molds, but they are not true fungi.

 2. There are many different strains of P. infestans. These are called clonal lineages and designated by a number code (i.e. US-23). Many clonal lineages affect both tomato and potato, but some lineages are specific to one host or the other.

 3. The host range is typically limited to potato and tomato, but hairy nightshade (Solanum physalifolium) is a closely related weed that can readily become infected and may contribute to disease spread. Under ideal conditions, such as a greenhouse, petunia also may become infected.

 How to prevent/cure the disease

1. Seed infection is unlikely on commercially prepared tomato seed or on saved seed that has been thoroughly dried.

2. Inspect tomato transplants for late blight symptoms prior to purchase and/or planting, as tomato transplants shipped from southern regions may be infected

3. If infection is found in only a few plants within a field, infected plants should be removed, disced-under, killed with herbicide or flame-killed to avoid spreading through the entire field.

The FERTILIZER components that are suggested

   Azoxystrobin
   Cymoxanil
   Chlorothalonil
   Dimethomorph

   Famoxadone/cymoxanil
   Fenamidone
    Mancozeb
   Mefenoxam/chlorothalonil
   Propamocarb hydrochloride
   pyraclostrobin
   Phosphites
""",

'Tomato___Bacterial_spot': """ Crop: Tomato
Disease: Bacterial Spot

 Cause of disease:

 1. The disease is caused by four species of Xanthomonas (X. euvesicatoria, X. gardneri, X. perforans, and X. vesicatoria). In North Carolina, X. perforans is the predominant species associated with bacterial spot on tomato and X. euvesicatoria is the predominant species associated with the disease on pepper.

 2. All four bacteria are strictly aerobic, gram-negative rods with a long whip-like flagellum (tail) that allows them to move in water, which allows them to invade wet plant tissue and cause infection.

 How to prevent/cure the disease

1. The most effective management strategy is the use of pathogen-free certified seeds and disease-free transplants to prevent the introduction of the pathogen into greenhouses and field production areas. Inspect plants very carefully and reject infected transplants- including your own!

2. In transplant production greenhouses, minimize overwatering and handling of seedlings when they are wet.

3. Trays, benches, tools, and greenhouse structures should be washed and sanitized between seedlings crops.

4. Do not spray, tie, harvest, or handle wet plants as that can spread the disease

The FERTILIZER components that are suggested

   copper and pyrethrins
   Sulphur
""",

'Tomato___Late_blight': """ Crop: Tomato
Disease: Late Blight

Late blight is a potentially devastating disease of tomato, infecting leaves, stems and fruits of plants. The disease spreads quickly in fields and can result in total crop failure if untreated.

 Cause of disease:

 1. Late blight is caused by the oomycete Phytophthora infestans. Oomycetes are fungus-like organisms also called water molds, but they are not true fungi.

 2. There are many different strains of P. infestans. These are called clonal lineages and designated by a number code (i.e. US-23). Many clonal lineages affect both tomato and potato, but some lineages are specific to one host or the other.

 3. The host range is typically limited to potato and tomato, but hairy nightshade (Solanum physalifolium) is a closely related weed that can readily become infected and may contribute to disease spread. Under ideal conditions, such as a greenhouse, petunia also may become infected.

The FERTILIZER components that are suggested

    Chlorothalonil

  Mancozeb

   Copper
Famoxadone/cymoxanil
Dimethomorph
Azoxystrobin
Azoxystrobin + Difenoconazole
pyraclostrobin
""",

'Tomato___Leaf_Mold': """ Crop: Tomato
Disease: Leaf Mold

 Cause of disease:

 1. Leaf mold is caused by the fungus Passalora fulva (previously called Fulvia fulva or Cladosporium fulvum). It is not known to be pathogenic on any plant other than tomato.

 2. Leaf spots grow together and turn brown. Leaves wither and die but often remain attached to the plant.

 3. Fruit infections start as a smooth black irregular area on the stem end of the fruit. As the disease progresses, the infected area becomes sunken, dry and leathery.

 How to prevent/cure the disease

1. Use drip irrigation and avoid watering foliage.

2. Space plants to provide good air movement between rows and individual plants.

3. Stake, string or prune to increase airflow in and around the plant.

4. Sterilize stakes, ties, trellises etc. with 10 percent household bleach or commercial sanitizer.

5. Circulate air in greenhouses or tunnels with vents and fans and by rolling up high tunnel sides to reduce humidity around plants.

6. Keep night temperatures in greenhouses higher than outside temperatures to avoid dew formation on the foliage.

7. Remove crop residue at the end of the season. Burn it or bury it away from tomato production areas.

The FERTILIZER components that are suggested
  Chlorothalonil
 Maneb
 Mancozeb
 Copper
 Difenoconazole
 Mandipropamid
 Cymoxanil
 Famoxadone
 Cyprodinil
""",

'Tomato___Septoria_leaf_spot': """ Crop: Tomato
Disease: Leaf Spot

 Cause of disease:

 Septoria leaf spot is caused by a fungus, Septoria lycopersici. It is one of the most destructive diseases of tomato foliage and is particularly severe in areas where wet, humid weather persists for extended periods.

 How to prevent/cure the disease

1. Remove diseased leaves.

2. Improve air circulation around the plants.

3. Mulch around the base of the plants

4. Do not use overhead watering.

5. Use fungicidal sprayes.

The FERTILIZER components that are suggested
    Copper
    bacillus subtilis
    Chlorothalonil
    Mancozeb
""" ,

'Apple___Black_rot': """ Crop: Apple
Disease: Black Rot

 Cause of disease:

Black rot is caused by the fungus Diplodia seriata (syn Botryosphaeria obtusa).The fungus can infect dead tissue as well as living trunks, branches, leaves and fruits. In wet weather, spores are released from these infections and spread by wind or splashing water. The fungus infects leaves and fruit through natural openings or minor wounds.

 How to prevent/cure the disease

1. Prune out dead or diseased branches.

2. Prune out dead or diseased branches.

3. Remove infected plant material from the area.

4. Remove infected plant material from the area.

5. Be sure to remove the stumps of any apple trees you cut down. Dead stumps can be a source of spores.

The FERTILIZER components that are suggested

     Captan
     Sulphur
     strobulurin

""" ,

'Apple___healthy': """ Crop: Apple
Disease: No disease

 Your crop is healthy.""" ,

'Corn_(maize)___healthy': """ Crop: Corn(maize)
Disease: No disease

 Don't worry. Your crop is healthy. Keep it up !!!""",

'Corn_(maize)___Northern_Leaf_Blight': """ Crop: Corn(maize)
Disease: Northern Leaf Blight

 Cause of disease:

Northern corn leaf blight (NCLB) is a foliar disease of corn (maize) caused by Exserohilum turcicum, the anamorph of the ascomycete Setosphaeria turcica. With its characteristic cigar-shaped lesions, this disease can cause significant yield loss in susceptible corn hybrids.

 How to prevent/cure the disease

1. Management of NCLB can be achieved primarily by using hybrids with resistance, but because resistance may not be complete or may fail, it is advantageous to utilize an integrated approach with different cropping practices and fungicides.

2. Scouting fields and monitoring local conditions is vital to control this disease.

The FERTILIZER components that are suggested

 Trichoderma harzianum
 Sulphur
 Bacillus Subtilis

""",

'Peach___Bacterial_spot': """ Crop: Peach
Disease: Bacterial Spot

 Cause of disease:

 1. The disease is caused by four species of Xanthomonas (X. euvesicatoria, X. gardneri, X. perforans, and X. vesicatoria). In North Carolina, X. perforans is the predominant species associated with bacterial spot on tomato and X. euvesicatoria is the predominant species associated with the disease on pepper.

\<br/\> 2. All four bacteria are strictly aerobic, gram-negative rods with a long whip-like flagellum (tail) that allows them to move in water, which allows them to invade wet plant tissue and cause infection.

\<br/\>\<br/\> How to prevent/cure the disease \<br/\>

\<br/\>1. The most effective management strategy is the use of pathogen-free certified seeds and disease-free transplants to prevent the introduction of the pathogen into greenhouses and field production areas. Inspect plants very carefully and reject infected transplants- including your own!

\<br/\>2. In transplant production greenhouses, minimize overwatering and handling of seedlings when they are wet.

\<br/\>3. Trays, benches, tools, and greenhouse structures should be washed and sanitized between seedlings crops.
\<br/\>4. Do not spray, tie, harvest, or handle wet plants as that can spread the disease.

```
<br><br/><b>The FERTILIZER components that are suggested</b>
<br>
<ul>
<li>Copper</li>
<li>oxytetracycline</li>
<li>syllit+captan</li>
</ul>
""",
```

'Peach___healthy': """ \<b\>Crop\</b\>: Peach \<br/\>Disease: No disease\<br/\>

\<br/\>\<br/\> Your crop is healthy."""
}

index.html

```
<!DOCTYPE html>
<html>

<head>
  <!-- Basic -->
```

```html
<meta charset="utf-8" />
<meta http-equiv="X-UA-Compatible" content="IE=edge" />
<!-- Mobile Metas -->
<meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no" />
<!-- Site Metas -->
<meta name="keywords" content="" />
<meta name="description" content="" />
<meta name="author" content="" />
<link rel="shortcut icon" href="../static/images/favicon.ico" type="">

<title class="title"> Uram </title>

<!-- bootstrap core css -->
<link rel="stylesheet" type="text/css" href="../static/css/bootstrap.css" />

<!--owl slider stylesheet -->
<link rel="stylesheet" type="text/css"
href="https://cdnjs.cloudflare.com/ajax/libs/OwlCarousel2/2.3.4/assets/owl.carousel.min.css" />

<!-- font awesome style -->
<link href="../static/css/responsive.css" rel="stylesheet" />

<!-- Custom styles for this template -->
<link href="../static/css/style.css" rel="stylesheet" />
<!-- responsive style -->
<link href="../static/css/responsive.css" rel="stylesheet" />

</head>

<body>

  <div class="hero_area">
    <div class="hero-bg">
      <img src="../static/images/banner.jpeg" alt="">
    </div>
    <!-- header section strats -->
    <header class="header_section">
      <div class="container">
        <nav class="navbar navbar-expand-lg custom_nav-container ">
```

```html
<a class="navbar-brand" href="/">
  <span><h1>
    Uram </h1>
  </span>
</a>


            <button class="navbar-toggler" type="button" data-toggle="collapse"
data-target="#navbarSupportedContent"            aria-controls="navbarSupportedContent"
aria-expanded="false" aria-label="Toggle navigation">
    <span class=""> </span>
  </button>

  <div class="collapse navbar-collapse" id="navbarSupportedContent">
    <ul class="navbar-nav  ">
      <li class="nav-item active">
        <a class="nav-link" href="/">Home <span class="sr-only">(current)</span></a>
      </li>
      <li class="nav-item">
        <a class="nav-link" href="/about"> About</a>
      </li>

      <li class="nav-item">
        <a class="nav-link" href="/prediction">Diagnosis</a>
      </li>

      <li class="nav-item">
        <a class="nav-link" href="/feedback">Feedback</a>
      </li>
      <form class="form-inline">
      </form>
    </ul>
  </div>
  </nav>
 </div>
</header>
<!-- end header section -->
<!-- slider section -->
<section class="slider_section ">
  <div id="customCarousel1" class="carousel slide" data-ride="carousel">
```

```html
<div class="carousel-inner">

  <div class="carousel-item active">
    <div class="container ">
      <div class="row">
        <div class="col-md-7 col-lg-6 mx-auto ">
          <div class="detail-box">
            <h1>
              Uram
            </h1>
            <p><h2>
              Plant disease diagnosis and fertilizer recommendation system.

            </h2></p>
          </div>
        </div>
      </div>
    </div>
  </div>


  <div class="carousel-item ">
    <div class="container ">
      <div class="row">
        <div class="col-md-7 col-lg-6 mx-auto ">
          <div class="detail-box">
            <h1>
              Make your crops healthy
            </h1>
            <p>
              Fertile soil is the best way to grow your plants.It helps in killing the unhealthy worms in your plant and make them fit for consumption. At regular intervals, you should keep adding fertilizers, manure and pesticides for the plants to keep the soil healthy and rich in nutrients. Organic fertilizers are a valuable sources of micronutrients to plants. They stimulate microbial activity and improve soil structure.
            </p>
          </div>
        </div>
      </div>
```

```
      </div>
    </div>

    <div class="carousel-item ">
      <div class="container ">
        <div class="row">
          <div class="col-md-7 col-lg-6 mx-auto ">
            <div class="detail-box">
              <h1>
                Make your crops disease-free
              </h1>
              <p>
```

Adequate mineral nutrition is central to crop production. The healthy plants are better able to fend off pathogens: the occurrence of pests and diseases is higher when the plant is stressed and malnourished. Well adapted fertilization, including integrated soil management and good irrigation practices, contributes to plants' vigour and their ability to fight diseases, which ensures that more and higher quality crops can be grown.

```
              </p>
            </div>
          </div>
        </div>
      </div>
    </div>

    <div class="carousel-item">
      <div class="container ">
        <div class="row">
          <div class="col-md-7 col-lg-6 mx-auto ">
            <div class="detail-box">
              <h1>
                Enrich the soil
              </h1>
              <p>
```

Plants survive and thrive when they get enough of the 14 essential nutrients they need from the soil, in addition to carbon and oxygen from the air and hydrogen from water. A lack of even one single essential nutrient in the right quantities can have a huge impact on plant health. Usually farmers enrich the soil by adding biological manure, fertilizers, pesticides and other chemicals to increase the yield exponentially. If these chemicals are used for a longer time

in high amounts then these may detoriate the quality of soil.So we recommend to use organic manure and fertilizer without much damage to the soil the plant can be grown well.

```
            </p>
          </div>
        </div>
      </div>
    </div>
  </div>
  <div class="container">
   <ol class="carousel-indicators">
    <li data-target="#customCarousel1" data-slide-to="0" class="active"></li>
    <li data-target="#customCarousel1" data-slide-to="1"></li>
    <li data-target="#customCarousel1" data-slide-to="2"></li>
    <li data-target="#customCarousel1" data-slide-to="3"></li>
   </ol>
  </div>
 </div>


 </section>
 <!-- end slider section -->
</div>




<!-- about section -->

<section class="about_section layout_padding-bottom">
  <div class="container  ">
   <div class="row">
    <div class="col-md-6 ">
     <div class="img-box">
      <img src="../static/images/aboutus.jpg" alt="">
     </div>
    </div>
    <div class="col-md-6">
     <div class="detail-box">
      <div class="heading_container">
       <h2>
```

```
     About <span>Us</span>
   </h2>
 </div>
 <p>
     We use the state-of-the-art machine learning and deep learning technologies to help you
guide through the
     usage of fertilizer for the detected disease.We have Developed a Web-Based Software
Named Fertilizer Recommendation
         System (Sapling Enrich). The System Is Capable Of Generating Fertilizer
Recommendations for the infected plant
         based on the image of the plant. Based on the detected disease our software will
recommend the organic fertilizer
     which will make the plant healthy and also enrich the soil.
   </p>


   </div>
  </div>
 </div>
</div>
</section>

<!-- end about section -->

<!-- why section -->

<section class="why_section layout_padding">
 <div class="container">
  <div class="heading_container heading_center">
   <h2>
    Our <span>Services</span>
   </h2>
  </div>
  <div class="row">
   <div class="col-md-6 mx-auto">
    <div class="box">
     <div class="img-box">
      <img src="../static/images/p5.png" alt="" width="200" height="200">
     </div>
     <div class="detail-box">
```

```html
        <h5>
          Plant Disease
        </h5>
        <p>
              Identifying the plant disaese by checking the symptoms shown on the leaves of the
plant. Deep learning techniques are used to identify the diseases and suggest the precautions that
can be taken for those diseases.
        </p>
       </div>
      </div>
    </div>
    <div class="col-md-6 mx-auto">
     <div class="box">
       <div class="img-box">
         <img src="../static/images/p4.png" alt="">
       </div>
       <div class="detail-box">
        <h5>
          Fertilizer Recommendation
        </h5>
        <p>
          Know How To Use The Right Fertilizer At Right Time!
              The important part of the successful garden is fertilizer. You have to use the fertilizer in
the correct way.
               Using wrong fertilizer or usage of right fertilizer in the wrong way will certainly cause
problems.
        </p>
       </div>
      </div>
     </div>
    </div>
   </div>
  </section>

  <!-- end why section -->

  <!-- contact section -->
  <section class="contact_section layout_padding">
   <div class="container">
```

```html
<div class="heading_container">
  <h2>
    Feedback
  </h2>
</div>
<div class="row">
  <div class="col-md-6">
    <div class="form_container contact-form">
      <form action="">
        <div>
          <input type="text" placeholder="Your Name" />
        </div>
        <div>
          <input type="text" placeholder="Phone Number" />
        </div>
        <div>
          <input type="email" placeholder="Email" />
        </div>
        <div>
          <input type="text" class="message-box" placeholder="Message" />
        </div>
        <div class="btn_box">
          <button class='btn' onclick='popup()'>
            SEND
          </button>
        </div>
      </form>
    </div>
  </div>
  <div class="col-md-6">
    <div class="map_container">
      <div class="map">
        <img src="../static/images/crop2.jpg"/>
      </div>
    </div>
  </div>
</div>
</section>
```

```html
<!-- end contact section -->



<!-- footer section -->
<footer class="footer_section">
  <div class="container">
    <a href="" class="footer-brand">
     Uram
    </a>
    <div class="row">
      <div class="col-lg-10 mx-auto">
        <div class="footer_items">
          <div class="row">
            <div class="col-md-4">
              <a href="/">
                <div class="item ">
                  <div class="img-box ">
                    <i class="fa fa-map-marker" aria-hidden="true"></i>
                  </div>
                  <p>
                    Home
                  </p>
                </div>
              </a>
            </div>
            <div class="col-md-4">
              <a href="/feedback">
                <div class="item ">
                  <div class="img-box ">
                    <i class="fa fa-phone" aria-hidden="true"></i>
                  </div>
                  <p>
                    Feedback
                  </p>
                </div>
              </a>
            </div>
            <div class="col-md-4">
```

```html
                                                                    <a
href="https://mail.google.com/mail/u/0/#inbox?compose=CllgCJqTgNDcSrWpRsFCnjbqLdqJQ
xFzsfNKwmWqhCbZMDPShkTFgChtThKXFDFCmGncSZKDhcL">
                <div class="item ">
                  <div class="img-box">
                    <i class="fa fa-envelope" aria-hidden="true"></i>
                  </div>
                  <p>
                    uramatservice@gmail.com
                  </p>
                </div>
              </a>
            </div>
          </div>
        </div>
      </div>
    </div>
    <div class="social-box">
      <h4>
        Follow Us
      </h4>
      <div class="box">
        <a href="https://www.linkedin.com/in/sneha-b-7439b9200/">
          <i class="fa fa-facebook" aria-hidden="true"></i>
        </a>
        <a href="https://twitter.com/Meghaa16092001?t=2Q_octaH3wZfyrl2tw2nUg&s=08">
          <i class="fa fa-twitter" aria-hidden="true"></i>
        </a>
        <a href="https://youtube.com/channel/UC_tDs5Cx5B-Ft6fMznfh5GQ">
          <i class="fa fa-youtube" aria-hidden="true"></i>
        </a>
        <a href="https://instagram.com/masl_c?igshid=YmMyMTA2M2Y=">
          <i class="fa fa-instagram" aria-hidden="true"></i>
        </a>
      </div>
    </div>
  </div>
  <div class="footer-info">
    <div class="container">
```

```html
      <p>
      <span id="displayYear"></span> Crafted with love
      </p>
    </div>
  </div>
</footer>
<!-- footer section -->
<!-- jQery -->
<script src="../static/js/jquery-3.4.1.min.js"></script>
<!-- popper js -->
        <script      src="https://cdn.jsdelivr.net/npm/popper.js@1.16.0/dist/umd/popper.min.js"
integrity="sha384-Q6E9RHvbIyZFJoft+2mJbHaEWldlvI9IOYy5n3zV9zzTtmI3UksdQRVvoxM
fooAo" crossorigin="anonymous">
</script>
<!-- bootstrap js -->
<script src="../static/js/bootstrap.js"></script>
<!-- owl slider -->
<script src="https://cdnjs.cloudflare.com/ajax/libs/OwlCarousel2/2.3.4/owl.carousel.min.js">
</script>
<!-- custom js -->
<script src="../static/js/custom.js"></script>
<!-- Google Map -->
                                                                          <script
src="https://maps.googleapis.com/maps/api/js?key=AIzaSyCh39n5U-4IoWpsVGUHWdqB6puE
khRLdmI&callback=myMap">
</script>
<!-- End Google Map -->
<script>
  function popup(){
    alert("Thank You for your valuable time!!!");
  }

  </script>
</body>
</html>
```

plants.html

```html
<!DOCTYPE html>
```

```html
<html>

<head>
 <!-- Basic -->
 <meta charset="utf-8" />
 <meta http-equiv="X-UA-Compatible" content="IE=edge" />
 <!-- Mobile Metas -->
 <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no" />
 <!-- Site Metas -->
 <meta name="keywords" content="" />
 <meta name="description" content="" />
 <meta name="author" content="" />
 <link rel="shortcut icon" href="../static/images/favicon.ico" type="">

 <title> Uram </title>

 <!-- bootstrap core css -->
 <link rel="stylesheet" type="text/css" href="../static/css/bootstrap.css" />

 <!--owl slider stylesheet -->
                                <link            rel="stylesheet"                 type="text/css"
href="https://cdnjs.cloudflare.com/ajax/libs/OwlCarousel2/2.3.4/assets/owl.carousel.min.css" />

 <!-- font awesome style -->
 <link href="../static/css/font-awesome.min.css" rel="stylesheet" />

 <!-- Custom styles for this template -->
 <link href="../static/css/style.css" rel="stylesheet" />
 <!-- responsive style -->
 <link href="../static/css/responsive.css" rel="stylesheet" />

</head>

<body class="sub_page">

 <div class="hero_area">
  <div class="hero-bg">
   <img src="../static/images/hero-bg.jpg" alt="">
  </div>
```

```html
<!-- header section strats -->
<header class="header_section">
 <div class="container">
   <nav class="navbar navbar-expand-lg custom_nav-container ">
    <a class="navbar-brand" href="">
     <span>
       Uram
     </span>
    </a>


                    <button  class="navbar-toggler"  type="button"  data-toggle="collapse"
data-target="#navbarSupportedContent"                 aria-controls="navbarSupportedContent"
aria-expanded="false" aria-label="Toggle navigation">
        <span class=""> </span>
      </button>

      <div class="collapse navbar-collapse" id="navbarSupportedContent">
       <ul class="navbar-nav  ">
        <li class="nav-item ">
         <a class="nav-link" href="/">Home <span class="sr-only">(current)</span></a>
        </li>
        <li class="nav-item">
         <a class="nav-link" href="/about"> About</a>
        </li>
        <li class="nav-item active">
         <a class="nav-link" href="/prediction">Diagnosis</a>
        </li>
        <li class="nav-item">
         <a class="nav-link" href="/feedback">Feedback</a>
        </li>

        <form class="form-inline">
         <button class="btn  my-2 my-sm-0 nav_search-btn" type="submit">
          <i class="fa fa-search" aria-hidden="true"></i>
         </button>
        </form>
       </ul>
      </div>
    </nav>
```

```html
      </div>
    </header>
    <!-- end header section -->
</div>
<div class="diagnosis">
  <h1>Find out which disease has been caught by your plant</h1>
  <div class="row">
    <div class="col-md-6">
      <div class="form_container contact-form">
        <form class="plants" action="/predict" enctype="multipart/form-data" method="POST">

          <div>
            <br/><br/>
            <label for="plants"><h2>Select your plant type:</h2></label>

              <select name="plants" id="plants" aria-placeholder="Select one">
                <option value="vegetable">Vegetable</option>
                <option value="fruit">fruit</option>
              </select><br/>
              <br/>
            <label><h2>Please Upload The Image</h2></label> <br>
            <input type="file" id="image" name="image" placeholder="Choose file" required/>
          </div>

          <div class="btn_box">
            <button>
              Diagnosis
            </button>
          </div>
        </form>
      </div>
    </div>
  </div>
</div>




<!-- footer section -->
<footer class="footer_section">
```

```html
<div class="container">
  <a href="" class="footer-brand">
Uram
  </a>
  <div class="row">
    <div class="col-lg-10 mx-auto">
      <div class="footer_items">
        <div class="row">
          <div class="col-md-4">
            <a href="/">
              <div class="item ">
                <div class="img-box ">
                  <i class="fa fa-map-marker" aria-hidden="true"></i>
                </div>
                <p>
                  Home
                </p>
              </div>
            </a>
          </div>
          <div class="col-md-4">
            <a href="/feedback">
              <div class="item ">
                <div class="img-box ">
                  <i class="fa fa-phone" aria-hidden="true"></i>
                </div>
                <p>
                  Feedback
                </p>
              </div>
            </a>
          </div>
          <div class="col-md-4">
            <a href=""https://mail.google.com/mail/u/0/#inbox?compose=CllgCJqTgNDcSrWpRsFCnjbqLdqJQxFzsfNKwmWqhCbZMDPShkTFgChtThKXFDFCmGncSZKDhcL"">
              <div class="item ">
                <div class="img-box">
                  <i class="fa fa-envelope" aria-hidden="true"></i>
```

```html
          </div>
          <p>
            uramatservice@gmail.com
          </p>
        </div>
      </a>
     </div>
    </div>
   </div>
  </div>
  <div class="social-box">
   <h4>
     Follow Us
   </h4>
   <div class="box">
    <a href="">
      <i class="fa fa-facebook" aria-hidden="true"></i>
    </a>
    <a href="">
      <i class="fa fa-twitter" aria-hidden="true"></i>
    </a>
    <a href="">
      <i class="fa fa-youtube" aria-hidden="true"></i>
    </a>
    <a href="">
      <i class="fa fa-instagram" aria-hidden="true"></i>
    </a>
   </div>
  </div>
</div>
<div class="footer-info">
 <div class="container">
  <p>
   <span id="displayYear"></span> Crafted with love

  </p>
 </div>
</div>
```

```html
</footer>
<!-- footer section -->
<!-- jQery -->
<script src="../static/js/jquery-3.4.1.min.js"></script>
<!-- popper js -->
        <script    src="https://cdn.jsdelivr.net/npm/popper.js@1.16.0/dist/umd/popper.min.js"
integrity="sha384-Q6E9RHvbIyZFJoft+2mJbHaEWldlvI9IOYy5n3zV9zzTtmI3UksdQRVvoxM
fooAo" crossorigin="anonymous">
</script>
<!-- bootstrap js -->
<script src="../static/js/bootstrap.js"></script>
<!-- owl slider -->
<script src="https://cdnjs.cloudflare.com/ajax/libs/OwlCarousel2/2.3.4/owl.carousel.min.js">
</script>
<!-- custom js -->
<script src="../static/js/custom.js"></script>
<!-- Google Map -->
                                                                        <script
src="https://maps.googleapis.com/maps/api/js?key=AIzaSyCh39n5U-4IoWpsVGUHWdqB6puE
khRLdmI&callback=myMap">
</script>
<!-- End Google Map -->
</body>
</html>
```

results.html

```html
<!DOCTYPE html>
<html>

<head>
<!-- Basic -->
<meta charset="utf-8" />
<meta http-equiv="X-UA-Compatible" content="IE=edge" />
<!-- Mobile Metas -->
<meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no" />
<!-- Site Metas -->
<meta name="keywords" content="" />
<meta name="description" content="" />
```

```html
<meta name="author" content="" />
<link rel="shortcut icon" href="../static/images/favicon.ico" type="">

<title> Uram </title>

<!-- bootstrap core css -->
<link rel="stylesheet" type="text/css" href="../static/css/bootstrap.css" />

<!--owl slider stylesheet -->
<link rel="stylesheet" type="text/css"
href="https://cdnjs.cloudflare.com/ajax/libs/OwlCarousel2/2.3.4/assets/owl.carousel.min.css" />

<!-- font awesome style -->
<link href="../static/css/font-awesome.min.css" rel="stylesheet" />

<!-- Custom styles for this template -->
<link href="../static/css/style.css" rel="stylesheet" />
<!-- responsive style -->
<link href="../static/css/responsive.css" rel="stylesheet" />

</head>

<body class="sub_page">

  <div class="hero_area">
   <div class="hero-bg">
    <img src="../static/images/hero-bg.jpg" alt="">
   </div>
   <!-- header section strats -->
   <header class="header_section">
    <div class="container">
     <nav class="navbar navbar-expand-lg custom_nav-container ">
      <a class="navbar-brand" href="/">
       <span>
        Uram
       </span>
      </a>
```

```html
                          <button class="navbar-toggler" type="button" data-toggle="collapse"
data-target="#navbarSupportedContent"                 aria-controls="navbarSupportedContent"
aria-expanded="false" aria-label="Toggle navigation">
        <span class=""> </span>
      </button>

      <div class="collapse navbar-collapse" id="navbarSupportedContent">
       <ul class="navbar-nav  ">
        <li class="nav-item ">
          <a class="nav-link" href="/">Home <span class="sr-only">(current)</span></a>
        </li>
        <li class="nav-item">
          <a class="nav-link" href="/about"> About</a>
        </li>
        <li class="nav-item active">
          <a class="nav-link" href="/prediction">Diagnosis</a>
        </li>
        <li class="nav-item">
          <a class="nav-link" href="/feedback">Feedback</a>
        </li>

        <form class="form-inline">
          <button class="btn  my-2 my-sm-0 nav_search-btn" type="submit">
           <i class="fa fa-search" aria-hidden="true"></i>
          </button>
        </form>
       </ul>
      </div>
    </nav>
   </div>
  </header>
  <!-- end header section -->
 </div>
 <div class="diagnosis">  <centre>
              <div class="result_content">
              <h4>{{disease}} </h4><br> </centre>
    </div>
 </div>
```

```html
<!-- footer section -->
<footer class="footer_section">
  <div class="container">
    <a href="" class="footer-brand">
  Uram
    </a>
    <div class="row">
      <div class="col-lg-10 mx-auto">
        <div class="footer_items">
          <div class="row">
            <div class="col-md-4">
              <a href="/">
                <div class="item ">
                  <div class="img-box ">
                    <i class="fa fa-map-marker" aria-hidden="true"></i>
                  </div>
                  <p>
                   Home
                  </p>
                </div>
              </a>
            </div>
            <div class="col-md-4">
              <a href="/feedback">
                <div class="item ">
                  <div class="img-box ">
                    <i class="fa fa-phone" aria-hidden="true"></i>
                  </div>
                  <p>
                    Feedback
                  </p>
                </div>
              </a>
            </div>
            <div class="col-md-4">
```

```html
                                                                  <a
href=""https://mail.google.com/mail/u/0/#inbox?compose=CllgCJqTgNDcSrWpRsFCnjbqLdqJ
QxFzsfNKwmWqhCbZMDPShkTFgChtThKXFDFCmGncSZKDhcL"">
              <div class="item ">
                <div class="img-box">
                  <i class="fa fa-envelope" aria-hidden="true"></i>
                </div>
                <p>
                  uramatservice@gmail.com
                </p>
              </div>
            </a>
          </div>
        </div>
      </div>
    </div>
  </div>
  <div class="social-box">
    <h4>
      Follow Us
    </h4>
    <div class="box">
      <a href="https://www.linkedin.com/in/sneha-b-7439b9200/">
        <i class="fa fa-facebook" aria-hidden="true"></i>
      </a>
      <a href="https://twitter.com/Meghaa16092001?t=2Q_octaH3wZfyrl2tw2nUg&s=08">
        <i class="fa fa-twitter" aria-hidden="true"></i>
      </a>
      <a href="https://youtube.com/channel/UC_tDs5Cx5B-Ft6fMznfh5GQ">
        <i class="fa fa-youtube" aria-hidden="true"></i>
      </a>
      <a href="https://instagram.com/masl_c?igshid=YmMyMTA2M2Y=">
        <i class="fa fa-instagram" aria-hidden="true"></i>
      </a>
    </div>
  </div>
</div>
<div class="footer-info">
  <div class="container">
```

```html
    <p>
     <span id="displayYear"></span> Crafted with love

    </p>
   </div>
  </div>
 </footer>
 <!-- footer section -->
 <!-- jQery -->
 <script src="../static/js/jquery-3.4.1.min.js"></script>
 <!-- popper js -->
        <script     src="https://cdn.jsdelivr.net/npm/popper.js@1.16.0/dist/umd/popper.min.js"
integrity="sha384-Q6E9RHvbIyZFJoft+2mJbHaEWldlvI9IOYy5n3zV9zzTtmI3UksdQRVvoxM
fooAo" crossorigin="anonymous">
 </script>
 <!-- bootstrap js -->
 <script src="../static/js/bootstrap.js"></script>
 <!-- owl slider -->
 <script src="https://cdnjs.cloudflare.com/ajax/libs/OwlCarousel2/2.3.4/owl.carousel.min.js">
 </script>
 <!-- custom js -->
 <script src="../static/js/custom.js"></script>
 <!-- Google Map -->
                                                      <script
src="https://maps.googleapis.com/maps/api/js?key=AIzaSyCh39n5U-4IoWpsVGUHWdqB6puE
khRLdmI&callback=myMap">
 </script>
 <!-- End Google Map -->

</body>

</html>
```

Github:

https://github.com/IBM-EPBL/IBM-Project-22452-1659852237

Demolink:

https://www.youtube.com/embed/-QB02XH2ZGM