Project report

1 Introduction

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.

a. Overview (a brief description about ur project) the project is named as fertilizer recommendation system for disease prediction. Here two datasets are taken- fruits and vegetables. Both these datasets have train and test images. I preprocess the data, by transforming and rescaling. Also I do data augmentation to increase the size of dataset. I then build model for both fruit training and vegetable training. Getting the aspired accuracy, I then deploy the models using flask.

b. Purpose (the use of this project. What can be achieved using this): the countries like India, are highly dependent on the cultivation yield. with increase in world population, good crop yield is utmost important. To meet the demand, farmers without proper knowledge use fertilizers and pesticides which many times lead to health hazards. The purpose of this project is to detect a diseased plant and also to recommend proper fertilizer for the same. Such a system assists farmers in choosing the right kind of fertilizer at right time and correct amount.

2. Literature Survey

a. Existing problem (existing approaches or method to solve this problem.) plant diseases are a serious threat, especially in the countries which lack the necessary infrastructure. With the advances in computer vision and deep neural network, the timely detection of crop diseases and the required care has become possible. Authors Sharada et.al. in their work [Mohanty SP, Hughes DP and Salathé M (2016) Using Deep Learning for Image-Based Plant Disease Detection. Front. Plant Sci. 7:1419. doi: 10.3389/fpls.2016.01419] used a public dataset of 54,306 images diseased and healthy plant leaves. They trained a convolutional neural network to identify 14 crop species and 26 diseases. They achieved an accuracy of 99.35%. the authors here used transfer learning and training from scratch of two deep neural networks, AlexNet and GoogleNet. They experimented 6 variations of test and train split and finalized the best one through F1 score. Authors Lee et.al., although propose a different approach for this problem.[Lee SH, Goëau H, Bonnet P and Joly A (2020) Attention-Based Recurrent Neural Network for Plant Disease Classification. Front. Plant Sci. 11:601250. doi: 10.3389/fpls.2020.601250] the authors here focus on the loopholes of CNN based models, as they fail on focusing precisely on the infected areas of plants but add background noise. To overcome this, the authors propose use of RNN model to automatically locate infected regions and extract relevant features for disease classification.

b. Proposed solution (what is the method or solution suggested by u): the solution that we propose here is to use convolutional neural network built deep neural network model. The model here takes real time plant images as inputs and predicts whether the plant is healthy or has disease. If the plant is having disease the already available draft for fertilizer, will recommend a proper fertilizer for the cure.

3. Theoretical analysis

a. Block analysis:

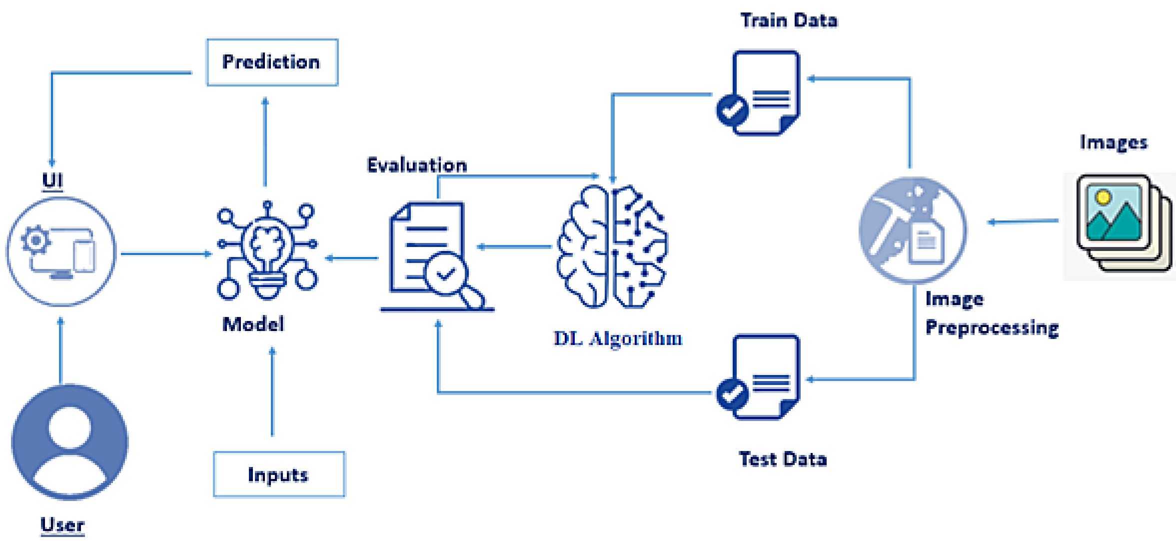

fig 1. diagrammatic representation

b. Hardware/Software designing (Hardware and software requirements of the projects): the system specification which I used for this project are: hardware- 64-bit OS, 4GB RAM, Intel® Core™ i3-6006U CPU @2.00 GHz.

Software: windows 10, Anaconda3(jupyter notebook, spyder), flask for deployment.

4. **Experimental investigations**

The dataset that is provided contains fruits and vegetables images, both have separate test and train sets. I made separate data models for both fruit and vegetable training. For the fruit training, the data model I used with a single convolution layer but four fully connected layers. The model is as follows

Layer (type)	Output Shape	Param #
conv2d_2 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_2 (MaxPooling 2D)	(None, 63, 63, 32)	0
flatten_2 (Flatten)	(None, 127008)	0

dense_8 (Dense)	(None, 160)	20321440
dense_9 (Dense)	(None, 90)	14490
dense_10 (Dense)	(None, 60)	5460
dense_11 (Dense)	(None, 6)	366

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Total params: 20,342,652
Trainable params: 20,342,652
Non-trainable params: 0

The loss we used here was ‘crossentropy loss’ and the optimizer was ‘adam’. The batch size was 32, number of epochs was 20. The accuracy for this model was train-accuracy=98.37% and val-accuracy = 94.95%.

For vegetable training the model that I formed had two convolution layers and four fully connected layer. The mode is as follows-

Model: "sequential_2"

Layer (type)	Output Shape	Param #
conv2d_3 (Conv2D)	(None, 126, 126, 64)	1792
max_pooling2d_3 (MaxPooling 2D)	(None, 63, 63, 64)	0
conv2d_4 (Conv2D)	(None, 61, 61, 32)	18464
max_pooling2d_4 (MaxPooling 2D)	(None, 30, 30, 32)	0
flatten_2 (Flatten)	(None, 28800)	0
dense_7 (Dense)	(None, 120)	3456120
dense_8 (Dense)	(None, 90)	10890

dense_9 (Dense)	(None, 60)	5460
dense_10 (Dense)	(None, 9)	549

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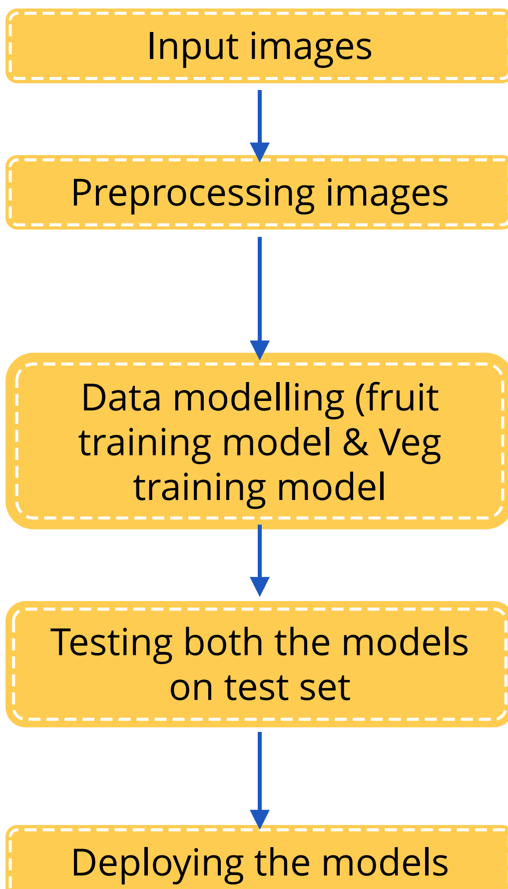
Total params: 3,493,275

Trainable params: 3,493,275

Non-trainable params: 0

The loss we used here was ‘crossentropy loss’ and the optimizer was ‘adam’. The batch size was 32, number of epochs was 15. The accuracy for this model was train-accuracy=92.19% and val-accuracy = 91.83%.

5. **Flowchart**



6. **Result**

The following images show the correct working of the model.

Fig. 2 home page

Fig 3. Home page while selecting the predict button

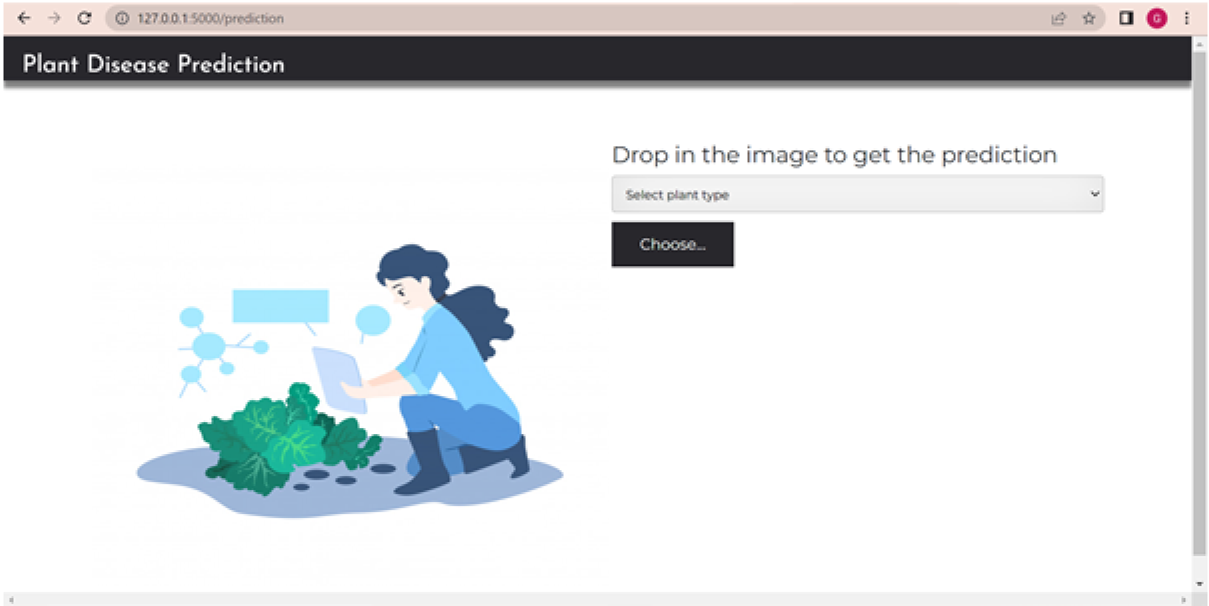


Fig 4. Predict page

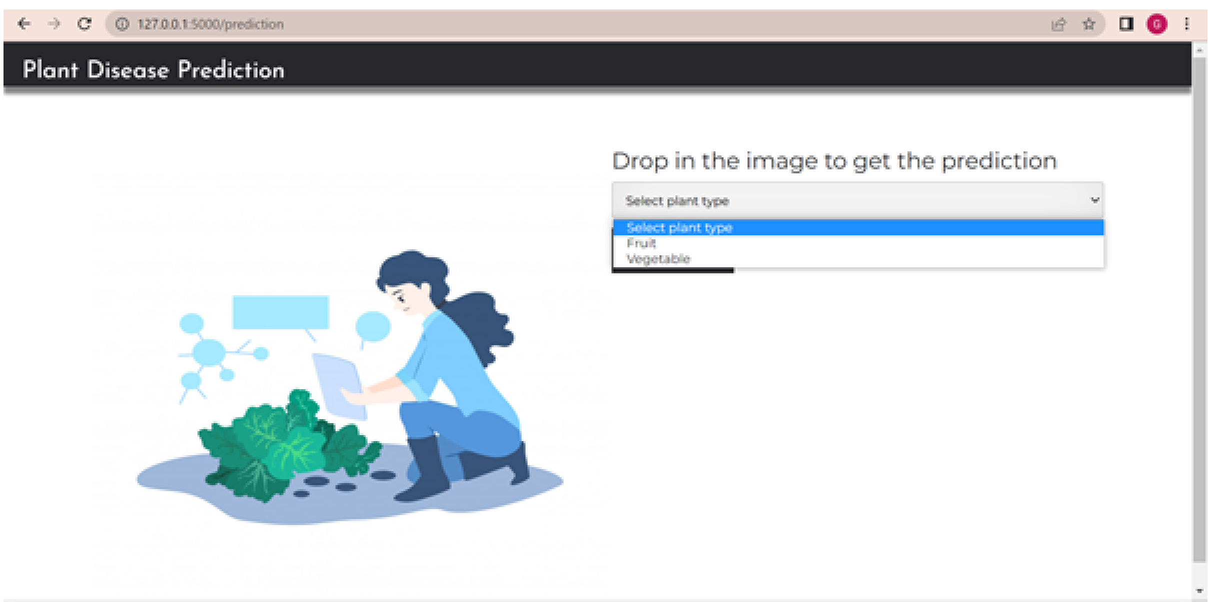


Fig 5. Predict page while selecting fruit or vegetable plant

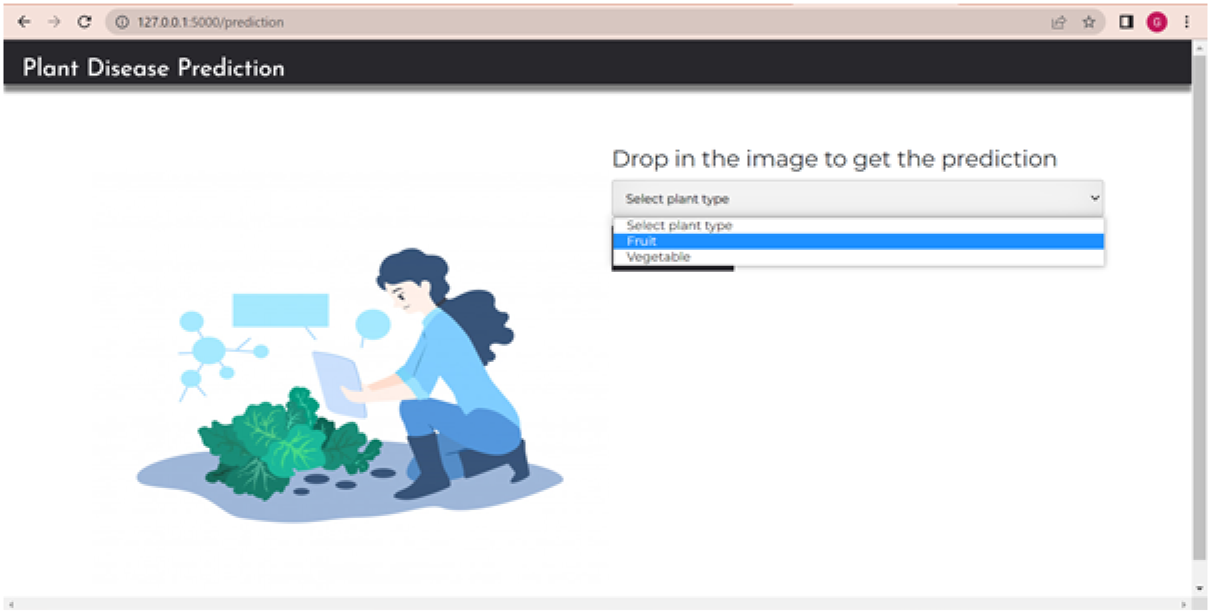


Fig 6. Predict page, selecting fruit plant

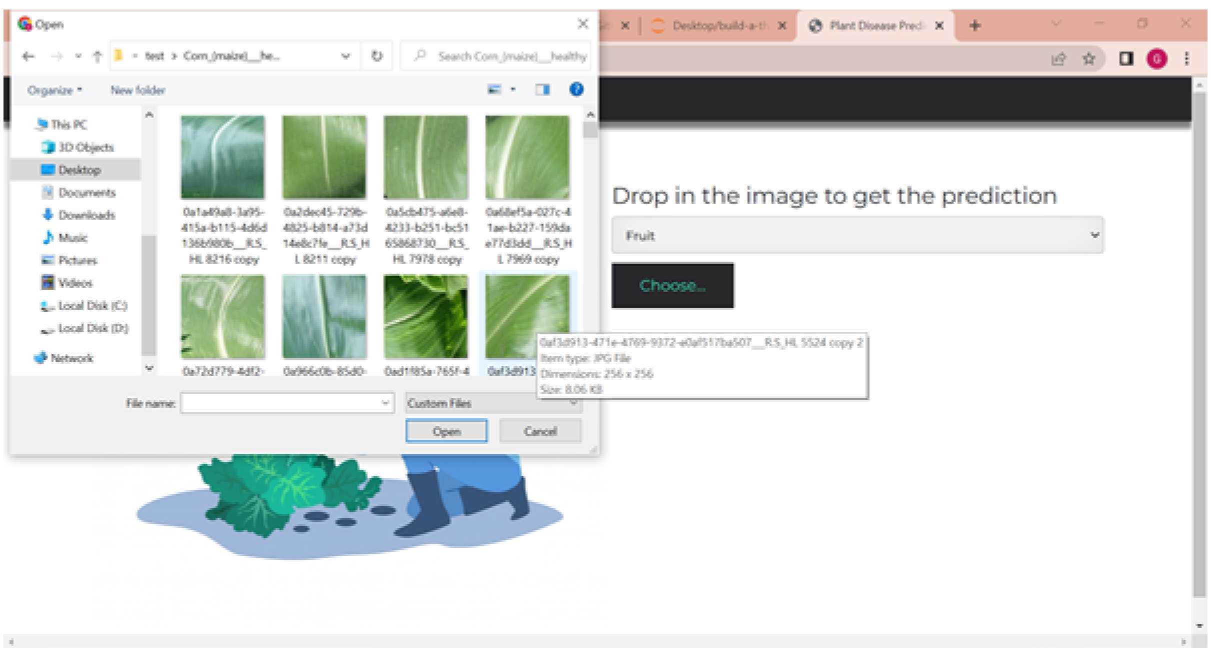


Fig 7. Predict page selecting the fruit plant, here selected corn healthy

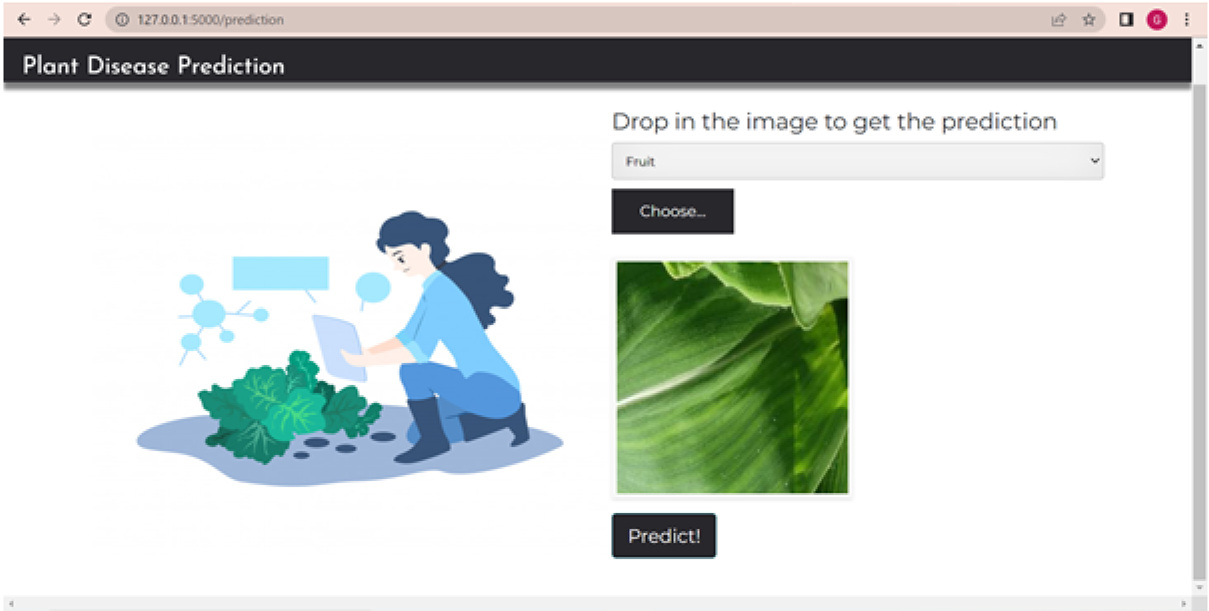


Fig 8. Displaying the selected image

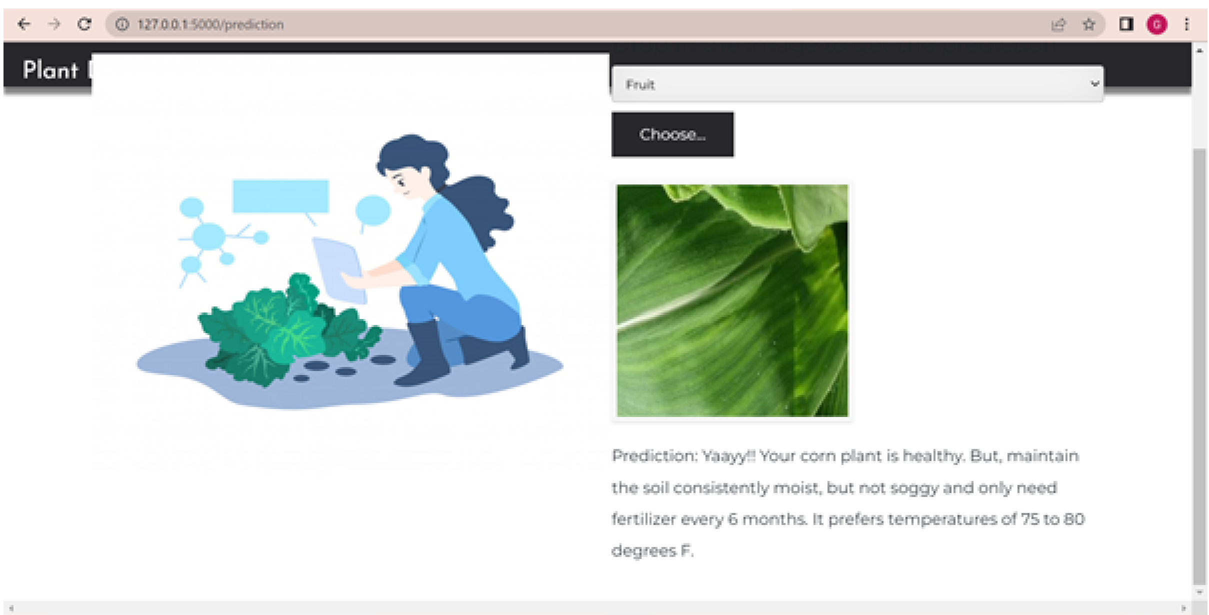


Fig 9. Correct prediction of healthy corn plant.

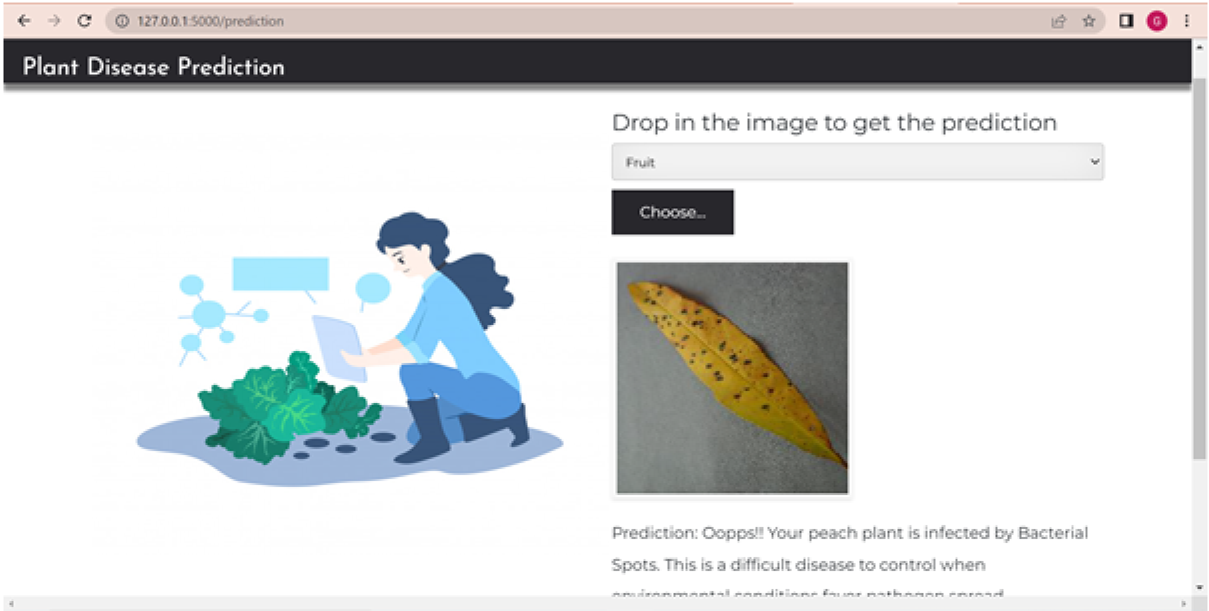


Fig 10. Correct prediction of peach plant with bacterial spots, and recommended fertilizer.

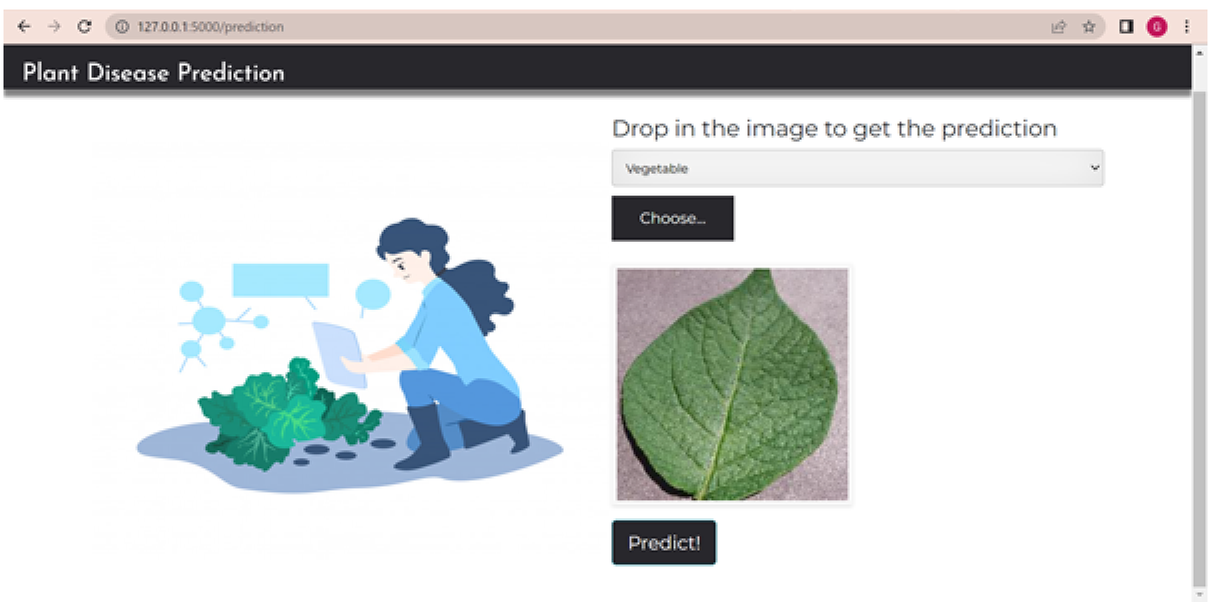


Fig 11. Choosing vegetable plant.

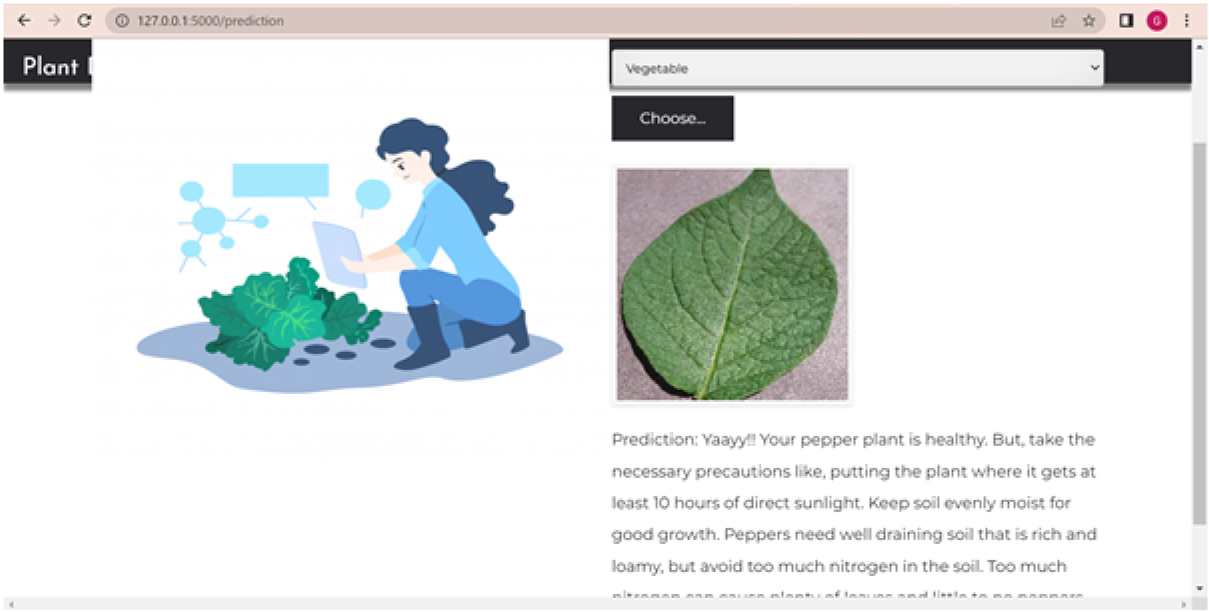


Fig 12. Correct prediction of healthy pepper plant

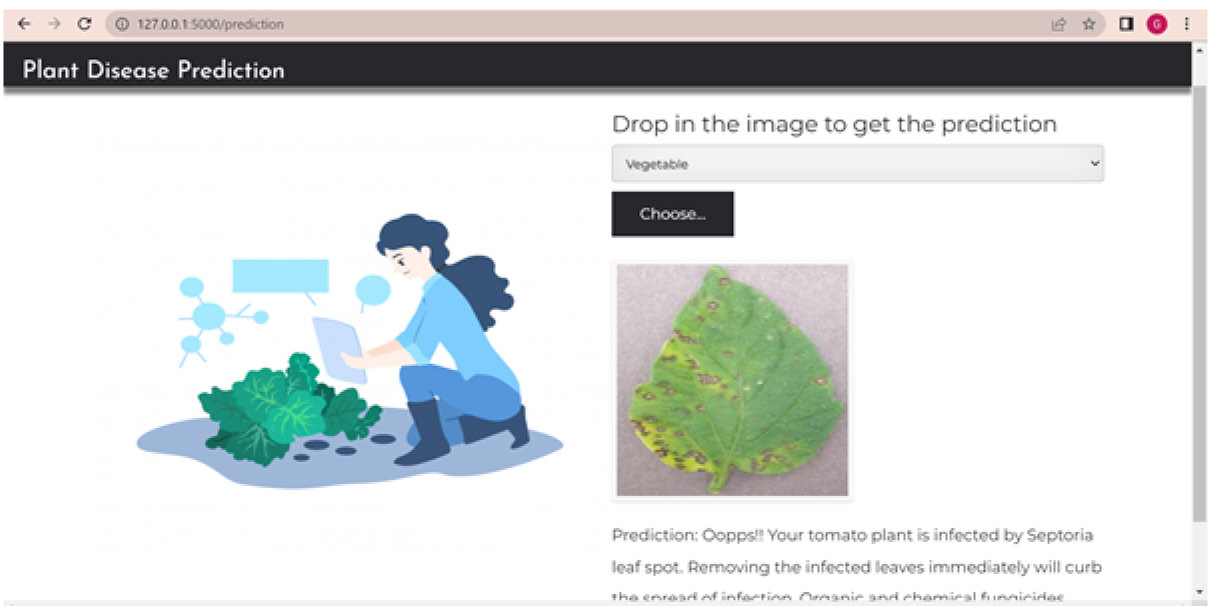


Fig 13. Correct prediction of infected tomato plant.

7. Advantages and disadvantages: The main advantage of such a system is, it guides the farmers with the correct fertilizer at the correct time in the proper amount, thus helping in getting proper yield for a crop.

8. Applications: The solution could be very useful for the farmers. Building a mobile

application for this project. And enabling the model to accept real time images can increase the usefulness of the project.

9. Conclusion: Many of the work been done in crop and fertilizer recommendation using various machine learning and deep learning approaches. Similarly, the project here also provides an accurate prediction of the plants being healthy or infected. Using the precautions draft the fertilizers are suggested for the infected plants.

10. Future scope: The mobile being one such device which is owned by even the poorest in India, the future scope for this project could be a mobile application. The project could be made real time by enabling the model to accept the real time images, and get the solution. Such an application will be very promising and useful for the farmers.