FERTILIZER RECOMENTATION SYSTEM FOR DISEASE PREDICTION

TEAM ID: PNT2022TMID41513

TEAM LEADER

S.KRISHNAPRIYA – 621119104010

TEAM MEMBERS

S.ABINAYA - 621119104001

A.ANCY- 621119104003

A.SOWMIYA - 621119104019

Bachelor of Engineering

In

Computer Science & Engineering

IDHAYA ENGINEERING COLLEGE FOR WOMEN

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PROJECT REPORT

TEAM ID	**PNT2022TMID41513**
PROJECT NAME	**Fertilizer Recomentation System for Disease Prediction.**

TEAM MEMBERS:

Team leader : KRISHNAPRIYA S

Team member 1 : ABINAYA S

Team member 2 : ANCY A

Team member 3 : SOWMIYA S

Fertilizer Recomentation System for Disease Prediction.

1.INTRODUCTION

1.1 Project Overview

Nowadays, artificial intelligence and sensor technology play a vital role in the agriculture field. The use of excess insecticides and fertilizers in farming poses a risk to human health. It is necessary to control them to ensure healthy crop production. Many techniques are used to identify the pest, suggest medications, and do soil nutrient analysis techniques separately. This paper applies the dual operator, Transition Probability Function (TPF), and Convolution Neural Network (CNN) to process the pest's image discretely and continuously for applying the recommended insecticide. The mathematical model with the objective function is derived in this paper. The soil nutrient analysis uses a soil NPK sensor with the recommendation of fertilizers according to the obtained nutrient values. On-spot results are obtained, and the time required for insecticide recommendation is within 10 s, and for fertilizer recommendation, it is within 80 s. Successful identification of five pests, namely aphids, bollworms, leaf folder, leaf miner, and green stink bug, was done with more than 90% accuracy.

The proposed approach is also compared with the other intelligent approaches, such as Artificial Neural Network (ANN), K-Nearest Neighbour (KNN), and Support Vector Machine (SVM), and it is observed that the proposed TPF-CNN approach gives higher accuracy in the shortest time.

1.2 Purpose

The proposed method uses SVM to classify tree leaves, identify the disease and suggest the fertilizer. The proposed method is compared with the existing CNN based leaf disease prediction. The proposed SVM technique gives a better result when compared to existing CNN.

2.LITERATURE SURVEY

2.1 Existing Problem

[1] The proposed method uses SVM to classify tree leaves, identify the disease and suggest the fertilizer. The proposed method is compared with the existing CNN based leaf disease prediction. The proposed SVM technique gives a better result when compared to existing CNN. For the same set of images, F-Measure for CNN is 0.7and 0.8 for SVM, the accuracyof identification of leaf disease of CNN is 0.6 and SVM is 0.8.

Advantages :

The prediction and diagnosing of leaf diseases are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves.

Disadvantages :

This further research is implementing the proposed algorithm with the existing public datasets. Also, various segmentation algorithms can be implemented to improve accuracy. The proposed algorithm can be modified further to identify the disease that affects the various plant organs such as stems and fruits.

[2] Detection of Leaf Diseases and Classification using Digital Image Processing International Conference on Innovations in Information, Embedded and Communication Systems(ICIIECS), IEEE, 2017.

Advantages:

The system detects the diseases on citrus leaves with 90% accuracy.

Disadvantages:

System only able to detect the disease from citrus leaves. 1 2 The main objective of this paper is image analysis & classification techniques for detection of leaf diseases and classification. The leaf image is firstly preprocessed and then does the further work. K-Means Clustering used for image segmentation and then system extract the GLCM features from disease detected images. The disease

classification done through the SVM classifier. Algorithm used: Gray-Level Co-Occurrence Matrix (GLCM) features, SVM, K-Means Clustering .

[3] Semi-automatic leaf disease detection and classification system for soybean culture IET Image Processing, 2018.

Advantages:

The system helps to compute the disease severity.

Disadvantages:

The system uses leaf images taken from an online dataset, so cannot implement in real time. This paper mainly focuses on the detecting and classifying the leaf disease of soybean plant. Using SVM the proposed system classifies the leaf disease in 3 classes like i.e. downy mildew, frog eye, and septoria leaf blight etc. The proposed system gives maximum average classification accuracyreported is ~90% using a big dataset of 4775 images. Algorithm used: SVM.

[4] Cloud Based Automated Irrigation And Plant Leaf Disease Detection System Using An Android Application. International Conference on Electronics, Communication and Aerospace Technology, ICECA 2017.

Advantages:

It is simple and cost effective system for plant leaf disease detection.

Disadvantages:

Any H/w failures may affect the system

performance. The current paper proposesan android application for irrigation and plant leaf disease detection with cloud and IoT. For monitoring irrigation system they use soil moisture and temperature sensor and sensor data send to the cloud. The user can also detect the plant leaf disease. K-means clustering used for feature extraction. Algorithm used: K-means clustering, Other than this there are some other levels which can be used for sentimental analysis these are- document level, sentence level, entity and aspect.

[6] The current work examines and describes image processing strategies for identifying plant diseases in numerous plant species. BPNN, SVM, K-means clustering, and SGDM are the most common approaches used to identify plant diseases. Disadvantages : Some of the issues in these approaches include the impact of background data on the final picture, optimization of the methodology for a specific plant leaf disease,and automation of the technique for continuous

automated monitoring of plant leaf diseasesin real-world field circumstances.

[7] The proposed method uses SVM to classify tree leaves, identify the disease and suggest the fertilizer. The proposed method is compared with the existing CNN based leaf disease prediction. The proposed SVM technique gives a better result when compared to existing CNN. For the same set of images, F-Measure for CNN is 0.7and

0.8 for SVM, the accuracyof identification of leaf disease of CNN is 0.6 and SVM is 0.8. Advantages : The prediction and diagnosing of leaf diseases are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves. Disadvantages : This further research is implementing the proposed algorithm with the existing public datasets. Also, various segmentation algorithms can be implemented to improve accuracy. The proposed algorithm can be modified further to identify the disease that affects the various plant organs such as stems and fruits.

[8]In this paper, we propose a user-friendly web applicationsystem based on machine learning and web-scraping calledthe 'Farmer's Assistant'. With our system, we are successfully able to provide several features - crop recommendation using Random Forest algorithm, fertilizer recommendation using arule based classification system, and crop disease detection using EfficientNet model on leaf images. The user can provide the input using forms on our user interface and quickly gettheir results.

In addition, we also use the LIME interpretability method to explain our predictions on the disease detectionimage, which can potentially help understand why our modelpredicts what it predicts, and improve the datasets and models using this information. Advantages : For crop recommendation and fertilizer recommendation, we can provide the availability of the same on the popular shopping websites, and possibly allow users to buy the crops and fertilizers directly from our application. Disadvantages : To provide fine-grained segmentations of the diseased portion of the dataset. this is not possible

due to lack of such data. However, in our application,we can integrate a segmentation annotation tool where theusers might be able to help us with the lack. Also, we can usesome unsupervised

algorithms to pin-point the diseased areas in the image. We intend to add these features and fix thesegaps in our upcoming work.

2.2.References

[1] Semi-automatic leaf disease detection and classification system for soybean culture IET Image Processing, 2018

[2] Cloud Based Automated Irrigation And Plant Leaf Disease Detection System Using An Android Application. International Conference on Electronics, Communication and Aerospace Technology, ICECA 2017.

[3] Ms. Kiran R. Gavhale, Ujwalla Gawande, Plant Leaves Disease detection using Image Processing Techniques, January 2014.

[4] Duan Yan-e, Design of Intelligent Agriculture Management Information System Based on IOT‖, IEEE,4th, Fourth International reference on Intelligent Computation Technology and Automation, 2011

[5] R. Neela, P. Fertilizers Recommendation System For Disease Prediction In Tree Leave International journal of scientific & technology research volume 8, issue 11, november 2019

[6] Swapnil Jori1, Rutuja Bhalshankar2, Dipali Dhamale3, Sulochana Sonkamble , Healthy Farm: Leaf Disease Estimation and Fertilizer Recommendation System using Machine Learning,International Journal of All Research Education and Scientific Methods (IJARESM), ISSN: 2455-6211

[7] Detection of Leaf Diseases and Classification using Digital Image Processing International Conference on Innovations in Information, Embedded and Communication Systems(ICIIECS), IEEE, 2017.

[8] Shloka Gupta ,Nishit Jain ,Akshay Chopade, Farmer’s Assistant: A Machine Learning BasedApplication for Agricultural Solutions.

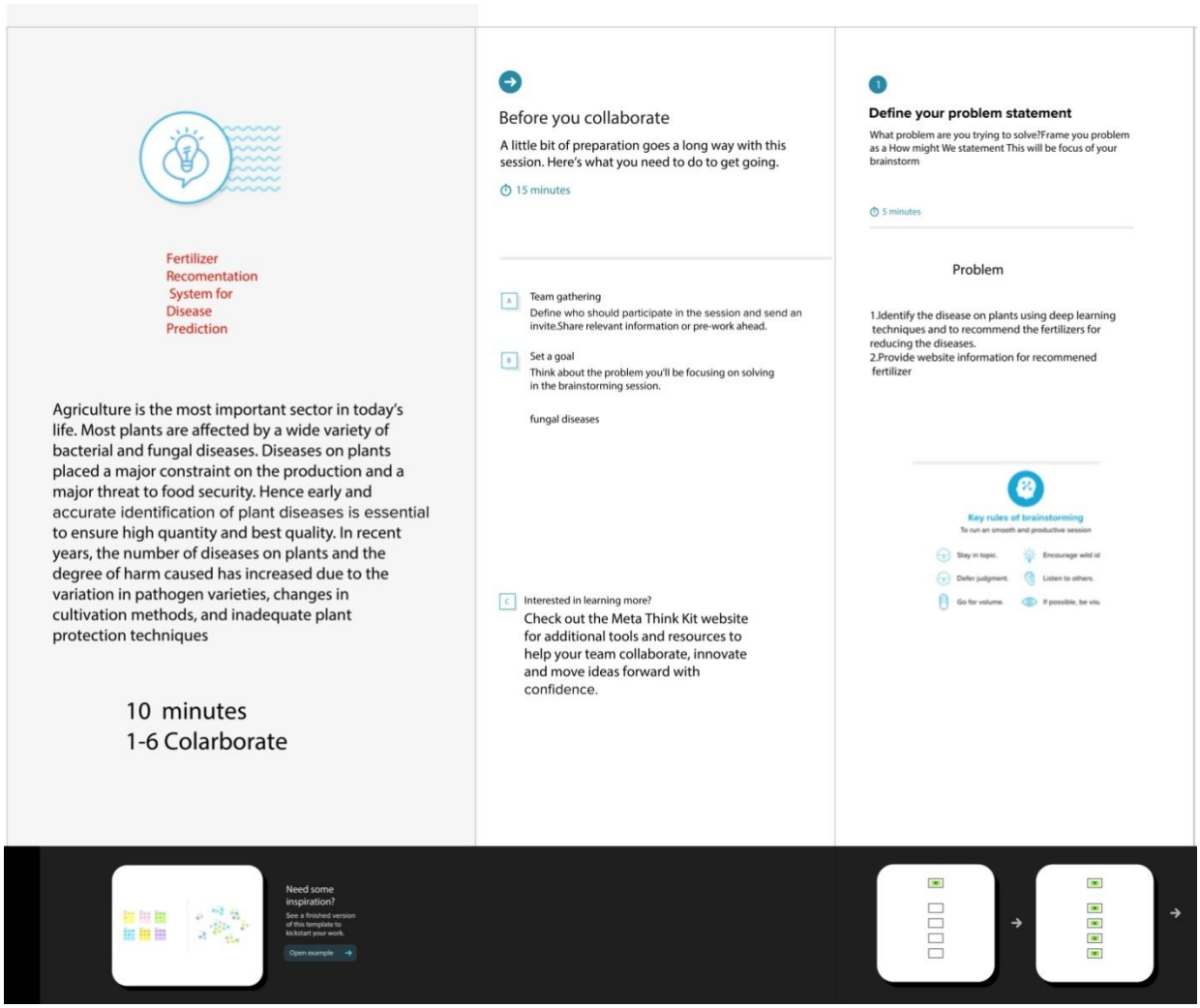
2.2.Problem Statement Definition

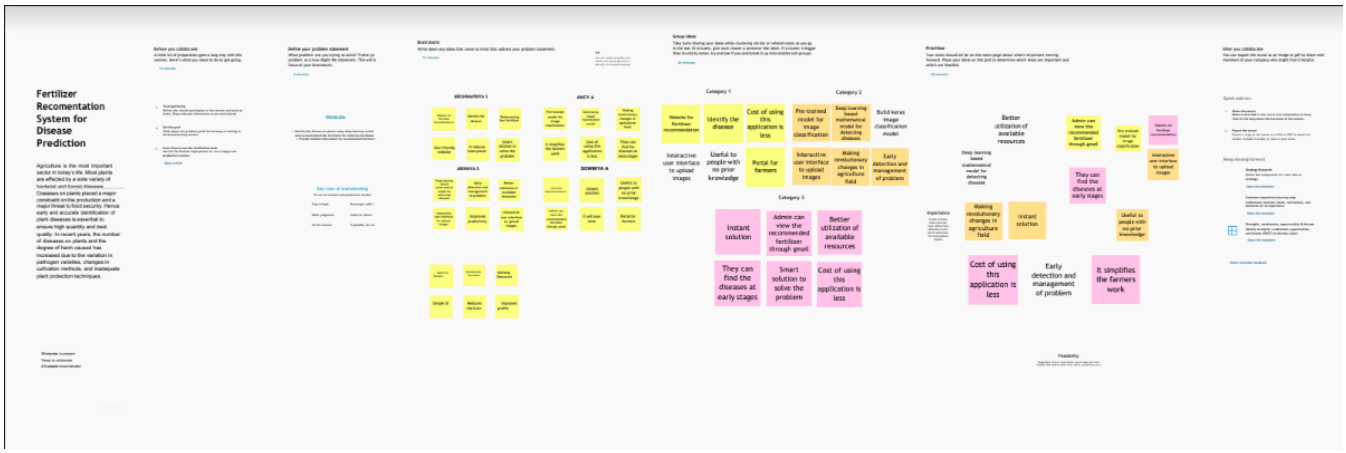
Mr.Munusamy is a 65 years old man. He had a own farming land and do Agriculture for past 30 Years , In this 30 Years he Faced a problem in Choosing Fertilizers and Controlling of Plant Disease. Mr.Munusamy wants to know the better recommendation for fertilizers for plants with the disease. He has faced huge losses for a long time.This problem is usually faced by most farmers. Mr.Munusamy needs to know the result immediately.

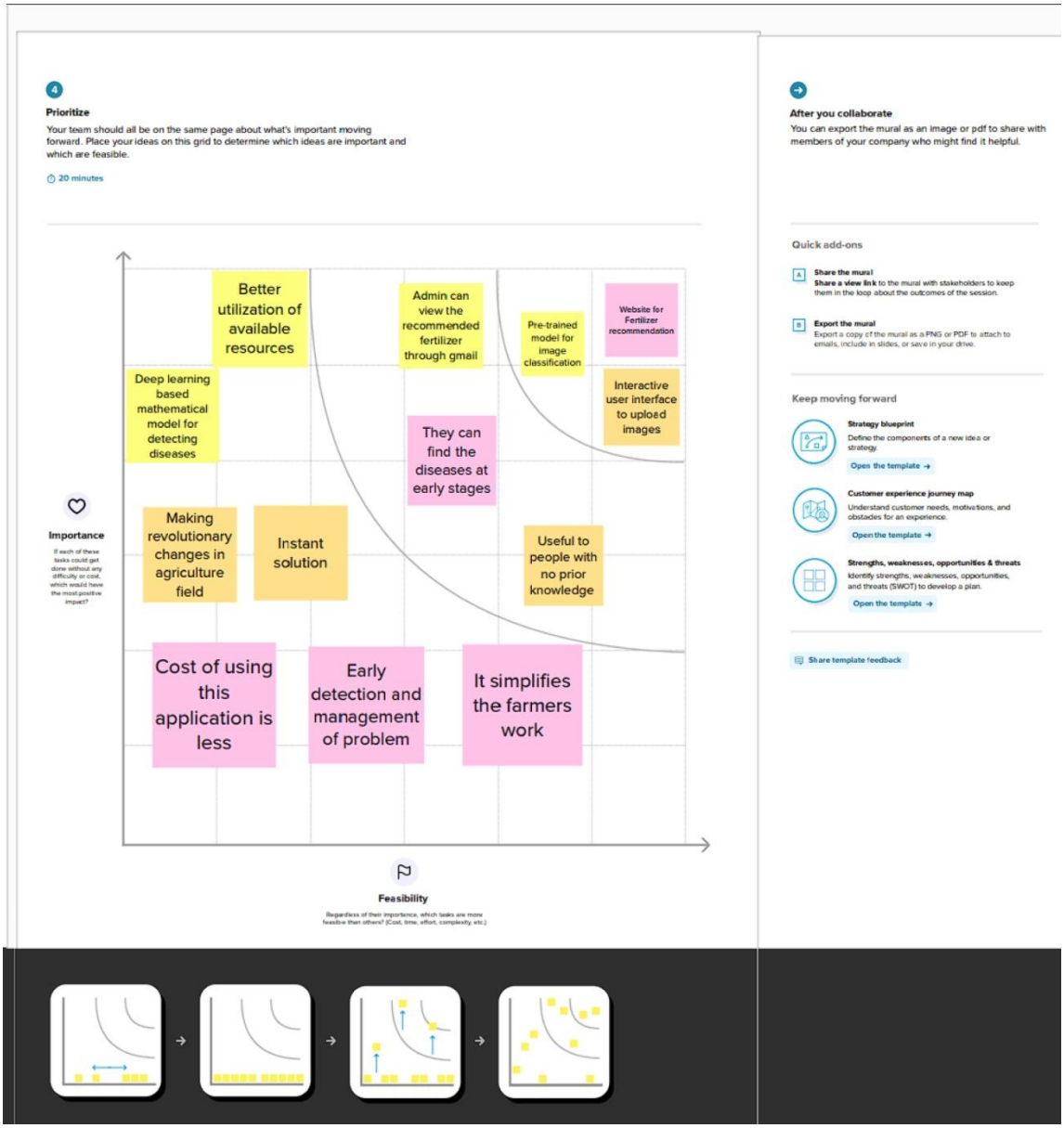
3.IDEATION & PROPOSED SOLUTION

3.1.Empathy Map Canvas:

3.2.Ideation & Brainstroming




Fertilizer Recomentation System for Disease Prediction
Agriculture is the most important sector in today's life. Most plants are affected by a wide variety of bacterial and fungal diseases. Diseases on plants placed a major constraint on the production and a major threat to food security. Hence early and accurate identification of plant diseases is essential to ensure high quantity and best quality. In recent years, the number of diseases on plants and the degree of harm caused has increased due to the variation in pathogen varieties, changes in cultivation methods, and inadequate plant protection techniques.
Before you collaborate
Define your problem statement
Brainstorm
Group ideas
Prioritize
After you collaborate
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
Better utilization of available resources
Deep learning based mathematical model for detecting diseases
Admin can view the recommended fertilizer through gmail
Pre-trained model for image classification
Website for Fertilizer recommendation
Interactive user interface to upload images
They can find the diseases at early stages
Useful to people with no prior knowledge
Making revolutionary changes in agriculture field
Instant solution
Cost of using this application is less
Early detection and management of problem
It simplifies the farmers work


4
Prioritize
Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.
20 minutes
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
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
Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?
Feasibility
Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)
After you collaborate
You can export the mural as an image or pdf to share with members of your company who might find it helpful.
Quick add-ons
Share the mural
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.
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

3.3.Proposed Solution

IBM FERTILIZER RECOMMENTATION USING DISEASE PREDICTON

★ INTRODUCTION

Fertilizer Recommentation system for disease Prediction is a simple ML and DL based website which recommends the best crop to grow, fertilizers to use and the diseases caught by your crops.

★ PROBLEM STATEMENT

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

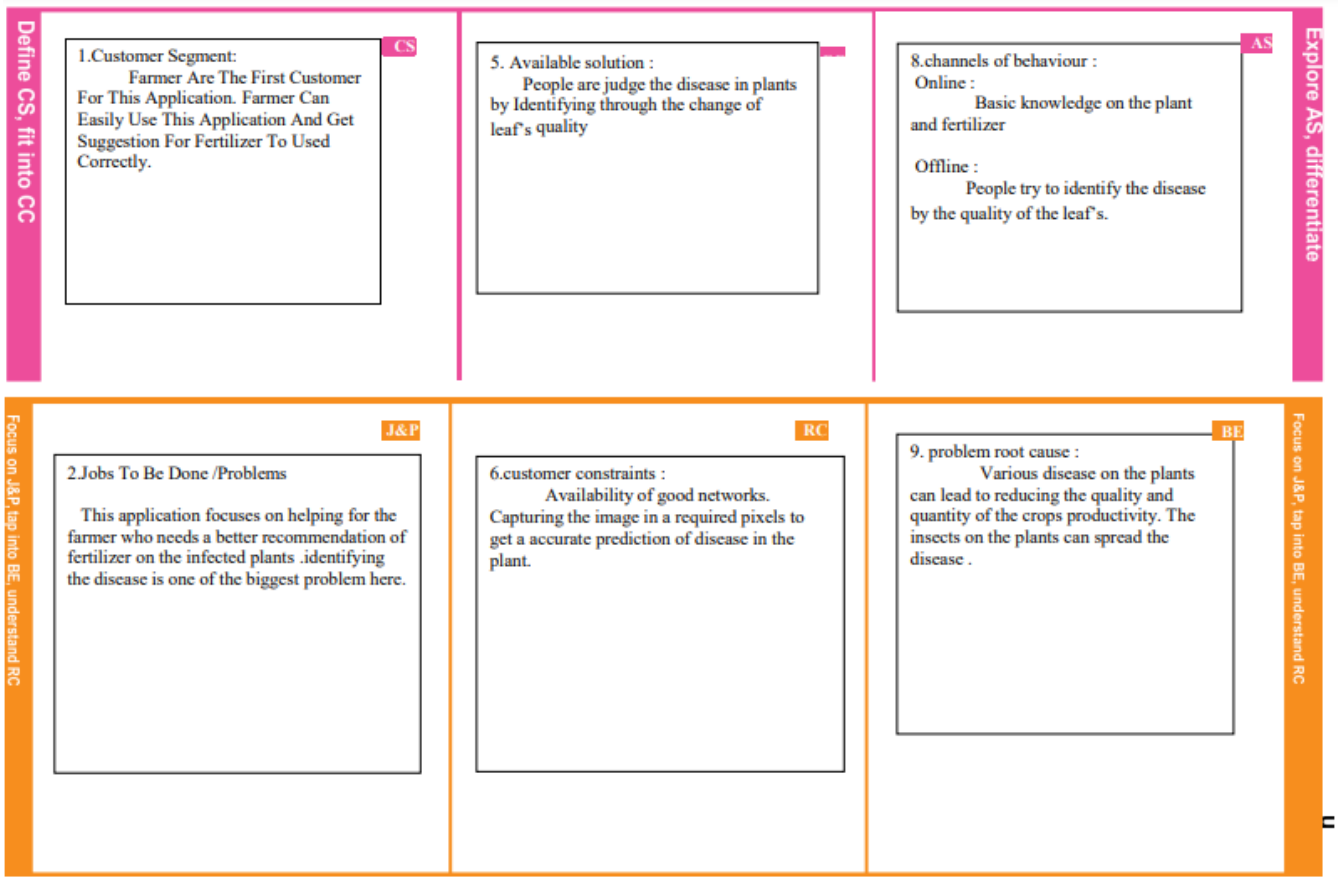
★ PROBLEM SOLUTION

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

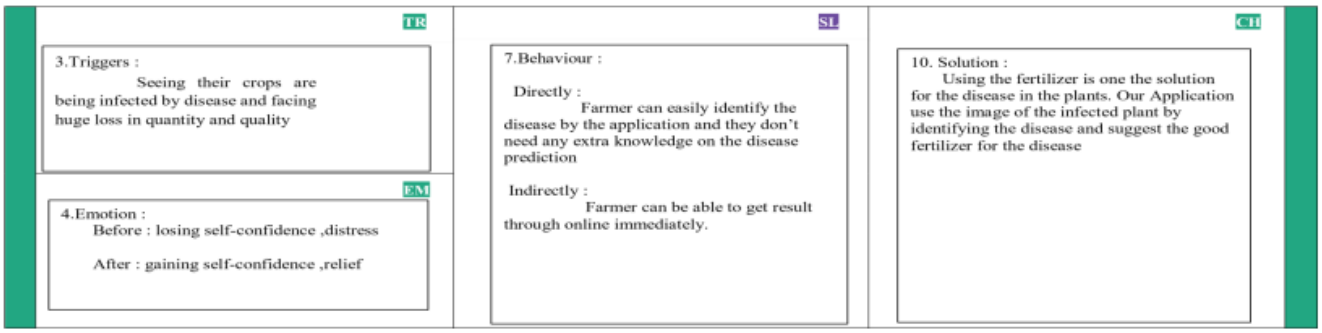
★ THE BENIFICIAL USERS

- ★ **Farmer**
- ★ **Common People**
- ★ **Seller**
- ★ **Buyer**
- ★ **Employees**
- ★ **Industrial People**

3.4 .Problem Solution fit.



Project Title : **Fertilizers Recommendation System For Disease Prediction** **Project Design Phase-I-Solution Fit** **Team Id:PNT2022TMID41513**



4.REQUIREMENT ANALYSIS

4.1.Functional Requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	**Registration through Form**
FR-2	User Confirmation	**Confirmation via Email**
FR-3	User Profile	**Filling the profile page after logging in**
FR-4	Uploading Dataset (Leaf)	**Images of the leaves are to be uploaded**
FR-5	Requesting solution	**Uploaded images is compared with the pre-defined Model and solution is generated**
FR-6	**Downloading Solution**	**The Solution in pdf format which contains the recommendations of fertilizers and the possible diseases.**

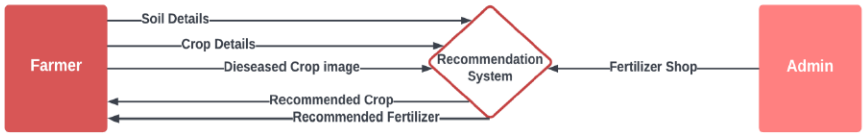
4.2.Non-Functional Requirement

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	**The system allows the user to perform the tasks easily and efficiently and effectively.**
NFR-2	**Security**	**Assuring all data inside the system or its part will be protected against malware attacks or unauthorized access.**
NFR-3	**Reliability**	**The website does not recover from failure quickly ,it takes time as the application is running in single server**
NFR-4	**Performance**	**Response Time and Net Processing Time is Fast**
NFR-5	**Availability**	**The system will be available up to 95% of the time**
NFR-6	**Scalability**	**The website is scalable**

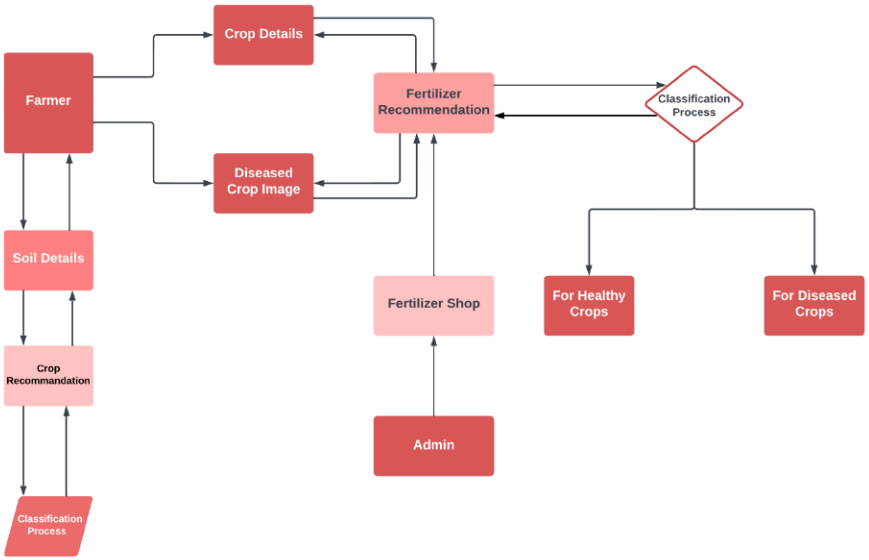
5.PROJECT DESIGN

5.2. Data Flow Diagram

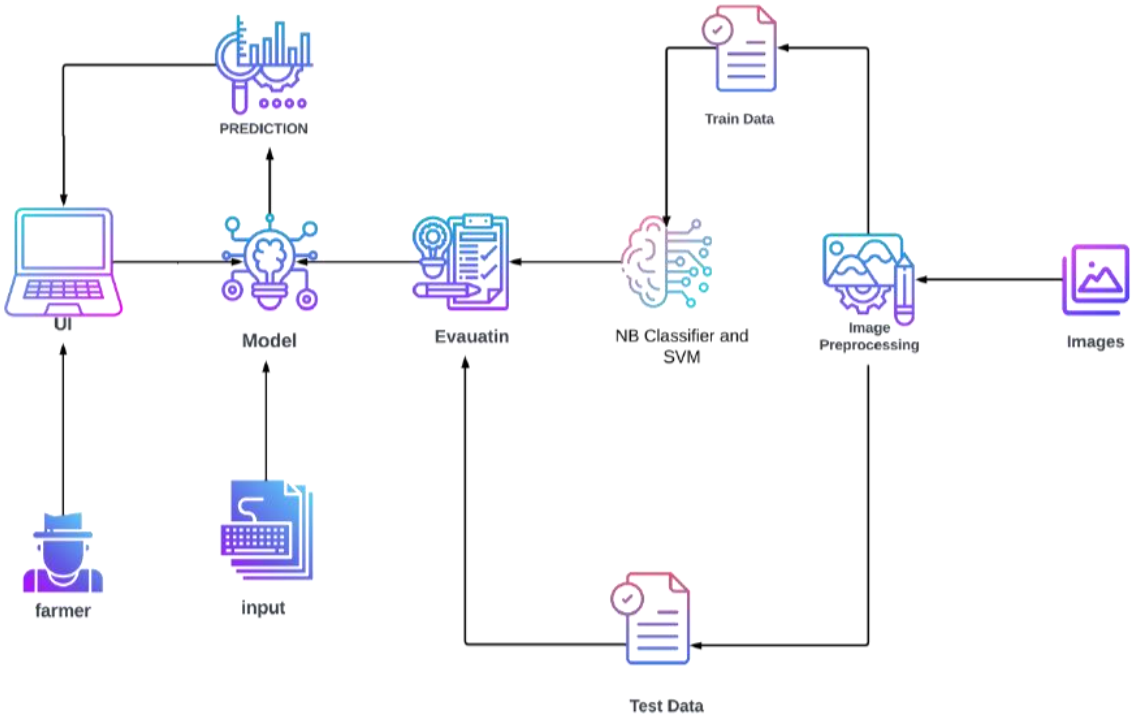
DFD LEVEL - 0



DFD LEVEL - 1



5.2.Solution & Techinical Architecture



5.3.Techinical Architecture

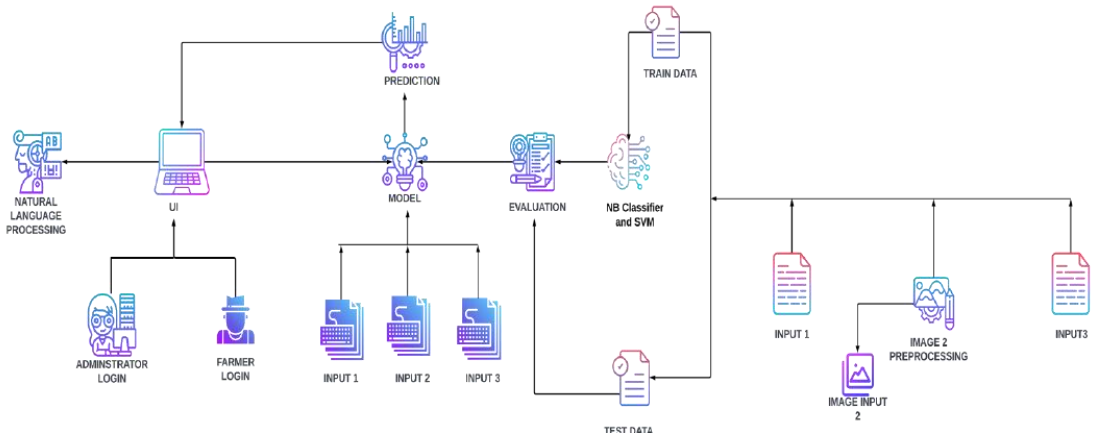


Table-1 : Components & Technologies

S.No	Component	Description	Technology
1.	User Interface	How the user interacts with the application .To depict the human-computer interaction andcommunication.	HTML, CSS,JSP
2.	Application Logic-1	A pageto upload imagesas input	Python
3.	Application Logic-2	To use the Machine Learning model and predicting the result	Python
4.	Database	Structured data-images	MySql
5.	Cloud Database	Database that typically runs on a cloud computing platform and access to the database is provided as-a- service	IBM Cloud Databases for MySQL
6.	File Storage	To store data in a hierarchicalstructure	Local File system
7.	Machine Learning Model	Here, we use a Support Vector Machine Algorithm that is used widely in Classification and Regression problems.	Random Forest ,XG Boost

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Flaskmicro web framework	Written in Python.It is classified as a micro frame work because it does not requireparticular tools or libraries. It has nodatabase abstraction layer, form validation, or any other components where preexisting third-party libraries provide commonfunctions.
2.	Security Implementations	With all aspects of the job including detecting malicious attacks, analyzing the network endpoint protection and vulnerability assessment, Sign inencryption	IBM CloudApp ID Services
3.	Availability	Available for all data size	–
4.	Performance	Can extend the storage according to our needs	Python,AngularJS

6.User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story/ Task	Acceptanc e criteria	Priority	Release
Customer (Mobile user)	Registration	US N-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
		US N-2	As a user, I will receive confirmation email once I have Registered for the application	I can receive confirmatio n email & click confirm	High	Sprint-1
		US N-3	As a user, I can register for the application through G mail	I can receive confirmatio n Gmail & click confirm	Medium	Sprint-1
	Login	US N-4	As a user, I can login to the application by entering email & password		High	Sprint-1
	Dashboard	US N-5	As a user, I can view all the plans and methods in dashboard		High	Sprint-1
Customer (Web user)	Insurance claim	US N-6	As a user, I can register for claim my insurance	I can receive confirmation Email & claim my Insurance	High	Sprint-2
Customer Care Executive	Q/A services	US N-7	As a user, I can make a call to Support line to get help with a product or service.	Phone call, messages and Email	High	Sprint-3
Administrator	Insurance	US N-8	As a user, I can claim my insurance After getting confirmation from the administrator.	I can accept the insurance After verified the documents	High	Sprint-3

7.PROJECT PLANNING & SCHEDULING

7.1.Sprint Planning & Estimation:

Sprint	Functional Requirement(Epic)	User Story Number	User Story / Task	Story Points (Total)
Sprint-1	Model Creation and Training (Fruits)		Create a model whichcan classify diseased fruit plants from given images.I also need to test the modeland deploy it on IBM Cloud	8
	Model Creation and Training (Vegetables)		Create a model which can classify diseased vegetableplants from givenimages	2

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points (Total)
Sprint-2	Model Creationand Training (Vegetables)		Create a model which can classify diseased vegetable plantsfrom given images and train onIBMCloud	6
	Registration	USN-1	As a user, I can register by entering my email, password, and confirming my password or via OAuth API	3
	Upload page	USN-2	As a user, I will be redirected to a pagewhere Icanupload my pictures of crops	4
	Suggestion results	USN-3	Asa user, I can view the results and then obtainthesuggestions provided by the ML model	4
	Base Flask App		A base Flask web app must be createdas aninterface for the ML model	2
Sprint-3	Login	USN-4	As a user/admin/shopkeeper, I can log into theapplication by entering email & password	2
	User Dashboard	USN-5	As a user,I can view the previous results andhistory	3
	Integration		Integrate Flask,CNN model with Cloudant DB	5
	Containerization		Containerize Flask app using Docker	2

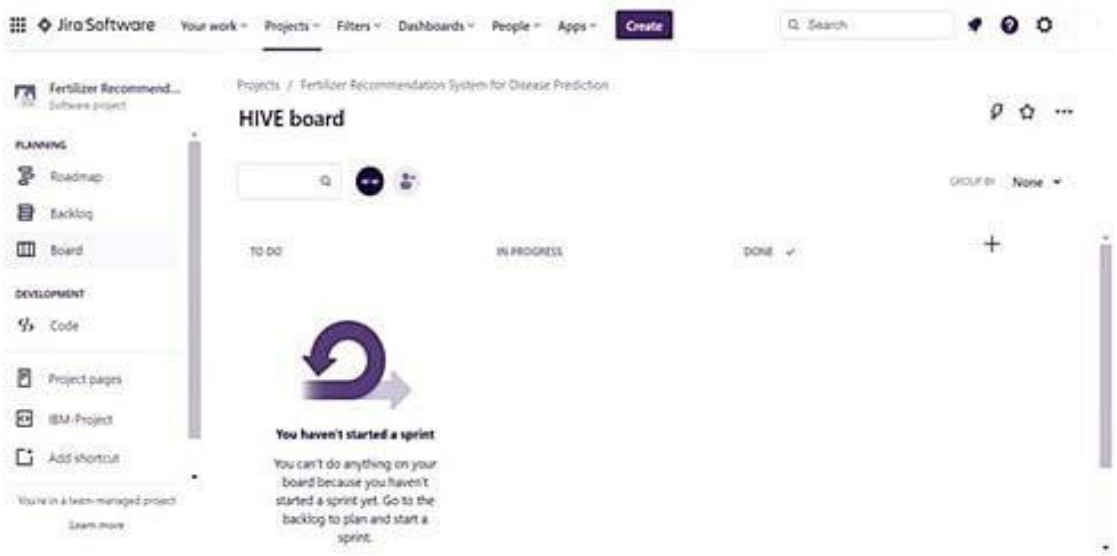
Sprint	Functional Requirement(Epic)	User Story Number	User Story / Task	Story Points (Total)
Sprint-4	Dashboard(Admin)	USN-6	As an admin, I can view other user details anduploads for other purposes	2
	Dashboard (Shopkeeper)	USN-7	Asa shopkeeper, I can enter fertilizer productsandthen update the details if any	2
	Containerization		Create and deploy Helm charts using DockerImagemade before	2

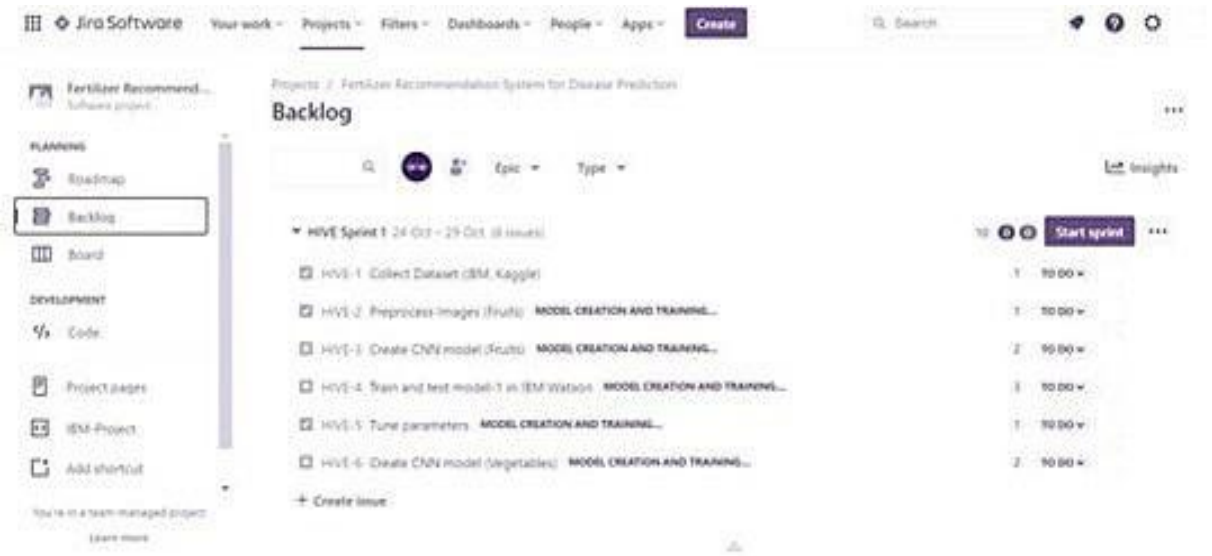
7.2.Sprint Delivery Schedule

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

8.Reports from JIRA

Screenshots:





9.CODING &SOLUTIONING

9.1.Features:

Feature 1: Registration

Feature 2: Login

Feature 3: User interfaceFeature 4:

Store database

Feature 5: Send Alert Emailsto us.

10.TESTING

10.1.TEST CASE

1. Purpose of Document

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

2.Defect Analysis

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

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

10.2.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	17	0	0	17
Mosaic leaf pattern	51	0	0	51
Misshapen leaves	20	0	0	20
Yellow leaves	7	0	0	7
Fruit rots	9	0	0	9
Fruit spots	4	0	0	4
Blights	2	0	0	2

11.RESULT

11.1.Performance Metrics

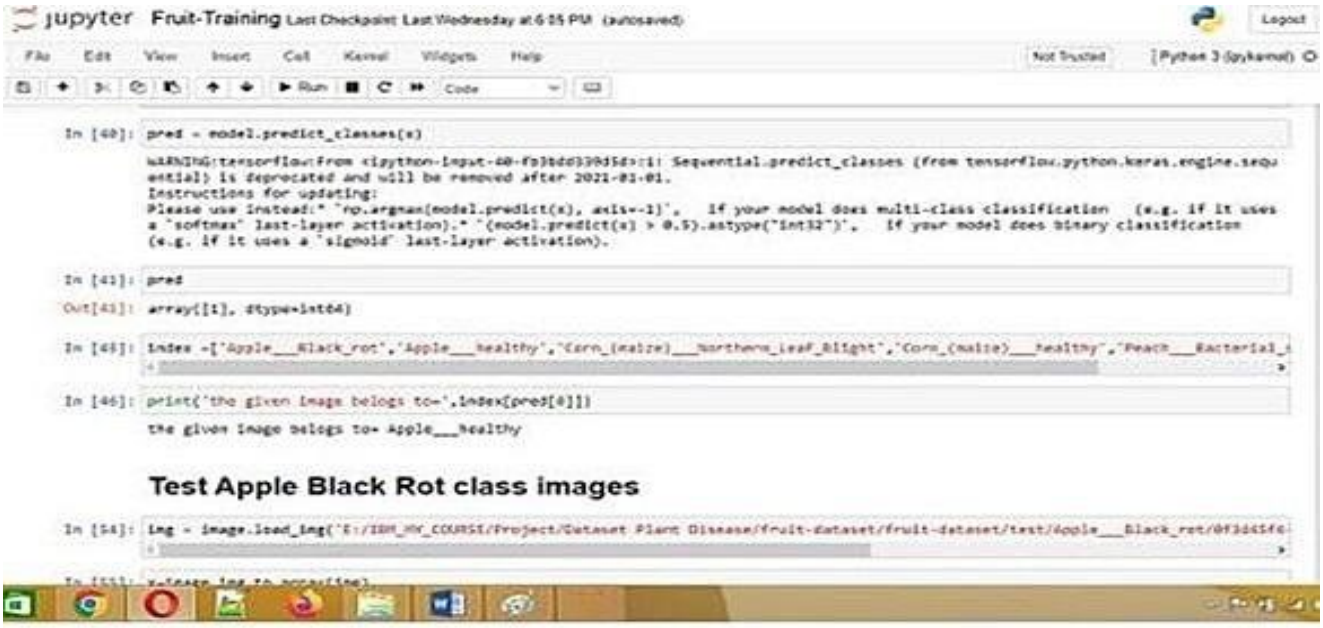


Figure.6.2 Test the Fruit dataset

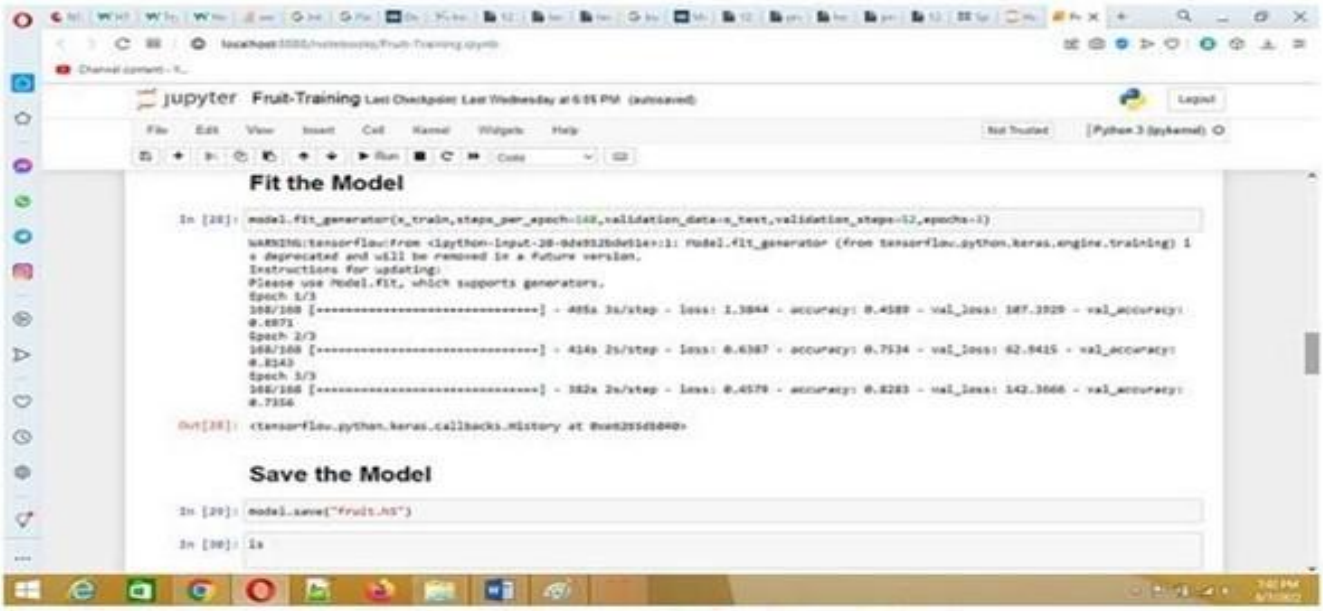


Figure.6.1. Fit a model for Fruit dataset

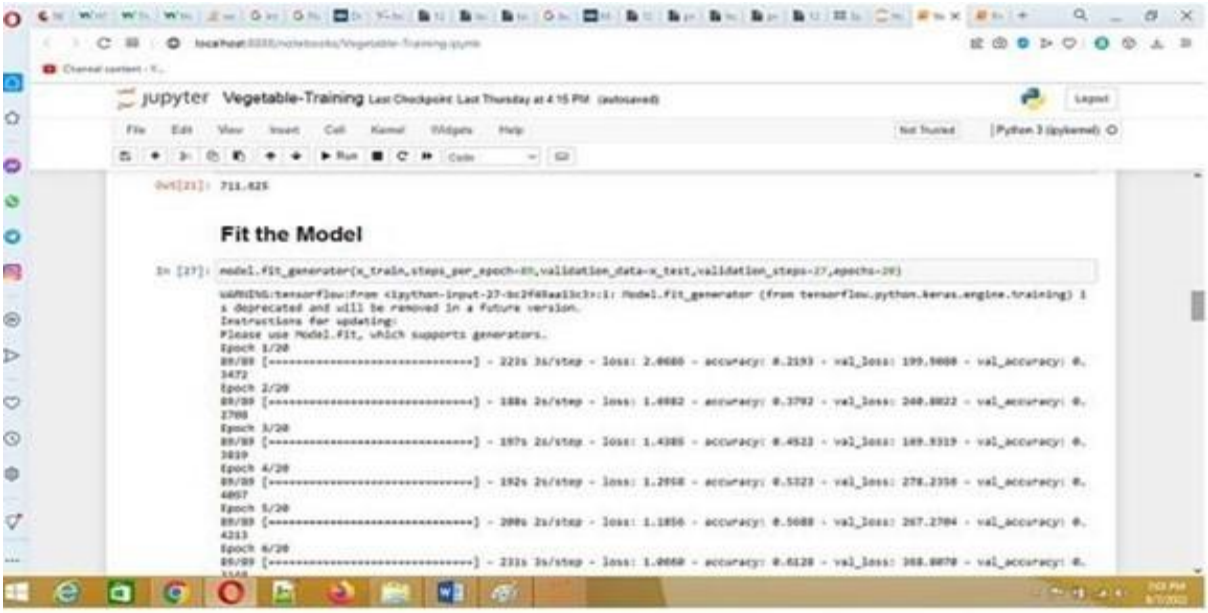


Figure.6.3. Train the Vegetable dataset

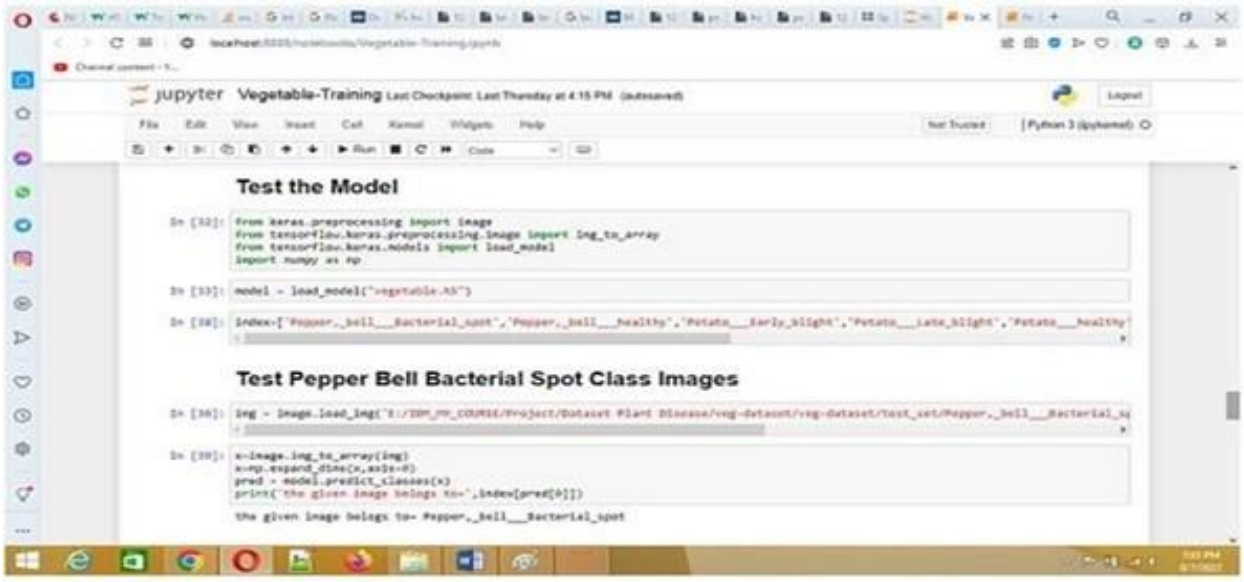
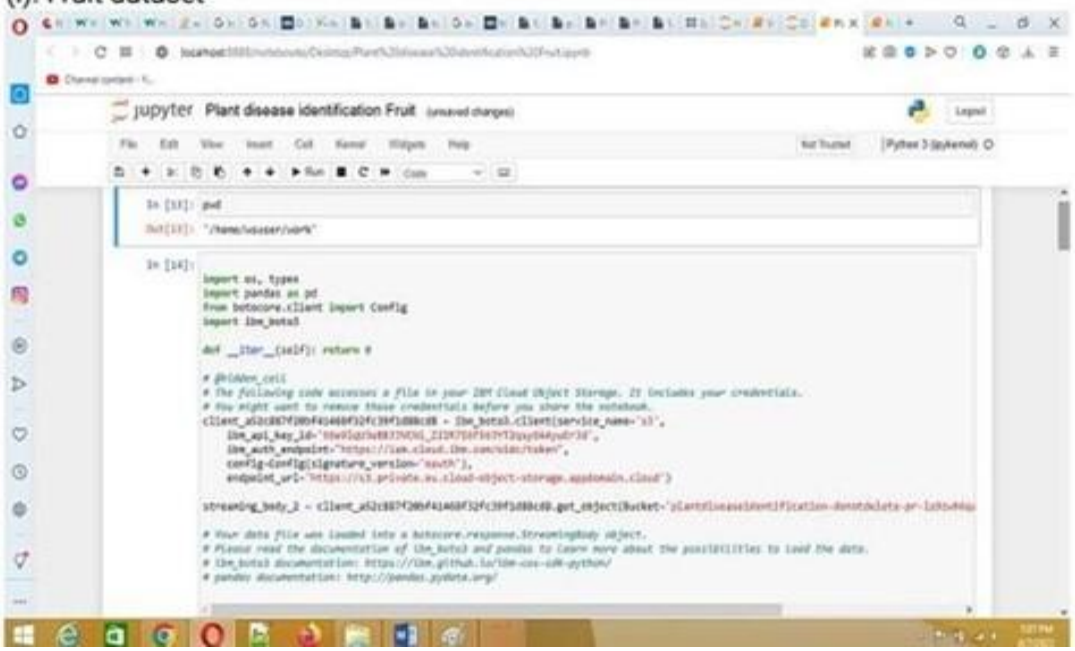


Figure.6.4. Test the Vegetable dataset

Train and Test Vegetable dataset IBM Cloud

Due to CUH limit exceeds, I have downloaded the notebooks and opened in Jupyter notebook

(i). Fruit dataset



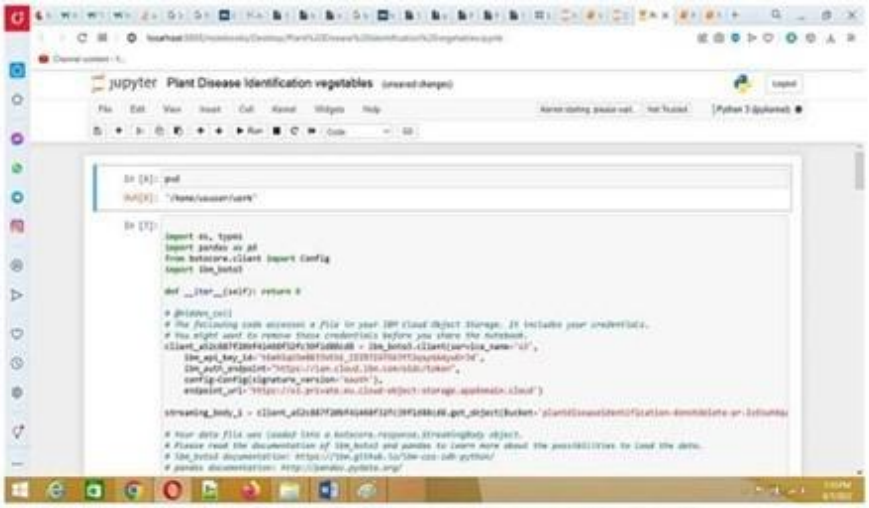
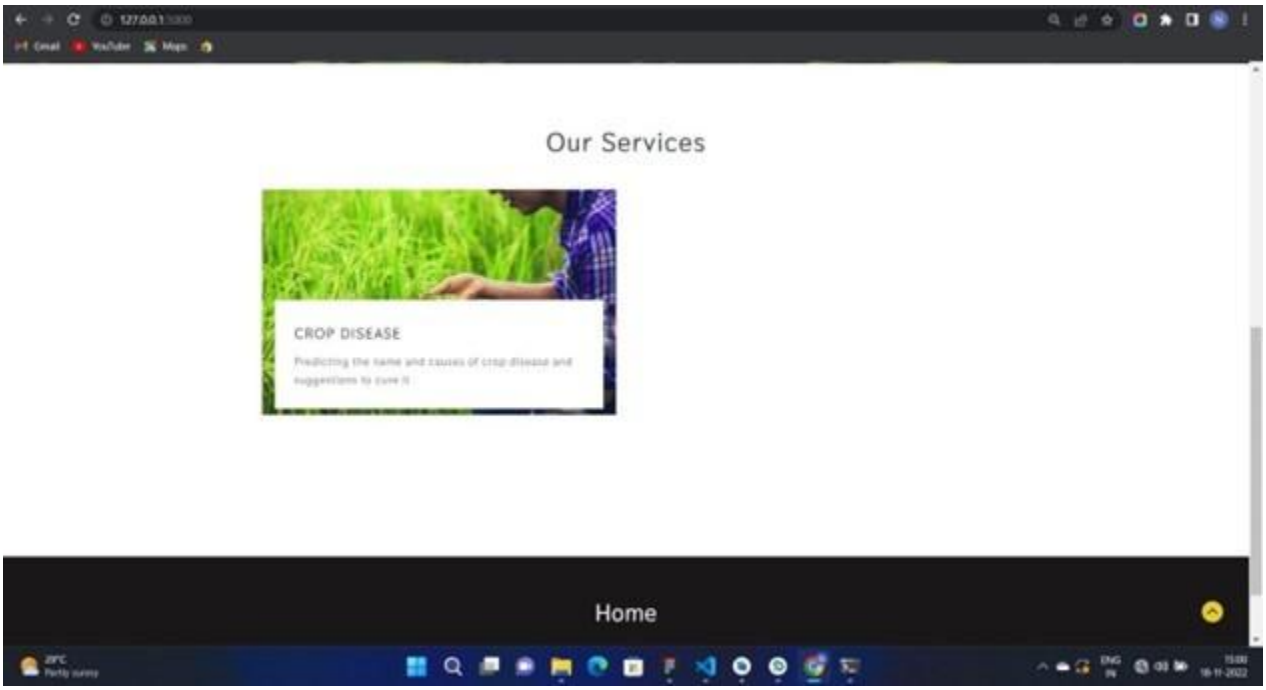
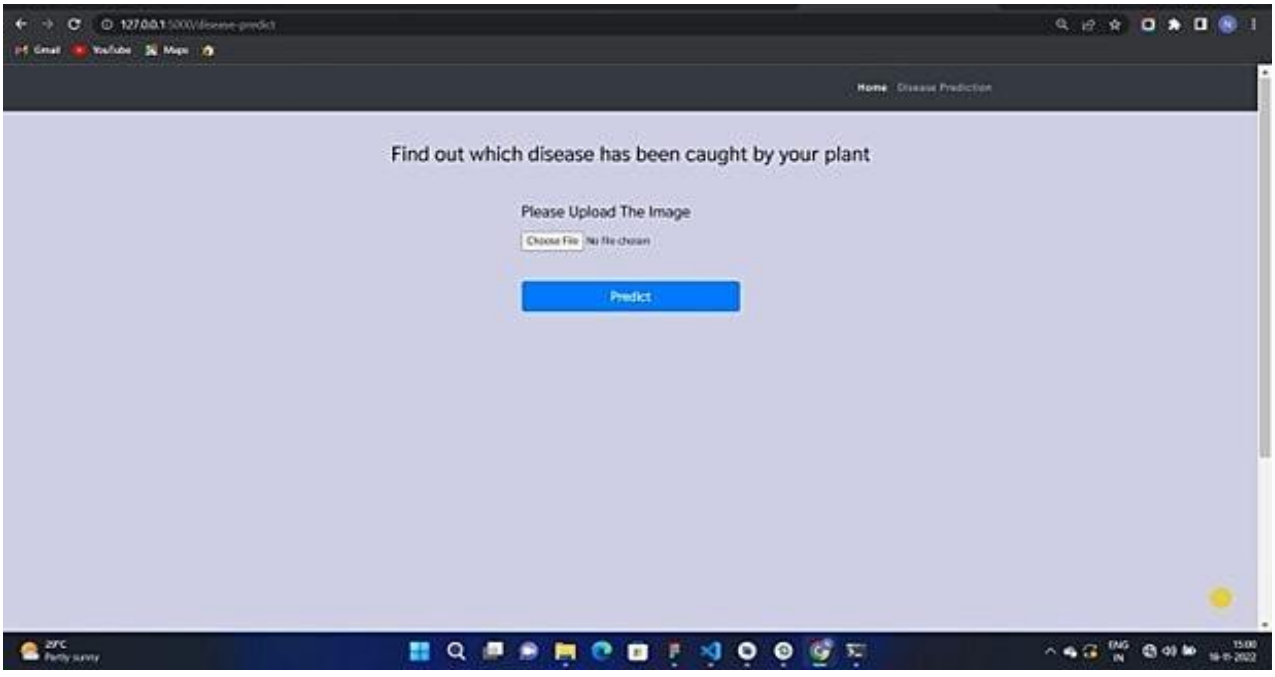
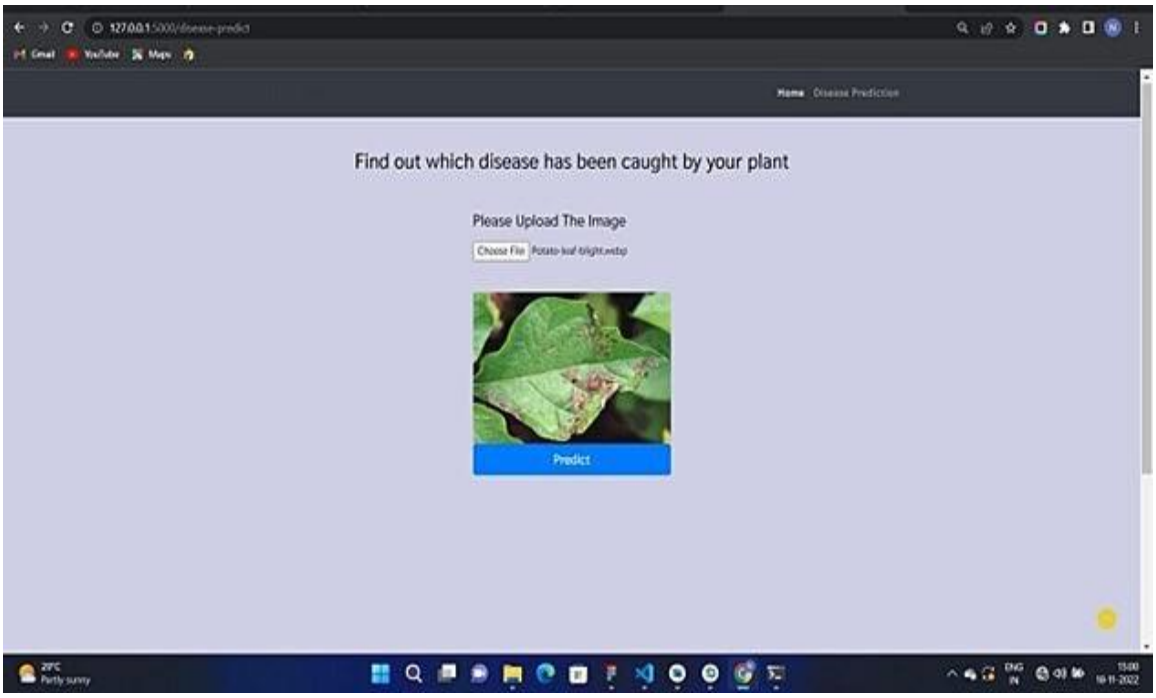


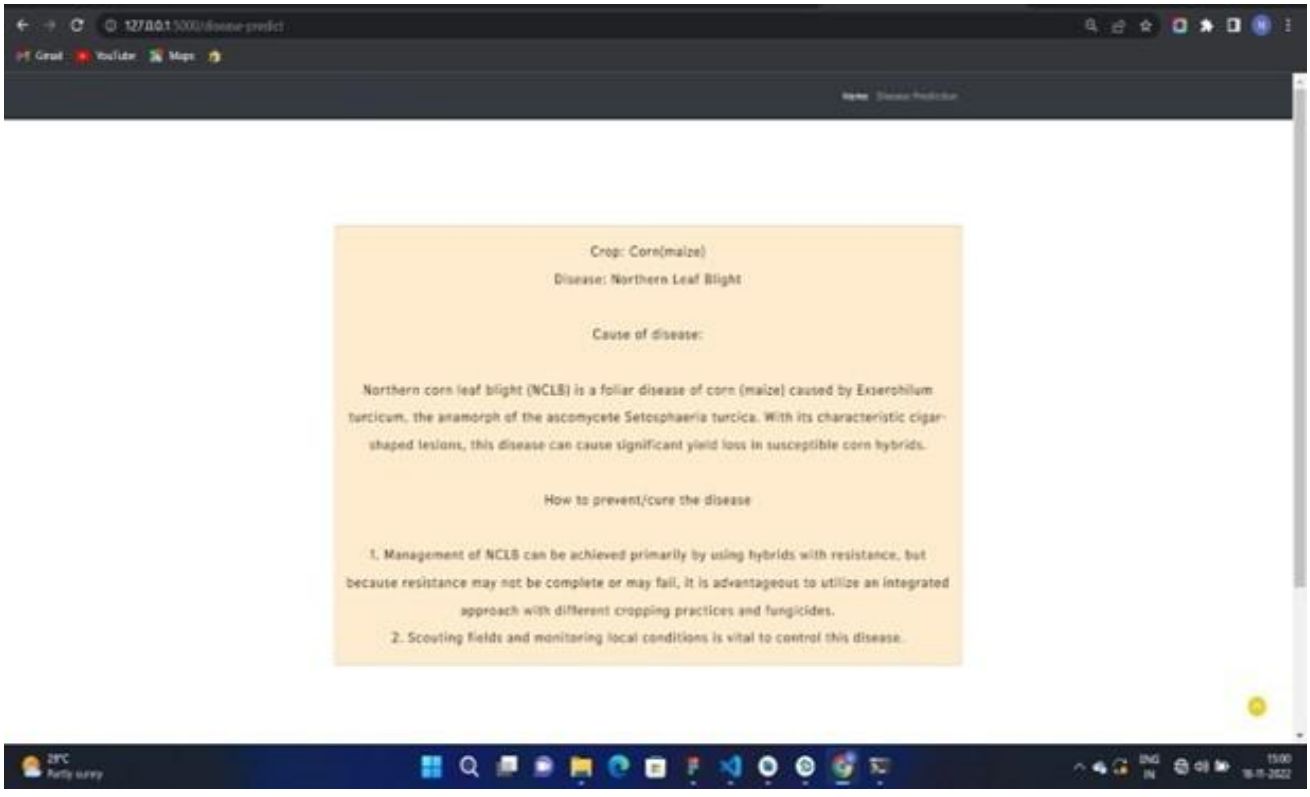
Figure.6.6. Training Vegetable Dataset in IBM Cloud

OUTPUT:


Our Services
CROP DISEASE
Home


Home
Find out which disease has been caught by your plant
Please Upload The Image
Choose File
No file chosen
Predict


Home Disease Prediction
Find out which disease has been caught by your plant
Please Upload The Image
Choose File
Predict


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.

11.ADVANTAGES & DISADVANTAGES

ADVANTAGES

Fertilizers have all nutrients required for plants growth.

It is soluble and easily absorbed by plants.

It enhances the metabolism of plants.

It is easily available in the market.

Highly needed for large production

DISADVANTAGE:

- Fertilizers are more expensive than manure.
- Over fertilization can damage the plants.
- It is toxic and can harm humans.
- It affected the environment and echo system.
- Long term use reduce soil quality.

12.CONCLUSION

The core strategy of this project is to predict the cropbased on the soil nutrient content and the locationwhere the crop is growing. This system will help hefarmers to choose the right crop for their land and togive the suitable amount of fertilizer to produce themaximum yield. The Support Vector Machine algorithmhelps to predict the crop the precisely based on thepre- processed crop data. This system will also help thenew comers to choose the crop which will grow intheir area and produce them a good profit.

A decentamount of profit will attract more people towards theagriculture. Also, the crop growth is based on theclimate conditions in the particular area and theseasonal monsoons happens now are unpredictable, hence it is easy for the farmers when the predictionresult is also based on the climatic conditions. Liveweather prediction will also help the users to predictthe crop water needs and also it will help the farmersto decrease the crop damage due to the rain ordrought.

The prediction of crop yield based on soil data and proper implementation of algorithms have proved that a higher crop yield can be achieved.

From crop recommendation system provides 82% of accuracy. the above work, we conclude that for soil classification Random Forest is a suitable algorithm with an accuracy of 99.09% compare to Gaussian Naive Bayes. The work can be extended further to add the following functionality. Building a Website can be built to help farmers by uploading an image of farms. Crop diseases detection uses image processing in which users get pesticides based on disease images and Fertilizer prediction based on soil condition.

By categorizing the soil samples according to the soil type, land type and macro nutrients Nitrogen (N), Phosphorus (P) and Potassium (K) present in the soil the suitable crop along with its appropriate fertilizer is suggested to the agricultural stakeholder. The month in which the yield will be high is also suggested to the user. The yield calculation is also provided for the crop selected by the farmer.

13.FUTURE SCOPE

The future work is to implement Machine Learning Algorithms like Ensemble Classifiers to predict the crop yield and recommend the crop with appropriate fertilizer. In the existing system only soil characteristics were considered to provide crop recommendations. In the future work the climatic parameters will also be taken into account to provide crop recommendations. Also the method can be extended to include diverse varieties of crop to be cultivated and to analyse it's performance.

This further research is implementing the proposed algorithm with the existing public datasets. Also, various segmentation algorithms can be implemented to improve accuracy. The proposed algorithm can be modified further to identify the disease that affects the various plant organs such asstems and fruits.

APPENDIX

SourceCode

https://github.com/IBM-EPBL/IBM-Project-48224-1660805745/tree/main/Application%20Building

GitHub & Project Demo Link

https://github.com/IBM-EPBL/IBM-Project-21216-1659775253