TEAM ID	**PNT2022TMID06694**
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Fertilizers Recommendation System For Disease Prediction

Documentation

TABLE OF CONTENT

1.INTRODUCTION

1.1 Overview

In this project, two datasets name fruit dataset and vegetable dataset are collected. The collected datasets are trained and tested with deep learning neural network named Convolutional Neural Networks(CNN). First, the fruit dataset is trained and then tested with CNN. It has 6 classes and all the classes are trained and tested. Second, the vegetable dataset is trained and tested. The software used for training and testing of datasets is Python. All the Python codes are first written in Jupyter notebook supplied along with Anaconda Python and then the codes are tested in IBM cloud. Finally a web based framework is designed with help Flask a Python library. There are 2 html files are created in templates folder along with their associated files in static folder. The Python program 'app.py' used to interface with these two webpages is written in Spyder-Anaconda python and tested. 1.2 Purpose This project is used to test the fruits and vegetables samples and identify the different diseases. Also, this project recommends fertilizers for prediced diseases.

1.2 Purpose

This project is used to test the fruits and vegetables samples and identify the different diseases. Also, this project recommends fertilizers for prediced diseases.

2. LITERATURE SURVEY

2.1 Existing problem

Indumathi proposed a method for leaf disease detection and suggest fertilizers to cure leaf diseases[1]. But the method involves less number of train and test sets which results in poor accuracy. Pandi selvi [2] proposed a simple prediction method for soil based fertilizer recommedation system forpredicted crop diseases. This method gives less accuracy and prediction. Shiva reddy [3] proposed an IoT based system for leaf disease detection and fertilizer recommendation which is based on Machine Learning techniques yields less 80 percentage accuracies.

2.2 References

[1]. R Indumathi.; N Saagari.; V Thejuswini.; R Swarnareka.," Leaf Disease Detection and Fertilizer Suggestion", IEEE International Conference on System, Computation, 9 Automation and Networking (ICSCAN), 29-30 March 2019, DOI: 10.1109/ICSCAN.2019.8878781.

[2]. P. Pandi Selvi, P. Poornima, "Soil Based Fertilizer Reco2.2mmendation System for Crop Disease Prediction System", International Journal of Engineering Trends and Applications (IJETA) – Volume 8 Issue 2, Mar-Apr 2021 .

[3]. H Shiva reddy, Ganesh hedge, Prof. DR Chinnaya3, "IoT based Leaf Disease Detection and Fertilizer Recommendation", International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 11, Nov 2019, e-ISSN: 2395- 0056.

2.3 Problem Statement Definition

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

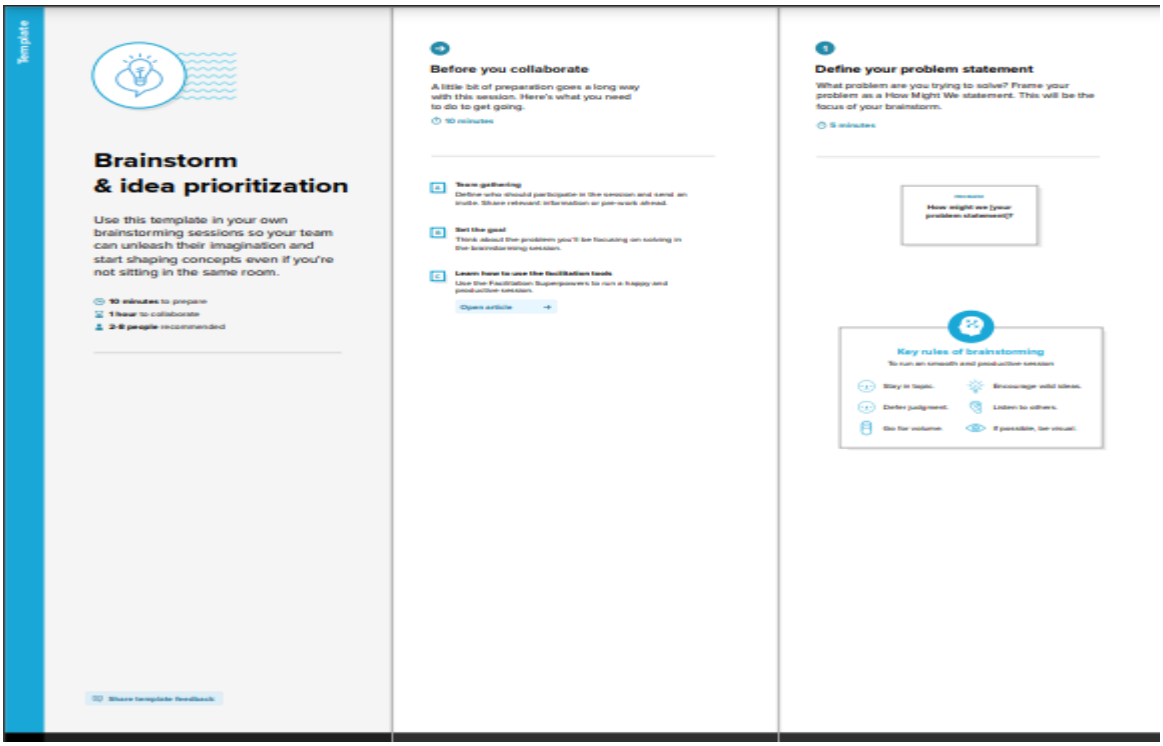
3. IDEATION & PROPOSED SOLUTION

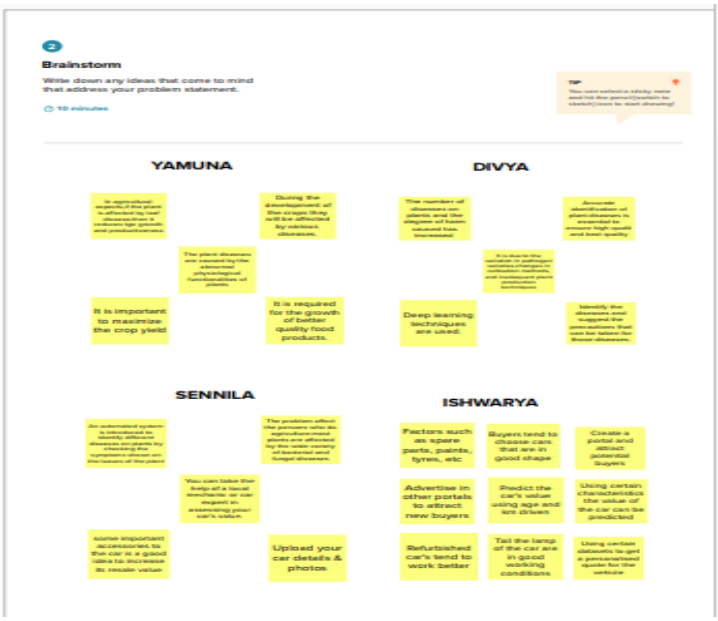
3.1 Empathy Map Canvas

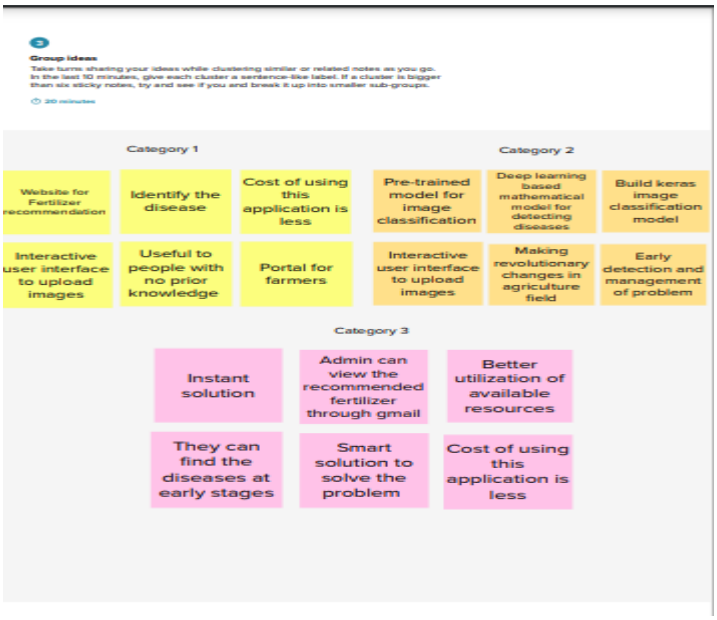
Empathy Map Canvas

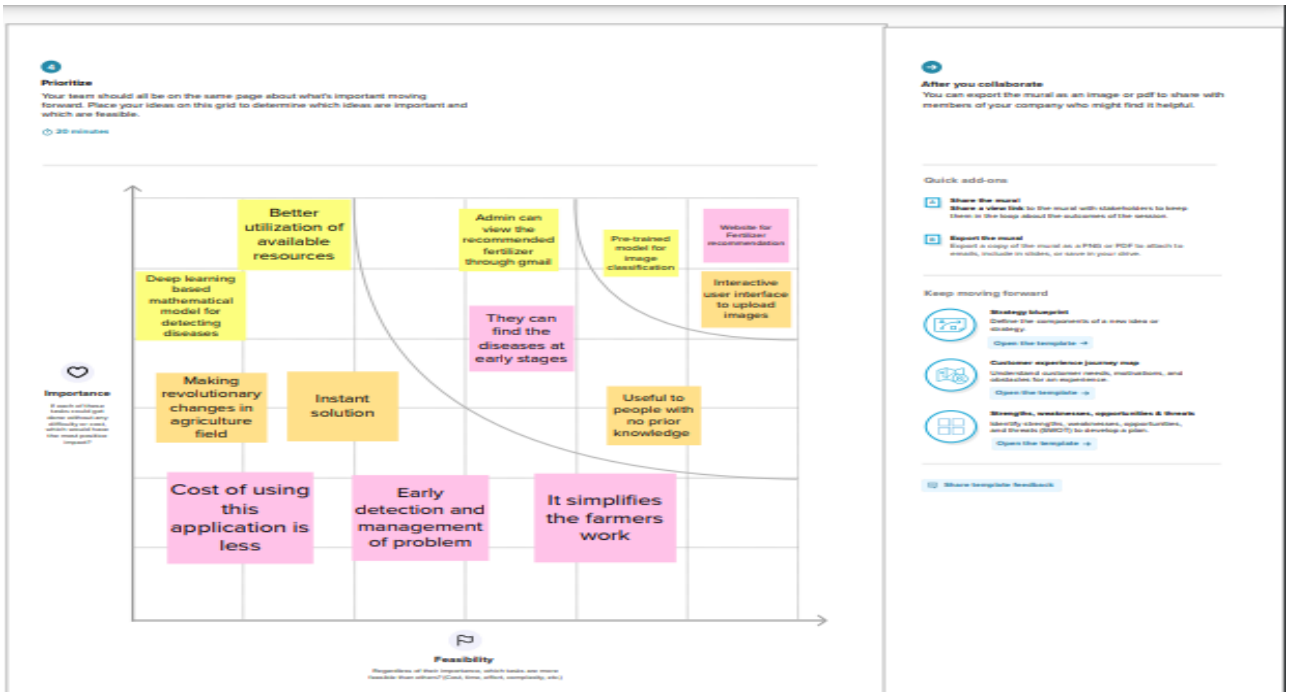
project Title: Fertilizers Recommendation System For Disease Prediction

3.2 Ideation & Brainstorming






3
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
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


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
Feasibility
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

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 affect less agricultural production and compromises with quality as well. To overcome all these issues this recommendation has been proposed . Nowadays a lot of 1 research and work is being implemented in the smart and modern agriculture domain. Crop recommendation is characterized by a soil database composed 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 BENEFICIAL 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: PNT2022TMID06694

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

This is used for farmers. It helps the farmers to identify the disease by themself and recommend fertilizers by themselves.

2. CUSTOMER CONSTRAINTS CC

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

3. AVAILABLE SOLUTIONS AS

People are judge the disease in plants by identifying through the change of leaves quality

Explore AS, differentiate

Focus on J&P, tap into BE, understand RC

4. JOBS-TO-BE-DONE / PROBLEMS J&P

This application helps the farmer who needs recommendation of fertilizer on the plant disease. Identifying disease is the major problem

5. PROBLEM ROOT CAUSE RC

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

6. BEHAVIOUR BE

Directly : Farmer can easily identify the disease by the application and they don't need any extra knowledge on the disease prediction.

Indirectly : Farmer can be able to get result through online immediately.

Focus on J&P, tap into BE, understand RC

7. TRIGGERS TR	8. YOUR SOLUTION SL	9.CHANNELS of BEHAVIOR CH
Seeing their crops are being infected by disease and facing huge loss in quantity and quality	Using fertilizer is one of the solutions for the disease in the plants. Our Application use the image of the infected plant by identifying the disease and suggest the good fertilizer for the disease	Online : Basic knowledge on the plant and fertilizer. Offline : People try to identify the disease by the quality of the leaf's.
10. EMOTIONS: BEFORE / AFTER EM Before : losing self-confidence ,distress. After : gaining self-confidence ,relief.		

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	**Registration through Form**
FR-2	User Confirmation	**Confirmation via Email**
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 requirements

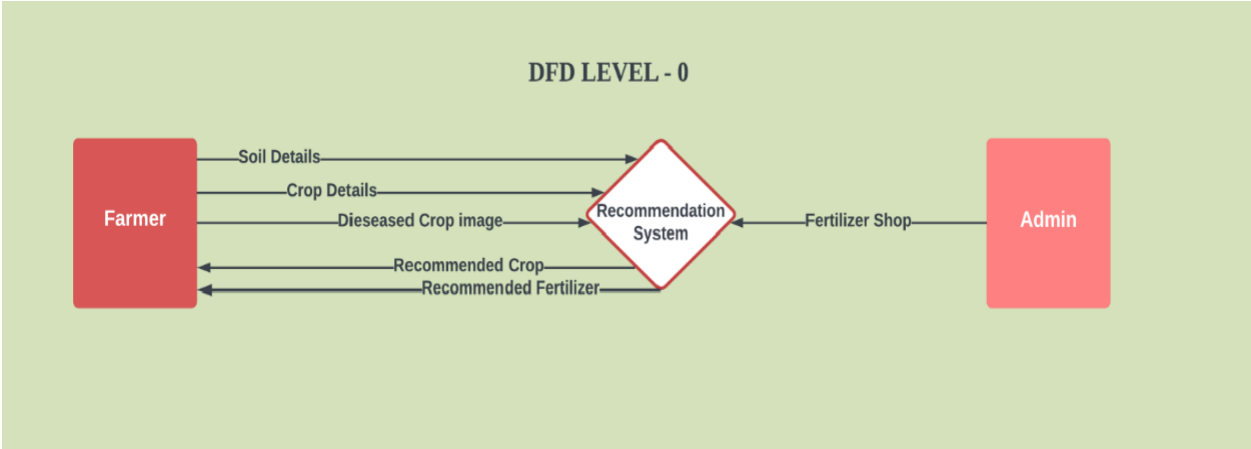
Non-functional Requirements:

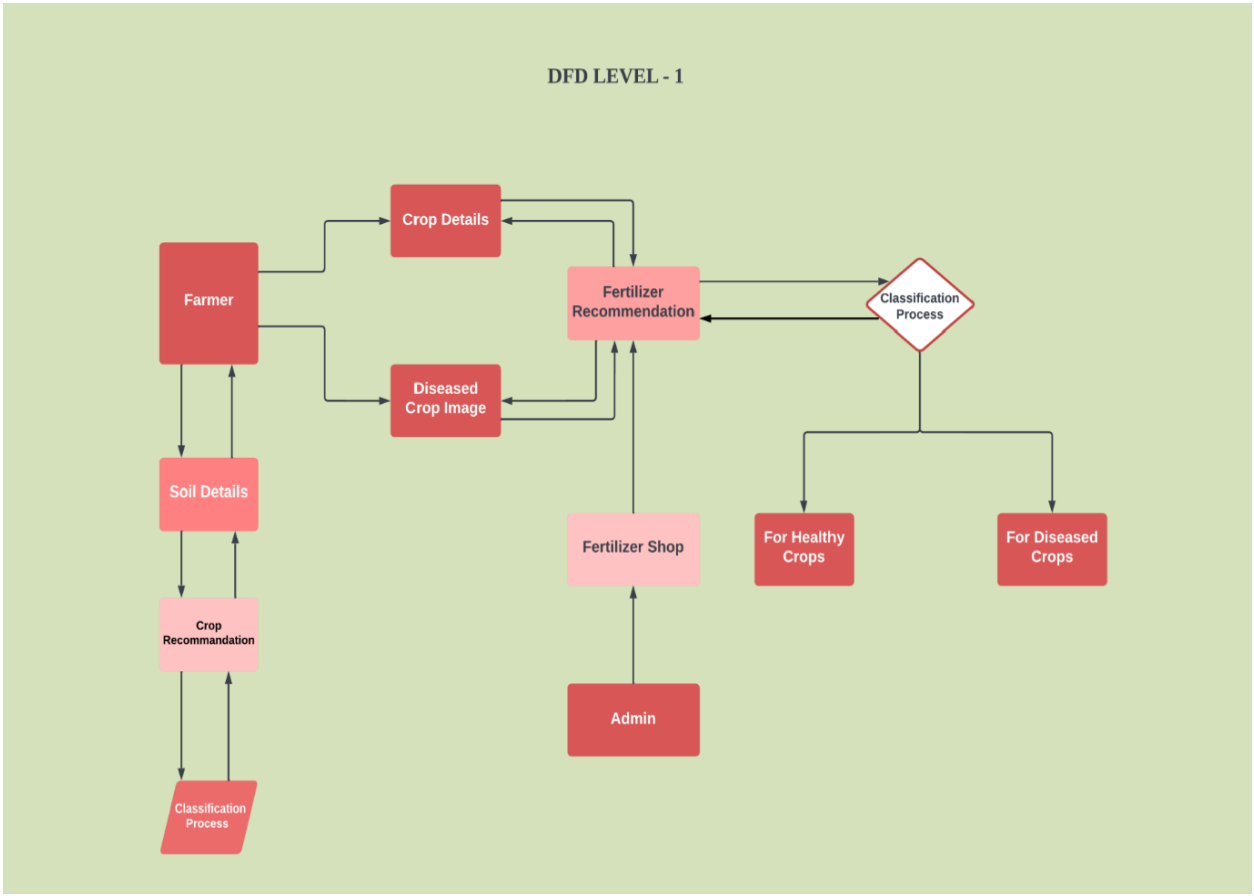
Following are the non-functional requirements of the proposed solution.

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

5.1 Data Flow Diagrams

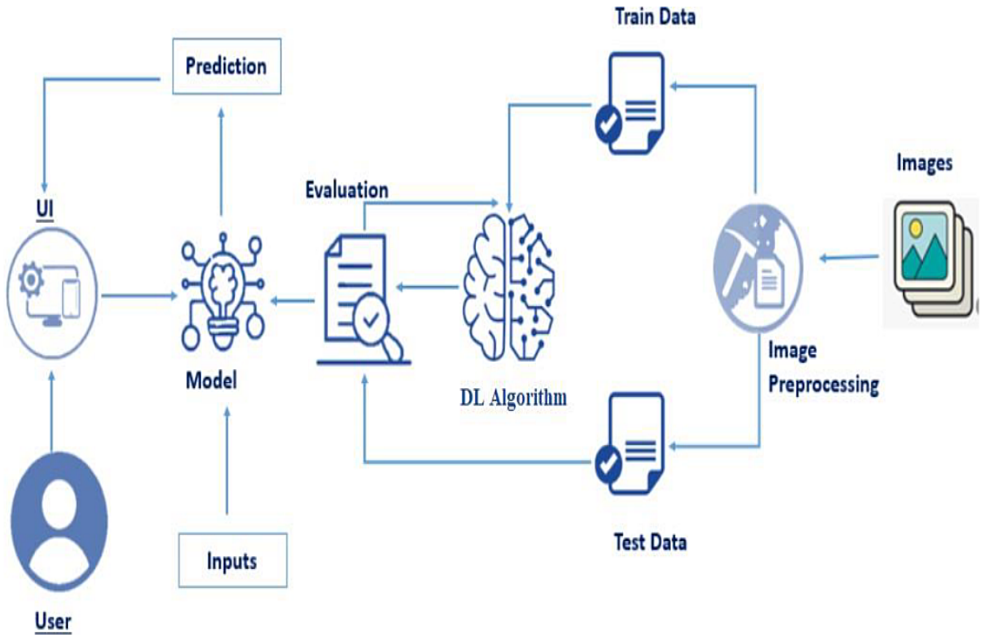



DFD LEVEL - 1
Crop Details
Farmer
Fertilizer Recommendation
Classification Process
Diseased Crop Image
Soil Details
Fertilizer Shop
For Healthy Crops
For Diseased Crops
Crop Recommandation
Admin
Classification Process

5.2 Solution & Technical Architecture

Solution Architecture:

Solution architecture is a complex process - with many sub-processes - that bridges the gap between business problems and technology solutions.



5.3 User Stories

User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile ssuser)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
	Login	USN-2	As a user, I can log into the application by entering email & password	I can login using my E-mail ID accounts or user credentials	High	Sprint-1
	Dashboard	USN-3	As a user, I can view the page of the application where i can upload my images and the fertilizer should be recommended	I can access my account/ dashboard	High	Sprint-2

Customer (Webuser)	Registration	USN-4	As a user, I can login to web dashboard just Like website dashboard	I can register using my username and password	High	**Sprint-3**
	Login	USN-5	As a user, I can login to my web dashboard with the login credentials	I can login using my User credentials	High	**Sprint-3**
	Dashboard	USN-6	As a user, I can view the web application where i can upload my images and thefertilizer should be recommended	I can access my account/ dashboard	High	**Sprint-4**
		USN-7	As a user, the fertilizer recommended to me should be of higher accuracy	I can access my accou nt/ dashb oard	High	**Sprint-4**
Administrator	Login	USN-8	As a admin, I can login to the website using my login credentials	I can login to the website using my login credentials	High	**Sprint-5**
	Dashboard	**USN-9**	**As a admin, I can view the dashboard of the application**	**I can access my dashboard**	**High**	**Sprint-5**

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points (Total)	Priority	Team Members
Sprint-1	Model Creation and Training (Fruits)		Create a model which can classify diseased fruit plants from given images. I also need to test the model and deploy it on IBM Cloud	8	High	Yamuna, Divya, Sennila, Ishwarya
	Model Creation and Training (Vegetables)		Create a model which can classify diseased vegetable plants from given images	2	High	Yamuna, Divya, Sennila, Ishwarya.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points (Total)	Priority	Team Members
Sprint-2	Model Creation and Training (Vegetables)		Create a model which can classify diseased vegetable plants from given images and train on IBM Cloud	6	High	Yamuna, Divya, Sennila, Ishwarya
	Registration	USN-1	As a user, I can register by entering my email, password, and confirming my password or via OAuth API	3	Medium	Yamuna, Divya, Sennila, Ishwarya
	Upload page	USN-2	As a user, I will be redirected to a page where I can upload my pictures of crops	4	High	Yamuna, Divya, Sennila, Ishwarya.
	Suggestion results	USN-3	As a user, I can view the results and then obtain the suggestions provided by the ML model	4	High	Yamuna, Divya, Sennila, Ishwarya.
	Base Flask App		A base Flask web app must be created as an interface for the ML model	2	High	Yamuna, Divya, Sennila, Ishwarya.

Sprint-3	Login	USN-4	As a user/admin/shopkeeper, I can log into the application by entering email & password	2	High	Yamuna, Divya, Sennila, Ishwarya.
	User Dashboard	USN-5	As a user, I can view the previous results and history	3	Medium	Yamuna, Divya, Sennila, Ishwarya.
	Integration		Integrate Flask, CNN model with Cloudant DB	5	Medium	Yamuna, Divya, Sennila, Ishwarya.
	Containerization		Containerize Flask app using Docker	2	Low	Yamuna, Divya, Sennila, Ishwarya.

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

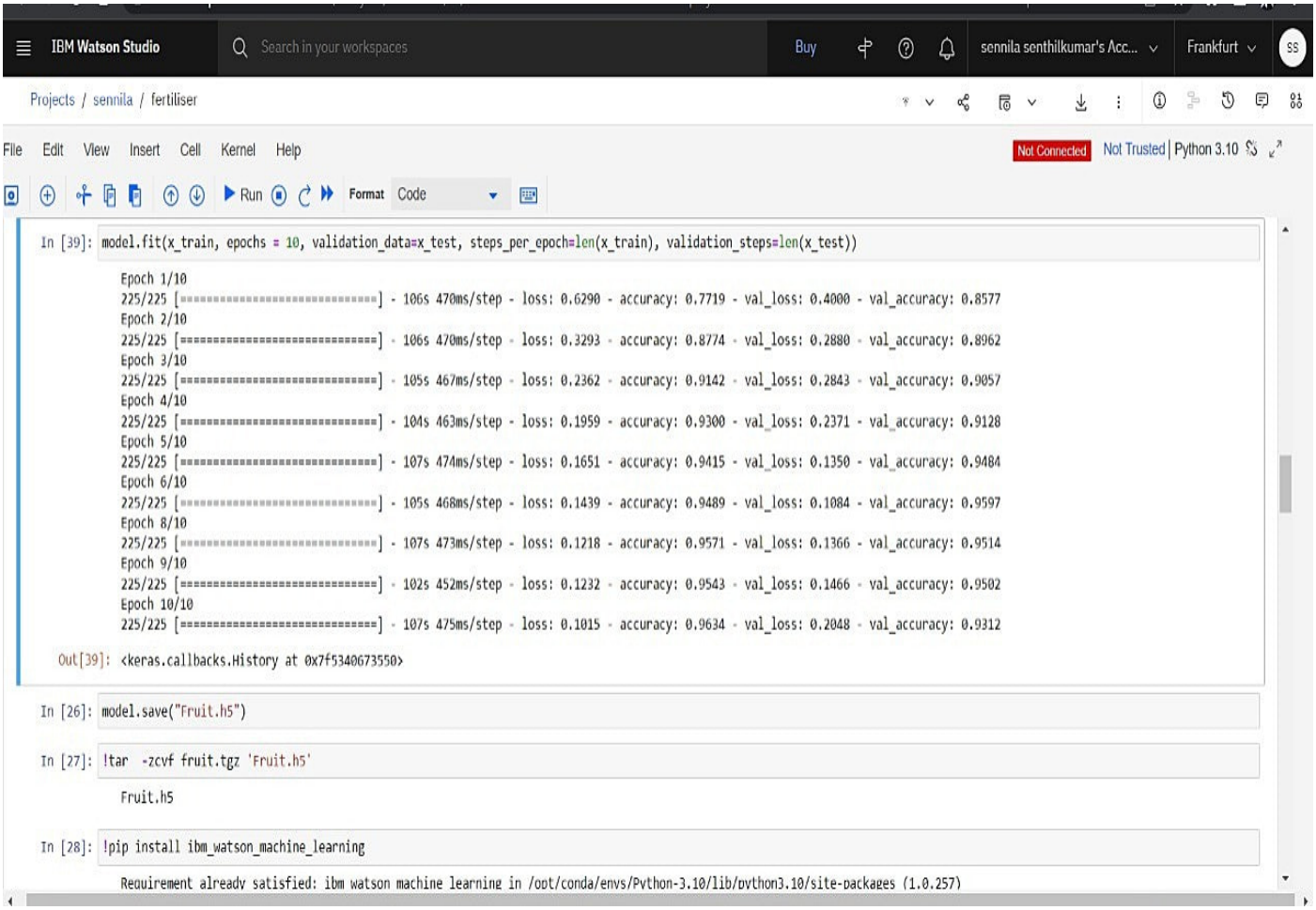
6.2 Sprint Delivery Schedule

sprint	Total story points	Duration	Sprint Start Date	Sprint end (planned)	Story points completed (as on Planned End Date)	Sprint Realse Date(actual)
Sprint-1	20	6 Days	24 oct 2022	29 oct 2022	10	30 oct 2022
Sprint-2	20	6 Days	31 nov 2022	05 nov 2022	15	06 Nov 202 2022
Sprint-3	20	6 Days	07 nov 2022	12 nov 2022	15	13 Nov 2022
Sprint-3	20	6 Days	14 nov 2022	19 nov 2022	10	20 Nov 2022

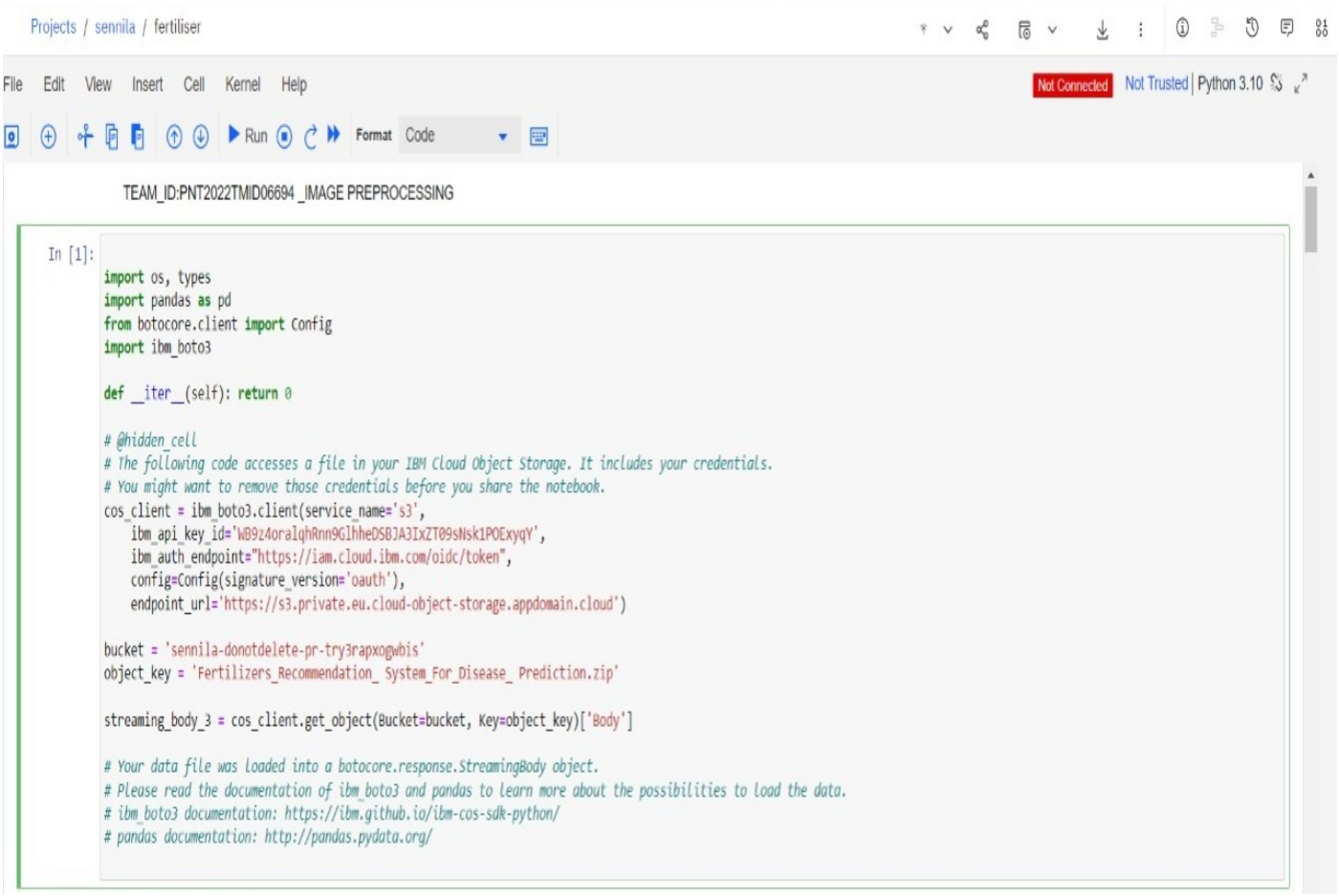
7.CODING & SOLUTION

7.1 Feature 1

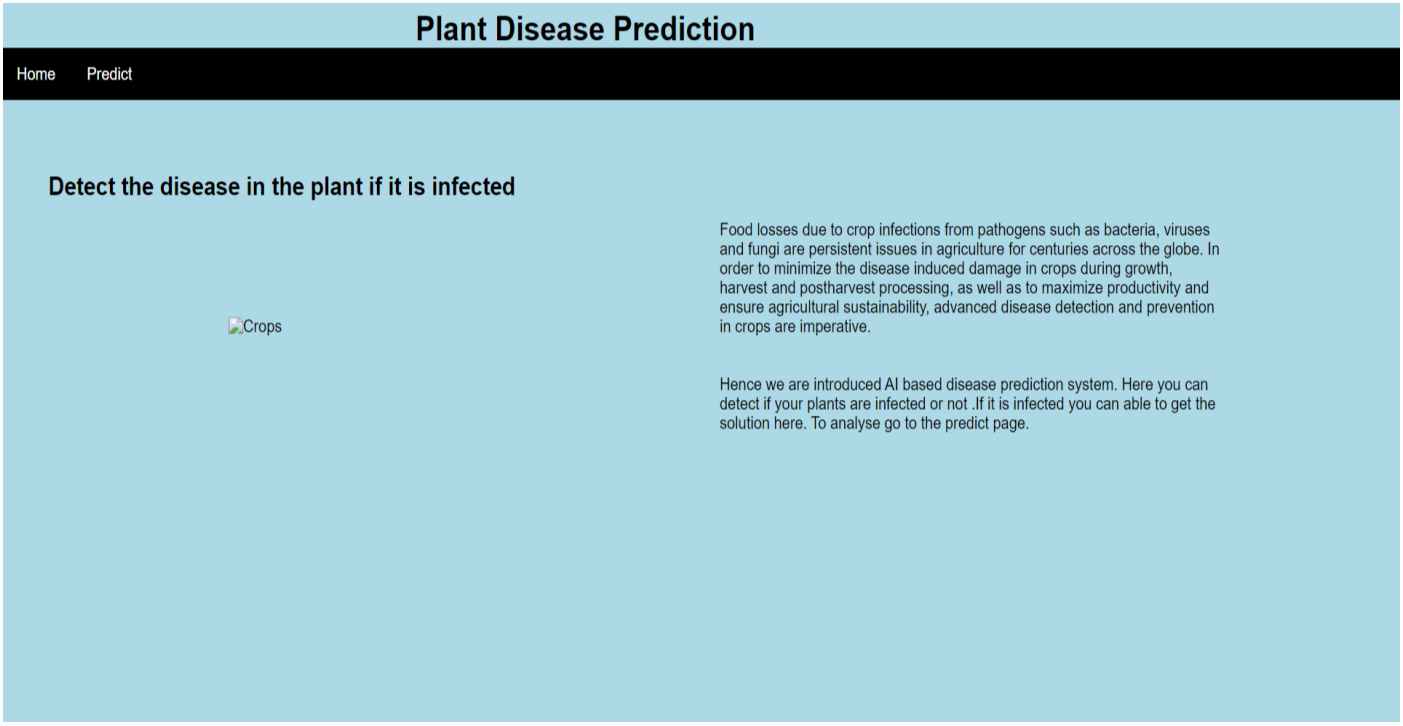
Test and train fruit,vegetable dataset

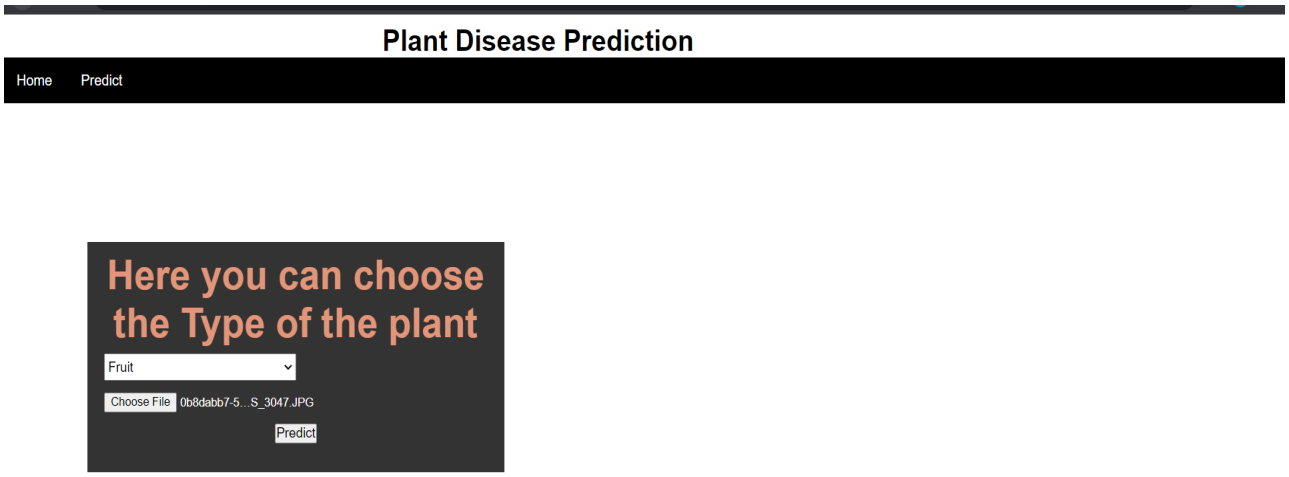


Training Dataset in IBM cloud

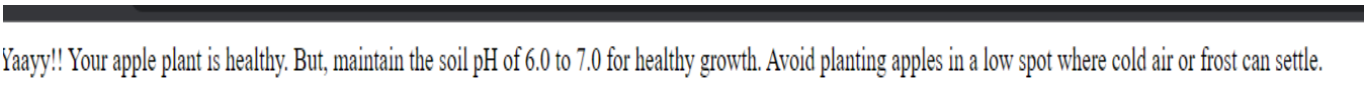


7.2 Features 2





8. RESULT



9. ADVANTAGES & DISADVANTAGES

List of advantages

- The proposed model here produces very high accuracy of classification.
- Very large datasets can also be trained and tested.
- Images of very high can be resized within the proposed itself. 8 List of disadvantages
- For training and testing, the proposed model requires very high computational time.
- The neural network architecture used in this project work has high complexity.

10. CONCLUSION

The model proposed here involves image classification of fruit datasets and vegetable datasets. The following points are observed during model testing and training:

- The accuracy of classification increased by increasing the number of epochs.
- For different batch sizes, different classification accuracies are obtained.
- The accuracies are increased by increasing more convolution layers.
- The accuracy of classification also increased by varying dense layers.
- Different accuracies are obtained by varying the size of kernel used in the convolution layer output.
- Accuracies are different while varying the size of the train and test datasets.

11. FUTURE SCOPE

The proposed model in this project work can be extended to image recognition. The entire model can be converted to application software using python to exe software. The real time image classification, image recognition and vidoe processing are possible with help OpenCV python library. This project work can be extended for security applications such as figure print recognition, iris recognition and face recognition.

12.APPENDIX

SOURCE CODE

```
import numpy as np
import os
import pandas as pd
from werkzeug.utils import secure_filename
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from flask import Flask,render_template,request,url_for
app=Flask(__name__)
model=load_model("vegetable.h5")
model1=load_model("fruit.h5")
@app.route('/')
def index():
    return render_template('home.html')
@app.route('/prediction')
def prediction():
    return render_template("predict.html")
@app.route('/prediction1',methods=['GET','POST'])
def predict_img():
    f=request.files['image']
    basepath=os.path.dirname(__file__)
    filepath=os.path.join(basepath,'uploads',secure_filename(f.filename))
    f.save(filepath)
    img=image.load_img(filepath, target_size=(64,64))
    x=image.img_to_array(img)
    x=np.expand_dims(x, axis=0)
    plant=request.form['plant']
    print(plant)
```

```
    if(plant=="vegetable"):
            preds = model.predict(x)
            preds =np.argmax(preds)
            print(preds)
            df=pd.read_excel('precautions - veg.xlsx')
            print(df.iloc[preds]['caution'])
    else:
             preds = model1.predict(x)
             preds =np.argmax(preds)
             df=pd.read_excel('precautions - fruits.xlsx')
             print(df.iloc[preds]['caution'])
    return (df.iloc[preds]['caution'])
if __name__=="__main__":
 app.run(debug=False)
```

GitHub Link:

https://github.com/IBM-EPBL/IBM-Project-30329-1660144104

Project Demo Link:

https://www.youtube.com/watch?v=GxVL6eDySlU