# PLANT DISEASE DETECTION

Submitted in partial fulfilment of the requirements of the degree of

BACHELOR OF COMPUTER ENGINEERING

by

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A. P. SHAH INSTITUTE OF TECHNOLOGY, THANE

(2022-2023)

A. P. SHAH INSTITUTE OF TECHNOLOGY, THANE

# CERTIFICATE

This is to certify that the project entitled "Plant Disease Detection" is a bonafide work of **"Aman Pandey"(21202008) ,"Sanket Naikwadi",(21202004), "Janavi Kharat",(21202010),"Sayali Nikam", (20102203)** submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of **Bachelor of Engineering** in **Computer Engineering**

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# Project Report Approval for B.E.

This project report entitled ***(Plant Disease Detection)*** by "**Aman Pandey"(21202008) ,"Sanket Naikwadi",(21202004), "Janavi Kharat",(21202010) , Sayali Nikam", (20102203)** is approved for the degree of ***Bachelor of Engineering*** in ***Computer Engineering***, ***2022-23***.

Examiner Name and Signature

1._____

2._____

Date:

Place: A.P.Shah Institute of Technology , Thane

# Declaration

We declare that this written submission represents our ideas in my own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Date:

# Abstract

The identification of plant diseases is critical to reducing yield and quantity losses in agricultural products. Plant disease research entails the examination of visually discernible patterns on plants. Plant health monitoring and disease detection are crucial for sustainable agriculture. One of the primary factors determining agricultural yield loss in crop production and agriculture is the identification and diagnosis of plant diseases. Plant disease research is the study of any visible points in any portion of the plant that aids in the differentiation of two plants, technically any spots or color shades. One of the most important aspects of agricultural growth is plant sustainability. It is extremely difficult to correctly identify plant diseases. Identification of the illness necessitates a great deal of effort and competence, as well as extensive knowledge of plants and disease detection investigations. As a result, image processing is utilised to identify plant illnesses. The Detection of diseases follows the methods of image acquisition, image extraction, image segmentation, and image pre-processing. This study examined the ways for detecting plant illnesses using photographs of their leaves.

## Keywords

Digital image processing , image acquisition , image extraction, image segmentation, image pre-processing ,Convolutional Neural Network (CNN) , Resnet , cuda , classification algorithm, deep learning

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# Chapter 1

# Introduction

In India about 70% of the populace relies on agriculture. Identification of the plant diseases is important in order to prevent the losses within the yield. It's terribly troublesome to observe the plant diseases manually. It needs a tremendous quantity of labor, expertise within the plant diseases, and conjointly need the excessive time interval. Hence, image processing and machine learning models can be employed for the detection of plant diseases.

The problem of efficient plant disease protection is closely related to the problems of sustainable agriculture and climate change. In India, Farmers have a great diversity of crops. Various pathogens are present in the environment which severely affects the crops and the soil in which the plant is planted, thereby affecting the production of crops .Various disease are observed on the plants and crops .The main identification of the affected plant or crop are its leaves. The various colored spots and patterns on the leaf are very useful in detecting the disease. The past scenario for plant disease detection involved direct eye observation, remembering the particular set of disease as per the climate, season etc. These methods were indeed inaccurate and very time consuming. The current methods of plant disease detection involved various laboratory tests, skilled people, well equipped laboratories etc. These things are not available everywhere especially in remote areas. Detection of disease through some automatic technique is helpful because it reduces an oversized work of watching in huge farms of crops, and at terribly early stage itself it detects the symptoms of diseases means that after they seem on plant leaves. There are several ways to detect plant pathologies. Some diseases do not have any visible symptoms, or the effect becomes noticeable too late to act, and in those situations, a sophisticated analysis is obligatory. However, most diseases generate some kind of manifestation in the visible spectrum, so the naked eye examination of a trained professional is the prime technique adopted in practice for plant disease detection.

In this project, we have described the technique for the detection of plant diseases with the help of their leaves pictures. Image processing is a branch of signal processing which can extract the image properties or useful information from the image. Machine learning is a sub part of artificial intelligence which works automatically or give instructions to do a particular task. The main aim of machine learning is to understand the training data and fit that training data into models that should be useful to the people. So it can assist in good decisions making and predicting the correct output using the large amount of training data.

Variations in symptoms indicated by diseased plants may lead to an improper diagnosis since amateur gardeners and hobbyists could have more difficulties determining it than a professional plant pathologist. An automated system designed to help identify plant diseases by the plant's appearance and visual symptoms could be of great help to amateurs in the gardening process and also trained professionals as a verification system in disease diagnostics. Advances in computer vision present an opportunity to expand and enhance the practice of precise plant protection and extend the market of computer vision applications in the field of precision agriculture.

# Chapter 2

# Literature Review

In paper —Plant disease detection using CNN and GAN" [1 ], by Emaneul Cortes, an approach to detect plant disease using Generative Adversarial networks has been proposed. Background segmentation is used for ensuring proper feature extraction and output mapping. It is seen that using Gans may hold promise to classify diseases in plants, however segmenting based on background did not improve accuracy.

In the paper —Applying image processing technique to detect plant diseases" [2] by A Kulkarni, a methodology for early and accurately plant diseases detection, using artificial neural network (ANN) and diverse image processing techniques. As the proposed approach is based on ANN classifier for classification and Gabor filter for feature extraction, it gives better results with a recognition rate of up to 91%.

The Paper Plant Disease Detection by image pre-processing by Ashwini C, focuses on using Linear SVM & Non Linear SVM[3] The images are contemplated for additional feature extraction, which will be done by using one of the exceeding algorithms. There are various method used in feature extraction like Image Sharpening, Edge detection, Image greyscaling etc. which further combines into giving classification of provided input.

Prof. Sanjay, B. Dhaygude Said in Agricultural plant Leaf Disease Detection Using Image Processing [4] The application of texture statistics for detecting the plant leaf disease has been explained Firstly by color transformation structure RGB is converted into HSV space because HSV is a good color descriptor. Masking and removing of green pixels with pre-computed threshold level. Then in the next step segmentation is performed using 32X32 patch size and obtained useful segments. These segments are used for texture analysis by color co-occurrence matrix.

Research Paper ResNet-based approach for Detection and Classification of Plant Leaf Diseases by Vinod Kumar, Hritik Arora proposes the Residual Neural Network for plant diseases detection[5]. The proposed ResNet model accomplished a 99.40% accuracy on a test set, illustrating the viability of the proposed model. Overall, the process of training ResNet models on an open image dataset provides a sound way towards crop disease detection using automated networks on an enormous global scale. Proposed method goes through four phases as Data acquisition, Data Pre-processing, feature extraction & classification.

Table 1 : literature Survey

| Sr No. | Author | Research Paper | Outcomes |
|---|---|---|---|
| 1 | Vinod Kumar, Hritik Arora | ResNet-based approach for Detection and Classification of Plant Leaf Diseases | Demonstrated the feasibility of using residual networks (ResNet) to classify plant diseases. |
| 2 | Ashwini C | Plant Disease Detection by image pre-processing | Linear & Non Linear SVM. Feature Extraction with Image greysccaling, edge detetction, image sharpening etc. |
| 3 | A Kulkarni | Applying image processing technique to detect plant diseases | Artificial Neural network (ANN) & Gabol Filter for feature extraction which is used in texture analysis. |
| 4 | Prof. Sanjay, B. Dhaygude | Agricultural plant Leaf Disease Detection Using Image | Vision-based detection algorithm, Conversion of RGB to HSV, Masking of Pixels, Texture Statistics. |
| 5 | Emaneul Cortes | Plant disease detection using CNN and GAN | Generative Adversarial networks & Convolutional Neural Network |

# Chapter 3

# Problem Statement

Human society would need to raise food production by an estimated 70% by 2050 to feed a population of more than 9 billion people. Infectious illnesses currently limit potential production by 40% on average, with many farmers in the developing countries facing yield losses of up to 100%.

The broad availability of smartphones among farmers worldwide has the potential to transform cellphones into a valuable tool for those farmers.

This project can be used by farmers to diagnose early if their plants are suffering from any diseases or not.

# Objectives

●The main objective is to identify the plant diseases using CNN model by image processing OpenCV.
●After identification of the disease, the model will give information about disease also treatment which needs to be done as a cure.
●Model will fetch data from datasets and display it to the user.
●Hence, we can limit pest attacks by utilizing appropriate pesticides and treatments.

## Features :

The features of the plants range from color, shape and disease type. This can make a million odd diseases which the model has to characterize and put in the system. As the features are put into various categories the images are decoded to get the next result, which is the layered output

## Scope :

- We will build a convolutional neural network (CNN Model) that can predict whether or not a plant is infected.
- We will use different layers and other hyperparameters for building, training and testing.
- This model is mainly built using TensorFlow and Keras.
- This system will assist farmers by facilitating the rapid identification and treatment of plant diseases, as well as assisting them in making informed decisions while using chemical pesticides.
- This project will be very helpful to farmers in rural areas and also will help them in saving their yields from diseases as farmers lose a huge amount of their cultivated crops because of diseases and this system will help them to avoid the similar situation.
- Also we have tried to implement this project in a regional language so as to make things more understandable for farmers. This project can also provide them cure by suggesting pesticide names and their quantity according to the prevailing disease and this project will also display and give an idea about the effect of crop disease on crop yield.

# Chapter 4

# Experimental Setup

## 5.1 Software Requirements :

- Operating System : Windows 8 and above.
- Programing language : Python , ReactJS
- Platform : Jupiter notebook,VScode
- Supporting libraries : Tensorflow, OpenCV

## 5.2 Hardware Requirements :

- Processor :  i5 or higher generation
- RAM : A minimum of  8GB of RAM.
- Hard disk : A minimum of 20 GB of available space.

# Technology Stack :

**HTML**

**CSS**

## Keras :

Keras is a high-level Python neural networks library that runs on top of either TensorFlow or Theano. There are other high level Python neural networks libraries that can be used on top of TensorFlow, such as TF-Slim.Keras is used for a graphical representation of the models which helps to understand the structure of the model.
Dataset link :
https://www.kaggle.com/datasets/vipoooool/new-plant-diseases-dataset

## Tensorflow:

Tensorflow lite is a deep learning framework and is based on the tensorflow framework. It is used to reduce the size of a normally huge tensorflow model so that it can be used in modular devices such as mobile phones. We can use tensorflow lite to access the model with android studio.

## CNN :

Convolutional Neural Networks are a complex neural network chain which work to get the features of an image from a dataset which is trained and classify them to get the required output. It trains the neural networks by using the dataset images and changing them to numerical values.

# Chapter 5

# Project Design

## 6.1 Architecture Diagram :

An architectural diagram is a visual representation that maps out the physical implementation for components of a software system.

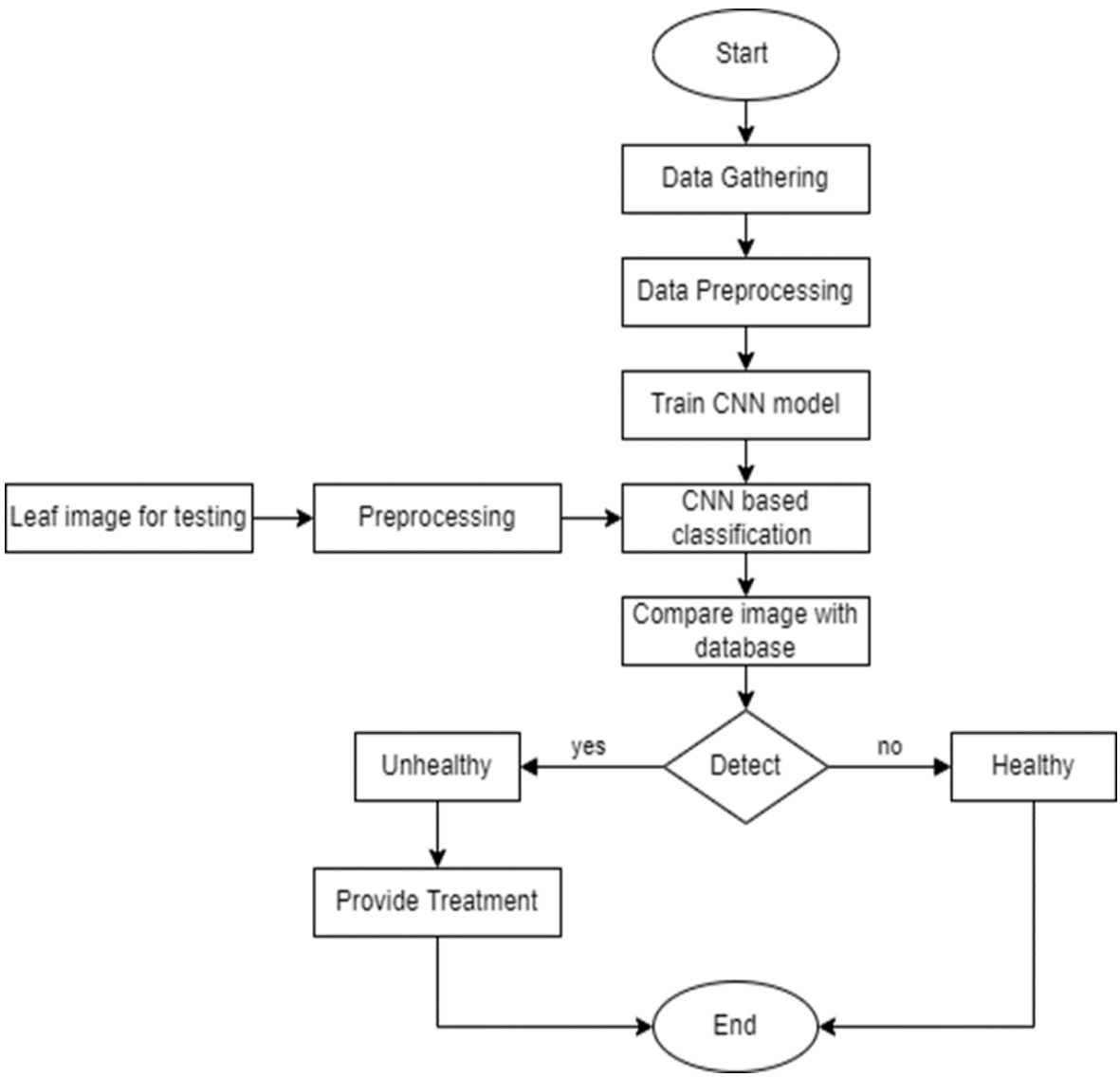
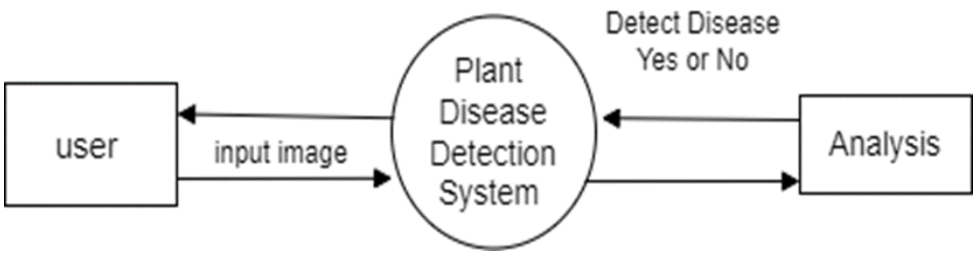



**Figure 1**

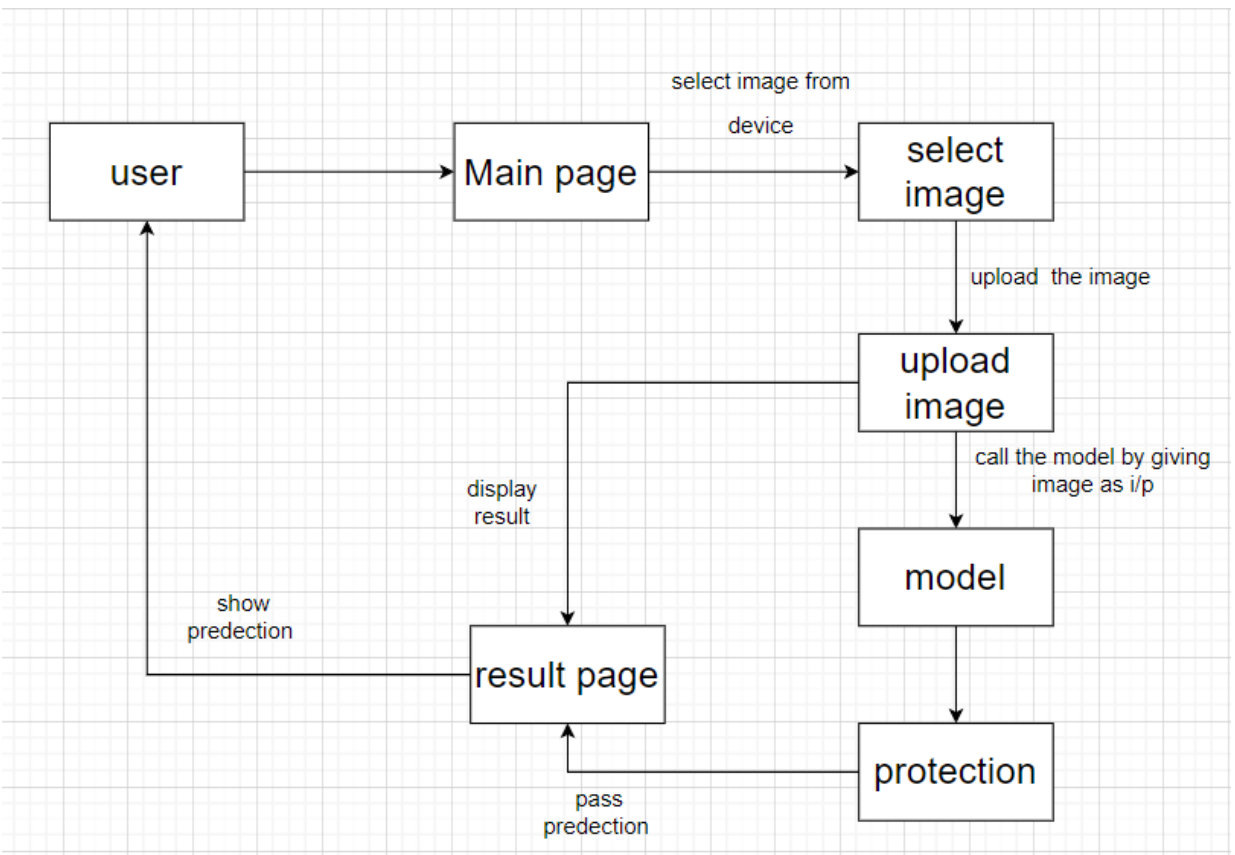
## 6.2 DFD Diagram :

A data flow Diagram is a graphical representation of the "flow" of data through an information system, modelling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated.

## Level 0 :




## Level 1 :



**Level 2 :**

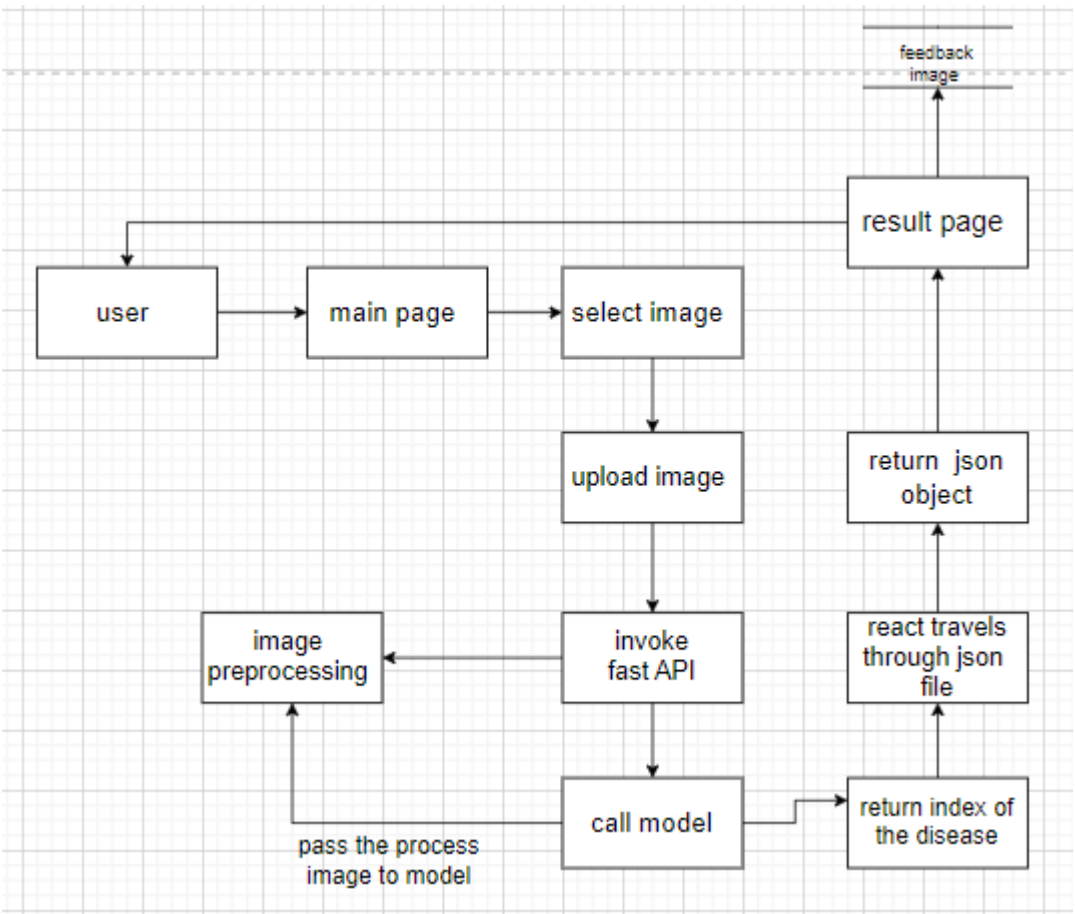



**Figure 2**

## 6.3 Use Case Diagram :

Use case diagram is a graphic depiction of the interactions among the elements of a system. Use cases will specify the expected behaviour, and the exact method of making it happen.

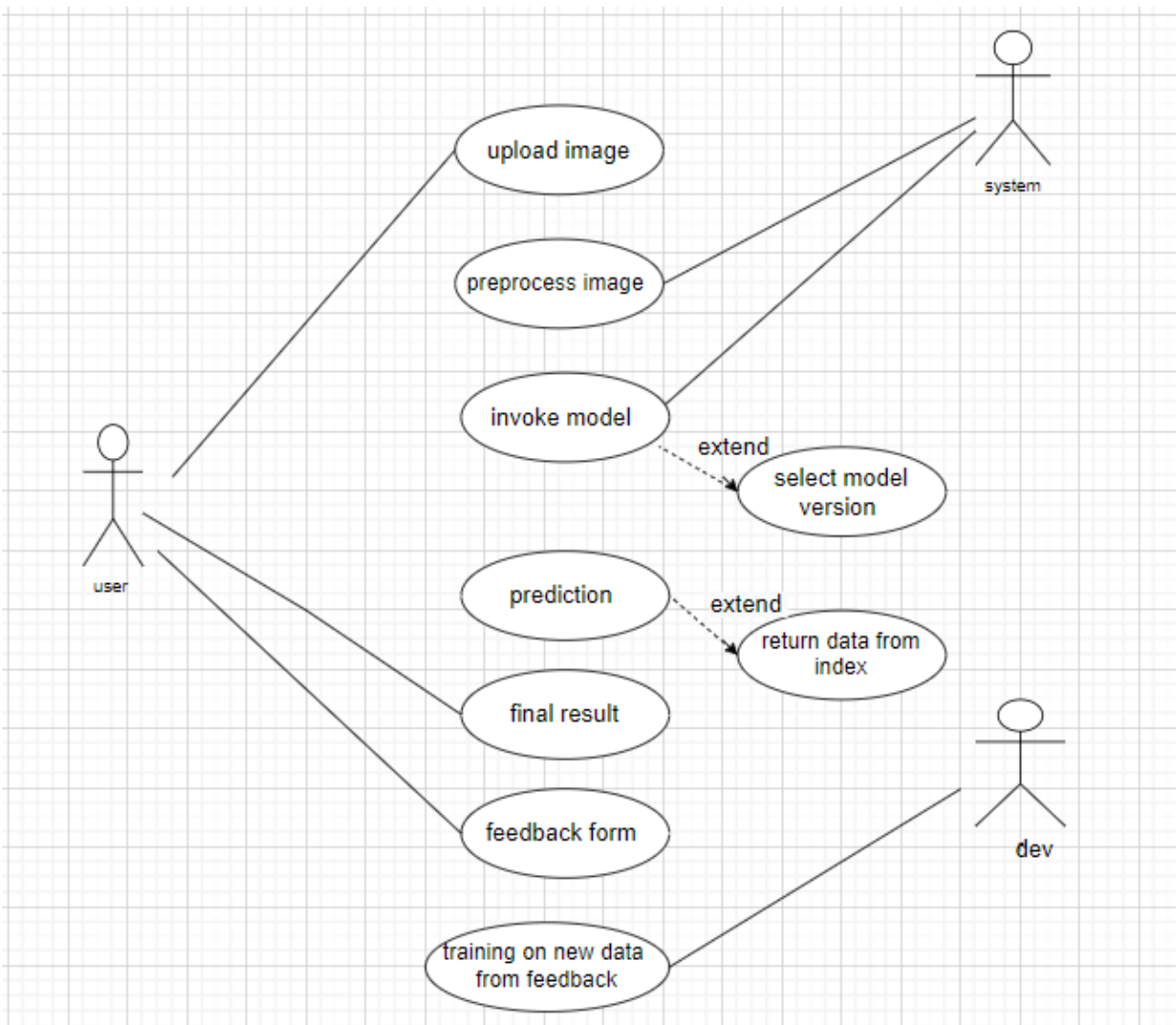



**Figure 3**

# Methodology :

1. Image Dataset Acquisition: The Dataset was taken from Kaggle of Plant Village dataset. In this data-set, 39 different classes of plant leaf and Background images are available. The data-set containing 61,486 images. There is a total of 35 Classes that we have to predict using the CNN Model.

2. Pre-processing of Images: Transforms are used for Data Augmentation like cropping the image, resize the image, convert the image to tensor, rotate the image, and many more. Transforms work as a filter for all images.

3. Train and Test Split: Split the data into train, test and validation data. Total 36584 for train, 15679 for validation and remaining images for testing.

4. Model Creation: We use a convolutional neural network for model creation. We also specified filter size for the Conv layer and Pool layer and the shape on each layer.

Sample Image of Dataset

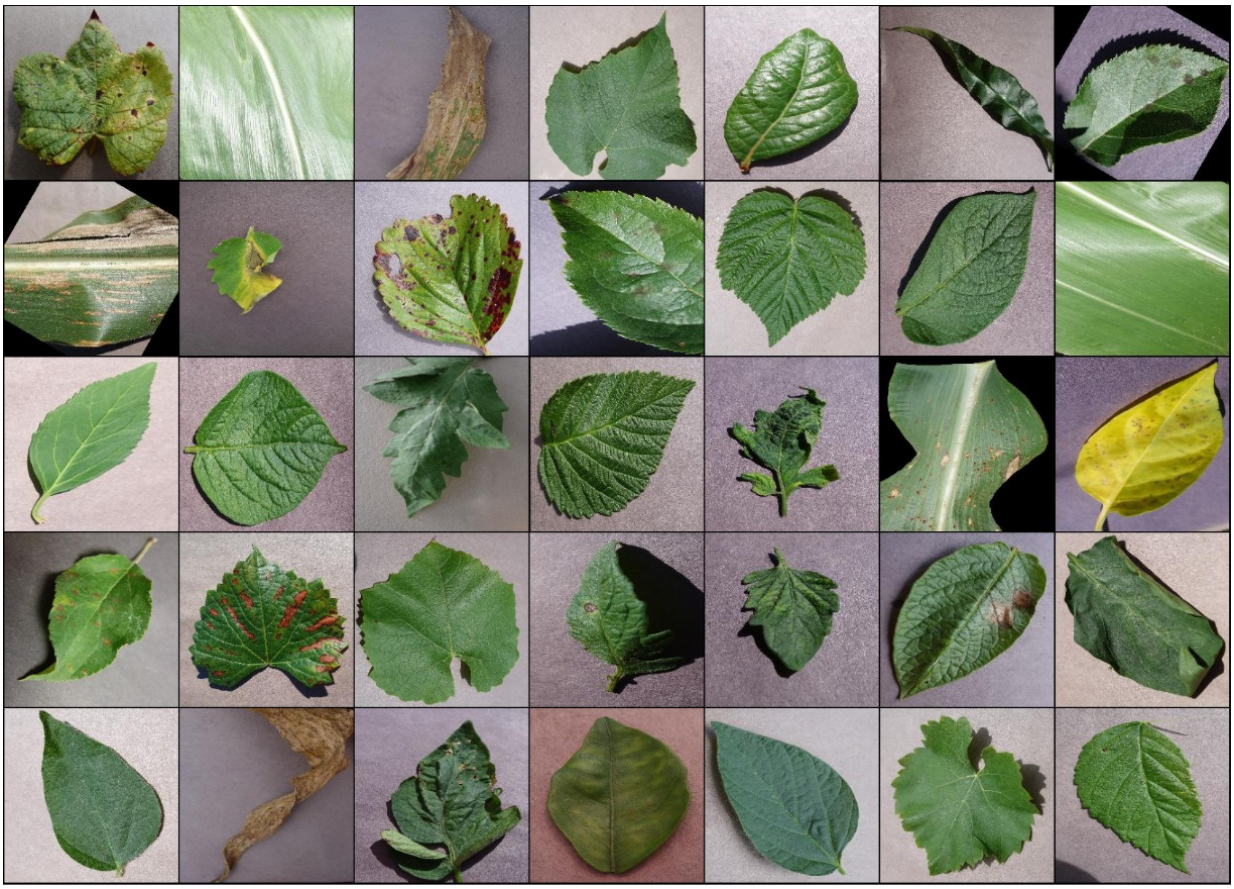
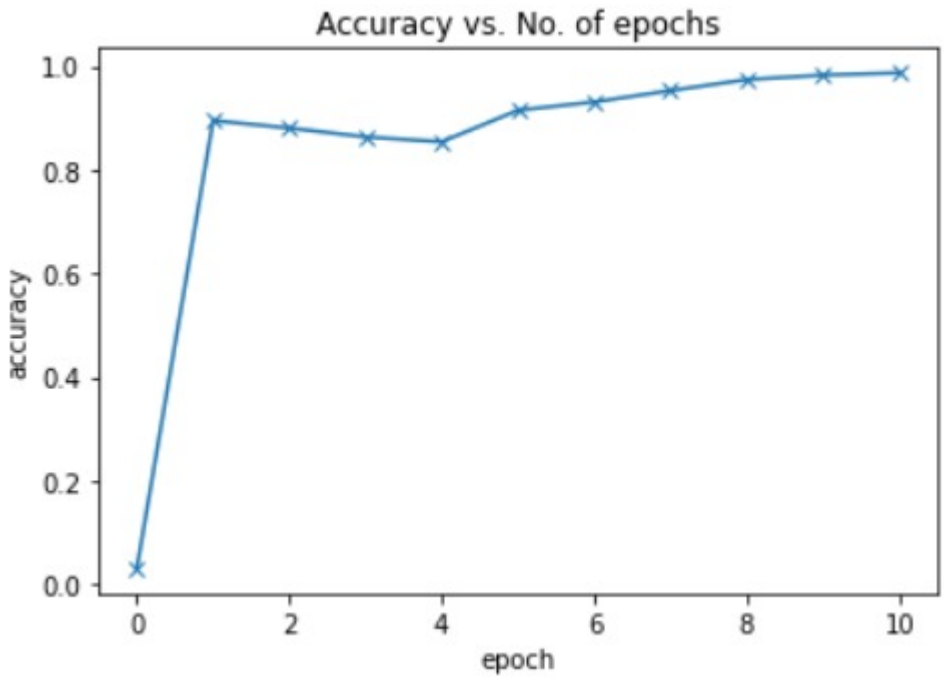
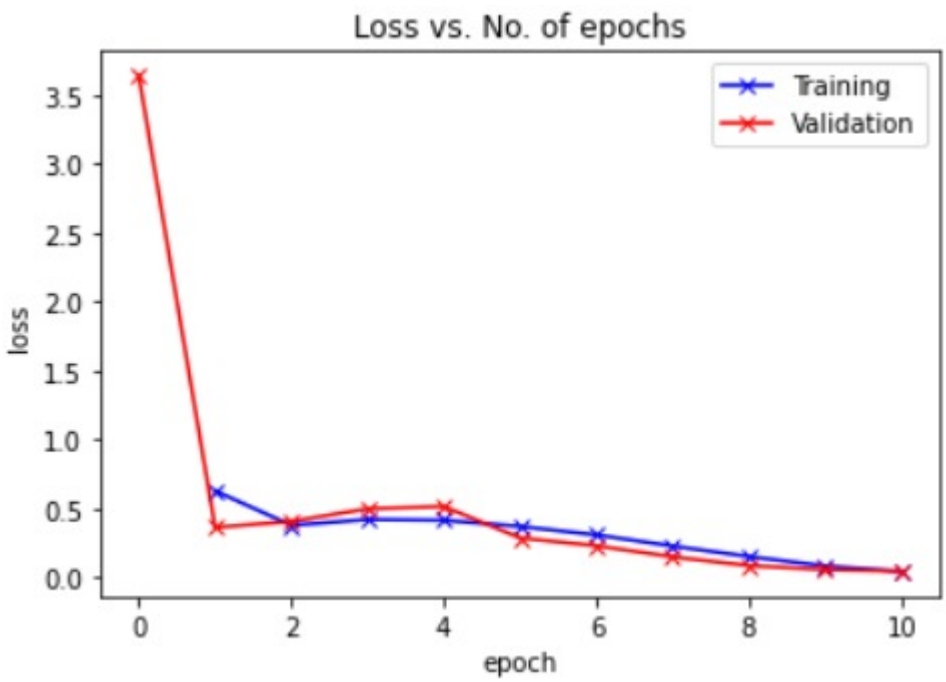
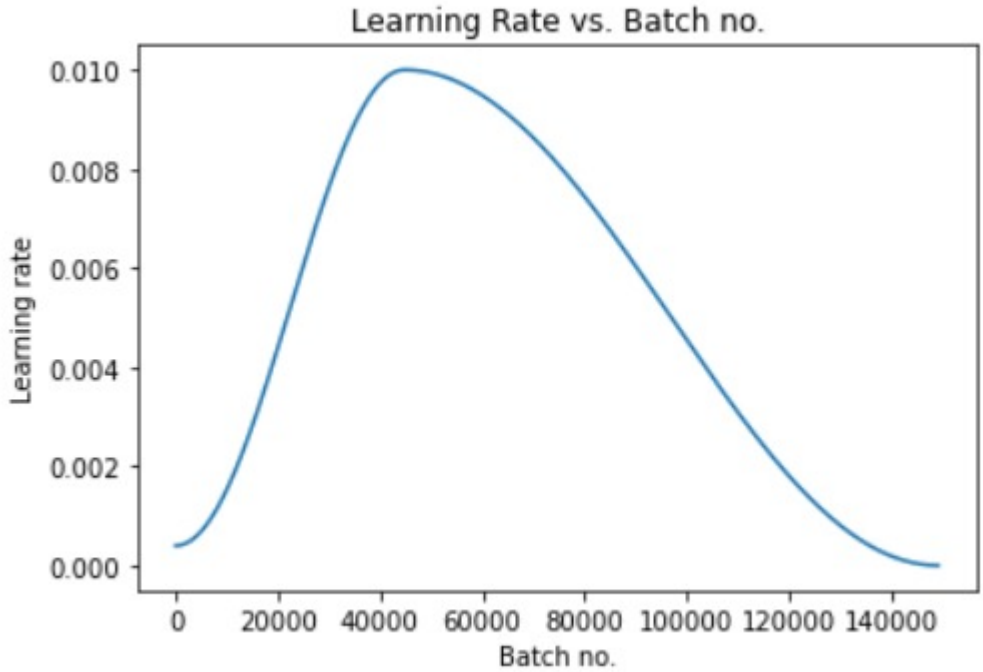


**Figure 4**


Accuracy vs. No. of epochs
accuracy
epoch
1.0
0.8
0.6
0.4
0.2
0.0
0
2
4
6
8
10


Loss vs. No. of epochs
Training
Validation
loss
epoch
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10


Learning Rate vs. Batch no.
0.010
0.008
0.006
0.004
0.002
0.000
Learning rate
0
20000
40000
60000
80000
100000
120000
140000
Batch no.

# Chapter 6

# Project Implementation

## Code :

```
class ResNet9(nn.Module):
    def __init__(self, in_channels, num_diseases):
        super().__init__()

        self.conv1 = ConvBlock(in_channels, 64)
        self.conv2 = ConvBlock(64, 128, pool=True)
        self.res1 = nn.Sequential(ConvBlock(128, 128), ConvBlock(128, 128))

        self.conv3 = ConvBlock(128, 256, pool=True)
        self.conv4 = ConvBlock(256, 512, pool=True)
        self.res2 = nn.Sequential(ConvBlock(512, 512), ConvBlock(512, 512))

        self.classifier = nn.Sequential(nn.MaxPool2d(4),
                                        nn.Flatten(),
                                        nn.Linear(512, num_diseases))

    def forward(self, xb):
        use_cuda = False
        out = self.conv1(xb)
        out = self.conv2(out)
        out = self.res1(out) + out
        out = self.conv3(out)
        out = self.conv4(out)
        out = self.res2(out) + out
        out = self.classifier(out)
        return out

def ConvBlock(in_channels, out_channels, pool=False):
    layers = [nn.Conv2d(in_channels, out_channels, kernel_size=3, padding=1),
              nn.BatchNorm2d(out_channels),
              nn.ReLU(inplace=True)]
    if pool:
        layers.append(nn.MaxPool2d(4))
    return nn.Sequential(*layers)

def to_device(data, device):
    if isinstance(data, (list,tuple)):
```

```
        return [to_device(x, device) for x in data]
    return data.to(device, non_blocking=True)

model = to_device(ResNet9(3, len(class_names)), dev)
#PATH = os.path('')
model.load_state_dict(torch.load("../Models/Fin_Plant_Model.pth",map_location=torch.device
(dev)))
model.eval()
#model = torch.load('../Model/plant_model2.pth', map_location=torch.device('cuda'))
def read_file_as_image(data):
        #image = torchvision.transforms.ToPILImage()(data)
        data = np.array(Image.open(BytesIO(data)))
        #image = torch.from_numpy(data).long()
        #image = Image.open(io.BytesIO(data))
        #image = image.resize((256,256))
        convert_tensor = transforms.ToTensor()
        image = convert_tensor(data)
        #image = np.expand_dims(data,0)
        return image

@app.post("/predict")
async def predict( file: UploadFile = File(...)):
        img = read_file_as_image(await file.read())
        xb = to_device(img.unsqueeze(0), dev)
        resize = Resize((256,256))
        xb = resize(xb)
        yb = model(xb)
        _, preds  = torch.max(yb, dim=1)

        newpreds = torch.nn.functional.softmax(yb,dim = 1) * 100
        maxpredcon = torch.max(newpreds,dim=1)
        confidencelev = maxpredcon[0].item()

        print(confidencelev)
        return {
        "class":preds[0].item(),
        "Confidence":confidencelev
        }
```

# User interface

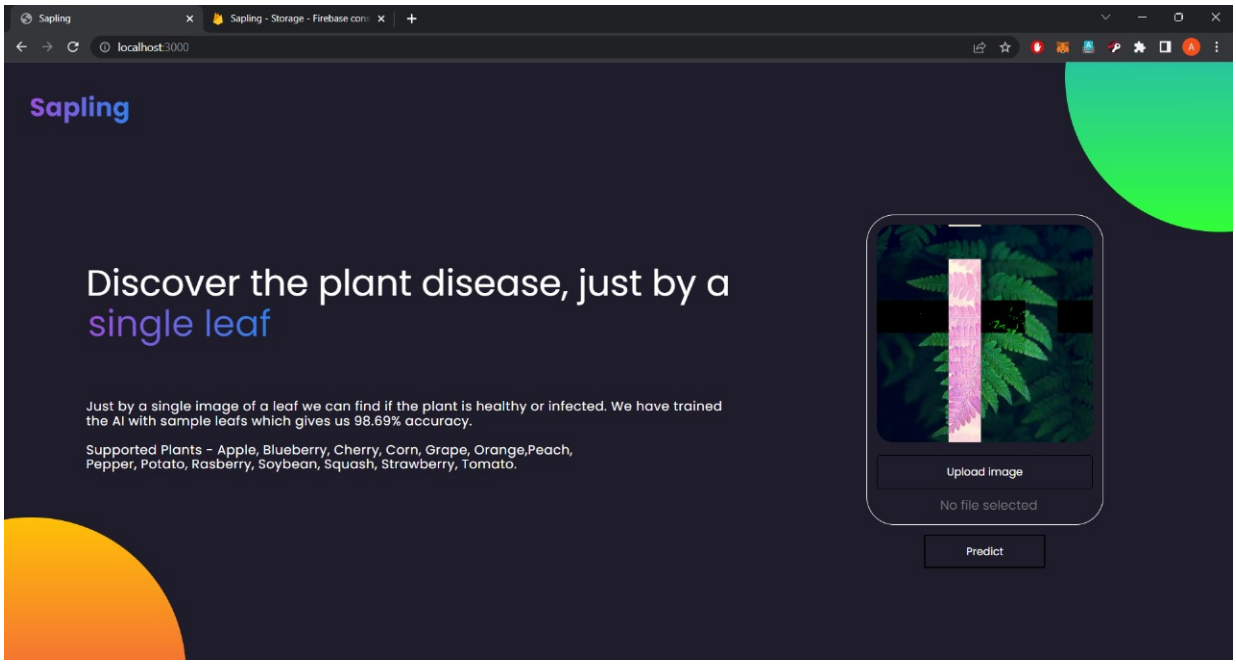



**Figure 5**

# Chapter 7

## Result :

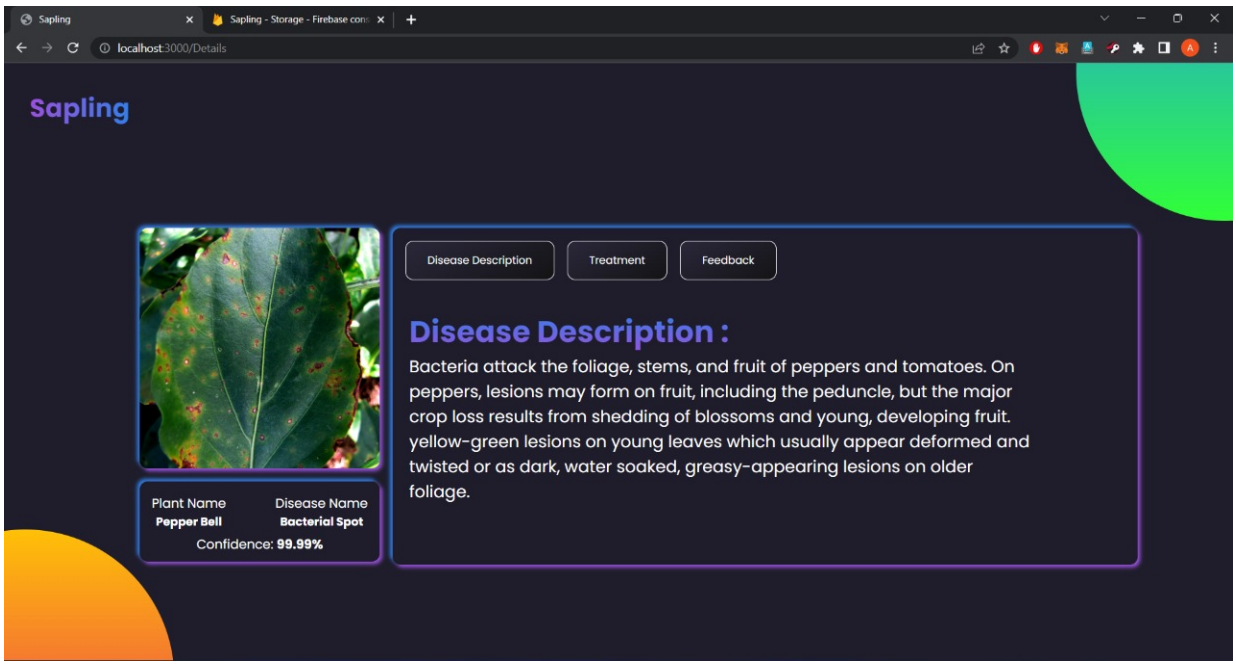



Figure 6

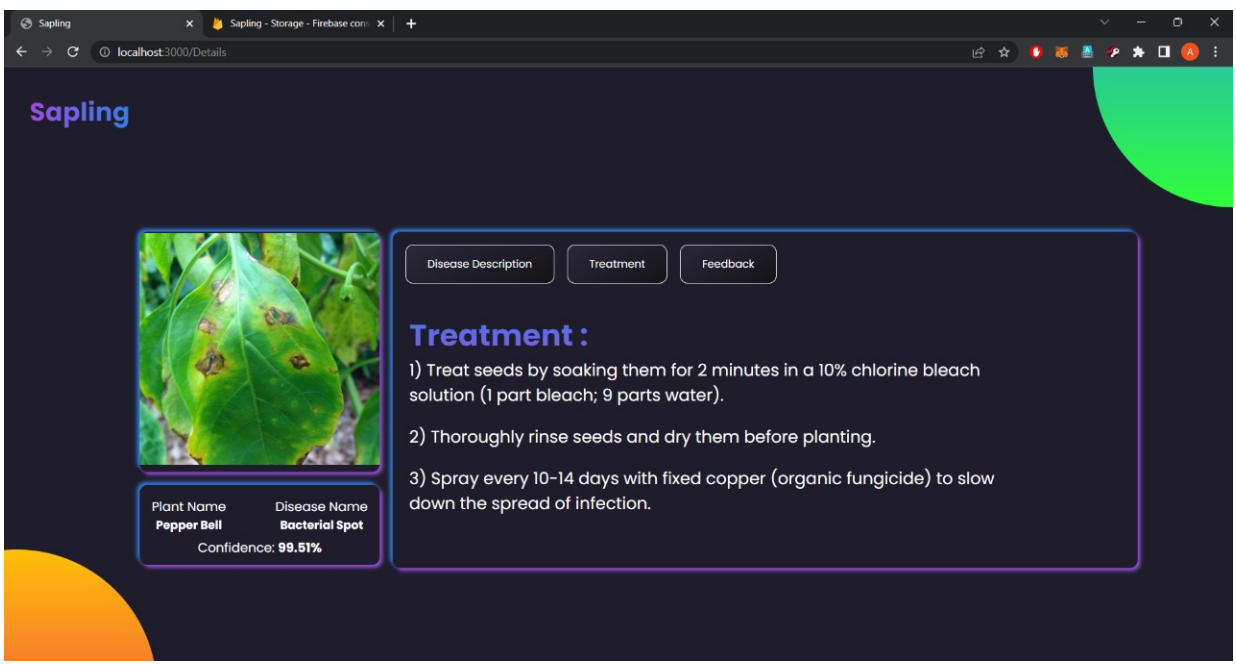



Figure 7

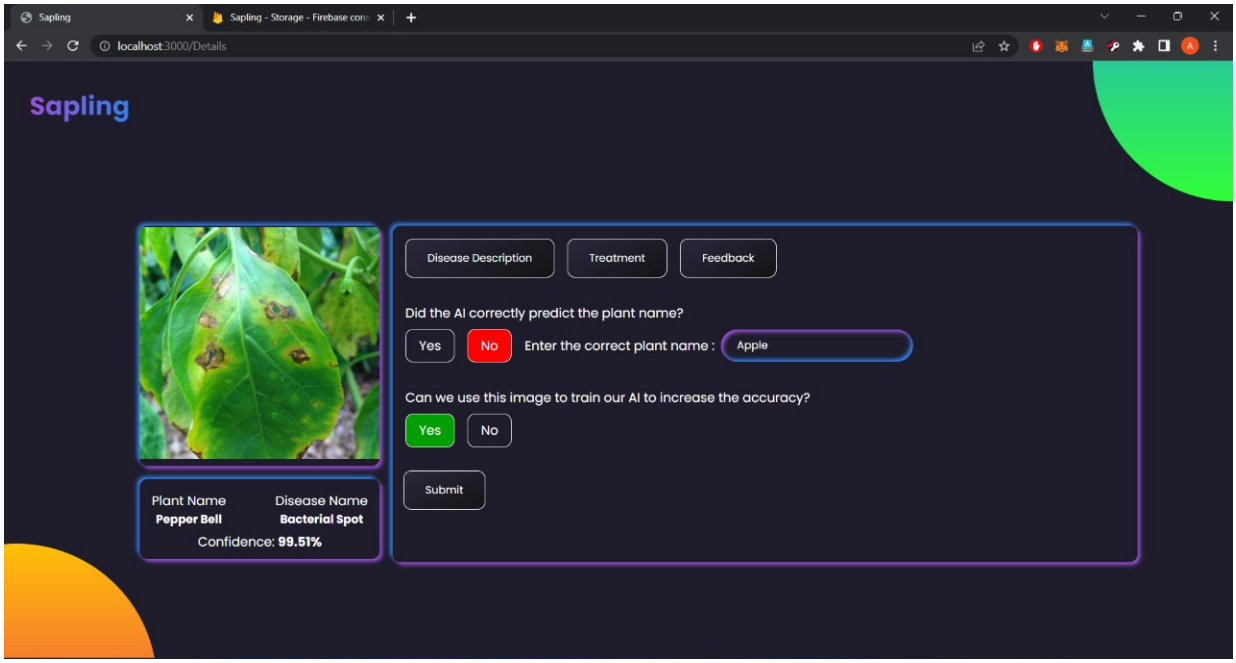



**Figure 8.1**

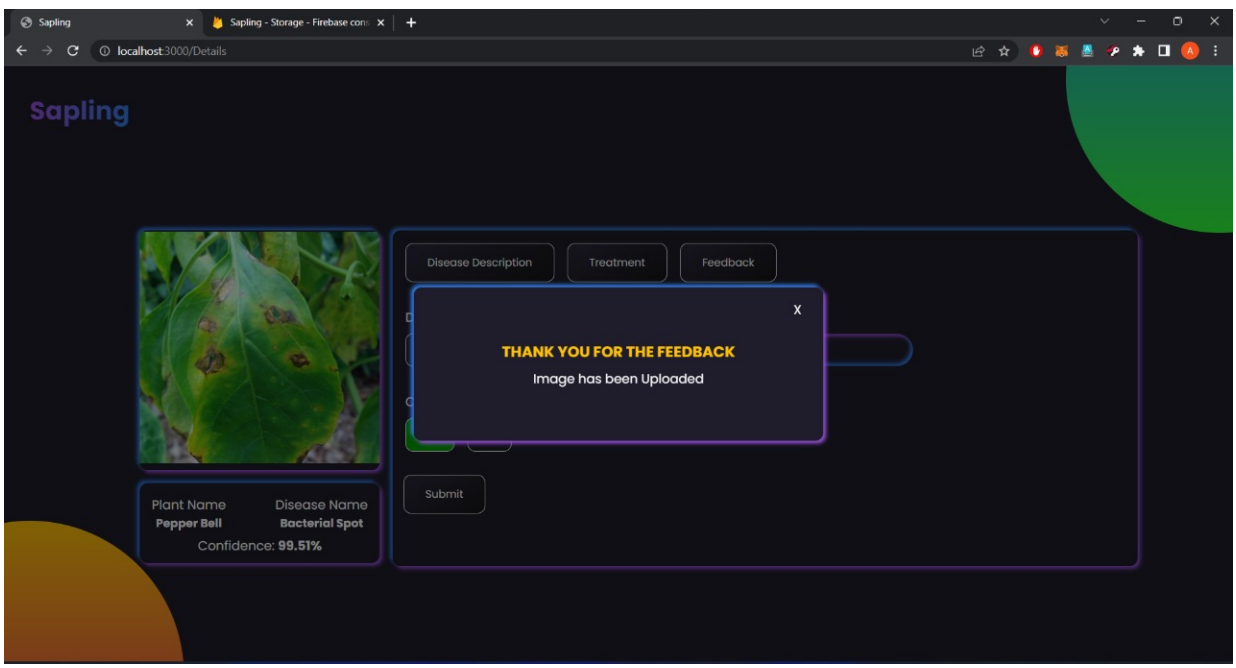



**Figure 8.2**

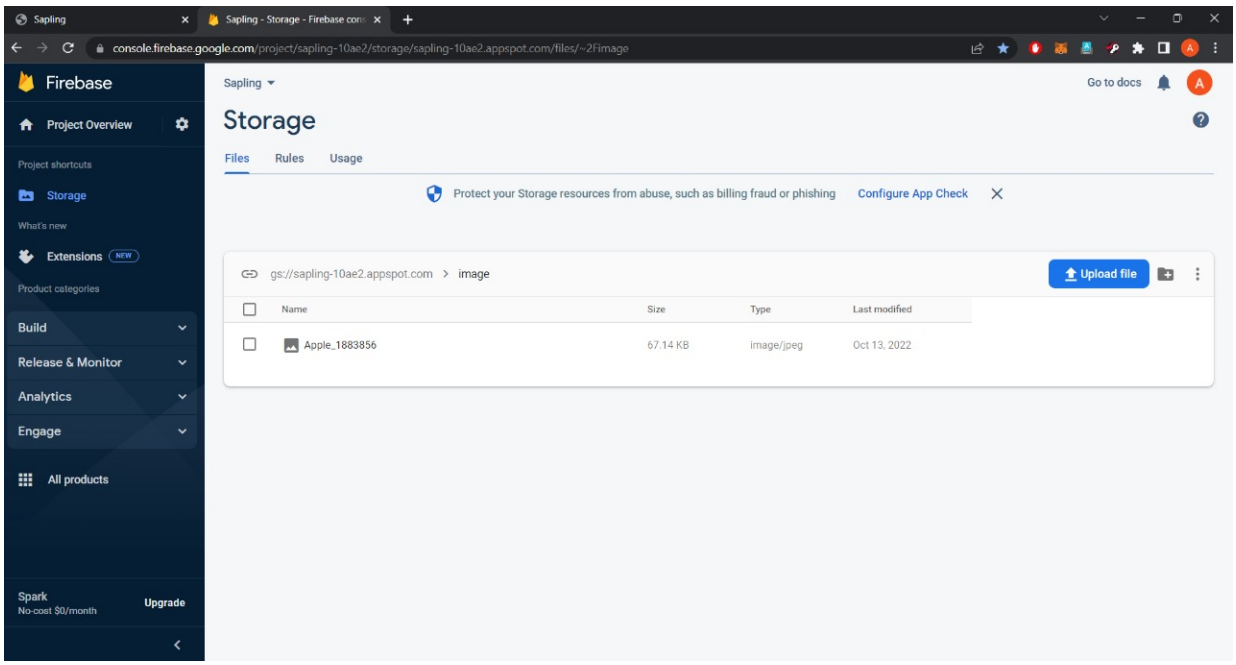

Sapling
Sapling - Storage - Firebase con
console.firebase.google.com/project/sapling-10ae2/storage/sapling-10ae2.appspot.com/files/~2Fimage
Firebase
Project Overview
Project shortcuts
Storage
What's new
Extensions NEW
Product categories
Build
Release & Monitor
Analytics
Engage
All products
Spark
No-cost $0/month
Upgrade
Sapling
Go to docs
Storage
Files
Rules
Usage
Protect your Storage resources from abuse, such as billing fraud or phishing
Configure App Check
gs://sapling-10ae2.appspot.com > image
Upload file
Name
Size
Type
Last modified
Apple_1883856
67.14 KB
image/jpeg
Oct 13, 2022

**Figure 9**

# Chapter 8

## Conclusion

The proposed system tracks the cultivated field on a regular basis. The CNN and DNN algorithms are used to identify crop diseases at an early stage. Machine learning methods are used to train the model, which aids in making appropriate disease decisions. To contain infected diseases, the farmer is advised to use pesticides as a cure. In the future, the proposed scheme could be expanded to provide additional facilities such as nearby government markets, pesticide price lists, and a nearby open market, among others..This paper presents a review of various disease classification strategies for crop disease detection, as well as an algorithm for image segmentation that can be used for automated detection and classification of plant leaf diseases in the future. Some of the organisms on which the proposed algorithm is evaluated include grape,corn,apple,strawberry,tomato,peach,orange,pepper bell,potato,raspberry,soyabean and squash. As a result, similar diseases for these plants were investigated. The best results were obtained with very little computational effort, demonstrating the efficacy of the proposed algorithm in recognising and classifying crop diseases. Another benefit of this approach is that plant diseases can be detected at an early stage, or even at the beginning. Convolution neural network.

## Future Scope

Since currently the system is trained using Plant Village dataset, the model is trained to detect only 26 types of plant diseases. We propose to train the system with much more data of various other plants and diseases to further increase the scope of the system. By adding images of many other plants, it will help in extracting many more features of the plants which certainly help in improving the accuracy of the system. The users using the system may also contribute to the system by capturing different types of plant images which can be added to the dataset. This dataset can be further used to build better models Also the may be improved in terms of accuracy by implementation of better algorithms in the coming future. We also propose to provide certain remedies for the crop diseases to the user by analyzing the diseases. This will certainly help the users to avoid such diseases in the future. Also the remedies will help the user to get rid of the diseases hence, improving their yield.

# References

[1] V. Kumar, H. Arora, Harsh and J. Sisodia, "ResNet-based approach for Detection and Classification of Plant Leaf Diseases," 2020 International Conference on Electronics and Sustainable Communication Systems (ICESC), 2020, pp. 495-502, doi: 10.1109/ICESC48915.2020.9155585.
https://www.semanticscholar.org/paper/ResNet-based-approach-for-Detection-and-of-Plant-Kumar-Arora/269a11cfd9e9b3a4af26fc5ce40f74e5c523d3ce

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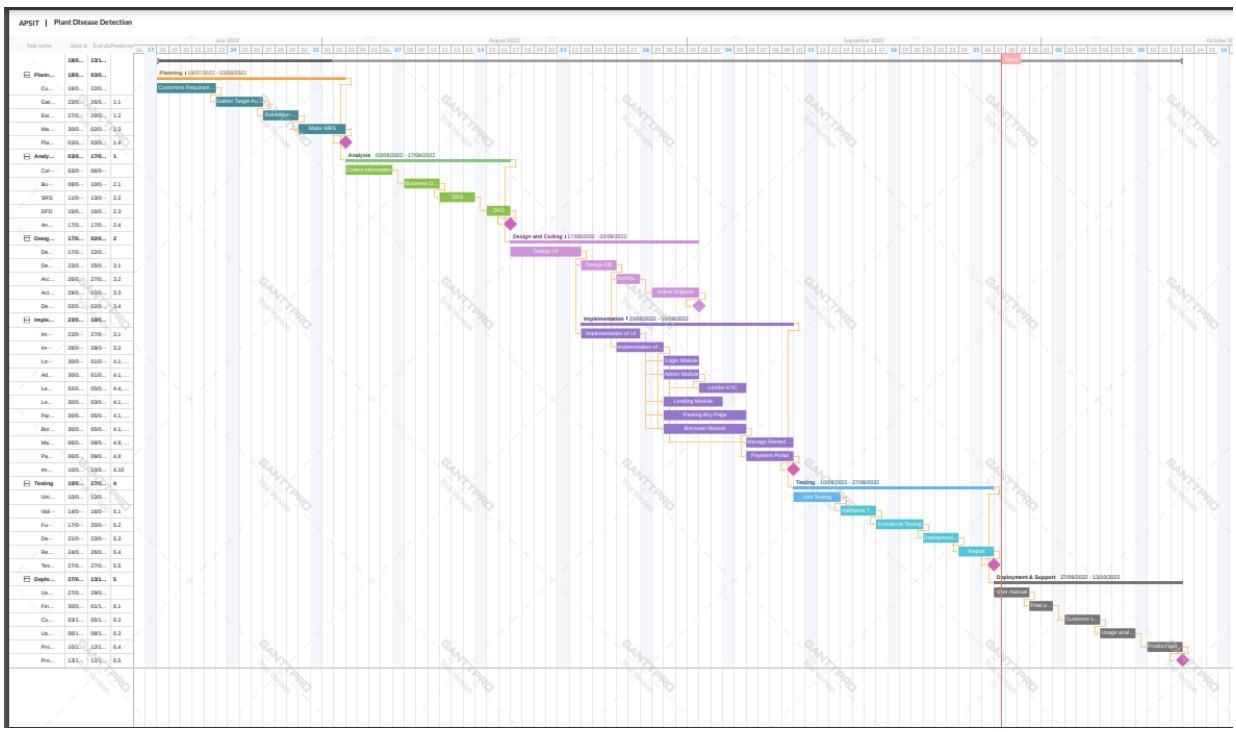
# Annexure

## Gantt Chart :

Gantt Chart is a chart in which a series of horizontal lines shows the amount of work done or production completed in certain periods of time in relation to the amount planned for those periods.



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