PROJECT REPORT

FERTILIZER RECOMMENDATION SYSTEM FOR DISEASE PREDICTION

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ABSTRACT

In India, The Agriculture industry is extremely vital and crucial for economic and social development and jobs. The agricultural sector provides a living for almost 48% of the population. As per the 2019-2020 economic survey, and 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.

CHAPTER 1. INTRODUCTION

1.1 PROJECT OVERVIEW

Detection and recognition of plant diseases using machine learning are very efficient in providing symptoms of identifying diseases at its earliest. Plant pathologists can analyze the digital images using digital image processing for diagnosis of plant diseases. Application of computer vision and image processing strategies simply assist farmers in all of the regions of agriculture. Generally, the plant diseases are caused by the abnormal physiological functionalities of plants. Therefore, the characteristic symptoms are generated based on the differentiation between normal physiological functionalities and abnormal physiological functionalities of the plants. Mostly, the plant leaf diseases are caused by Pathogens which are positioned on the stems of the plants. These different symptoms and diseases of leaves are predicted by different methods in image processing. These different methods include different fundamental processes like segmentation, feature extraction and classification and so on. Mostly, the prediction and diagnosis of leaf disease are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves.

1.2 PURPOSE

- Detect and recognize the plant diseases and to recommend fertilizer, it is necessary to identify the diseases and to recommend to get different and useful features needed for the purpose of analyzing later.

- Plants need 17 elements for normal growth. Carbon, hydrogen, and oxygen come from the air and water. Soil is the principal source of other nutrients. Primary nutrients (nitrogen, phosphorus, and potassium) are used in relatively large amounts by plants, and often are supplemented as fertilizers.
- 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.

CHAPTER 2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

In natural systems, host plant and pathogen are constantly changing with pathogens evolving new pathogenicity to overcome host defecnse systems and plants evolving to reduce pathogen attack. Plant disease results from complex interactions among biotic and abiotic factors including hosts, pathogens and environments, to which should be added vectros for some diseases and human activities that modify the interaction intentionally or uninterntionally through agricultural practices such as cropping systems, resistance gene deployment and application of pesticides. In recnet times, technology evolutions are at their peak and the public like illiterate, rural people, are aware of technologies right now. Advantages of new technologies in agriculture:

- Steadier crop yields.
- Decrease in water, fertilizer and pesticide use, in turn, keeps food prices low.
- Reduced impact on the surrounding environment.
- Prevent runoff.
- Safety improvements for workers.

Going on with the flow, if the fertilizer recommendation is don’t manually it might delay the process so we are in need of an application that fastens the process.

2.2 REFERENCES

1. Establishing a scientific basis for fertilizer recommendations for wheat in

China: Yield response and agronomic efficiency; Limin Chuana, Ping Hea; Volume

140; January 2013

2. Design and Implementation of Crop Recommendation Fertilization Decision

System Based on WEBGIS at Village Scale; Hao Zhang, Li Zhang,

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Springer, Berlin, Heidelberg

3. Crop Recommendation and Fertilizer Purchase System; Mansi Shinde1,

Kimaya Ekbote, Sonali Ghorpade, Sanket Pawar, Shubhada Mone; International

Journal of Computer Science and Information Technologies, Vol. 7 (2)

4. http://www.smart-fertilizer.com/

5. Design of Precision Fertilization Management Information System on GPS and

GIS Technologies; Zhimin Liu, Weidong Xiong, Xuewei Cao; Vol 2

6. OWL 2 Web Ontology Language: Primer (Second Edition) Pascal Hitzler, Markus

Krötzsch, Bijan Parsia, Peter F. Patel-Schneider, Sebastian Rudolph, eds.;

7. Crop Recommendation and Fertilizer Purchase System; Mansi Shinde,

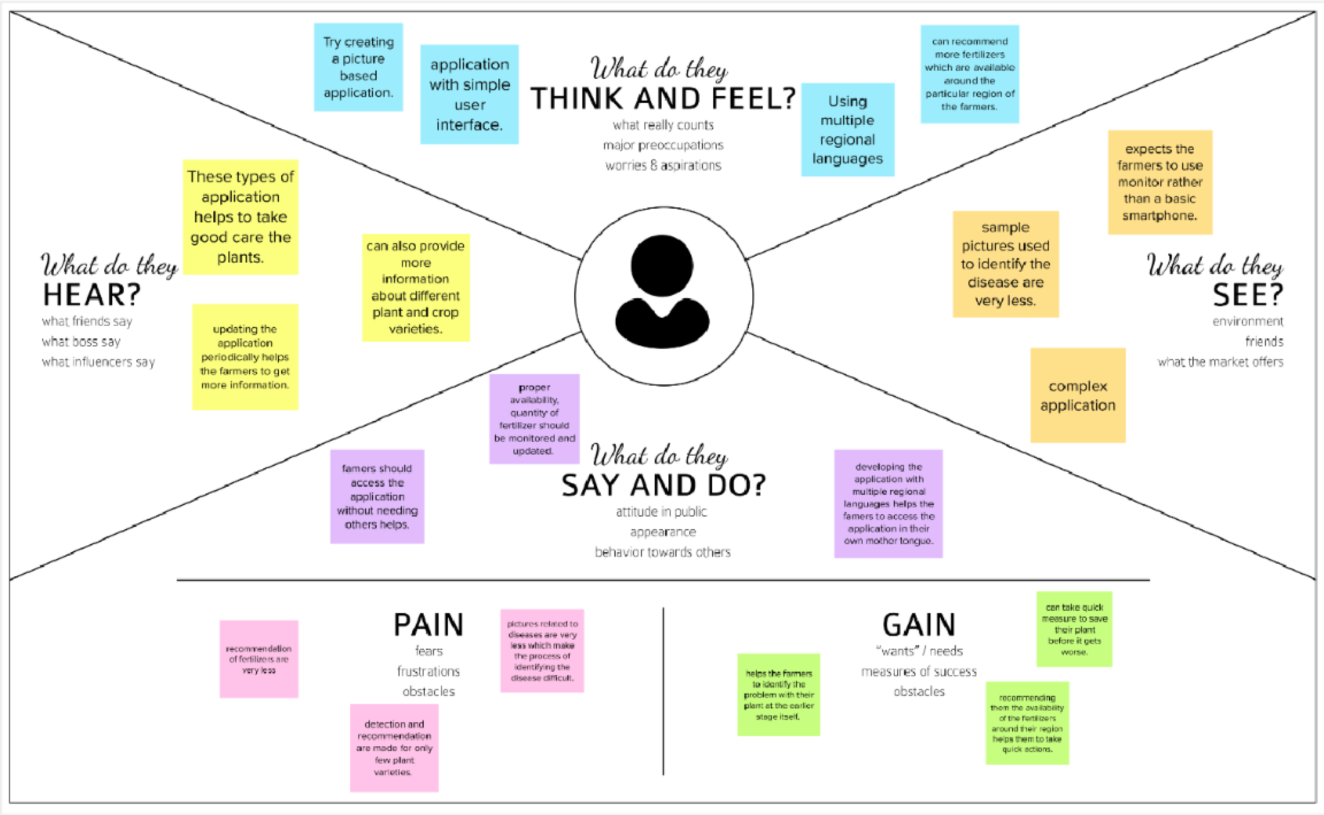
Kimaya Ekbote, Sonali Ghorpade, Sanket Pawar, Shubhada Mone; International journal of computer science and information technologies, vol. 7 (2)

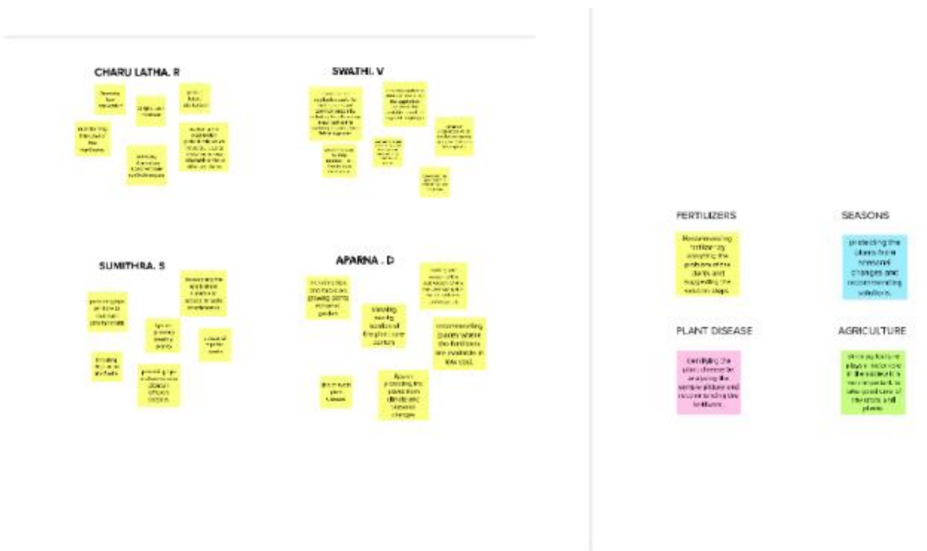
2.3 PROBLEM STATEMENT DEFINITION

Agriculture is the most important sector in today's life. Most plants are affected by a wide variety of bacterial and fungal disease. Diseases on placed a major constraint on the production and a major threat to food security. Hence, early and accurate identification of plant disease 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 cariation in pathogen varieties, changes in cultivation methods, and inadequate plant protection techniques. An automated system is introduced ot identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the disease and suggest the precautions that can be taken for those diseases.

Chapter 3. Ideation and proposed solution

3.1 EMPATHY MAP CANVAS



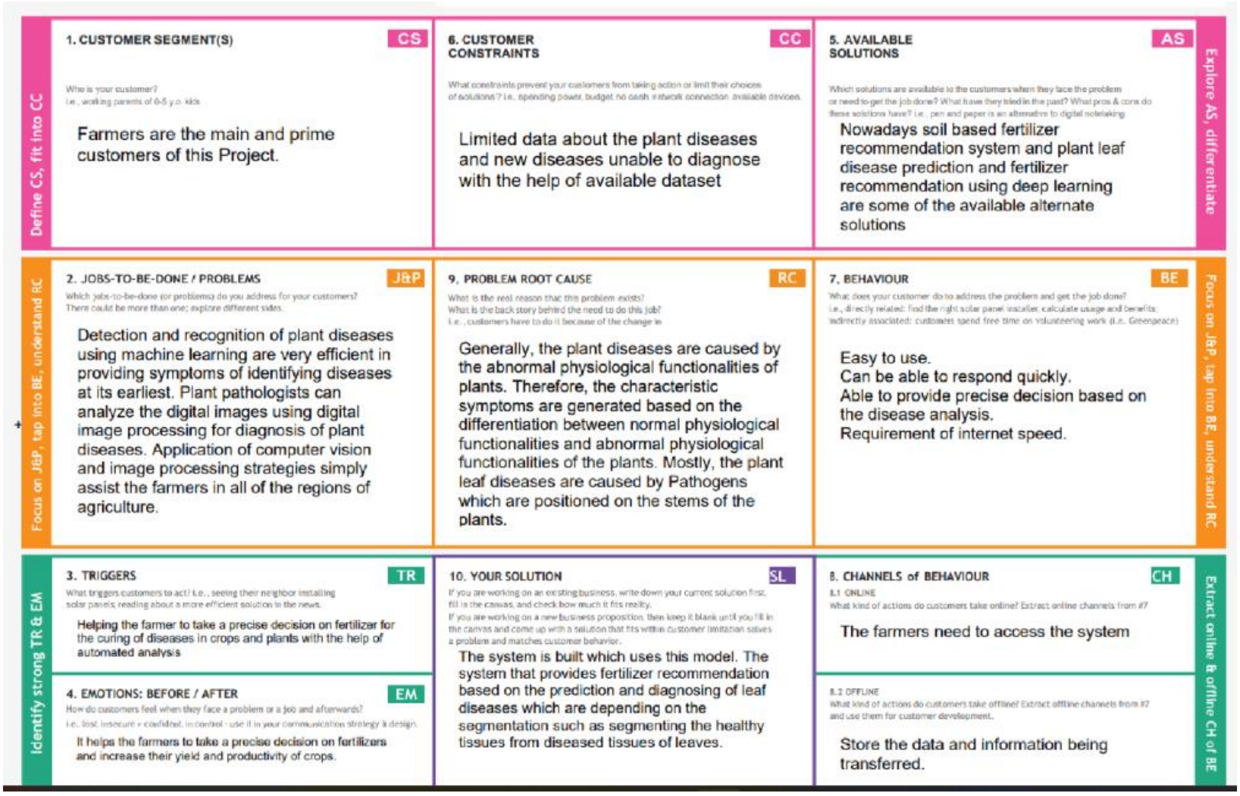


3.2 IDEATION AND BRAINSTROMING

3.3 PROPOSED SOLUTION

The proposed system recommends the fertilizer for affected leaves based on the severity level of the crops. Fertilizers may be organic or inorganic. The user can also save the recommended fertilizers in the device's local storage and can be viewed at any time. The measurements of fertilizers (i.e.) the effectiveness of the fertilizers are suggested based on disease severity. We propose a user-friendly web application system based on machine learning. So, the user can provide the input using forms on our user interface and quickly get their results. The proposed method is also found to perform better and produce a higher number of yields. Using the proposed model, crop yield production increased and gave the super ability to decide the right combination of different types of available resources. This will help farmers and agriculture experts to adopt the method for other crops. A digital camera or similar devices can be used to capture the image of the affected leaves. Then the user uploads the image to the model. Then different image preprocessing techniques are applied to the dataset and then split into training and testing data and also to get different features needed for the purpose of analyzing leaf disease identification. Now the trained data and tested data are evaluated using the Machine Learning algorithm and then the algorithm generates an output image as a grayscale, an invert, and a smoothed one. After that, the prediction of disease is done and a suitable fertilizer is recommended to the user. Now the user can use the recommended fertilizers for the diseased plants.

3.4 PROBLEM SOLUTION FIT



Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?
i.e., working parents of 0-5 y.o. kids

Farmers are the main and prime customers of this Project.

6. CUSTOMER CONSTRAINTS CC

What constraints prevent your customers from taking action or limit their choices of solutions? i.e., spending power, budget, no cash, network connection, available devices.

Limited data about the plant diseases and new diseases unable to diagnose with the help of available dataset

5. AVAILABLE SOLUTIONS AS

Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e., pen and paper is an alternative to digital notetaking

Nowadays soil based fertilizer recommendation system and plant leaf disease prediction and fertilizer recommendation using deep learning are some of the available alternate solutions

Explore AS, differentiate

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

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

Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.

Detection and recognition of plant diseases using machine learning are very efficient in providing symptoms of identifying diseases at its earliest. Plant pathologists can analyze the digital images using digital image processing for diagnosis of plant diseases. Application of computer vision and image processing strategies simply assist the farmers in all of the regions of agriculture.

9. PROBLEM ROOT CAUSE RC

What is the real reason that this problem exists?
What is the back story behind the need to do this job?
i.e., customers have to do it because of the change in

Generally, the plant diseases are caused by the abnormal physiological functionalities of plants. Therefore, the characteristic symptoms are generated based on the differentiation between normal physiological functionalities and abnormal physiological functionalities of the plants. Mostly, the plant leaf diseases are caused by Pathogens which are positioned on the stems of the plants.

7. BEHAVIOUR BE

What does your customer do to address the problem and get the job done?
i.e., directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

Easy to use.
Can be able to respond quickly.
Able to provide precise decision based on the disease analysis.
Requirement of internet speed.

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

Identify strong TR & EM

3. TRIGGERS TR

What triggers customers to act? i.e., seeing their neighbor installing solar panels, reading about a more efficient solution in the news.

Helping the farmer to take a precise decision on fertilizer for the curing of diseases in crops and plants with the help of automated analysis

4. EMOTIONS: BEFORE / AFTER EM

How do customers feel when they face a problem or a job and afterwards?
i.e., lost, insecure > confident, in control - use it in your communication strategy & design.

It helps the farmers to take a precise decision on fertilizers and increase their yield and productivity of crops.

10. YOUR SOLUTION SL

If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitation, solves a problem and matches customer behavior.

The system is built which uses this model. The system that provides fertilizer recommendation based on the prediction and diagnosing of leaf diseases which are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves.

8. CHANNELS of BEHAVIOUR CH

8.1 ONLINE
What kind of actions do customers take online? Extract online channels from #7

The farmers need to access the system

8.2 OFFLINE
What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.

Store the data and information being transferred.

Extract online & offline CH of BE

CHAPTER 4- REQUIREMENT ANALYSIS

4.1 FUNTIONAL REQUIREMENT

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through Facebook
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP Via Call
FR-3	Capturing Image	Capture the image of the leaf and check the parameter of the captured image.
FR-4	Image Processing	Upload the image for the prediction of the disease in the leaf.
FR-5	Leaf Identification	Identify the leaf and predict the disease in leaf.
FR-6	Image Description	Suggesting the best fertilizer for the disease.

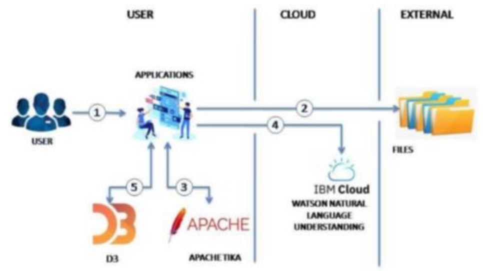
4.2 NON FUNTIONAL REQUIREMENT

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Datasets of all the leaf is used to detecting the disease that present in the leaf.
NFR-2	**Security**	The information belongs to the user and leaf are secured highly.
NFR-3	**Reliability**	The leaf quality is important for predicting the disease in leaf/plant.
NFR-4	**Performance**	It is available for all user to predict the disease.
NFR-5	**Availability**	It is available for all user to predict the disease in the plant.
NFR-6	**Scalability**	Increasing the prediction of the disease in the leaf.

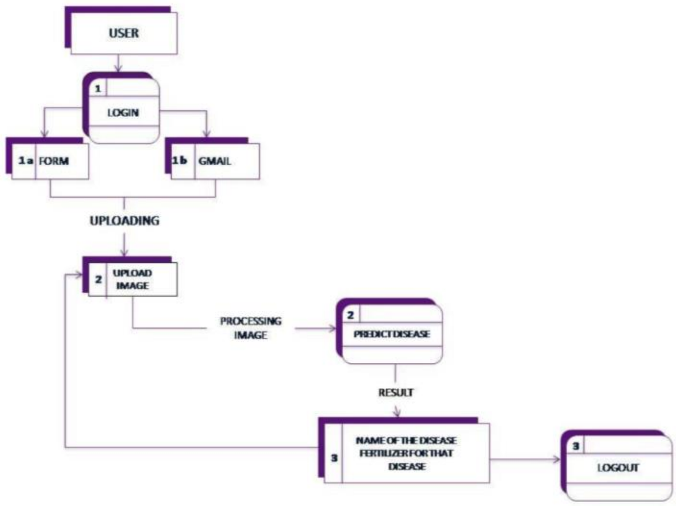
CHAPTER 5 . PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

Data Flow Diagrams:



USER PROCESS:



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 user)	Registration	USN 1	As a user, I can register for the application by entering my email as a user, password, and confirming my password.	I can access my profile / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can Access the Application via Gmail	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can use the Application for Disease Prediction	High	Sprint-1
Customer (Web user)	Registration	USN-6	As a Web user, I can register with a User ID on the System	I can able to access the app as a website	High	Sprint-1
Customer Care Executive	Customer Support	USN-7	As a Supporter, I can Understand exactly how customer use the product	I can create Guidelines and Practices for Customer	Low	Sprint-2
Administrator	Analyst	USN-8	As a Admin, I can Update many dataset about the Plant Diseases	I can able to store large Amount of Data	High	Sprint-1
Customer Purpose	Prediction	USN-9	It uses AI to identify the Plants Disease within the Captured photos and Live View of Prediction	I can Predict Disease of the Plant	High	Sprint-1

CHAPTER 6 PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points (Total)	Priority	Team Members
Sprint-1	Data collection	USN-1	As a user, I can collect the datasets from different open sources like Kaggle.com, data.gov. UCI machine learning repository, google, etc. with different plant leaf images.	8	High	R. Charu Latha, V. Swathi, S. Sumithra.

		USN-2	Create a model which can classify diseased vegetable plants from given images	2	High	R. Charu Latha, V. Swathi, S. Sumithra.
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 plants from given images and train on IBM Cloud	6	High	R. Charu Latha, V. Swathi, S. Sumithra.
	Registration	USN-1	As a user, I can register by entering my phone number, password, and confirming my password or via OTP.	3	Medium	R. Charu Latha, V. Swathi, S. Sumithra.
	Upload page	USN-2	As a user, I will be redirected to a page where I can upload my pictures of crops or take the picture of the crop using the camera.	4	High	R. Charu Latha, V. Swathi, S. Sumithra.
	Suggestion results	USN-3	As a user, I can view the results and then obtain the suggestions provided by the ML model	4	High	R. Charu Latha, V. Swathi, S. Sumithra.
	Base Flask App		A base Flask web app must be created as an interface for the ML model	2	High	R. Charu Latha, V. Swathi.

Sprint-3	Login	USN-4	As a user/admin/shopkeeper, I can log into the application by entering phone number and password or OTP.	2	High	R. Charu Latha, V. Swathi.
	User Dashboard	USN-5	As a user, I can view the previous results and history.	3	Medium	R. Charu Latha, V. Swathi.
	Integration		Integrate Flask, CNN model with Cloudant DB	5	Medium	R. Charu Latha, V. Swathi.
Sprint-4	Dashboard (Admin)	USN-6	As an admin, I can view other user details and uploads for other purposes	2	Medium	R. Charu Latha, V. Swathi, D. Aparna, S. Sumithra.
	Dashboard (Shopkeeper)	USN-7	As a shopkeeper, I can enter fertilizer products and then update the details if needed	2	Low	R. Charu Latha, V. Swathi, D. Aparna, S. Sumithra.

6.2 SPRINT DELIVERY SCHEDULE

Project Tracker, Velocity & Burndown Chart: (4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	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

6.3 REPORTS FROM JIRA

Monthly report

Weekly report

Quarter report

CHAPTER 7. CODING AND SOLUTIONING

7.1 MODEL BUILDING FOR FRUITS DISEASE PREDICTION

For model building, first necessary libraries will be imported. Then from the dataset uploaded images can be retrieved using ImageDataGenerator. Training the model starts. We have usedVGG19 CNN model for training and necessary packages are also installed. Once training is completed, trained model will be compiled, defined and tested.

tested.

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import os

import keras
import tensorflow

from keras.preprocessing.image import ImageDataGenerator

from keras.applications.vgg19 import VGG19,preprocess_input,decode_predictions

from tensorflow.keras.utils import img_to_array

from keras_preprocessing.image import load_img
```

```
train_datagen = ImageDataGenerator(zoom_range=0.5,shear_range=0.3,horizontal_flip=True,preprocessing_function= preprocess_input)
val_datagen = ImageDataGenerator(rescale= 1/255)
```

```
x_train=train_datagen.flow_from_directory(r'/content/drive/MyDrive/Dataset Plant Disease/fruit-dataset/test',target_size=(256,256),class_mode='categorical',batch_size=32)
x_val=val_datagen.flow_from_directory(r'/content/drive/MyDrive/Dataset Plant Disease/fruit-dataset/train',target_size=(256,256),class_mode='categorical',batch_size=32)
```

```
Found 1686 images belonging to 6 classes.
Found 5394 images belonging to 6 classes.
```

```
from keras.layers import Dense, Flatten
from keras.models import Model
from keras.applications.vgg19 import VGG19
import keras
```

```
base_model = VGG19(input_shape=(256, 256, 3), include_top = False)
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vgg19/vgg19_weights_tf_dim_ordering_tf_kernels_notop.h5
80134624/80134624 [==============================] - 4s 0us/step
```

```
for layer in base_model.layers:
  layer.trainable= False
```

```
base_model.summary()
```

Model: "vgg19"

Layer (type)	Output Shape	Param #
input_1 (InputLayer)	[(None, 256, 256, 3)]	0
block1_conv1 (Conv2D)	(None, 256, 256, 64)	1792
block1_conv2 (Conv2D)	(None, 256, 256, 64)	36928
block1_pool (MaxPooling2D)	(None, 128, 128, 64)	0
block2_conv1 (Conv2D)	(None, 128, 128, 128)	73856
block2_conv2 (Conv2D)	(None, 128, 128, 128)	147584
block2_pool (MaxPooling2D)	(None, 64, 64, 128)	0

```
[ ]  block5_conv4 (Conv2D)       (None, 16, 16, 512)      2359808

     block5_pool (MaxPooling2D)  (None, 8, 8, 512)        0

    =================================================================
    Total params: 20,024,384
    Trainable params: 0
    Non-trainable params: 20,024,384
    _________________________________________________________________
```

```
[ ] X = Flatten()(base_model.output)
    X= Dense(units = 6, activation='softmax')(X)

    #creating our model
    model = Model(base_model.input, X)
    model.summary()
```

```
    Model: "model"
    _________________________________________________________________
     Layer (type)                Output Shape              Param #
    =================================================================
     input_1 (InputLayer)        [(None, 256, 256, 3)]     0

     block1_conv1 (Conv2D)       (None, 256, 256, 64)      1792

     block1_conv2 (Conv2D)       (None, 256, 256, 64)      36928

     block1_pool (MaxPooling2D)  (None, 128, 128, 64)      0

     block2_conv1 (Conv2D)       (None, 128, 128, 128)     73856

     block2_conv2 (Conv2D)       (None, 128, 128, 128)     147584
```

```
[ ]  flatten (Flatten)           (None, 32768)             0

     dense (Dense)               (None, 6)                 196614

    =================================================================
    Total params: 20,220,998
    Trainable params: 196,614
    Non-trainable params: 20,024,384
    _________________________________________________________________
```

```
[ ] import tensorflow as tf
    tf.keras.losses.CategoricalCrossentropy()
    loss = 'categorical_crossentropy'
    model.compile(optimizer= 'adam', loss = 'categorical_crossentropy' , metrics=['accuracy'])
```

```
[ ] from keras.callbacks import ModelCheckpoint, EarlyStopping
    es= EarlyStopping(monitor= 'val_accuracy',min_delta=0.01, patience = 3, verbose = 1)

    #model check point
    mc= ModelCheckpoint(filepath ="fruit_model.h5",
                       monitor= 'val_accuracy',
                       min_delta=0.01,
                       patience= 3,
                       verbose = 1,
                       save_best_only= True)
    cb= [es, mc]
```

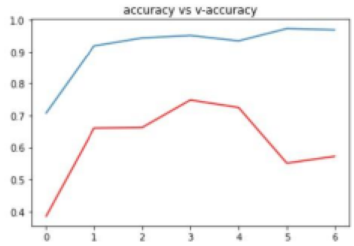
```
[ ] his= model.fit_generator(x_train, steps_per_epoch = 16, epochs= 50, verbose= 1, callbacks= cb, validation_data= x_val, validation_steps = 16)

    /usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which
```

```
16/16 [==============================] - 878s 57s/step - loss: 0.4416 - accuracy: 0.9727 - val_loss: 1.6773 - val_accuracy: 0.5508
Epoch 7/50
16/16 [==============================] - ETA: 0s - loss: 0.7685 - accuracy: 0.9688
Epoch 7: val_accuracy did not improve from 0.74805
16/16 [==============================] - 867s 56s/step - loss: 0.7685 - accuracy: 0.9688 - val_loss: 2.0626 - val_accuracy: 0.5723
Epoch 7: early stopping
```

```
h= his.history
h.keys()
```

```
dict_keys(['loss', 'accuracy', 'val_loss', 'val_accuracy'])
```

```
plt.plot(h['accuracy'])
plt.plot(h['val_accuracy'], c= "red")
plt.title("accuracy vs v-accuracy")
plt.show()
```



7.2 MODEL BUILDING FOR VEGETABLE DISEASE PREDICTION

For model building, first necessary libraries will be imported. Then from the dataset uploaded images can be retrieved using ImageDataGenerator. Training the model starts. We have usedVGG19 CNN model for training and necessary packages are also installed. Once training is completed, trained model will be compiled, defined and tested.

CHAPTER 8. TESTING

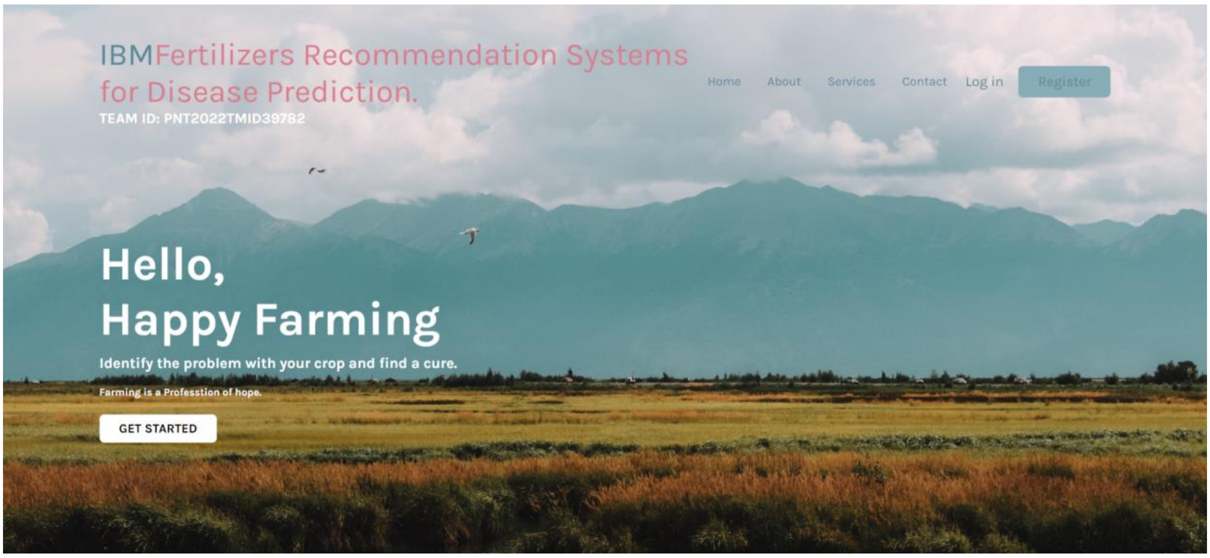
8.1 Test Cases

Is done and uploaded on GitHub

8.2 User Acceptance Testing

Is done and uploaded on GitHub

CHAPTER 9. RESULTS



9.1 Performance Metrics

Is done and submitted

CHAPTER 10. ADVANTAGES & DISADVANTAGES

ADVANTAGES

The system comes with a model to be precise and accurate in predicting crop yield and deliver the end user with proper recommendations about required fertilizer ratio based on atmospheric and soil parameters of the land which enhance to increase the crop yield and increase farmer revenue. The prediction of crop yield based on location and proper implementation of algorithms have proved that the higher crop yield can be achieved. From above work I conclude that for soil classification Random Forest is good with accuracy 86.35% compare to Support Vector Machine. For crop yield prediction Support Vector Machine is good with accuracy 99.47% compare to Random Forest algorithm. The work can be extended further to add following functionality. Mobile application can be build to help farmers by uploading image of farms. Crop diseases detection using image processing in which user get pesticides based on disease images. Implement Smart Irrigation System for farms to get higher yield.

DISADVANTAGES

Though the use of deep learning algorithms in disease prediction in agriculture crops reduces the time in determining the disease and in recommending suitable fertilizers, there are predictions of there being millions of unemployed field workers in the next decades primarily due to the impact of AI in the agriculture industry.

● Weather changes can affect the prediction process and make it slow or create some changes in it.

● 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.

CHAPTER 11. CONCLUSION

The core strategy of this project is to predict the crop based on the soil nutrient content and the location where the crop is growing. This system will help he farmers to choose the right crop for their land and to give the suitable amount of fertilizer to produce the maximum yield. The Support Vector Machine algorithm helps to predict the crop the precisely based on the pre-processed crop data. This system will also help the new comers to choose the crop which will grow in their area and produce them a good profit. A decent amount of profit will attract more people towards the agriculture. Also, the crop growth is based on the climate conditions in the particular area and the seasonal monsoons happens now are unpredictable, hence it is easy for the farmers when the prediction result is also based on the climatic conditions. Live weather prediction will also help the users to predict the crop water needs and also it will help the farmers to decrease the crop damage due to the rain or drought .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 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.

CHAPTER 12. 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 analyses 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 as stems and fruits.

CHAPTER 13. APPENDIX

Source Code

Source code of html, css, java and python are uploaded.

GitHub & Project Demo Link

GitHub link: https://github.com/IBM-EPBL/IBM-Project-16700-1659620385

Project Demo Link:
https://drive.google.com/file/d/1zoZOKUCoKPFMahzp0r9SHhEnWptgT_dA/view?usp=share_link