# Fertilizers  Recommendation System For Disease Prediction

## 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 diseases are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves.

### 1.2 Purpose

It allows us to predict which crops would be appropriate for a given climate. Using the weather and disease related data sets, the crop quality can also be improved. Prediction algorithms help us to classify the data based on the disease, and data extracted from the classifier is used to predict soil and crop Agriculture is the main aspect of country development. Many people lead their life from agriculture field, which gives fully related to agricultural products. Plant disease, especially on leaves, is one of the major factors of reductions in both quality and quantity of the food crops. In agricultural aspects, if the plant is affected by leaf disease then it reduces the growth of the agricultural level. Finding the leaf disease is an important role of agriculture preservation. After pre-processing using a median filter, segmentation is done by Guided Active Contour method and finally, the leaf disease is identified by using Support Vector Machine. The disease-based similarity measure is used for fertilizer recommendation. Keywords: Disease Prediction, Graph Cut Algorithm, Guided Active Contour method, Leaf segmentation, Leaf Feature Identification.

## 2. LITERATURE SURVEY

[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 accuracy of 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. 2 The main objective of this paper is image analysis & classification techniques for detection of leaf diseases and classification. The leaf image is firstly preprocessing 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 senatorial leaf blight etc. The proposed system gives maximum average classification accuracy reported 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 proposes an 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 level to study positive and negative, interrogative, sarcastic, good and bad functionality, sentiment without sentiment, conditional sentence and author and reader understanding points.

[5] The author proposes a method which helps us predict crop yield by suggesting the best crops. It also focuses on soil types in order to identify which crop should be planted in the field to increase productivity. In terms of crop yield, soil types are vital. By incorporating the weather details of the previous year into the equation, soil information can be obtained.

Advantages :It allows us to predict which crops would be appropriate for a given climate. Using the weather and disease related data sets, the crop quality can also be improved. Prediction algorithms help us to classify the data based on the disease, and data extracted from the classifier is used to predict soil and crop. 3

Disadvantages :Due to the changing climatic conditions, accurate results cannot be predicted by this system.

[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 diseases in 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 accuracy of identification of leaf disease of CNN is 0.6 and SVM is 0.8.

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[8] In this paper, we propose a user-friendly web application system based on machine learning and web-scraping called ‘Farmer’s Assistant’. With our system, we are successfully able to provide several features - crop recommendation using Random Forest algorithm, fertilizer recommendation using a rule 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 get their results. In addition, we also use the LIME interpret ability method to explain our predictions on the disease detection image, which can potentially help understand why our model predicts 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 segmentation s 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 the users might be able to help us with the lack. Also, we can use some unsupervised algorithms to pin-point the diseased areas in the image. We intend to add these features and fix these gaps in our upcoming work.

shows a case study related to wireless sensor networks for crop monitoring, growth and measurement of meteorological factors. The paper suggests farmers for application of specific pesticides and insecticides in stressful conditions. There was no focus on soil nutrients, the level of soil fertility and monitoring the crop growth or suggest the crop for the next season in the above proposed paper. The solution to the issues in agriculture trends is proposed in this paper. The study suggests that farmers need to increase the fertility of soil and measure all parameters which are required to grow a crop in healthy condition. [2] data mining algorithms are used on agriculture data. The main criterion for this categorization is that if the pH value is greater than 8.5, the soil is unsuitable for crop cultivation; otherwise, it is. To overcome this problem the proposed system will give necessary suggestion to increase or decrease the pH value of soil. [3] the proposed system is related to increase net yield rate of the crop, based on the parameter related to the soil and atmosphere. The model gives the Crop prediction which can be carried out by using the "Bayesian algorithm". Data mining is used to extract the large amount of data from the data set and analyses those data to predict the crop yield and suggest the crop. The limitation of this includes atmospheric prediction is not accurate. [4] In his article, the author proposes a method which helps us predict crop yield by suggesting the best crops. It also focuses on soil types in order to identify which crop should be planted in the field to increase productivity. In terms of crop yield, soil types are vital. By incorporating the weather details of the previous year into the equation, soil information can be obtained. It allows us to predict which crops would be appropriate for a given climate. Using the weather and disease related data sets, the crop quality can also be improved. Prediction algorithms help us to classify the data based on the disease, and data extracted from the classifier is used to predict soil and crop. Due to the changing climatic conditions, accurate results cannot be predicted by this system. [5] Based on fuzzy logic and neural networks & interval-based partition, the author proposed a model which is used currently in rice to predict crop production using a fuzzy time series model. Using this model and comparing it to an existing algorithm, the result was compared to the reduction in AFER and MSE in the prediction. [6] Using previous years' data, the author provides a model to forecast rice production based on information that is correct and robust. To improve prediction accuracy, it uses a fuzzy time series

approach based on percentage change, effective length and emphatic computations on time series data. [7] Measuring p using a glass electrode. principles of the glass-electrode method [8] Inherently low soil fertility continues to be a barrier to potato production in kenya, threatening food security. the soil fertility status of smallholder potato farms in quandary and menu counties was investigated. 198 farms provided soil and plant tissue samples for analysis of selected nutrients (p, on, n, p, k, s, ca, mg, in, b, and cu). the sufficiency of nutrients for potato growth was determined using critical nutrient levels. soils in the sampled farms were acidic (p-cacl2 3.9–6.6) with low to high soil organic matter concentration (1.5–97.5 g kg1). [9] 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. 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 diseases in real-world field circumstances. According to the review, this disease detection technology has a lot of promise and certain drawbacks, including the capacity to identify plant leaf illnesses. As a result, existing research has room for improvement. [10] Deep learning algorithms were used in this study to develop a novel way for automatically categorizing and detecting plant illnesses using leaf pictures. The developed computer could detect the presence of leaves and distinguish between healthy leaves and 13 abnormalities that could be seen visually. In the end, the trained model's overall accuracy was 96.3 percent. Because the suggested approach had not been applied in the field of plant disease detection, there was no comparison with similar findings obtained using the exact process. This study will be expanded to include the development of a whole system composed of server-side components including a trained model and an application for smart mobile devices capable of identifying diseases captured by a smart phone camera. The authors anticipate that by expanding this research, they will have a substantial impact on sustainable development, influencing crop quality for future generations. [11] Plant Leaf Disease Detection and Classification Based on CNN with LVQ Algorithm - Me like Dogansar, Adem Tuncer, Yunus Ozen. Early disease detection is critical in agriculture for efficient crop yield. The diseases bacterial spot, late blight, senatorial leaf spot, and yellow curved leaf have an impact on tomato crop quality. Automatic plant disease classification methods also aid in taking action after detecting symptoms of leaf diseases. This paper describes a Convolution al Neural Network (CNN) model and Learning Vector Quantization (LVQ) algorithm-based method for detecting and classifying tomato leaf disease. The dataset contains 500 images of tomato leaves with

four disease symptoms. We created a CNN model for automated feature extraction and classification. Col our information is being extensively employed in plant leaf disease research .The filters in our model are applied to three channels depending on RGB components. For training the network, the LVQ was fed the output feature vector of the convolution component. The experimental findings show that the proposed approach accurately detects four forms of tomato leaf diseases. [12] Deep learning models for plant disease detection and diagnosis Inconstant P.Ferentinos Hellenic Agricultural Organization “Demeter”, Institute of Soil & Water Resources, Dept. of Agricultural Engineering, 61 Dimokratias Av., 13561 Athens, Greece Through deep learning approaches, convolution neural network models were constructed in this paper to detect and diagnose plant diseases using simple leaf photos of healthy and ill plants. The models were trained using an open collection of 87,848 photos, which contained 25 different plants in 58 separate classes of [plant, illness] pairs, including healthy plants. Several model architectures were trained, with the top performing model achieving a success rate of 99.53 percent in detecting the corresponding [plant, illness] pair (or healthy plant). The model's very high success rate makes it a very useful advising or early warning tool, and it might be expanded to enable an integrated plant disease identification system that operates in real-world production circumstances [13] Plant Disease Detection and Classification using CNN Model with Optimized Activation Function S. Waywardness Riyadh; T. Senthilkumar; S. Jayanthy; J. Judeson Antony Kovilpillai This research discusses the application of Convolution Neural Networks (CNN) algorithms for the optimum real-time detection of diseases that impact the plant and the afflicted area, so that proper fertilizer can be employed to prevent additional harm to plants from pathogenic viruses. The activation function is at the heart of the CNN model since it combines non-linearity to create a true artificial intelligence system for classification. ReLu is one of the best activation functions, however it has the problem that its derivative is 0 for negative values, resulting in neuronal necrosis.To increase the accuracy and performance of the system using a TensorFlow framework, a new mathematical activation function is constructed and compared with current activation functions.Experiment findings on trained databases demonstrate that the created activation function increased CNN model accuracy and performance by 95%.The suggested optimizer improves the training speed of the CNN model by 83 percent when implemented in an ARM processor. A further area impacted by illness is computed using the K - means clustering approach for fertilizer optimization [14] Transfer Learning Based Plant Diseases Detection Using ResNet50 Plant diseases are a principal threat to the safety of food. In agriculture sectors, it is the greatest challenge to identify plant diseases. The state-of-the-art Convolution Neural Network (CNN) gives

excellent results to solve image classification tasks in computer vision. Transfer Learning enables us to develop a deep CNN network in a most cost effective way. In this work, a Transfer Learning based CNN model was developed for the identification of plant diseases precisely. The dataset, we have used is consists of 70295 training images and 17572 validation images holding 38 different classes of plant leaves images. We have focused mainly on ResNet50 network, a popular CNN architecture as our pre-trained model in Transfer Learning. Additionally, several Transfer Learning architectures were experimented with few other popular pre-trained models (VGG16, VGG19, AlexNet) and compared with the proposed model. The proposed model has given the best performance of 99.80 % training accuracy. [15] Disease Detection and Classification in Agricultural Plants Using Convolution Neural Networks — A Visual Understanding Merlin Francis Dept. of Computer Science & Engineering, Thingamajig College of Engineering, Madurai, India; C. Deisy All deep learning models start with a conventional neural network. As a result, a Convolution Neural Network model was designed and developed to identify and classify plant diseases using photos of healthy and diseased apple and tomato leaves. Each convolution layer is followed by a pooling layer in the model. The presence of disease is determined using two fully connected dense layers and the sigmoid function. The model was trained using a 3663 picture dataset of apple and tomato leaves, resulting in an accuracy of 87 percent. With the dropout value adjusted to 0.2, the over fitting problem is discovered and removed. The model is also run on GPU Tesla to evaluate its speed and accuracy because it permits parallel processing. As a result, the report inspires researchers to design an integrated plant disease identification system that delivers accurate results in real time.

### 2.1 Existing problem

Farmers' conventional methods of agricultural cultivation are ineffective. It does not make proper use of all available resources. Farmers are unable to detect crop diseases due to a lack of knowledge and old practices, which often result in soil nutrient deterioration and exhaustion. As a result, crop failure occurs. Growing only certain crops depletes the soil, and if the crops are harmed by illnesses, farmers are uninformed of how to recover such crops. Food needs cannot be met until and unless efficient resource management and use is implemented. 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.

2.2 References

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## 2.3 Problem Statement Definition

- In India, The Agriculture industry is extremely vital and crucial for economic

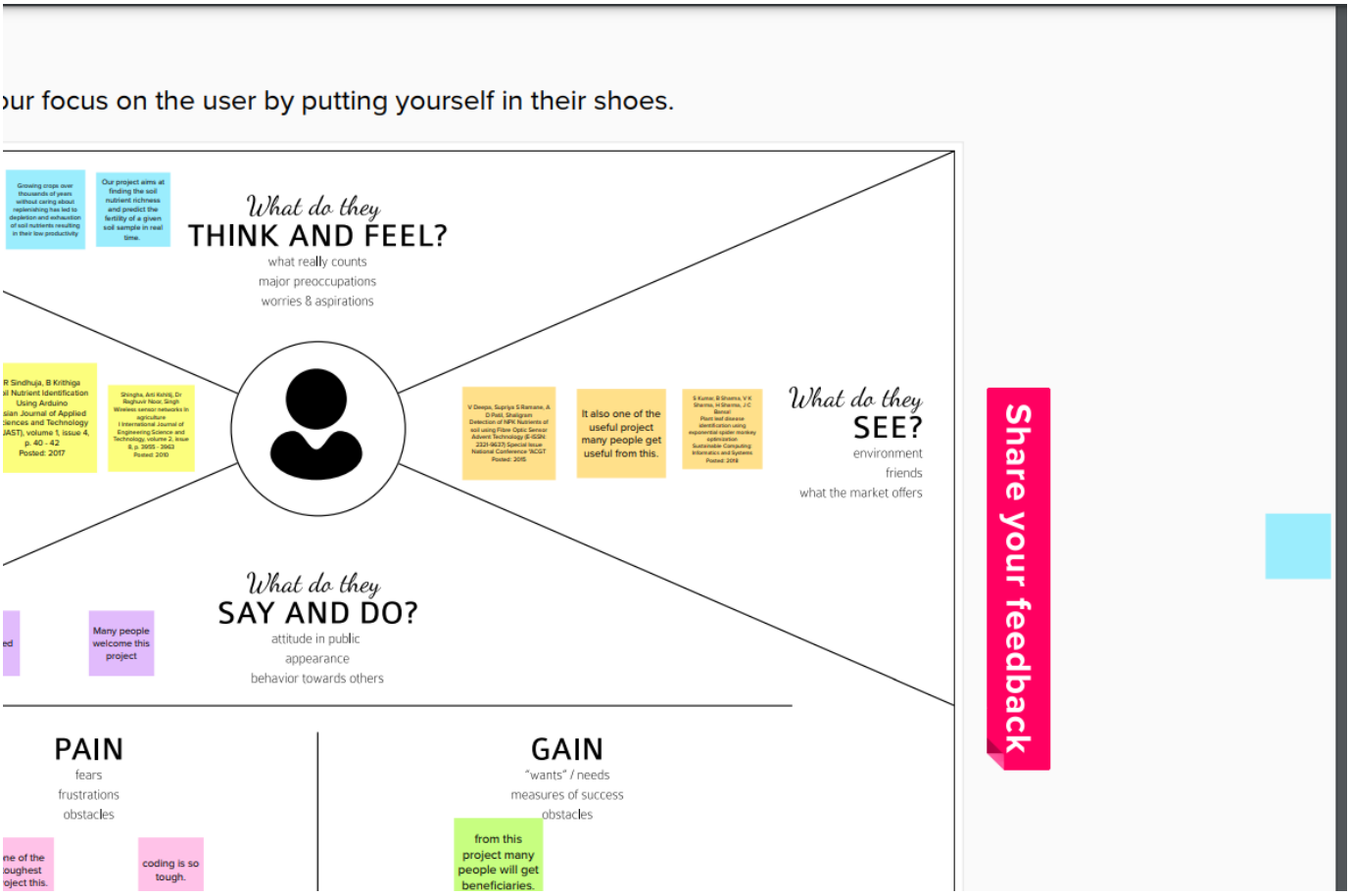
and social development and jobs. In India, the agricultural sector provides a living for almost 48% of the population. As per the 2019-2020 economic survey, an Indian farmer's median wage in 16 states is Rupees 2500. Most of the Indian population depends on agriculture for their livelihood. Agriculture 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

An empathy map is **a collaborative tool teams can use to gain a deeper insight into their customers**. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. The empathy map was originally created by Dave Gray and has gained much popularity within the agile community.

An Empathy Map consists of four quadrants. The four quadrants reflect four key traits, which the user demonstrated/possessed during the observation/research stage. The four quadrants refer to what the user: **Said**, **Did**, **Thought**, and **Felt**. It’s fairly easy to determine what the user said and did. However, determining what they thought and felt should be based on careful observations and analysis as to how they behaved and responded to certain activities, suggestions, conversations, etc.

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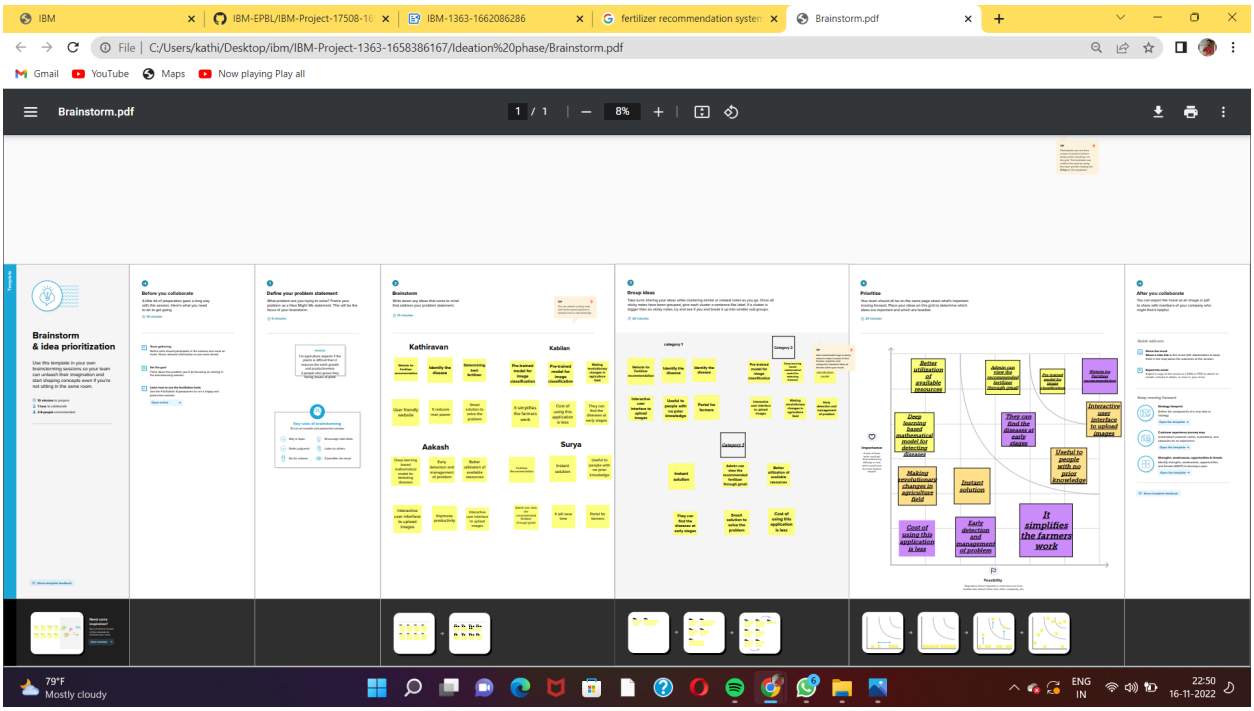
conversations, etc.

## 3.2 Ideation & Brainstorming

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

**Brainstorming is one of the primary methods employed during the Ideation stage of a typical Design Thinking process**. Brainstorming is a great way to generate many ideas by leveraging the collective thinking of the group, engaging with each other, listening, and building on other ideas.




### 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 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.

A digital camera or similar devices are used to take images of different types, and then those are used to identify the affected area in leaves. Then different types of image-processing techniques are applied to them, the process those images, to get different

and useful features needed for the purpose of analyzing later-Plant leaf disease identification is especially needed to predict both the quality and quantity of the First segmentation step primarily based on a mild polygonal leaf model is first achieved and later used to guide the evolution of an energetic contour. Combining global shape descriptors given by the polygonal model with local curvature based features, the leaves are then classified overleaf datasets. In this research work introduce a method designed to deal with the obstacles raised by such complex images, for simple and plant leaves. A first segmentation step based on graph-cut approach is first performed and later used to guide the evolution of leaf boundaries, and implement classification algorithm to classify the diseases and recommend the fertilizers to affected leaves as shown in Figure 1.

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. IBM-Project-52754-1661147072 B2-2M4E 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

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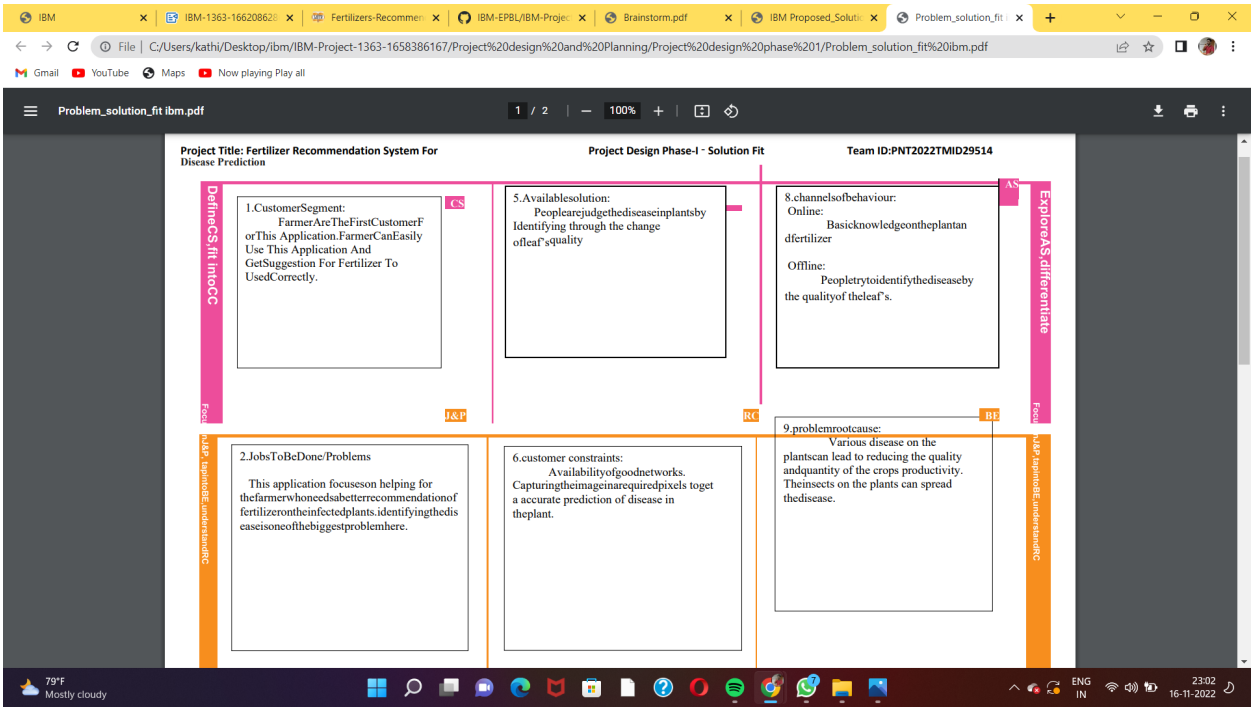
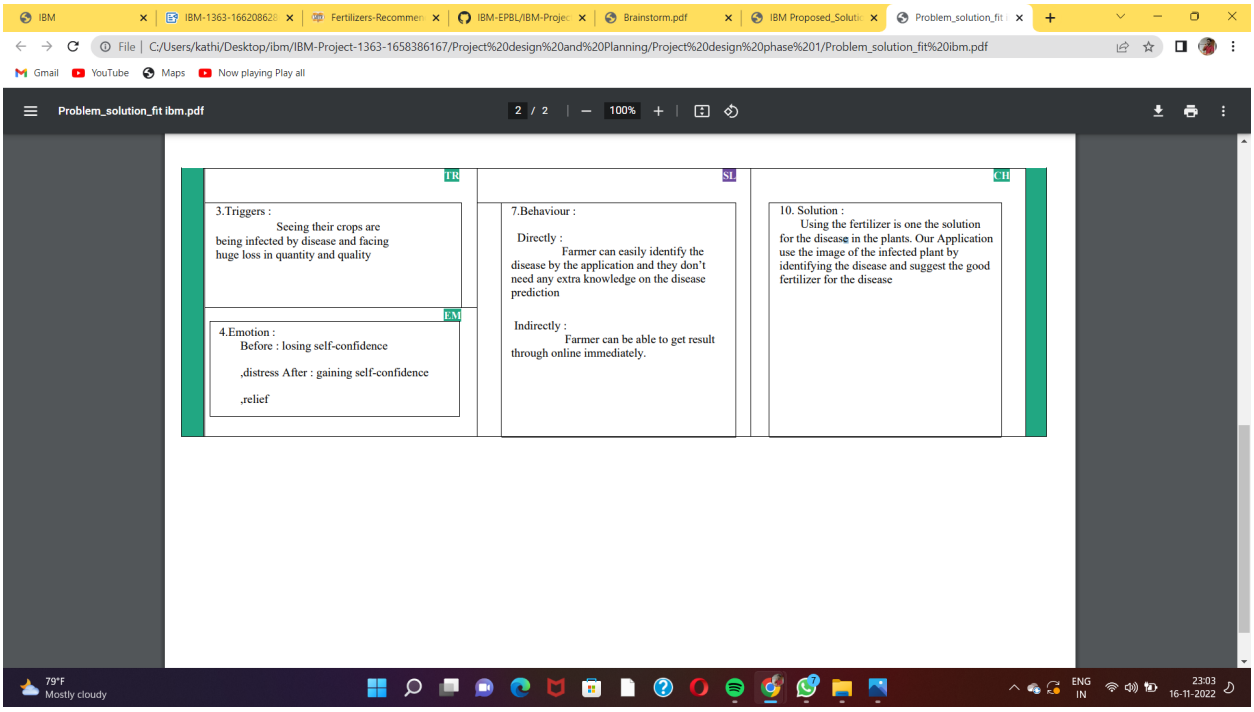
## 3.4 Problem Solution fit






1.CustomerSegment:

FarmerAreTheFirstCustomerF orThis Application.FarmerCanEasily Use This Application And GetSuggestion For Fertilizer To UsedCorrectly

2.JobsToBeDone/Problems

This application focuses on helping for thefarmerwhoneedsabetterrecommendationof fertilizerontheinfectedplants.identifyingthedis easeisoneofthebiggestproblemhere.

3.Triggers :

Seeing their crops are being infected by disease and facing huge loss in quantity and quality

4.Emotion :

Before : losing self-confidence ,distress After : gaining self-confidence.

5.Availablesolution:

Peoplearejudgethediseaseinplantsby Identifying through the change heterosexuality

6.customer constraints: Availabilityofgoodnetworks.

Capturingtheimageinarequiredpixels to get a accurate prediction of disease in the plant.

7.Behaviour :

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.

8.channelsofbehaviour: Online:

Basicknowledgeontheplantan d fertilizer
Offline: Peopletrytoidentifythediseaseby the quality of theleaf's.
9.problemrootcause:

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.

10. Solution :

Using the fertilizer is one the solution 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

## 4. REQUIREMENT ANALYSIS

### 4.1 Functional requirement

| FR No. Sub | Functional Requirement (Epic) | Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | User Registration | Registration through Form |
| FR-2 | User Confirmation | Confirmation via Email<br>Confirmation via OTP |
| FR-3 | Uploading the images | Drag and drop feature<br>Browse through device folders |
| FR-4 | Image Pre-processing | Uploaded images are pre-processed using the preprocessing model deployed IBM cloud. |
| FR-5 | Disease Prediction | Disease prediction model is trained with a large dataset and deployed in the IBM cloud to predict the disease by analyzing the uploaded images. |
| FR-6 | Fertilizer Recommendation | Based on the disease predicted by the model the fertilizer required to cure the disease is suggested to the user |
| FR-7 | Report Generation | The fertilizer to be used and the amount and other details are specified in the report which can be downloaded by the user. |

4.2 Non-Functional requirements

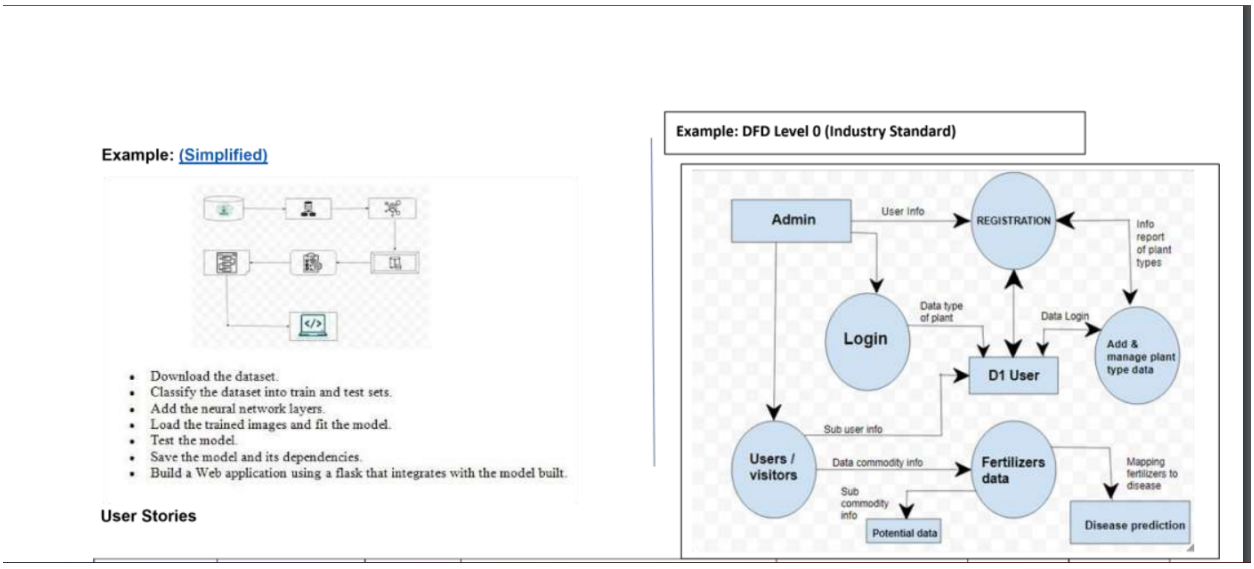
| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | Usability | The website is designed to be responsive and user friendly so that it can be used on any device and by anyone. |
| NFR-2 | Security | The user details are confidential and the user account is verified with the email id provided to ensure security. |
| NFR-3 | Reliability | As the deployment is done in a cloud environment the model and the website are highly reliable with efficient and accurate outputs. |
| NFR-4 | Performance | As the models are deployed in the IBM |

| | | |
|---|---|---|
| | | cloud the performance will be efficient. |
| NFR-5 | Availability | The website will be hosted so that it is available for a large number of people. |
| NFR-6 | Scalability | As the models are deployed in the IBM cloud they can easily be scaled for large inputs and to handle many requests. |

## 5. PROJECT DESIGN

### 5.1 Data Flow Diagrams

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



| 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 | I can receive confirmation email & click confirm | High | Sprint-1 |
| | | USN-3 | As a user, I can register for the application via mobile/desktop. | I can register & access the dashboard with login credentials. | Low | Sprint-2 |
| | | USN-4 | As a user, I can register for the application through Google service/cloud. | Valid Google account to be linked and verified. | Medium | Sprint-1 |
| | Login | USN-5 | As a user, I can see or access the data for crops and disease respectively. | To access, his credentials must be verified. | High | Sprint-1 |
| | Dashboard | USN-6 | As a user I want the dashboard to be glitch free and the records to be updated effectively. | Valid and accurate records to be entered. | Low | Sprint-2 |
| **Customer (Web user)** | Login | USN-7 | As a web user, I can login into the application so that it presents me my preferences. | Preference presentation must be accurate and necessary | Medium | Sprint-1 |
| | Dataset | USN-8 | As a web user, I want to view the dataset so that I can know which plants are there. | The plant types should be of different species and of wide variety. | Medium | Sprint-1 |
| **Customer Care Executive** | Validation | USN-9 | As a customer care executive, I want the customers portfolio to be verified and of high priority. | The customer's SSN details to be provided with proof. | High | Sprint-1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | free and the records to be updated effectively. | records to be entered. | | |
| **Customer (Web user)** | Login | USN-7 | As a web user, I can login into the application so that it presents me my preferences. | Preference presentation must be accurate and necessary | Medium | Sprint-1 |
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| **Customer Care Executive** | Validation | USN-9 | As a customer care executive, I want the customers portfolio to be verified and of high priority. | The customer's SSN details to be provided with proof. | High | Sprint-1 |
| | Capital | USN-10 | As a customer care executive, I need minimal amount/fees for those who access dataset and resources. | Payment modes can be done through valid banks or digitally(gpay,paytm etc) | High | Sprint-1 |
| **Administrator** | Access/Privileges | USN-11 | As an admin, I want to allow access and restrict to whom I prefer. | Customer Records to be provided | High | Sprint-1 |
| | Modification/Update | USN-12 | As an admin, I want to modify or update records or application if required. | Only valid requests to modify will be allowed access | Medium | Sprint-1 |

## 5.2 Solution & Technical Architecture

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.

An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases.

**Table -1: Components & Technologies :**

| S.NO | Component | Description | Technology |
|---|---|---|---|
| 1, | User Interface | How user interacts with thewebsite. | HTML,CSS, etc,. |
| 2, | Disease Prediction | Here the disease in the leaf is predicted | Karas,CNN. |
| 3. | Fertilizer Recommendation | The fertilizer is recommendedfor the predicted disease | User interface, HTML, CSS. |
| 4. | Dataset | The training and testing data are collectively stored | Kaggle.com, data.gov, UCI machine learning repository,etc. |
| 5. | File Storage | File storage requirements | IBM, Local File system. |
| 6, | Modules | Purpose of deep learning modules | Image Recognition Modules,etc. |
| 7. | Infrastructure(Server) | Application development onLocal System-local server configuration: | Local File system. |

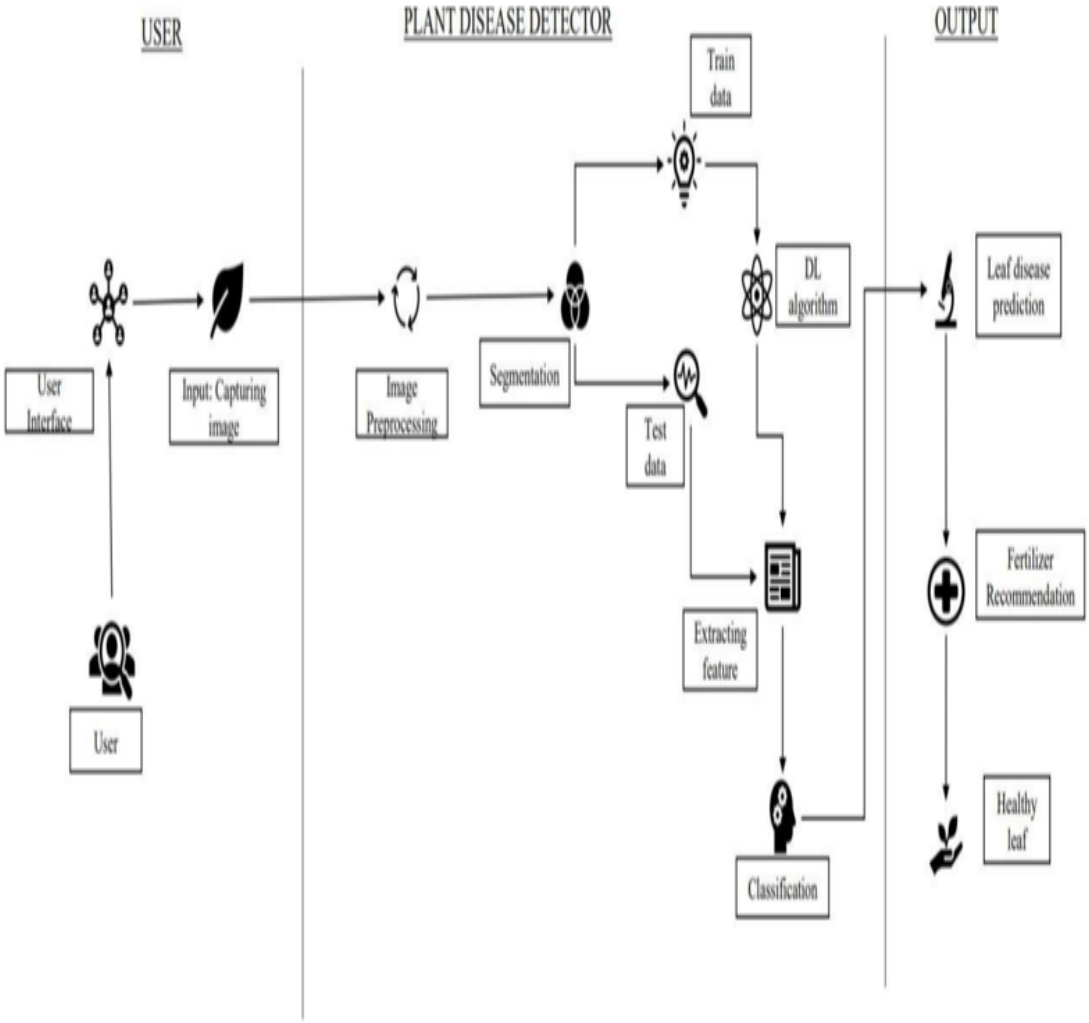
USER
PLANT DISEASE DETECTOR
OUTPUT
Train data
DL algorithm
Leaf disease prediction
User Interface
Input: Capturing image
Image Preprocessing
Segmentation
Test data
Fertilizer Recommendation
Extracting feature
User
Healthy leaf
Classification

**Table – 2: Application Characteristics:**

| S.NO | Characteristics | Description | Technology |
|---|---|---|---|
| 1. | Opensource Framework | List of the open sourceframework used | Open source- PyCharm, anaconda navigator, flask framework. |
| 2. | Login | List of the access controlimplementation | Security - OWASP |
| 3. | Scalable Architecture | Justify the scalable architecture | PyCharm |
| 4. | Availability | Justify the availability of website | Web application access to all. |
| 5. | Performance | Design consideration for theperformance of the website | Convolution al NeuralNetworks. |

5.3 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 |
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| | | USN-3 | As a user, I can register for the application via mobile/desktop. | I can register & access the dashboard with login credentials. | Low | Sprint-2 |
| | | USN-4 | As a user, I can register for the application through Google service/cloud. | Valid Google account to be linked and verified. | Medium | Sprint-1 |
| | Login | USN-5 | As a user, I can see or access the data for crops and disease respectively. | To access, his credentials must be verified. | High | Sprint-1 |
| | Dashboard | USN-6 | As a user I want the dashboard to be glitch free and the records to be updated effectively. | Valid and accurate records to be entered. | Low | Sprint-2 |
| **Customer (Web user)** | Login | USN-7 | As a web user, I can login into the application so that it presents me my preferences. | Preference presentation must be accurate and necessary | Medium | Sprint-1 |
| | Dataset | USN-8 | As a web user, I want to view the dataset so that I can know which plants are there. | The plant types should be of different species and of wide variety. | Medium | Sprint-1 |
| **Customer Care Executive** | Validation | USN-9 | As a customer care executive, I want the customers portfolio to be verified and of high priority. | The customer's SSN details to be provided with proof. | High | Sprint-1 |

# 6. PROJECT PLANNING & SCHEDULING

## 6.1 Sprint Planning & Estimation

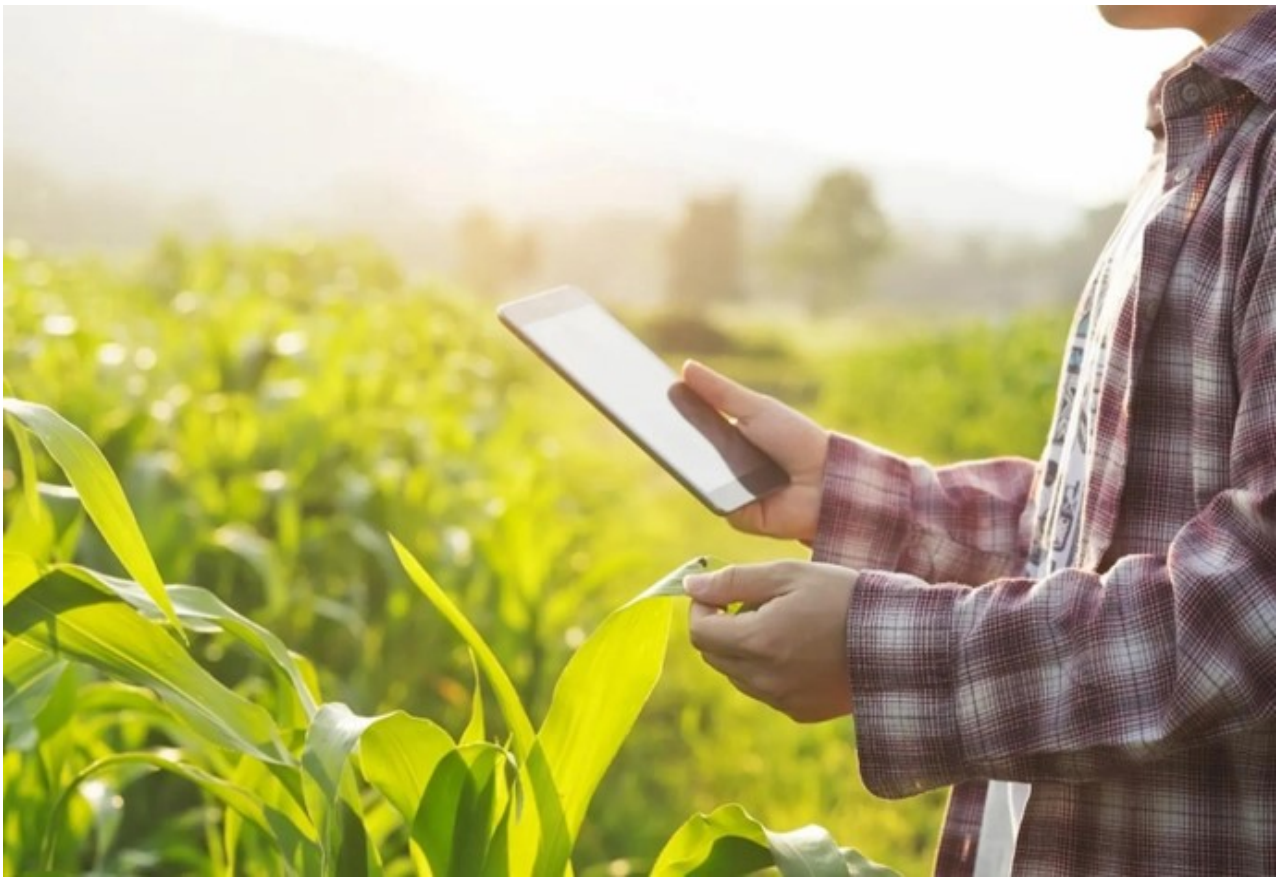
Milestone:

Modern Technology are increasing and optimizing the Performance of the Artificial Intelligences (AI) Model.

Based Crop Yield Disease Prediction System, is helpful for farmers to prevent the crop from the various Disease which can identify the Disease with in a process of capturing the Image at the plant and Machine Learning Algorithm will giveaffected DiseaseName.

In this ProjectMilestone will be given the Best Solution for the farmer using the complete friendly and simple user interface web application to fetching the solution by own.

In addition, process we are planned to add a validModule that is Fertilizer recommendation for the SpecificDisease. It can give both Artificial fertilizer and Natural Fertilizer in suggestion manner.



Activity List:

In ProjectManagement Planning is an Metropolitanska to scheduling the phrase of the project to the Team Member.

In this Activity can shows the various activity are allocated and Done by the Team Members!

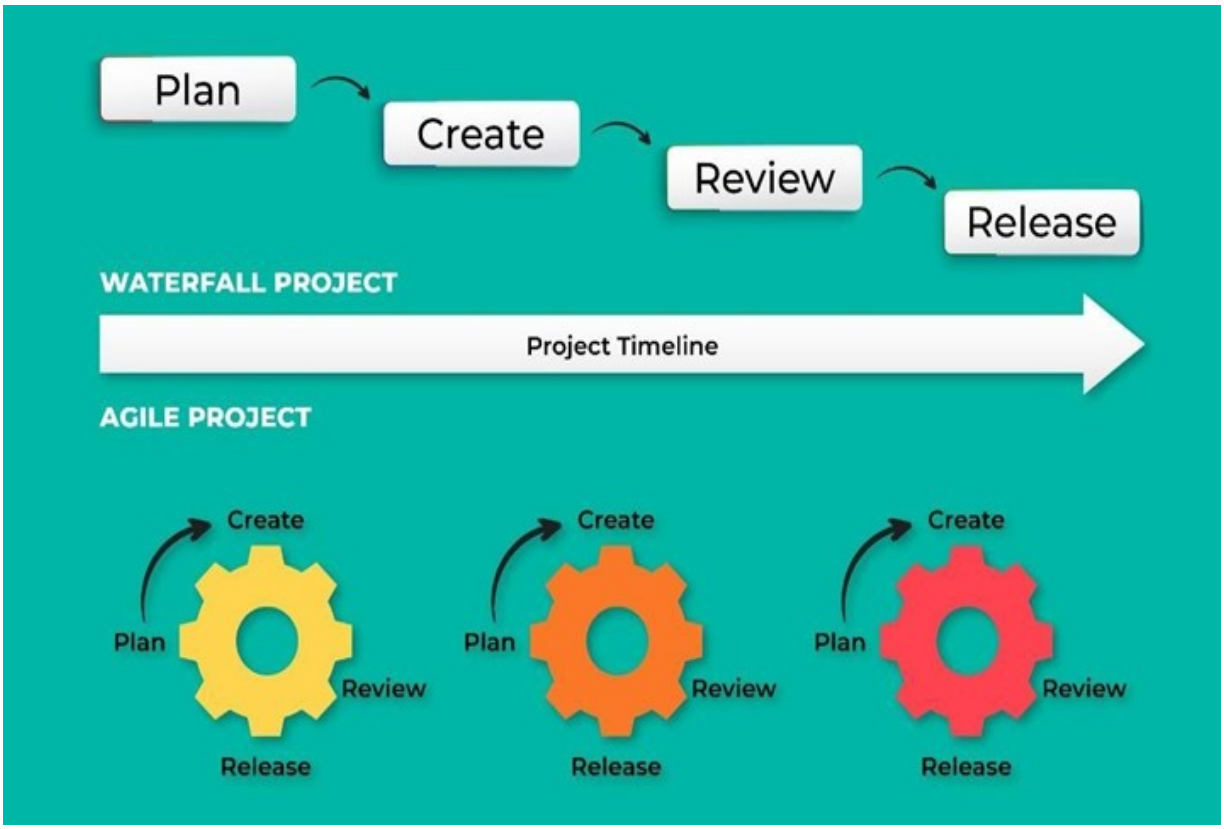
In Protected can Split into the Four Step of Phrases are

Phrase 1: Information Collection and Requirement Analysis

Phrase 2: Project Planning and Developing Modules

Phrase 3: Implementing the High AccuracyDeep Learning Algorithm to Perform

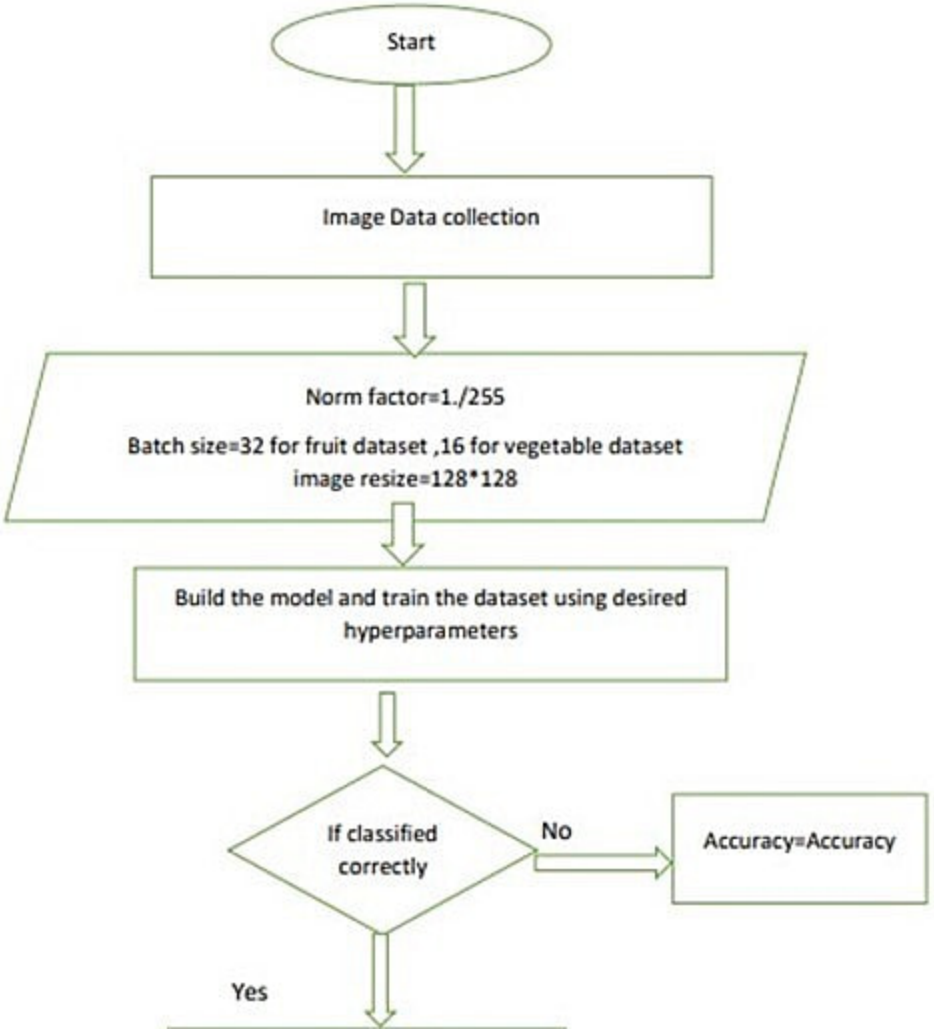
Phrase 4: Deploying the Model on Cloud and Testing the Model and UI Performance




6.2 Sprint Delivery Schedule

The delivery plan of project deliverables is a strategic element for every Project Manager. The goal of every project is, in fact, to produce a result that serves a specific purpose. With the word „purpose “, we can mean the most disparate goals: a software program, a chair, a building, a translation, etc.... In Project SpiritDeliveryPlanning is one of the processes of Completing the project and ShowCasingthe Time Line of the Project Planning. This Delivery plan help to understanding the process and Work Flow of the Project working by the Team Mates. Every Single Modules are assigned to the team mates to show case their work and contribution developing the Project


7. CODING & SOLUTIONING



Final findings(output) of the project given below in the form of screenshot:
Training and Testing of Fruit dataset

Figure.6.3. Train the Vegetable dataset

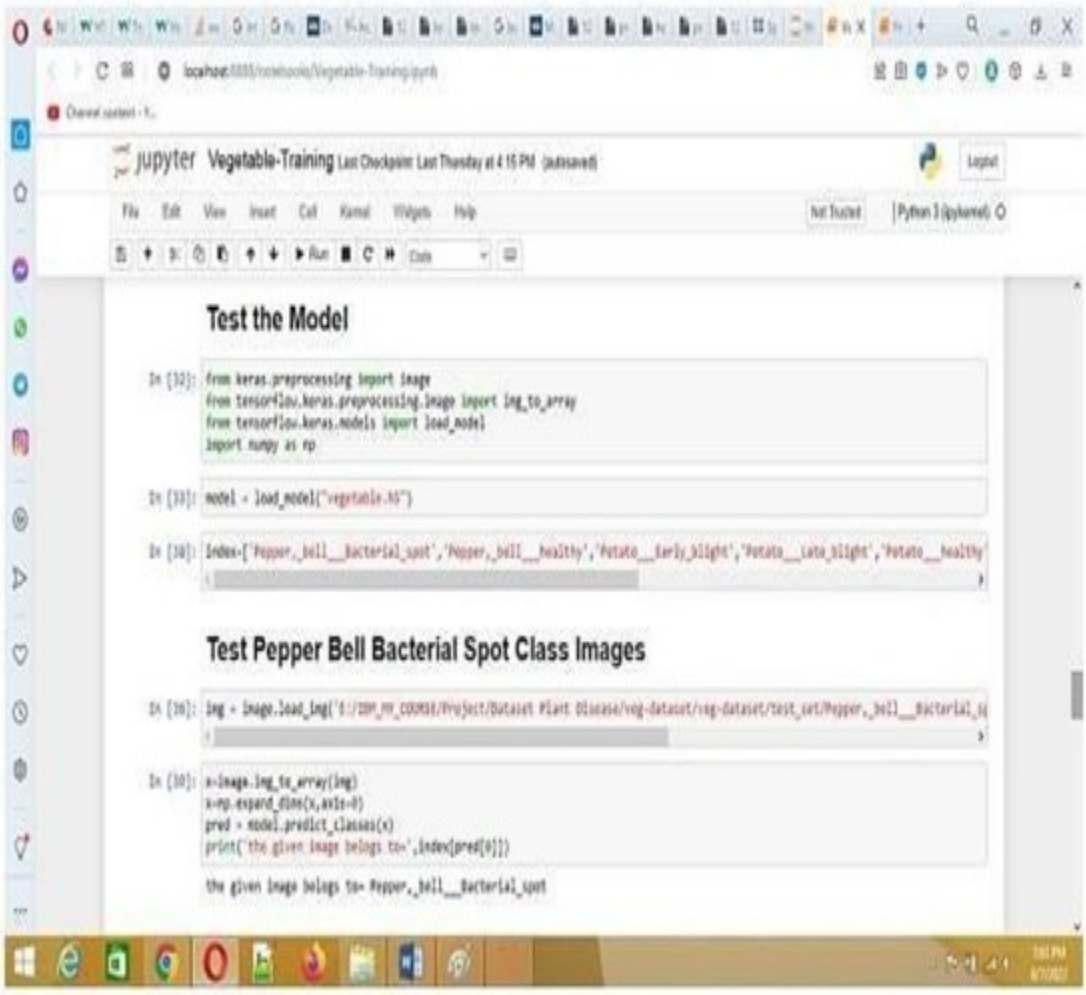



Figure.6.4. Test the Vegetable dataset

Figure.6.5. Training Fruit Dataset in IBM Cloud

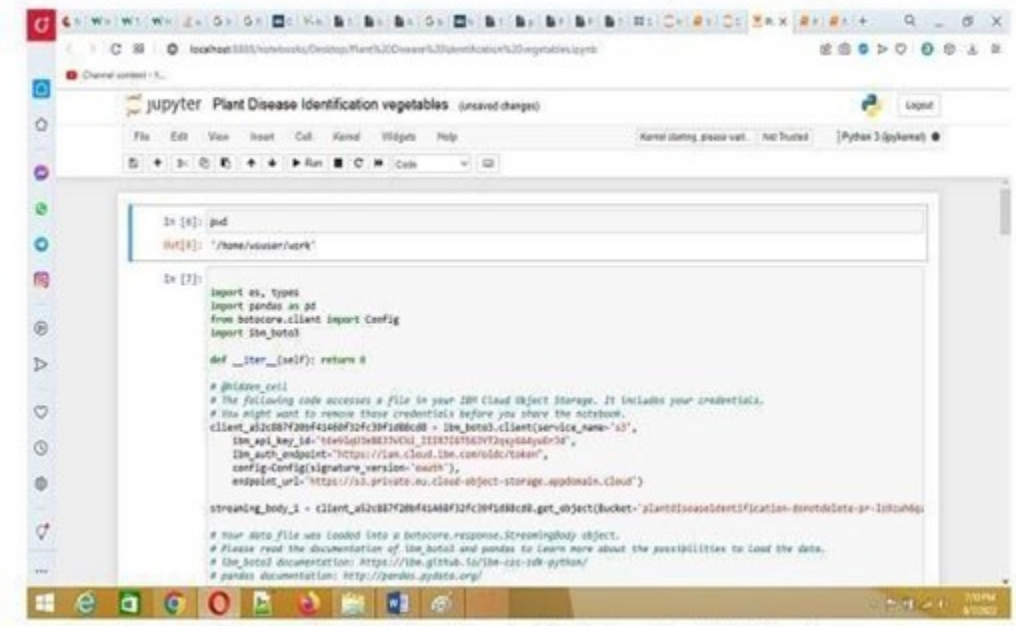
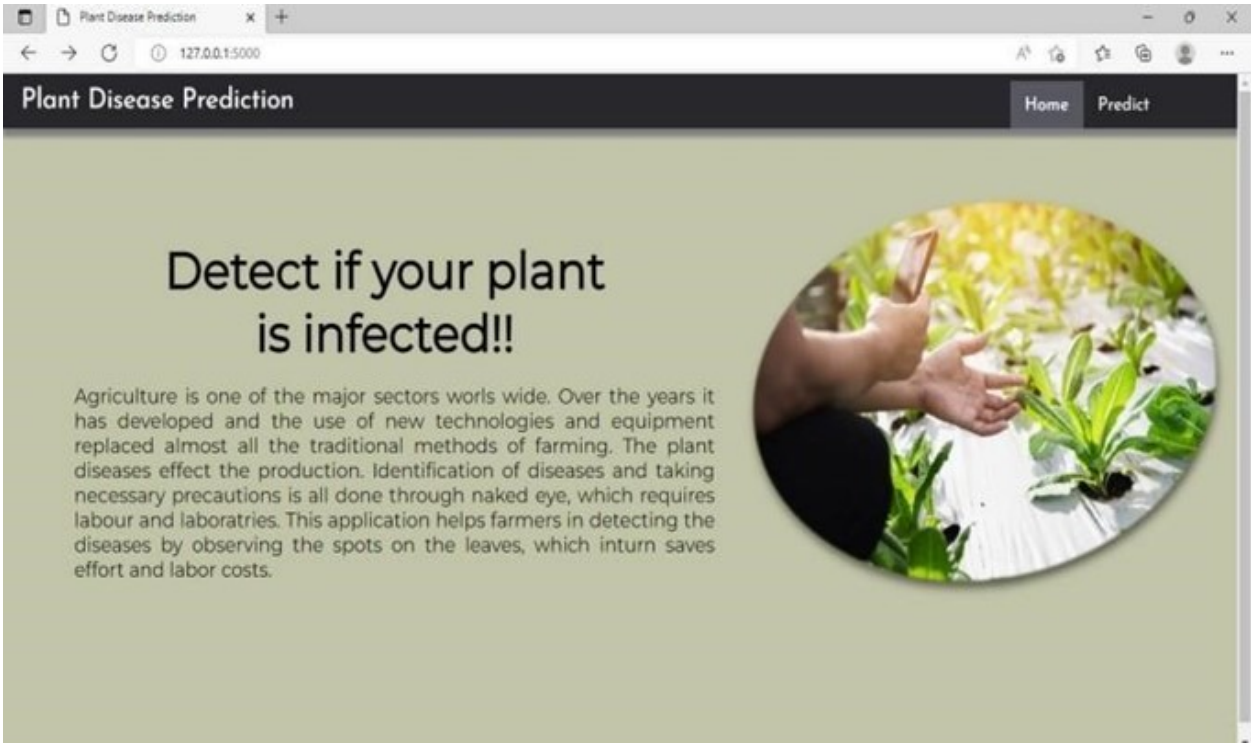
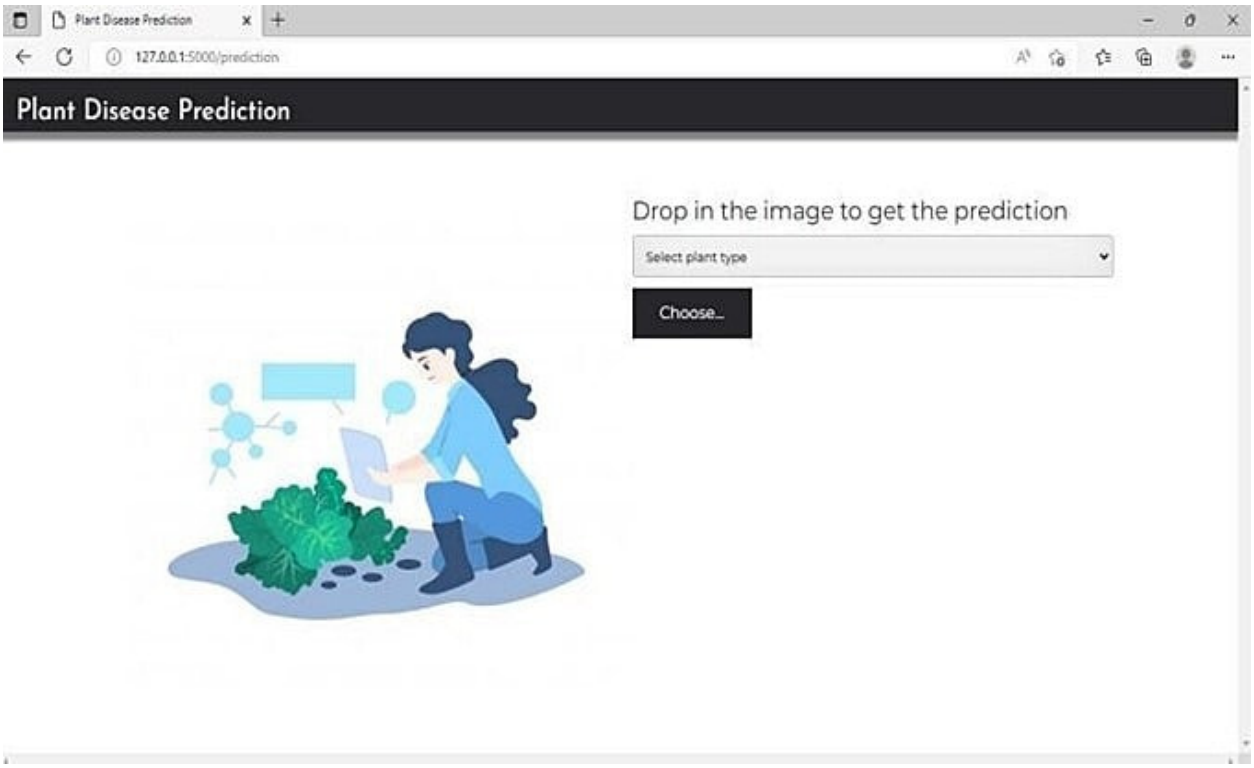


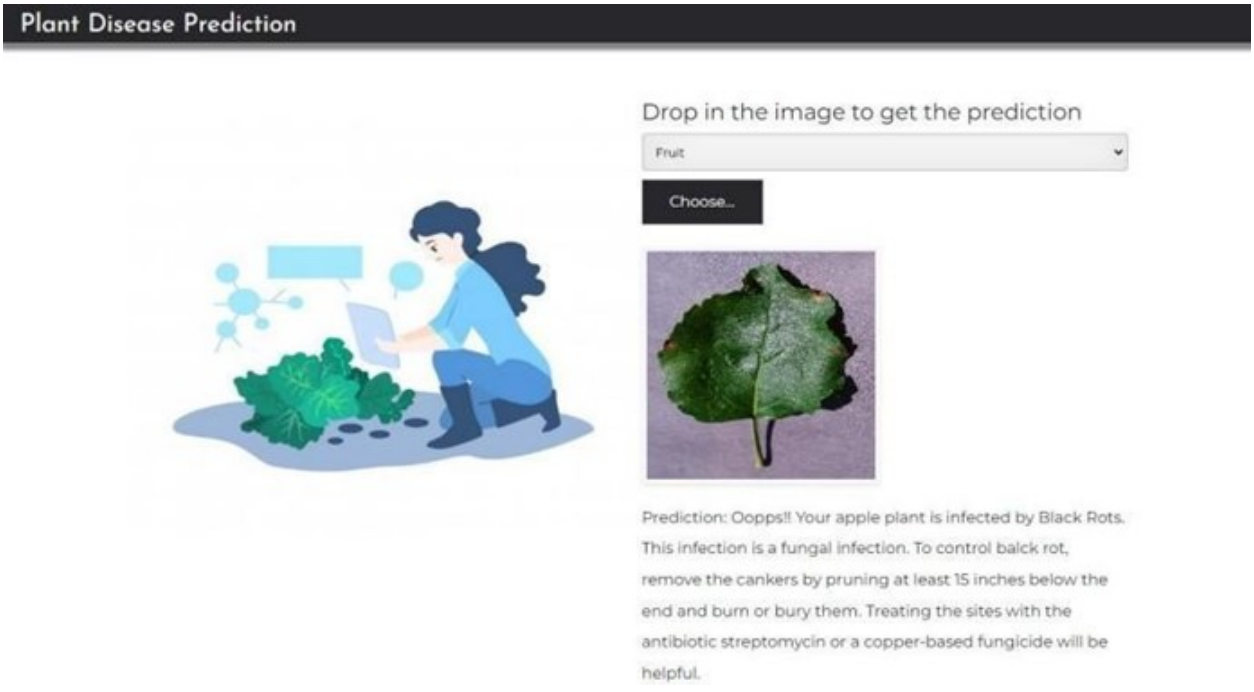

Figure.6.6. Training Vegetable Dataset in IBM Cloud

# Output:

*HOME PAGE*




Plant Disease Prediction
127.0.0.1:5000/prediction
Plant Disease Prediction
Drop in the image to get the prediction
Select plant type
Choose...


Plant Disease Prediction
Drop in the image to get the prediction
Fruit
Choose...
Prediction: Oopps!! Your apple plant is infected by Black Rots. This infection is a fungal infection. To control balck rot, remove the cankers by pruning at least 15 inches below the end and burn or bury them. Treating the sites with the antibiotic streptomycin or a copper-based fungicide will be helpful.

## Plant Disease Prediction

Drop in the image to get the prediction

Vegetable

Choose...

Prediction: Yaayy!! Your pepper plant is healthy. But, take the necessary precautions like, putting the plant where it gets at least 10 hours of direct sunlight. Keep soil evenly moist for good growth. Peppers need well draining soil that is rich and loamy, but avoid too much nitrogen in the soil. Too much nitrogen can cause plenty of leaves and little to no peppers. Your soil should have a pH between 6.0 and 6.5.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Date | 03-Nov-22 | | |
| | | | | Team ID | PNT2022TMID37519 | | |
| | | | | Project Name | Fertilizer Recommendation System for Disease Prediction | | |
| | | | | Maximum Marks | 4 Marks | | |
| Test case ID | Feature Type | Componenet | Test Scenario | Steps To Execute | Test Data | Expected Result | Actual Result |
| HomePage_TC_OO1 | UI | Home Page | Display the Harvester page | Enter URL(http://127.0.0.1:5000) | http://127.0.0.1:5000 | Displaying the Home Page | Home Page displayed |
| HomePage_TC_OO2 | UI | Home Page | Displayed the About us page | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us | http://127.0.0.1:5000 | Displaying the About us | Displays detail about harvesting |
| HomePage_TC_OO3 | Functional | Home page | Displays a Crop button in top of Home Page | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button | http://127.0.0.1:5000 | Displays the Button | Crop Button is pops up. |
| CropPage_TC_OO4 | Functional | Crop page | It will displays a crop page and shows a given questions | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button<br>4.Fill the Questions | http://127.0.0.1:5000 | In crop page it should displays the questions | Crop page is displayed |
| CropPage_TC_OO4 | Functional | Crop page | Displays a Predict Button | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button<br>4.Fill the Questions<br>5.Click the Predict Button | http://127.0.0.1:5000 | Displays a Button | Displays a Button |
| CropPage_TC_OO4 | Functional | Crop page | Displays a Fertilizer Button in top of crop page | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button<br>4.Fill the Questions<br>5.Click the Predict Button<br>6.Click the Fertilizer Button | http://127.0.0.1:5000 | Displays a Button | Fertilizer Button is pops up |
| FertilizerPage_TC_OO4 | Functional | Fertilizer Page | It will displays a Fertilizer page and shows a given questions | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button<br>4.Fill the Questions<br>5.Click the Predict Button<br>6.Click the Fertilizer Button<br>7.Fill the Questions | http://127.0.0.1:5000 | In fertilizer page it should displays the questions | Fertilizer Page is displayed |
| FertilizerPage_TC_OO4 | Functional | Fertilizer Page | Displays a Predict Button | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button<br>4.Fill the Questions<br>5.Click the Predict Button<br>6.Click the Fertilizer Button<br>7.Fill the Questions | http://127.0.0.1:5000 | Displays a Button | Displays a Button |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FertilizerPage_TC_OO4 | Functional | Fertilizer Page | Displays a Disease Button in top of fertilizer page | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button<br>4.Fill the Questions<br>5.Click the Predict Button<br>6.Click the Fertilizer Button<br>7.Fill the Questions<br>8.Click the Disease e Button | http://127.0.0.1:5000 | Displays a Button | Disease Button is pops up |
| DiseasePage_TC_OO4 | Functional | Disease Page | It will displays a Disease page and shows a given questions<br>and then displays a Predict Button | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button<br>4.Fill the Questions<br>5.Click the Predict Button<br>6.Click the Fertilizer Button<br>7.Fill the Questions<br>8.Click the Disease e Button<br>9.Fill the Questions and Click the Predict Button | http://127.0.0.1:5000 | Displays a Disease Page and<br>Predict Button | Disease page is displayed.Predict t image Button was Clicked |
| DiseasePage_TC_OO4 | UI | Disease Page | It shows the result | 1.Enter URL(http://127.0.0.1:5000)<br>2.Scroll Down the Home Page it should displayed the About us<br>3.Click the Crop Button<br>4.Fill the Questions<br>5.Click the Predict Button<br>6.Click the Fertilizer Button<br>7.Fill the Questions<br>8.Click the Diseasee Button | http://127.0.0.1:5000 | Displaying the results | Results is displayed |

**10.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.

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

11.**CONCLUSIONS**

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 ac curacies are obtained.

● The ac curacies are increased by increasing more convolution layers.

● The accuracy of classification also increased by varying dense layers.

● Different ac curacies are obtained by varying the size of kernel used in the convolution layer output.

● Ac curacies are different while varying the size of the train and test datasets

12. **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 video 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. 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 video 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

SOURCE CODE:https://github.com/IBM-EPBL/IBM-Project-1363-1658386167/tree/main/Final%20Deliverables/Source%20Code

GITHUB LINK:https://github.com/IBM-EPBL/IBM-Project-1363-1658386167

DEMO VIDEO LINK:https://drive.google.com/file/d/1TvU1WaKluEDLmM4e-5Ozpcd17oJHf9Xd/view?usp=share_link