FERTILIZER RECOMMENDATION SYSTEM FOR DISEASE PREDICTION

PROJECT REPORT

Submitted by

JENIFFER E J	**(712919104022)**
SORNA K	**(712919104044)**
VIMALRAJ P	**(712919104050)**
YESHWANTH R A	**(712919104051)**

In partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

COMPUTE SCIENCE AND ENGINEERING

Index

1. INTRODUCTION

Project Overview

Agriculture is the most crucial one for the human existence. Crop disease prediction helps in enhancing the growth of agricultural crops and booming up the agriculture. Plant disease prediction helps in the detection and recognition of the plant diseases. The images of plants are captured and analyzed for certain symptoms using Computer vision and image processing. By identifying the disease, the deficit nutrients that lead to the disease are found. Based on the available data on fertilizers are recommended for curing the disease and also suggests some effective measures for increasing the crop yield.

Purpose

The plant diseases may lead to the reduction in the yield of crops. The main objective of the project is to detect the crop diseases effectively and suggesting the suitable fertilizers for diagnosing the disease. The project also aims at guiding the farmers with the proper choice of the fertilizers that are required to counter the deficiency of the nutrients that cause the disease.

2. LITERATURE SURVEY

Existing Problem

Agriculture is the heart and life of most Indians. But in recent days, the field was going down due to various natural calamities. In order to overcome the problem, various issues in this field need to be addressed. The soil type, fertilizer recommendation, diseases in plants and leaves. All these features need to be considered. Our proposed system was organized in such a way, to analyse the soil type, diseases in the leaves and finally to recommend the appropriate fertilizer to the farmers, that may be of great help to them. Plant disease, especially on leaves, is one of the major factors that reduce the yield in both quality and quantity of the food crops. Finding the leaf disease is an important role to preserve agriculture. Smart analysis and Comprehensive prediction model in agriculture helps the farmer to yield right crop at the right time. The main benefits of the proposed system are as follows: Yield right crop at the right time, Balancing the crop production, control plant disease, Economic growth, and planning to reduce the crop scarcity. Hence to Detect and recognize the plant diseases and to recommend fertilizer it is necessary to provide symptoms in identifying the disease at its earliest. Hence the authors proposed and implemented new fertilizers Recommendation System for crop disease prediction.

It is universally accepted fact that crop diseases are one of the major threats in agriculture that ultimately result in drastic reduction of food supply. The present project study aims to use artificial intelligence in building a model which is integrated with a user-friendly web application. The web application is created using the Python-based Django framework. This user interface allows the user to choose a crop name and upload an image of a leaf wherein the trained model then begins the process of feature extraction on the image and tries to make an accurate prediction. The final result is displayed to the user confirming whether the crop may be "healthy" or the "diseased "and even the name of the disease that infects the plant will be displayed. The application also suggests a suitable treatment to combat the disease. Thus, the scope of this project study is very scalable as it can be easily be used by amateur gardeners as well as by farmers. The model itself can also be extended to include more plant types along with any new diseases which may arise due to factors like climate change, pest - resistance etc.

Machine learning is an emerging research field in crop yield analysis. Yield prediction is a very important issue in agriculture. Any farmer is interested in knowing how much yield he isabout to expect. In the past, yield prediction was performed by considering farmer's experience on field and crop. The yield prediction is a major issue that remains to be solved based on available data. Machine learning techniques are the better choice for this purpose. Different Machine learning techniques are used and evaluated in agriculture for estimating the future year's crop production. This paper proposes and implements a system to predict crop yield from previous data. This is achieved by applying machine learning algorithms like Support Vector Machine andRandom Forest on agriculture data and recommends fertilizer suitable for every crop. The paper focuses on creation of a prediction model which may be used for future prediction of crop yield. It presents a brief analysis of crop yield prediction using machine learning techniques.

References

[1]. G. Preethi, P. Rathi, S. M. Sanjula, S. D. Lalitha, B. V. Bindhu, "Agro based crop and fertilizer recommendation system using machine learning", European Journal of Molecular & Clinical Medicine, 7, 4, 2020, 2043- 2051 https://deepai.org/publication/farmer-s-assistant-a-machine-learningbased-application-for-agricultural-solutions.

[2]. Plant Disease Detection Using Image Processing and Machine Learning Pranesh Kulkarni1 , Atharva Karwande1 , Tejas Kolhe1 , Soham Kamble1 , Akshay Joshi1 , Medha Wyawahare1 1 Department of Electronics and Telecommunication, Vishwakarma Institute of Technology. https://arxiv.org/ftp/arxiv/papers/2106/2106.10698.pdf

[3]. Zhen Nan Liu, et al., (2018), In this paper, authors have compared different machine learning algorithms for calculating, Standardised Precipitation Index (SPI) and SPEI. After data collection, Extreme learning methods, Online sequential extreme learning machine, Selfadaptive evolutionary extreme learning machine. Authors claimed that all three algorithms can be applied successfully on drought forecasting. However, OS-ELM and SADE- ELM performs better than ELM.

[4]. K. G. Liakos et al., (2018) presented a comprehensive review of research dedicated to machine learning applications in agriculture domain. Various parameters on which work was analysed were: crop management, livestock management, water management and soil management. ML models have applied for crop yield prediction and disease detection. ML based

detection can be extracted without the need of fusion of data from other resources. Author claims that farm management systems are evlvong into real artificial intelligent systems, with the ultimate scope of production improvement. Author motivates to use ML for the benefit of agriculture as it is the basic need amongst all other needs for survival.

[5]. S. D. Khirade, A. B. Patil, "Plant Disease Detection Using Image Processing", 2015 International Conference on Computing Communication Control and Automation, 2015, pp. 768-771, doi: 10.1109/ICCUBEA.2015.153

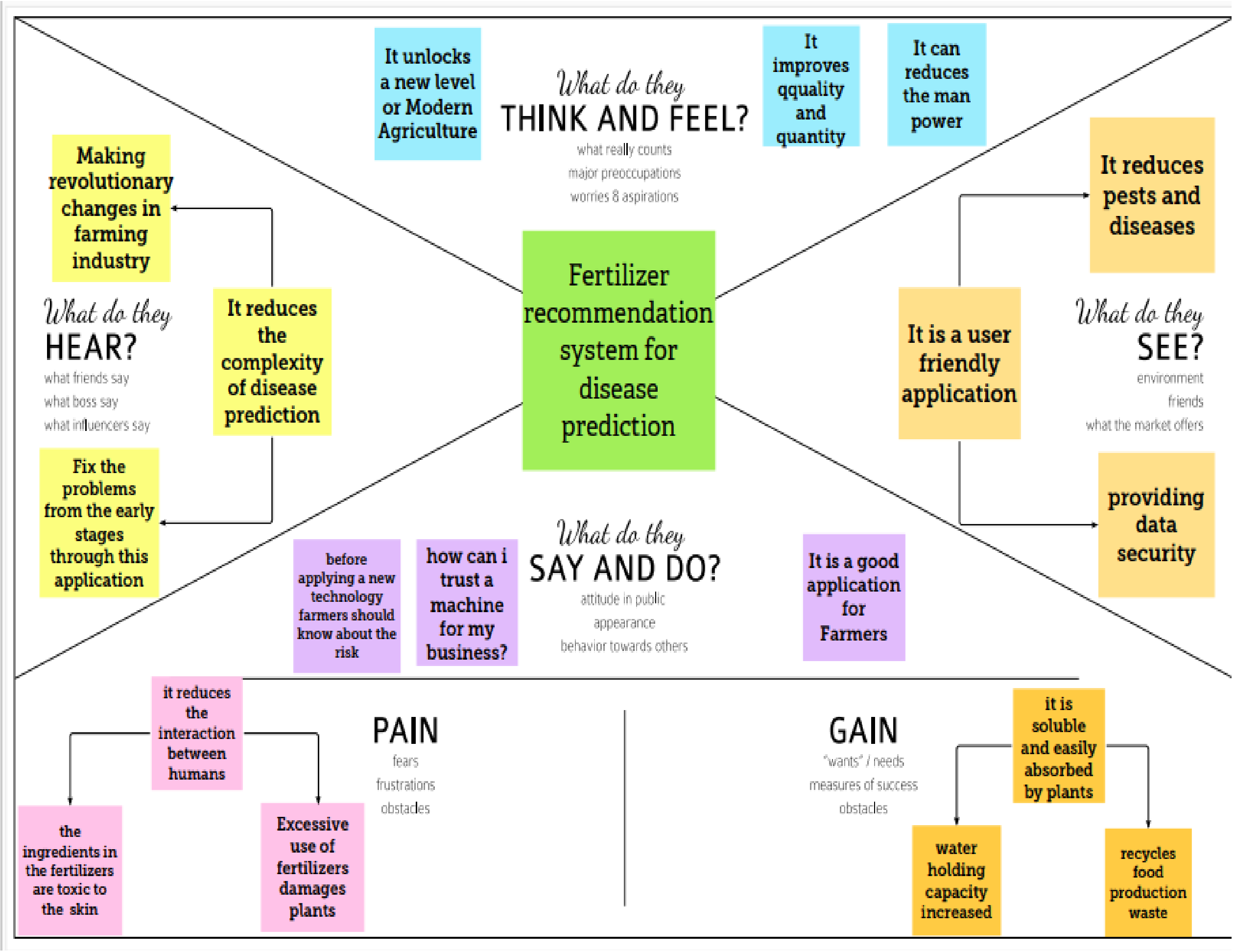
2.2 Problem Statement Definition

Problem Statement (PS)	**I am**	**I'm trying to**	**But**	**Because**	**Which makes me feel**
PS-1	Farmer	Find the solution for the disease.	I was not able to find the resources.	There was no centralized and organized information about diseases.	Helpless and hopeless.
PS-2	Student	Learn about the diseases and their appropriate fertilizers for curing.	I did not have enough capital for the gain of knowledge.	I was not able to find the free resources.	Clueless and unguided.

3 IDEATION & PROPOSED SOLUTION

Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.
It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.


It unlocks a new level or Modern Agriculture
What do they
THINK AND FEEL?
what really counts
major preoccupations
worries & aspirations
It improves qquality and quantity
It can reduces the man power
Making revolutionary changes in farming industry
What do they
HEAR?
what friends say
what boss say
what influencers say
It reduces the complexity of disease prediction
Fix the problems from the early stages through this application
Fertilizer recommendation system for disease prediction
It reduces pests and diseases
It is a user friendly application
What do they
SEE?
environment
friends
what the market offers
providing data security
before applying a new technology farmers should know about the risk
how can i trust a machine for my business?
What do they
SAY AND DO?
attitude in public
appearance
behavior towards others
It is a good application for Farmers
it reduces the interaction between humans
PAIN
fears
frustrations
obstacles
the ingredients in the fertilizers are toxic to the skin
Excessive use of fertilizers damages plants
GAIN
"wants" / needs
measures of success
obstacles
it is soluble and easily absorbed by plants
water holding capacity increased
recycles food production waste

Ideation & Brainstorming

Ideation and Brainstorming are performed to generate ideas and solutions. Brainstorming is a group activity unlike ideation.

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

Brainstorm

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

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

PROBLEM

1) In agricultural aspects, if the plant is affected by leaf disease, then it reduces the growth and productiveness. Generally, the plant diseases are caused by the abnormal physiological Functionalities of plants.

2) People who Grow Crops and facing issues of Plant Disease .

3) The Traditional methods of Fertilizer prediction and Disease analysis are Expensive and takes a lot of time .

Key rules of brainstorming

To ru an smooth and productive session

Stay in topic.

Encourage wild ideas.

Defer judgment.

Listen to others.

Go for volume.

If possible, be visual.

Jeniffer E J

Website for Fertilizer recommendation

Identify the disease

Determining best fertilizer

User friendly website

It reduces man power

Smart solution to solve the problem

Sorna k

Pre-trained model for image classification

Build keras image classification model

Making revolutionary changes in agriculture field

It simplifies the farmers work

Cost of using this application is less

They can find the diseases at early stages

YeshwantH R A

Deep learning based mathematical model for detecting diseases

Early detection and management of problem

Better utilization of available resources

Interactive user interface to upload images

Improves productivity

Interactive user interface to upload images

Vimal Raj P

Fertilizer Recommendation

Instant solution

Useful to people with no prior knowledge

Admin can view the recommended fertilizer through gmail

It will save time

Portal for farmers

Category 1

Website for Fertilizer recommendation

Identify the disease

Cost of using this application is less

Interactive user interface to upload images

Useful to people with no prior knowledge

Portal for farmers

Category 2

Pre-trained model for image classification

Deep learning based mathematical model for detecting diseases

Build keras image classification model

Interactive user interface to upload images

Making revolutionary changes in agriculture field

Early detection and management of problem

Category 3

Instant solution

Admin can view the recommended fertilizer through gmail

Better utilization of available resources

They can find the diseases at early stages

Smart solution to solve the problem

Cost of using this application is less

Quick add-ons

A **Share the mural**
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

B **Export the mural**
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint

Define the components of a new idea or strategy.

Open the template

Customer experience journey map

Understand customer needs, motivations, and obstacles for an experience.

Open the template

Strengths, weaknesses, opportunities & threats

Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.

Open the template

Share template feedback

Better utilization of available resources

Admin can view the recommended fertilizer through gmail

Pre-trained model for image classification

Website for Fertilizer recommendation

Deep learning based mathematical model for detecting diseases

Interactive user interface to upload images

They can find the diseases at early stages

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Making revolutionary changes in agriculture field

Instant solution

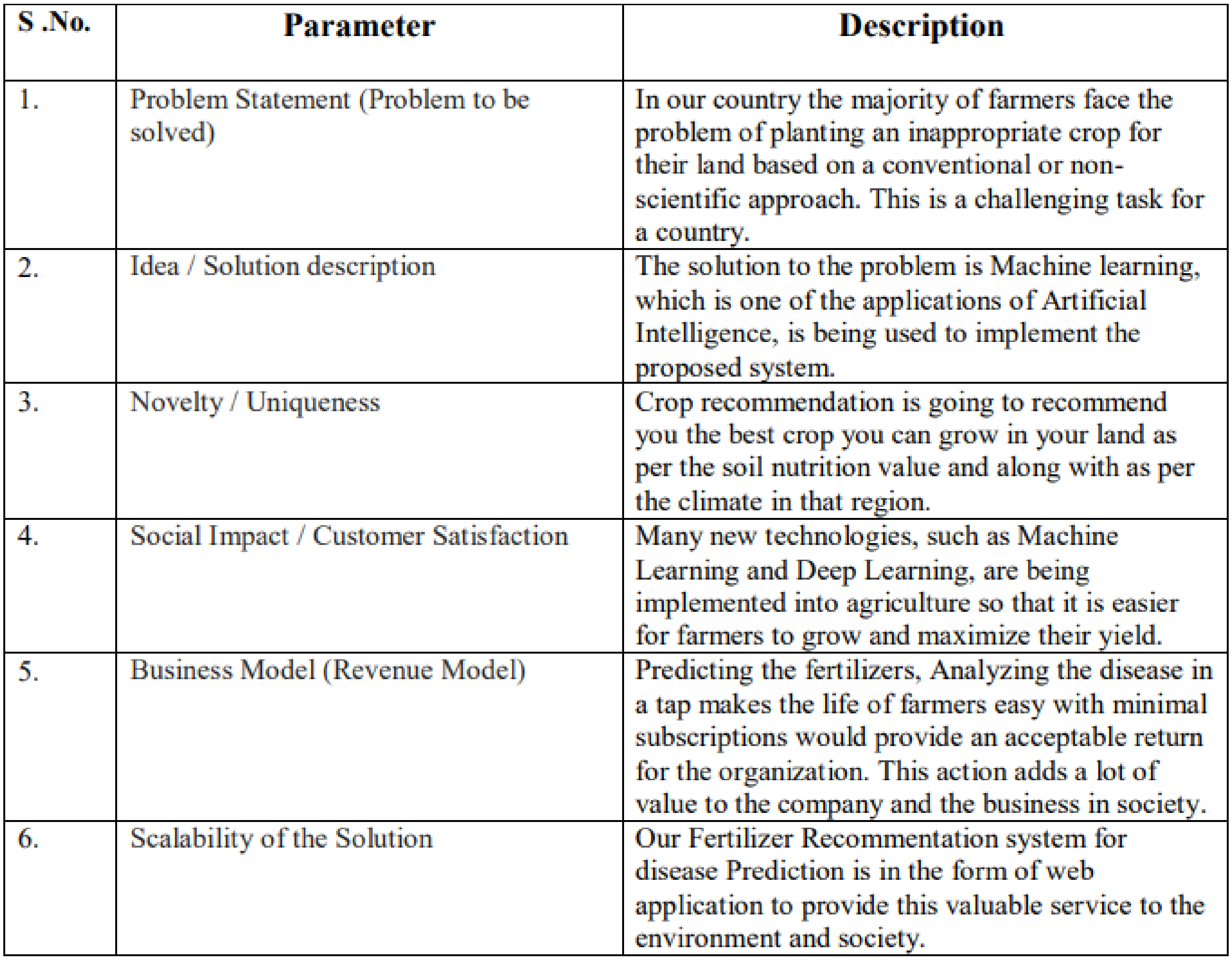
Useful to people with no prior knowledge

Cost of using this application is less

Early detection and management of problem

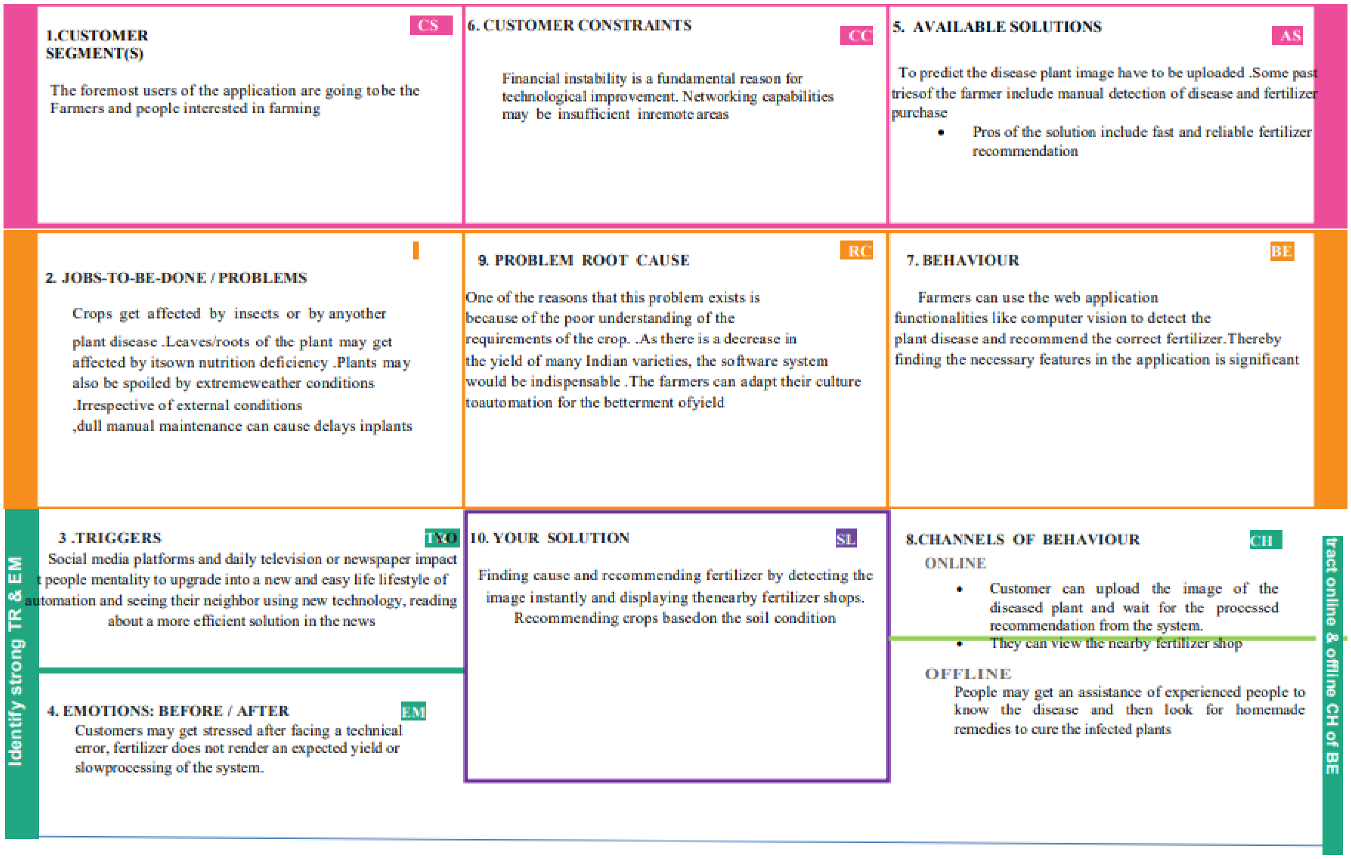
It simplifies the farmers work

Proposed Solution



S .No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	In our country the majority of farmers face the problem of planting an inappropriate crop for their land based on a conventional or non-scientific approach. This is a challenging task for a country.
2.	Idea / Solution description	The solution to the problem is Machine learning, which is one of the applications of Artificial Intelligence, is being used to implement the proposed system.
3.	Novelty / Uniqueness	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.
4.	Social Impact / Customer Satisfaction	Many new technologies, such as Machine Learning and Deep Learning, are being implemented into agriculture so that it is easier for farmers to grow and maximize their yield.
5.	Business Model (Revenue Model)	Predicting the fertilizers, Analyzing the disease in a tap makes the life of farmers easy with minimal subscriptions would provide an acceptable return for the organization. This action adds a lot of value to the company and the business in society.
6.	Scalability of the Solution	Our Fertilizer Recommentation system for disease Prediction is in the form of web application to provide this valuable service to the environment and society.

Problem Solution Fit



1.CUSTOMER SEGMENT(S)

CS

The foremost users of the application are going tobe the Farmers and people interested in farming

6. CUSTOMER CONSTRAINTS

CC

Financial instability is a fundamental reason for technological improvement. Networking capabilities may be insufficient inremote areas

5. AVAILABLE SOLUTIONS

AS

To predict the disease plant image have to be uploaded .Some past triesof the farmer include manual detection of disease and fertilizer purchase

- Pros of the solution include fast and reliable fertilizer recommendation

2. JOBS-TO-BE-DONE / PROBLEMS

Crops get affected by insects or by anyother plant disease .Leaves/roots of the plant may get affected by itsown nutrition deficiency .Plants may also be spoiled by extremeweather conditions .Irrespective of external conditions ,dull manual maintenance can cause delays inplants

9. PROBLEM ROOT CAUSE

RC

One of the reasons that this problem exists is because of the poor understanding of the requirements of the crop. .As there is a decrease in the yield of many Indian varieties, the software system would be indispensable .The farmers can adapt their culture toautomation for the betterment ofyield

7. BEHAVIOUR

BE

Farmers can use the web application functionalities like computer vision to detect the plant disease and recommend the correct fertilizer.Thereby finding the necessary features in the application is significant

Identify strong TR & EM

3 .TRIGGERS

TYO

Social media platforms and daily television or newspaper impact t people mentality to upgrade into a new and easy life lifestyle of automation and seeing their neighbor using new technology, reading about a more efficient solution in the news

4. EMOTIONS: BEFORE / AFTER

EM

Customers may get stressed after facing a technical error, fertilizer does not render an expected yield or slowprocessing of the system.

10. YOUR SOLUTION

SL

Finding cause and recommending fertilizer by detecting the image instantly and displaying thenearby fertilizer shops. Recommending crops basedon the soil condition

8.CHANNELS OF BEHAVIOUR

CH

ONLINE

- Customer can upload the image of the diseased plant and wait for the processed recommendation from the system.
- They can view the nearby fertilizer shop

OFFLINE

People may get an assistance of experienced people to know the disease and then look for homemade remedies to cure the infected plants

tract online & offline CH of BE

4 REQUIREMENT ANALYSIS

a. Functional Requirement

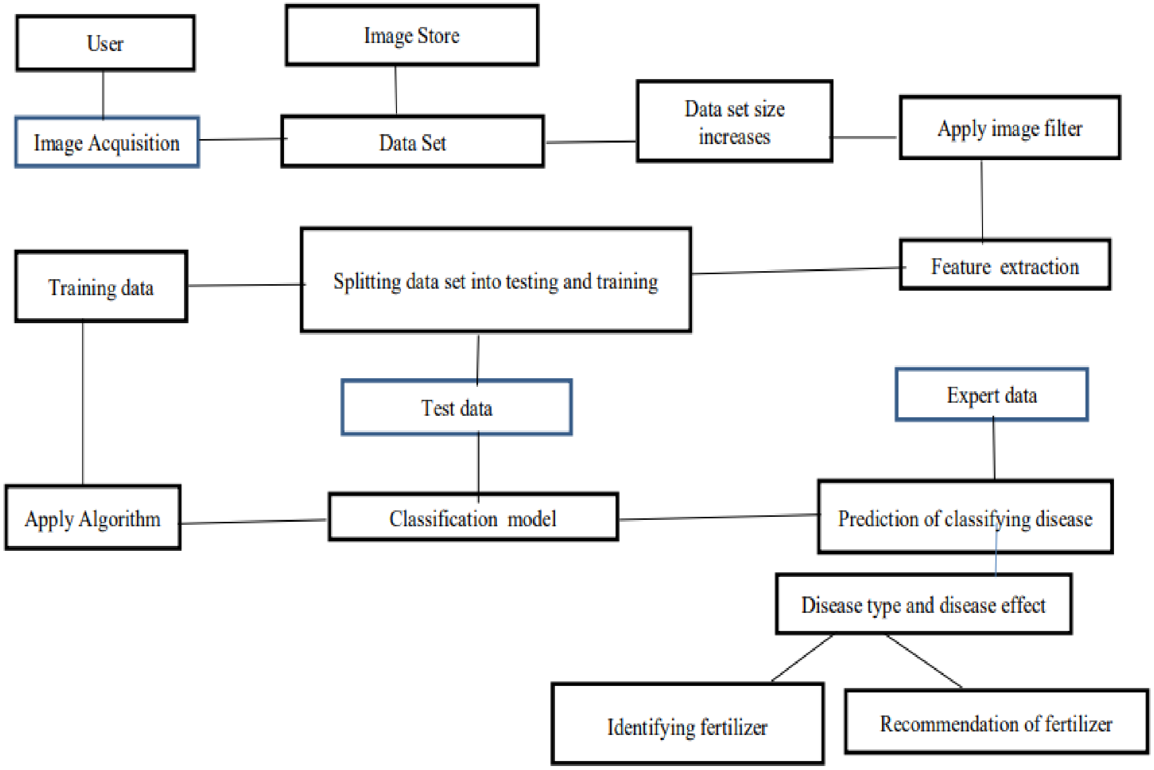
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Mobile Number Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Capturing Image	Capture the pictures of the infected leaves and upload it for the recognition of the disease
FR-4	Image Processing	The user uploads the images and those images will be processed and prediction of disease will be done
FR-5	Disease prediction	Using the images and trained datasets, the model will identify the accurate crop disease
FR-6	Fertilizer Recommendation	Using the inputs and trained datasets, suitable fertilizers will be suggested for the diseases

b. Non-Functional Requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Considering the level of knowledge possessed by the users of this system, it is developed as more user friendly and ease of use is the key feature.
NFR-2	**Security**	The subsystem should provide a high level of security and integrity of the data, only authorized personnel can gain access with valid password and username to view user's page
NFR-3	**Reliability**	The system provides a relatively high degree of consistency and executes its intended functions adequately without failure
NFR-4	**Performance**	On focussing its functionality, the system shows an efficient performance and never lets down its consistent state
NFR-5	**Availability**	The system will be available for all the time for all the users with its related features
NFR-6	**Scalability**	The system is even more efficient for large number of inputs and user scale.

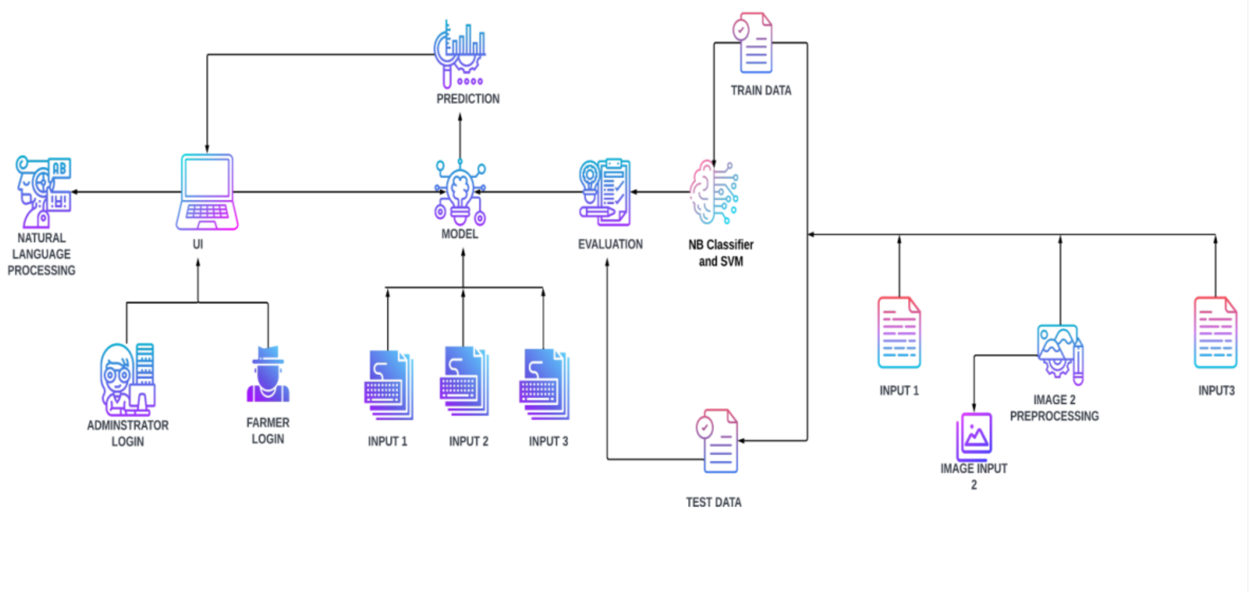
5 PROJECT DESIGN

a. Data Flow Diagrams



b. Solution & Technical Architecture

Solution architecture is the process of developing solutions based on predefined processes, guidelines and best practices with the objective that the developed solution fits within the enterprise architecture in terms of information architecture, system portfolios, integration requirements, etc.



c. 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	Confirmation through email	High	Sprint-1
	Login	USN-3	As a user, I can register for the application through Facebook	Login detail were made is successful.	High	Sprint-1
	Dashboard	USN-4	As a user, I can register for the application through Gmail		Low	Sprint-2
Customer (Web user)	Registration	USN-1	As a user, I can log into the application by entering email & password and confirmation through mail	They can access the account details and dashboard.	High	Sprint-1
Customer Care Executive	Login	USN-1	Login into the executive portal to help the user	Help in accessing the moment and the access	High	Sprint-1
Administrator	Help dashboard	USN-2	Can provide the necessary details of help through desired way like mobile, email, phone and SMS		Medium	
	User account control	USN-1	The person or administrator who is responsible for the website control and other management activities.	Provides support to the team or the individual	High	Sprint-1

6 PROJECT PLANNING & SCHEDULING

a. Sprint Planning & Estimation

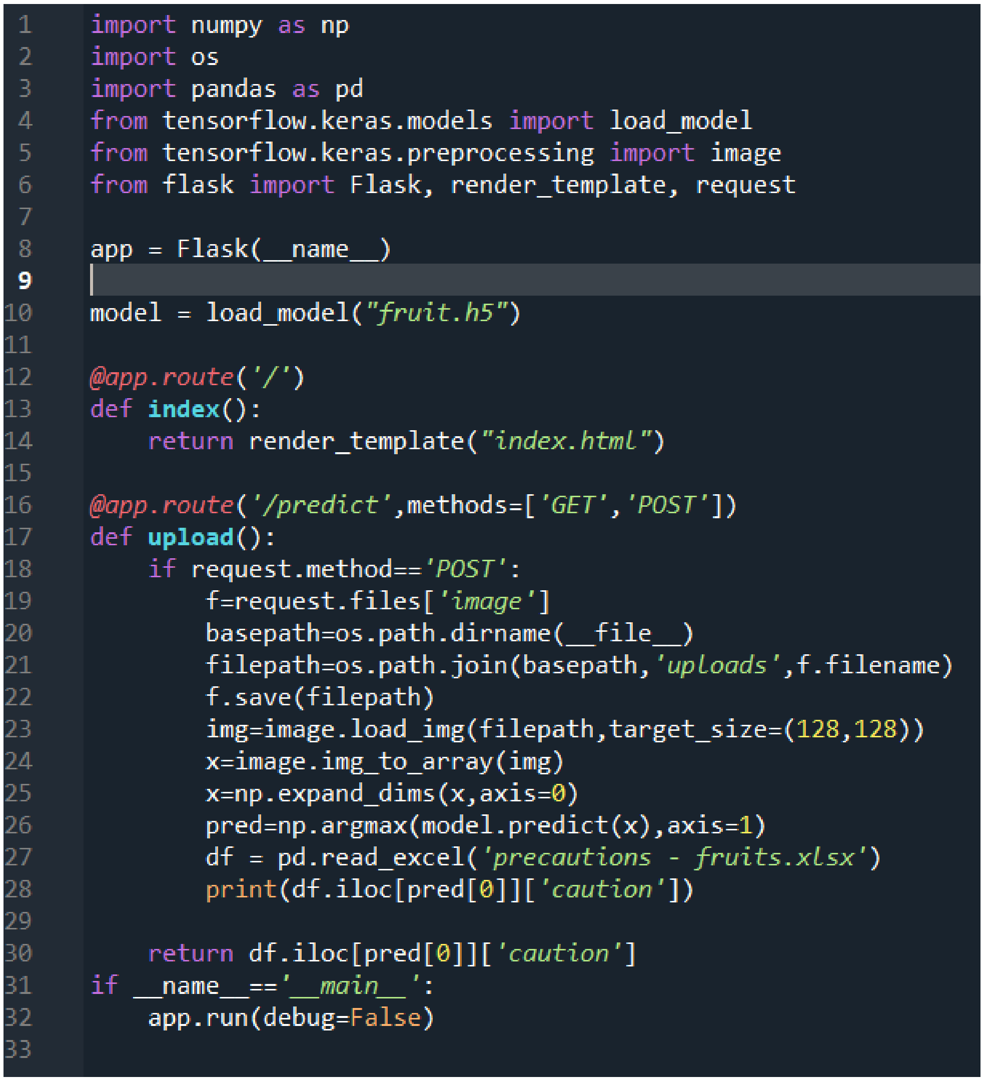
Sprint	Functional Requirement (Epic)	User Number Story	User Story/Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application using email and password.	5	High	Jeniffer Sorna Vimalraj Yeshwanth
Sprint-1	Pre-processing	USN-2	All the data that are collected is cleaned and uploaded in the database or IBM cloud.	8	Medium	Jeniffer Sorna Vimalraj Yeshwanth
Sprint-2	Analyze	USN-3	The uploaded data are completely analyzed and making of predictions are done.	8	Medium	Jeniffer Sorna Vimalraj Yeshwanth
Sprint-3	Dashboard	USN-4	Once getting logged in, I can use dashboard menu and capture images and upload images and update.	5	Medium	Jeniffer Sorna Vimalraj Yeshwanth
Sprint-4	Visualization	USN-5	I can visualize the list of available diseases and their suitable fertilizer in the list.	5	High	Jeniffer Sorna Vimalraj Yeshwanth
Sprint-4	Prediction	USN-6	We can Protect the crops from the diseases by predicting suitable fertilizers.	5	High	Jeniffer Sorna Vimalraj Yeshwanth

b. Sprint Delivery Schedule

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

7 CODING & SOLUTIONING

a. Python – app_feretilizer.py



```python
import numpy as np
import os
import pandas as pd
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from flask import Flask, render_template, request

app = Flask(__name__)

model = load_model("fruit.h5")

@app.route('/')
def index():
    return render_template("index.html")

@app.route('/predict',methods=['GET','POST'])
def upload():
    if request.method=='POST':
        f=request.files['image']
        basepath=os.path.dirname(__file__)
        filepath=os.path.join(basepath,'uploads',f.filename)
        f.save(filepath)
        img=image.load_img(filepath,target_size=(128,128))
        x=image.img_to_array(img)
        x=np.expand_dims(x,axis=0)
        pred=np.argmax(model.predict(x),axis=1)
        df = pd.read_excel('precautions - fruits.xlsx')
        print(df.iloc[pred[0]]['caution'])

    return df.iloc[pred[0]]['caution']
if __name__=='__main__':
    app.run(debug=False)
```

b. Index.html

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

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>Fertilizer Recommented System and Disease Prediction</title>
    <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">
    <script
src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
    <script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
    <script
src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
    <link href="{{ url_for('static', filename='css/main.css') }}"
rel="stylesheet">
```

```
 <style>

        .bg-dark {
            background-color: #7CFC00!important;
        }
        #result {
            color: #000f;
        }
 body
{
    background-image: url("https://wallpaperaccess.com/full/327148.jpg");
    background-size: cover;
}

 </style>
</head>

<body>

    <nav class="navbar navbar-dark bg-dark">
        <div class="container">
            <a class="navbar-brand" href="#"><center><b>CROfl DISEASE
flREDICTION</b></center></a>
        </div>
    </nav>
    <div class="container">
        <div id="content" style="margin-top:2em">
        <div class="container">
          <div class="row">
               <div class="col-sm-6 bd">
                 <h3>flant Disease flrediction: </h3>
                 <br>
                 <p>Agriculture is one of the major sectors world wide over the
years it has developed and the use of new technologies and equipment replaced
almost all the traditional methods of farming . the plant diseases affect the
production , Identification of disesases and taking necessary precautions are
done through naked eye , which requires labour and labratries . This
application helps farmers in detecting thr diseases by observing the spots and
the leaves , which in turn saves effort and labour costs .</p>
                      <img src="http://www.geocities.ws/senthilirtt/First.jpg"
height="50%",width="20%">
               </div>
               <div class="col-sm-6">
                      <div>
                             <h4>Upload Image Here To Identify the flant
Disease</h4>
               <form action = "http://localhost:5000/" id="upload-file"
method="post" enctype="multipart/form-data">
                      <label for="imageUpload" class="upload-label">
                             Choose...
                      </label>
                      <input type="file" name="image" id="imageUpload"
accept=".png, .jpg, .jpeg">
               </form>


               <div class="image-section" style="display:none;">
                      <div class="img-preview">
```

```
                    <div id="imagePreview">
                    </div>
                </div>
                <div>
                    <button type="button" class="btn btn-info btn-lg "
id="btn-predict">Predict!</button>
                </div>
            </div>

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

            <h3>
                <span id="result"> </span>
            </h3>

        </div>
            </div>

          </div>
        </div>
        </div>
    </div>
</body>

<footer>
    <script src="{{ url_for('static', filename='js/main.js') }}"
type="text/javascript"></script>
</footer>

</html>
```

c. main.css

```
.img-preview {
    width: 256px;
    height: 256px;
    position: relative;
    border: 5px solid #F8F8F8;
    box-shadow: 0px 2px 4px 0px rgba(0, 0, 0, 0.1);
    margin-top: 1em;
    margin-bottom: 1em;
}

.img-preview>div {
    width: 100%;
    height: 100%;
    background-size: 256px 256px;
    background-repeat: no-repeat;
    background-position: center;
}

input[type="file"] {
    display: none;
}

.upload-label{
    display: inline-block;
    padding: 12px 30px;
    background: #39D2B4;
    color: #fff;
    font-size: 1em;
    transition: all .4s;
    cursor: pointer;
}

.upload-label:hover{
    background: #34495E;
    color: #39D2B4;
}

.loader {
    border: 8px solid #f3f3f3; /* Light grey */
    border-top: 8px solid #3498db; /* Blue */
    border-radius: 50%;
    width: 50px;
    height: 50px;
    animation: spin 1s linear infinite;
}

@keyframes spin {
    0% { transform: rotate(0deg); }
    100% { transform: rotate(360deg); }
}
```

d. **main.js**

```
$(document).ready(function () {
    // Init
    $('.image-section').hide();
    $('.loader').hide();
    $('#result').hide();

    // Upload flreview
    function readURL(input) {
        if (input.files && input.files[0]) {
            var reader = new FileReader();
            reader.onload = function (e) {
                $('#imageflreview').css('background-image', 'url(' +
e.target.result + ')');
                $('#imageflreview').hide();
                $('#imageflreview').fadeIn(650);
            }
            reader.readAsDataURL(input.files[0]);
        }
    }
    $("#imageUpload").change(function () {
        $('.image-section').show();
        $('#btn-predict').show();
        $('#result').text('');
        $('#result').hide();
        readURL(this);
    });

    // flredict
    $('#btn-predict').click(function () {
        var form_data = new FormData($('#upload-file')[0]);

        // Show loading animation
```

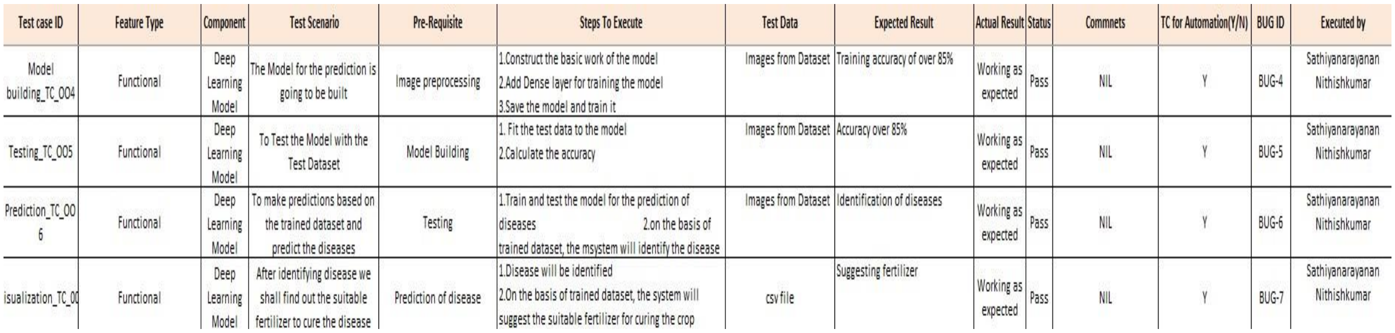
```
            $(this).hide();
            $(".loader").show();

            // Make prediction by calling api /predict
            $.ajax({
                type: "flOST",
                url: "/predict",
                data: form_data,
                contentType: false,
                cache: false,
                processData: false,
                async: true,
                success: function (data) {
                    // Get and display the result
                    $(".loader").hide();
                    $("#result").fadeIn(600);
                    $("#result").text(" Result:   " + data);
                    console.log("Success!");
                },
            });
        });

    });
```

8 TESTING

a. Test Cases



Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Commnets	TC for Automation(Y/N)	BUG ID	Executed by
Model building_TC_OO4	Functional	Deep Learning Model	The Model for the prediction is going to be built	Image preprocessing	1.Construct the basic work of the model 2.Add Dense layer for training the model 3.Save the model and train it	Images from Dataset	Training accuracy of over 85%	Working as expected	Pass	NIL	Y	BUG-4	Sathiyanarayanan Nithishkumar
Testing_TC_OO5	Functional	Deep Learning Model	To Test the Model with the Test Dataset	Model Building	1. Fit the test data to the model 2.Calculate the accuracy	Images from Dataset	Accuracy over 85%	Working as expected	Pass	NIL	Y	BUG-5	Sathiyanarayanan Nithishkumar
Prediction_TC_OO6	Functional	Deep Learning Model	To make predictions based on the trained dataset and predict the diseases	Testing	1.Train and test the model for the prediction of diseases 2.on the basis of trained dataset, the msystem will identify the disease	Images from Dataset	Identification of diseases	Working as expected	Pass	NIL	Y	BUG-6	Sathiyanarayanan Nithishkumar
isualization_TC_O0	Functional	Deep Learning Model	After identifying disease we shall find out the suitable fertilizer to cure the disease	Prediction of disease	1.Disease will be identified 2.On the basis of trained dataset, the system will suggest the suitable fertilizer for curing the crop	csv file	Suggesting fertilizer	Working as expected	Pass	NIL	Y	BUG-7	Sathiyanarayanan Nithishkumar

b. User Acceptance Testing

1. Purpose of Document

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

2. 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
Leaf Spots	10	4	2	3	19
Mosaic Leaf Pattern	9	6	3	0	24
Blights	4	5	2	1	12
Yellow leaves	11	4	3	20	38
Fruit rots	3	2	1	1	6
Misshapen leaves	2	7	1	0	10
Fruits spots	5	4	2	1	11
Totals	44	31	13	13	120

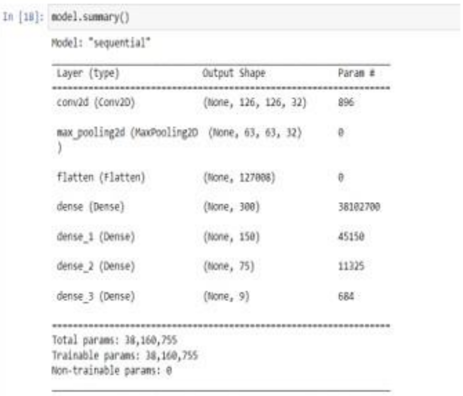
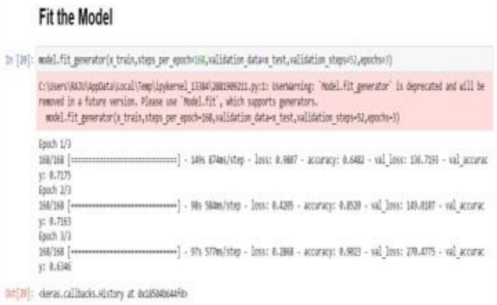
3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Leaf spots	18	0	0	18
Fruit spots	5	0	0	5
Mosaic leaf pattern	43	0	0	43
Blights	2	0	0	2
Misshapen Leaves	25	0	0	25
Yellow leaves	7	0	0	7
Fruit rots	9	0	0	9

9 RESULTS

a. Performance Metrics

S.No.	Parameter	Values	Screenshot
1.	Model Summary	Total params: 38,160,755 Trainable params: 38,160,755 Non-Trainable params: 0	 In [18]: model.summary() Model: "sequential" Layer (type) Output Shape Param # conv2d (Conv2D) (None, 126, 126, 32) 896 max_pooling2d (MaxPooling2D (None, 63, 63, 32) 0) flatten (Flatten) (None, 127008) 0 dense (Dense) (None, 300) 38102700 dense_1 (Dense) (None, 150) 45150 dense_2 (Dense) (None, 75) 11325 dense_3 (Dense) (None, 9) 684 Total params: 38,160,755 Trainable params: 38,160,755 Non-trainable params: 0
2.	Accuracy	Training Accuracy – 97.55 Validation Accuracy – 96.45	 Fit the Model In [20]: model.fit_generator(x_train,steps_per_epoch=168,validation_data=x_test,validation_steps=52,epochs=3) C:\Users\RAJU\AppData\Local\Temp\ipykernel_13384\2881909211.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators. model.fit_generator(x_train,steps_per_epoch=168,validation_data=x_test,validation_steps=52,epochs=3) Epoch 1/3 168/168 [==============================] - 149s 874ms/step - loss: 0.9807 - accuracy: 0.6482 - val_loss: 136.7193 - val_accuracy: 0.7175 Epoch 2/3 168/168 [==============================] - 98s 584ms/step - loss: 0.4205 - accuracy: 0.8520 - val_loss: 149.0187 - val_accuracy: 0.7163 Epoch 3/3 168/168 [==============================] - 97s 577ms/step - loss: 0.2868 - accuracy: 0.9023 - val_loss: 270.4775 - val_accuracy: 0.6346 Out[20]: <keras.callbacks.History at 0x18504b644f0>

10 ADVANTAGES & DISADVANTAGESAdvantages

- Early detection of plant diseases.
- Proper fertilizer recommendation to prevent or cure the plant infection or disease.
- No need to consult any specialists.
- Fully automated system.

Disadvantages

- Requires training the system with large dataset.
- Works only on the pretrained diseases.
- When a plant is infected with multiple diseases the system may not predict all the diseases due to the mixed symptoms.
- Requires a good device connected to the internet.

11 CONCLUSION

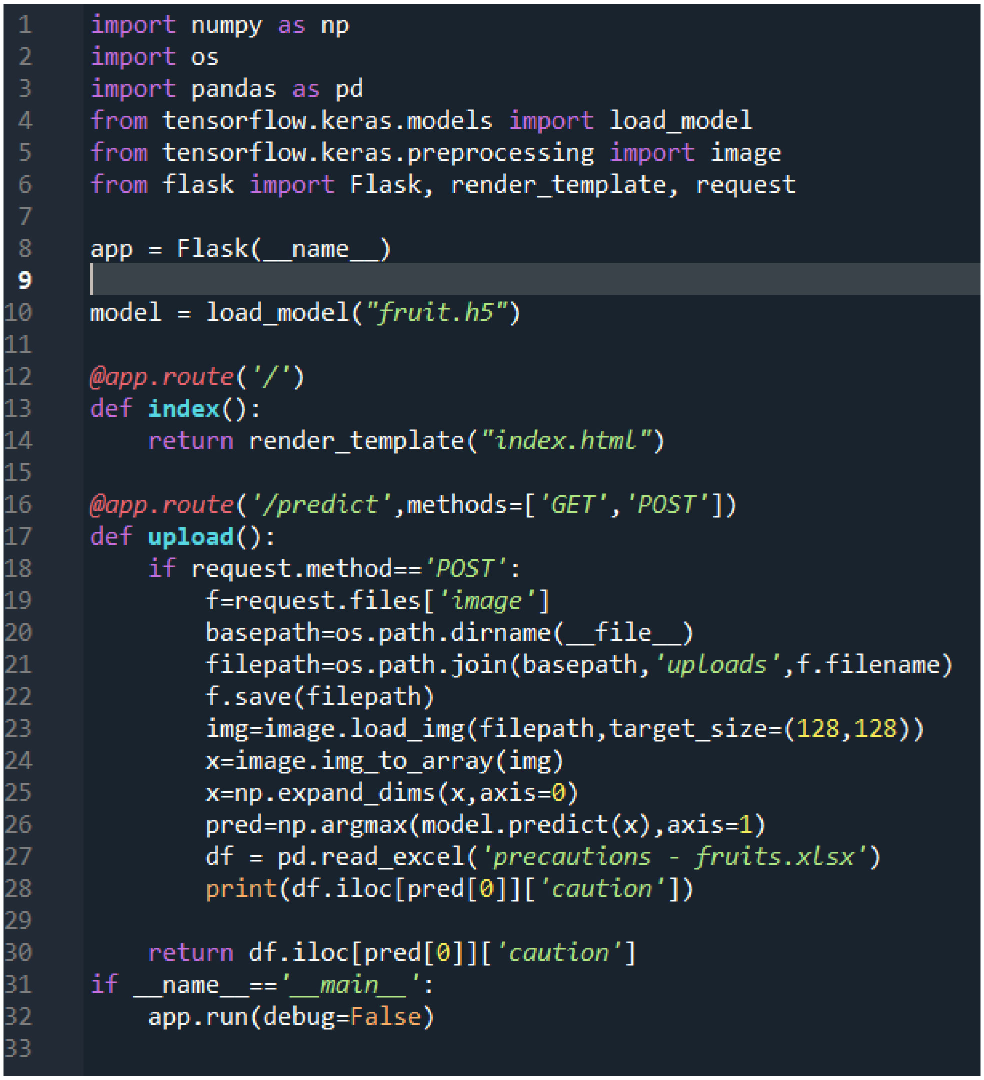
The procedure starts from collecting the images used for training, testing and validation to image preprocessing and augmentation and finally comparison of different pretrained models over their accuracy. Finally, at the end, our model detects and distinguishes between a healthy plant and different diseases 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.

12 FUTURE SCOPE

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.

13 APPENDIX

Source code



```python
import numpy as np
import os
import pandas as pd
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from flask import Flask, render_template, request

app = Flask(__name__)

model = load_model("fruit.h5")

@app.route('/')
def index():
    return render_template("index.html")

@app.route('/predict',methods=['GET','POST'])
def upload():
    if request.method=='POST':
        f=request.files['image']
        basepath=os.path.dirname(__file__)
        filepath=os.path.join(basepath,'uploads',f.filename)
        f.save(filepath)
        img=image.load_img(filepath,target_size=(128,128))
        x=image.img_to_array(img)
        x=np.expand_dims(x,axis=0)
        pred=np.argmax(model.predict(x),axis=1)
        df = pd.read_excel('precautions - fruits.xlsx')
        print(df.iloc[pred[0]]['caution'])

    return df.iloc[pred[0]]['caution']
if __name__=='__main__':
    app.run(debug=False)

```

Python – app_feretilizer.py

index.html

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

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>Fertilizer Recommented System and Disease Prediction</title>
    <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">
    <script
src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
    <script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
    <script
src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
    <link href="{{ url_for('static', filename='css/main.css') }}"
rel="stylesheet">
  <style>

        .bg-dark {
            background-color: #7CFC00!important;
        }
        #result {
            color: #000f;
        }
  body
{
    background-image: url("https://wallpaperaccess.com/full/327148.jpg");
    background-size: cover;
}

  </style>
</head>

<body>

    <nav class="navbar navbar-dark bg-dark">
        <div class="container">
            <a class="navbar-brand" href="#"><center><b>CROfl DISEASE
flREDICTION</b></center></a>
        </div>
    </nav>
    <div class="container">
        <div id="content" style="margin-top:2em">
        <div class="container">
          <div class="row">
              <div class="col-sm-6 bd">
                <h3>flLant Disease flrediction: </h3>
                <br>
                <p>Agriculture is one of the major sectors world wide over the
years it has developed and the use of new technologies and equipment replaced
almost all the traditional methods of farming . the plant diseases affect the
production , Identification of disesases and taking necessary precautions are
done through naked eye , which requires labour and labraties . This
application helps farmers in detecting thr diseases by observing the spots and
the leaves , which in turn saves effort and labour costs .</p>
                    <img src="http://www.geocities.ws/senthilirtt/First.jpg"
height="50%",width="20%">
              </div>
              <div class="col-sm-6">
                    <div>
                           <h4>Upload Image Here To Identify the flLant
Disease</h4>
              <form action = "http://localhost:5000/" id="upload-file"
method="post" enctype="multipart/form-data">
                    <label for="imageUpload" class="upload-label">
                           Choose...
                    </label>
                    <input type="file" name="image" id="imageUpload"
accept=".png, .jpg, .jpeg">
              </form>
```

```
                <div class="image-section" style="display:none;">
                    <div class="img-preview">
                        <div id="imageflreview">
                        </div>
                    </div>
                    <div>
                        <button type="button" class="btn btni nfo btn-lg "
id="btn-predict">flredict!</button>
                    </div>
                </div>

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

                <h3>
                    <span id="result"> </span>
                </h3>

            </div>
                </div>

             </div>
            </div>
            </div>
    </div>
</body>

<footer>
    <script src="{{ url_for('static', filename='js/main.js') }}"
type="text/javascript"></script>
</footer>

</html>
```

main.css

```
.img-preview {
    width: 256px;
    height: 256px;
    position: relative;
    border: 5px solid #F8F8F8;
    box-shadow: 0px 2px 4px 0px rgba(0, 0, 0, 0.1);
    margin-top: 1em;
    margin-bottom: 1em;
}

.img-preview>div {
    width: 100%;
    height: 100%;
    background-size: 256px 256px;
    background-repeat: no-repeat;
    background-position: center;
}

input[type="file"] {
    display: none;
}

.upload-label{
    display:inline-block;
    padding: 12px 30px;
    background: #39D2B4;
    color: #fff;
    font-size: 1em;
    transition: all .4s;
    cursor: pointer;
}

.upload-label:hover{
    background: #34495E;
    color: #39D2B4;
}

.loader {
    border: 8px solid #f3f3f3; /* Light grey */
    border-top: 8px solid #3498db; /* Blue */
    border-radius: 50%;
    width: 50px;
    height: 50px;
    animation: spin 1s linear infinite;
}

@keyframes spin {
    0% { transform: rotate(0deg); }
    100% { transform: rotate(360deg); }
}
```

main.js

```
 $(document).ready(function () {
     // Init
     $(".image-section").hide();
     $(".loader").hide();
     $("#result").hide();

     // Upload flreview
     function readURL(input) {
         if (input.files && input.files[0]) {
             var reader = new FileReader();
             reader.onload = function (e) {
                 $("#imageflreview").css("background-image", "url(" +
 e.target.result + ")");
                 $("#imageflreview").hide();
                 $("#imageflreview").fadeIn(650);
             }
             reader.readAsDataURL(input.files[0]);
         }
     }
     $("#imageUpload").change(function () {
         $(".image-section").show();
         $("#btn-predict").show();
         $("#result").text("");
         $("#result").hide();
```

```
        readURL(this);
    });

    // flredict
    $("#btn-predict").click(function () {
        var form_data = new FormData($("#upload-file")[0]);

        // Show loading animation
        $(this).hide();
        $(".loader").show();

        // Make prediction by calling api /predict
        $.ajax({
            type: "flOST",
            url: "/predict",
            data: form_data,
            contentType: false,
            cache: false,
            processData: false,
            async: true,
            success: function (data) {
                // Get and display the result
                $(".loader").hide();
                $("#result").fadeIn(600);
                $("#result").text(" Result:   " + data);
                console.log("Success!");
            },
        });
    });

});
```

Fruit Model

Image Pre-processing

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(r'C:\Users\RAJU\OneDrive\Desktop\Sathiya\IBM\Dataset Plant Disease\fruit-dataset\fruit-dataset\train',target_size=(128,128),batch_size=32,class_mode='categorical')

x_test=test_datagen.flow_from_directory(r'C:\Users\RAJU\OneDrive\Desktop\Sathiya\IBM\Dataset Plant Disease\fruit-dataset\fruit-dataset\train',target_size=(128,128),

from tensorflow.keras.models import Sequential

from tensorflow.keras.layers import Dense,Convolution2D,MaxPool2D,Flatten

model=Sequential()

Adding CNN Layers

```
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
x_train.class_indices
model.add(MaxPool2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(40, kernel_initializer='uniform',activation='relu'))
model.add(Dense(20, kernel_initializer='random_uniform',activation='relu'))
model.add(Dense(6,activation='softmax', kernel_initializer='random_uniform'))
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
len(x_train)
5384/32
```

Fitting The Model

```
model.fit_generator(x_train,steps_per_epoch=168,validation_data=x_test,validation_steps=52,epochs=3)
model.save("fruit.h5")
ls
from keras.preprocessing import image
from tensorflow.keras.preprocessing.image import img_to_array
from tensorflow.keras.models import load_model
import numpy as np
model = load_model("fruit.h5")
```

Testing Model

```
import keras.utils as image
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/fruit-dataset/fruit-dataset/test/Apple___healthy/00fca0da-2db3-481b-b98a-9b67bb7b105c___RS_HL 7708.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
pred
```

```
index
=['Apple___Black_rot','Apple___healthy','Corn_(maize)___Northern_Leaf_Blight','Corn_(maize)_
__healthy','Peach___Bacterial_spot','Peach___healthy']
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant
Disease/fruit-dataset/fruit-dataset/test/Apple___Black_rot/0f3d45f4-e121-42cd-a5b6-
be2f866a0574___JR_FrgE.S 2870.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant
Disease/fruit-dataset/fruit-dataset/test/Corn_(maize)___Northern_Leaf_Blight/00a14441-7a62-
4034-bc40-b196aeab2785___RS_NLB 3932.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant
Disease/fruit-dataset/fruit-dataset/test/Corn_(maize)___healthy/0a68ef5a-027c-41ae-b227-
159dae77d3dd___R.S_HL 7969 copy.jpg',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant
Disease/fruit-dataset/fruit-dataset/test/Peach___Bacterial_spot/00ddc106-692e-4c67-b2e8-
569c924caf49___Rutg._Bact.S 1228.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
```

```
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/fruit-dataset/fruit-dataset/test/Peach___healthy/1a07ce54-f4fd-41cf-b088-144f6bf71859___Rutg._HL 3543.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
```

Vegetable Model

Image Pre-processing

```
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(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/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(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/veg-dataset/veg-dataset/test_set',target_size=(128,128),
                                    batch_size=16,class_mode='categorical')
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Convolution2D,MaxPool2D,Flatten
model=Sequential()
```

Adding CNN Layers

```
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
x_train.class_indices
model.add(MaxPool2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(300, kernel_initializer='uniform',activation='relu'))
model.add(Dense(150, kernel_initializer='uniform',activation='relu'))
model.add(Dense(75, kernel_initializer='uniform',activation='relu'))
model.add(Dense(9,activation='softmax', kernel_initializer='uniform'))
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
len(x_train)
11386/16
```

Fitting The Model

```
model.fit_generator(x_train,steps_per_epoch=89,validation_data=x_test,validation_steps=27,epochs=20)
model.save("vegetable.h5")
ls
model.summary()
```

Test The Model

```
from keras.preprocessing import image
from tensorflow.keras.preprocessing.image import img_to_array
from tensorflow.keras.models import load_model
import numpy as np
model = load_model("vegetable.h5"
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']
import keras.utils as image
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/veg-dataset/veg-dataset/test_set/Pepper,_bell___Bacterial_spot/ad921dec-e88f-41d8-9455-0880c69063fc___NREC_B.Spot 9216.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/veg-dataset/veg-dataset/test_set/Pepper,_bell___healthy/b45d62a2-3de1-411b-8f88-ab52195b6dda___JR_HL 7639.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
```

```
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/veg-dataset/veg-dataset/test_set/Potato___Early_blight/b6220993-c51f-48fa-bee9-fb5cb89cc0c4___RS_Early.B 7467.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/veg-dataset/veg-dataset/test_set/Potato___Late_blight/d20fef22-7016-4115-9930-a66b32c718c6___RS_LB 4417.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/veg-dataset/veg-dataset/test_set/Potato___healthy/ff700844-68ad-4e99-8427-58a39c07f817___RS_HL 1860.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/veg-dataset/veg-dataset/test_set/Tomato___Bacterial_spot/b433dcf3-c57d-4f5e-9116-5aaeecbaef01___GCREC_Bact.Sp 3715.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant Disease/veg-dataset/veg-dataset/test_set/Tomato___Late_blight/b19055d9-6a5d-4b73-90a5-3b3685ac344a___GHLB2 Leaf 8729.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
```

```
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant
Disease/veg-dataset/veg-dataset/test_set/Tomato___Leaf_Mold/d8f27502-b864-4da3-9dd5-
b7eccf2e8cbc___Crnl_L.Mold 6708.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
img = image.load_img(r'C:/Users/RAJU/OneDrive/Desktop/Sathiya/IBM/Dataset Plant
Disease/veg-dataset/veg-dataset/test_set/Tomato___Septoria_leaf_spot/c3233f4f-a6f5-4bfb-a6bf-
bd5e5d045f7a___JR_Sept.L.S 2728.JPG',target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
print('the given image belogs to=',index[pred[0]])
```