A PROJECT STAGE-II REPORT

ON

"PLANT DISEASES DETECTION AND PESTICIDE RECOMMENDATION USING MACHINE LEARNING "

Submitted to

SAVITRIBAI PHULE PUNE UNIVERSITY

In Partial Fulfilment of the Requirement for the Award of

BACHELOR'S DEGREE IN
COMPUTER ENGINEERING

BY

GAYATRI GAIKWAD	- 72034856M
MIHIR BHATTAD	- 72034879L
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UNDER THE GUIDANCE OF
DR.V.A.SURYAWANSHI

DEPARTMENT OF COMPUTER ENGINEERING
TRINITY ACADEMY OF ENGINEERING
Kondwa Annex, Pune - 411048

2022-2023

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AFFILIATED TO

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Department of Computer Engineering

CERTIFICATE

This is to certify that the project entitled

PLANT DISEASES DETECTION AND PESTICIDE RECOMMENDATION USING MACHINE LEARNING

submitted by

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is a record of bonafide work carried out by them, in the partial fulfilment of the requirement for the award of Degree of Bachelor of Engineering (Computer Engineering) at Trinity Academy of Engineering , Pune under the Savitribai Phule Pune University. This work is done during year 2022-2023, under our guidance.

Date: / /

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This project report has been examined by us as per the Savitribai Phule Pune University requirements at Trinity Academy of Engineering, Pune-48 on ————————.

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Gayatri Gaikwad
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Pritamsingh Solanki

ABSTRACT

One of the important and tedious tasks in agricultural practice is the detection of diseases in crops. The increasing prevalence of diseases has prompted the development of advanced computational techniques for accurate disease detection and personalized treatment recommendations.

A novel approach for disease detection and cure recommendation using Convolutional Neural Networks is a form of artificial neural network designed specifically to process input pixels and is used for image recognition. The proposed methodology focuses on medical image analysis, where CNN is trained on large-scale datasets of annotated medical images to learn complex patterns and discriminate between healthy and diseased leaf.

Upon successful disease detection, the system further recommends personalized cure options for patients based on their diagnosed condition, facilitated by an expert system that integrates the disease classification output from the CNN model with a comprehensive knowledge base of treatment protocols, medical literature, and clinical guidelines.

To evaluate the performance of the proposed system, we conducted extensive experiments on diverse medical imaging datasets and benchmarked the results against state-of-the-art methods. Our experiments demonstrate the superior performance of the proposed system in terms of disease detection accuracy and personalized cure recommendations.

Keywords: Leaf, Diseases, Image Pre-processing, GLCM, CNN

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1 INTRODUCTION

The three basic needs—food, shelter, and clothing which are crucial for human survival and are often referred to as the primary physiological needs where Food plays a vital role in human life and is of immense importance for several reasons. It is essential for human survival, physical health, energy, disease prevention, growth, mental well-being, and cultural significance. Emphasizing a balanced diet, nutrition education, and sustainable food practices contribute to a healthier, happier, and more sustainable future. India is the second one maximum populated.

Wherein Agriculture plays a crucial role in India's economy, supporting the livelihoods of 58 percent of the population and contributing 17-18 percent of the GDP. However, plant pests and diseases pose significant challenges, leading to biotic stress that hampers yield potential and diminishes the quality and quantity of food. Crop sicknesses can have extensive effects on yield manufacturing, main to reduced crop high-quality and quantity.

In developing nations, farmers face the want to closely display their plants to hit upon and perceive diseases. However, this assignment can be difficult because of restricted sources, technical information, and time constraints. Therefore, software-based identity of plant diseases is beneficial because it simplifies the detection process, reduces the attempt required from individuals, and saves time.

These are frequently designed to provide consumer-friendly interfaces and databases in order that farmers can quick access applicable information and discover potential illnesses affecting their plants. Overall, plant disease detection plays a critical role in effective disease management, crop protection, and ensuring sustainable agricultural practices.

This version is ordinarily useful for plant diseases because it simplifies the detection method, reduces the effort required from individuals and saves time. These are frequently designed to offer man or woman-friendly interfaces and databases that contain facts approximately numerous sicknesses, their signs and symptoms and viable manage strategies. Plant disease detection plays a vital function in powerful ailment manipulate, crop protection and ensuring sustainable agricultural practices.

In this paper, we've designed the CNN model which is supposed to helps farmers in detection of ailment in plants and its remedy. CNN models excel at analyzing visible facts, consisting of photos, and extracting significant features from them. The pics are used to train the version, and the output is decided by means of the input leaf. A inflamed leaf is taken and its photo is processed as input and from the patterns that appear on the leaves ,the ailment is detected.

CNN fashions offer a powerful device for automatic plant ailment detection. They leverage the competencies of system mastering to research and classify photographs, enabling early detection, correct diagnosis, and powerful sickness control in agricultural systems. We purpose to discover illnesses specifically Apple Scab Disease, Strawberry Leaf Scorch Disease and Corn Northern Blight Disease

Figure 1: Technology helping Good Cultivation

1.1 PROBLEM DEFINITION AND OBJECTIVES

1. **Problem definition:**
   Our venture pursuits to expand an efficient and dependable machine for crop sickness detection and remedy advice using Convolutional Neural Networks (CNNs) to reduce yield losses and contribute to the overall sustainability and productivity of agricultural structures.

2. **Objective:**
   - Develop CNN based version: The primary objective is to design and develop a sturdy and correct CNN version mainly tailored for crop ailment detection.
   - Achieve high detection accuracy: The objective is to achieve excessive accuracy in detecting crop diseases the use of the CNN model.
   - Provide customized treatment recommendations: Along with sickness detection, the system have to provide personalized therapy tips based at the recognized disease.

Figure 2: Protect plant, Protect life

1.2 PROJECT SCOPE AND LIMITATIONS

1. **Project Scope:**
   The undertaking scope makes a speciality of developing a robust and effective machine for crop disease detection and remedy advice the use of CNN technology. It covers the degrees of information collection, model improvement, photo preprocessing, training, assessment, ailment detection, therapy recommendation, user interface design, checking out, and documentation. The challenge aims to offer a sensible solution to address the demanding situations of crop ailment management and support farmers in making informed choices for disorder control and prevention.

2. **Limitation:**
   (a) Small variety of examples in dataset
   (b) Small quantity of plant illnesses
   (c) Low accuracy while checking out in real circumstance
   (d) Complex historical past
   (e) Multiple disease in the equal pattern
   (f) Location
   (g) Infection status
   (h) Train and test is done with identical database

Figure 3: Scope

2 LITERATURE SURVEY

In 2015, S. Khirade et Al. developed digital image processing and back propagation neural network (BPNN) to detect plant disease using leaves. BPNN was used to insert the infected part into a splint and extract features such as color, texture, morphology, and edge set..[1].

Pound and Michael P. presented a deep learning framework by which difficult plant phenotyping tasks, such as crop disease is diagnosis. It talks about using CNNs with other machine learning methods to classify and extract features. The study emphasises CNNs' potential for picking up on minute illness signs and boosting the precision of disease detection..[2]

Jitesh P Shah et Al conducted a review of 19 publications covering the work on rice illnesses and other distinct fruits and plants based on essential criteria such as size, number of classes (diseases), segmentation and pre-processing approaches, classifiers and their accuracy, and so on...[3]

Garima Shrestha et Al. used a convolutional neural network to decode the detect the plant disease, this is the first time that a computer has successfully identified 12 plant diseases with 88.80 accuracy and low F1 score of 0.12, which is very low because of higher number of false negative predictions...[4]

The studies of Sladojevic and Srdjan offers a top level view of deep gaining knowledge of procedures, which include CNNs, for plant disease detection and prognosis. It discusses the demanding situations in dataset collection, preprocessing, and model schooling. The have a look at emphasizes the importance of huge-scale datasets and transfer studying strategies for robust and correct disease recognition..[5]

3 SOFTWARE REQUIREMENTS SPECIFICATION

3.1 Assumptions and Dependencies

3.1.1 Assumptions

1. As we provide input image of plant, system need to discover the sickness on crop
2. It is assumed that every one the Users can access the device thru Internet.
3. The farmers and Users can receive facts through cellular.
4. The farmers experiment the files and upload the identical. The consumer also can upload the Audio/Videos/Presentations/Text.
5. Common features which includes Login, Logout, Forgot password, Change Password, User management features etc. So that it will be used throughout all software program packages as part of Mission Mode Project might be advanced commonly and uniformly.

3.1.2 Dependencies

1. Image Processing:
   Image processing is a method, which is used to identify affected area of leaf and to discover variations within the colour of the affected place.
2. Machine Learning:
   Machine learning algorithms are fast and correct to come across any leaf sicknesses. In order to growth the identification rate and the accuracy of the outcomes via the use of deep learning algorithm used to identify plant illness.
3. Deep Learning:
   Machine learning algorithms are fast and correct to come across any leaf sicknesses. In order to growth the identification rate and the accuracy of the outcomes via the use of deep learning algorithm used to identify plant illness.
4. Convolution Neural Network
   Convolutional Neural Networks (CNNs) are taken into consideration contemporary in image popularity and offer the capability to offer a spark off and definite analysis.

3.2 FUNCTIONAL REQUIREMENTS

3.2.1 Entry of Data

The consumer will be able to enter facts for each carrier component, which includes vegetation, farm device, schooling, and appropriate agricultural practises (GAPs), as well as for the aid repository that houses SREP, CDAP, SEWP, and agriculture contingency plans, among different matters.

3.2.2 Data Verification:

The consumer might be in a position to test the facts for every service factor, such as plants, farm device, training, and good agricultural practises (GAPs), as well as the Resource Repository's series of SREP, CDAP, SEWP, and agriculture contingency plans, so as to be shown to the person.

3.2.3 Transfer of Data:

The user will have the choice to add facts the usage of the machine. The user can be capable of put up agricultural contingency plans, farm equipment specs, and e-learning materials. Additionally, the consumer should put up the Audio, Video, and Presentation in conjunction with their respective Meta tags. The era will permit users to upload paperwork in order for farmers to get input subsidies.

3.2.4 Information based on SMS and Alerts:

The system will notify the user through SMS and signals of any vegetation which have sicknesses or different symptoms.

3.2.5 Algorithms and Techniques:

Convolution Neural Network (CNN) for photo detection, K-manner and NB Classifier Algorithms for mathematical purposes, Support Vector Machine (SVM) for type purposes, and plenty of different algorithms and techniques are used for crop sickness detection and management guidelines.

3.3 EXTERNAL INTERFACE REQUIREMENTS

3.3.1 USER INTERFACE

Identification of the User who will input the facts within the extraordinary function inside the system glide of the machine. The Users might be gaining access to the software utility the usage of diverse connectivity eventualities.

i. Front side: Web-software construct the use of Flask.

ii. Back side: Feature Selection Module and Data Clustering Module.

3.3.2 HARDWARE INTERFACE

Following are the Hardware used for the device

i. Image/Video Capturing Device : Camera/CCTV/IP Camera

ii. Host Device : Windows, 4GB RAM, 500GB HDD

iii. Streaming media server: Consists of rack mount high give up servers with Streaming Media Server, huge garage area and backup device.

iv. Video capturing card with breakout container.

3.3.3 SOFTWARE INTERFACE

Following are the software used for the systems

a. Operating System: We have chosen Windows OS for it's first-rate assist for the model and consumer friendliness.

b. Database: To store the student's records, we've chosen Sql + Database.

c. Python: To enforce the version we've got used python language for it's high interactive foundation.

d. Media converter: To convert the video files inside the photograph format media converter is used to convert into the pictures.

e. Encoder Software: To convert the textual content into device understandable shape and vice-versa the encoder software is used.

3.4 NON-FUNCTIONAL REQUIREMENTS

A Non-functional requirement (NFR) is a demand that specifies criteria that may be used to judge the operation of a system, instead of particular behaviours. The numerous Non-functional necessities are indexed under

3.4.1 Performance Requirement:

1. The overall performance of the capabilities and each module ought to be good.
2. Alltogether the performance of the software program will permit the customers to work correctly.
3. Performance of response need to be fast.
4. Performance of the presenting virtual environment must be fast.

3.4.2 Scalability Requirements

1. Scalability refers to the how the proposed machine may be scaled up with want and time.
2. In the contemporary situation, there might be average one hundred,000 software Users of the gadget at vital, nation and village stage.
3. Ninety percent of the responses ought to be within 10 second.
4. The SMS indicators to reach the Users cellular or hand-held tool in an appropriate time restrict from the SMS gateway/programs. Ideally it is inside a hundred and twenty Seconds from records cause, from principal server to national jurisdiction.
5. For audio and video streaming and information importing, the reaction time need to be framed inside admissible limit of presidency infrastructure.

3.4.3 Security Requirements

1. To prevent foremost crop losses, the deep studying method can be used to locate the leaf sicknesses from captured photos.
2. Unauthorized introduction/change of facts - through User call and password authentication as defined for applicable User businesses.

3. . The software have to adhere to protection pointers, standards and guidelines prescribed by NIC's Security Division and should be audited certified for compliance to these standards by Security Division before it is hosted in Production Environment.

4. The software program ought to be covered against any unauthorized get admission to to the software program.

5. System Administrator have to moderate for the audio and video Contents the ones are uploaded into the device to test any objectionable facts isn't always uploaded.

3.4.4 Software Quality Attributes

1. Usability:
   The displays have to be made smooth to use for non-technical Users who are strange with computer systems. The GUI should be mission-based and simple, and not using a useless layout.

2. Reliability:
   It is expected that there may not be any harmful software anymore, and the machine will go through prevent-case checking out as a way to offer customers with a outstanding and dependable package deal. The gadget should always characteristic

3. Accessibility:
   The device is out there to everyone with a top-notch internet connection and a Python surroundings established.

4. Maintainability:
   Each report shall be arranged in accordance with the requirements for documentation as mentioned. The database must be regularly sponsored up via the tool administrator.

5. Portability:
   The information uploaded and downloaded into and from the utility can be viewed, taken into consideration, or opened via pass platform, running gadget, and devices. The Content might be handy through diverse systems and across many structures.

3.5 SYSTEM REQUIREMENTS

3.5.1 Database Requirements

1. General Data:
   i. Database of States, Districts, Villages
   ii. Database of Agro Climatic Zone (ACZs)
   iii. Topology Details, Geographical Area
   iv. Rainfall Details, Weather, Temperature and relative humidity
   v. Demographic data
2. Crops
   i: Database of State-wise and Agro-climatic Zone (NARP) wise Crops and their varieties
   ii: Database on crop wise disease
   iii: Database of IPM Practices on Pest and Diseases
   iv: Database of Demonstration details, Locations and Participants list

3.5.2 Software Requirements

1. IDE: Spyder
2. Coding Language: Python
3. Operating System: Windows 10

3.5.3 Hardware Requirements

1. RAM: 8 GB
2. Hard Disk: 40 GB
3. Processor: Intel i5 Processor

3.6 ANALYSIS MODEL

Waterfall lifestyles-cycle may be implemented in this gadget. Initially, we had achieved research approximately conventional coaching-getting to know approach. As conventional strategies calls for a great deal efforts to analyse and manually estimate the techniques.

1. Requirements : Initially, we are able to take the pictures the use of Video Capturing Device and procedure them and extract insights of body capabilities of learners from the pics.

2. Design : In this phase, we've got designed our gadget such that, first pics as input would be taken after which system it the usage of some facial algorithms and we will generate the output the use of system studying set of rules.

3. Implementation : The machine is divided into two subsystem. In the primary device, IP Camera might be connect with the Host Device and the principle program will run at the again-stop and extract the features and shop the statistics. On different hand, the machine learning algorithm will examine the records and generate the feedback for teachers.

4. Training and Testing Dataset : The model can be skilled by offering positive functions like facial feelings, frame posture and gaze course as enter. Then the output of that version could be used as dataset for in addition testing of our device. We will educate our version the use of the manually generated dataset.

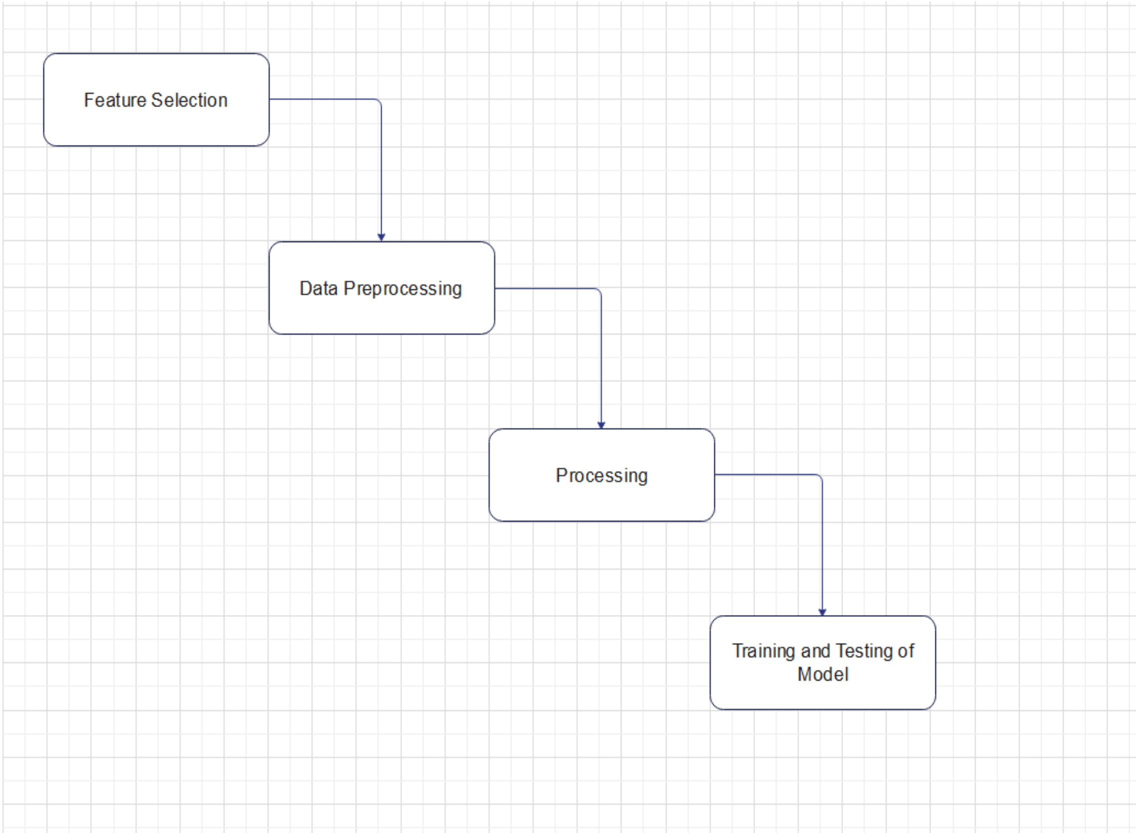

Figure 4: Waterfall model

4 SYSTEM DESIGN

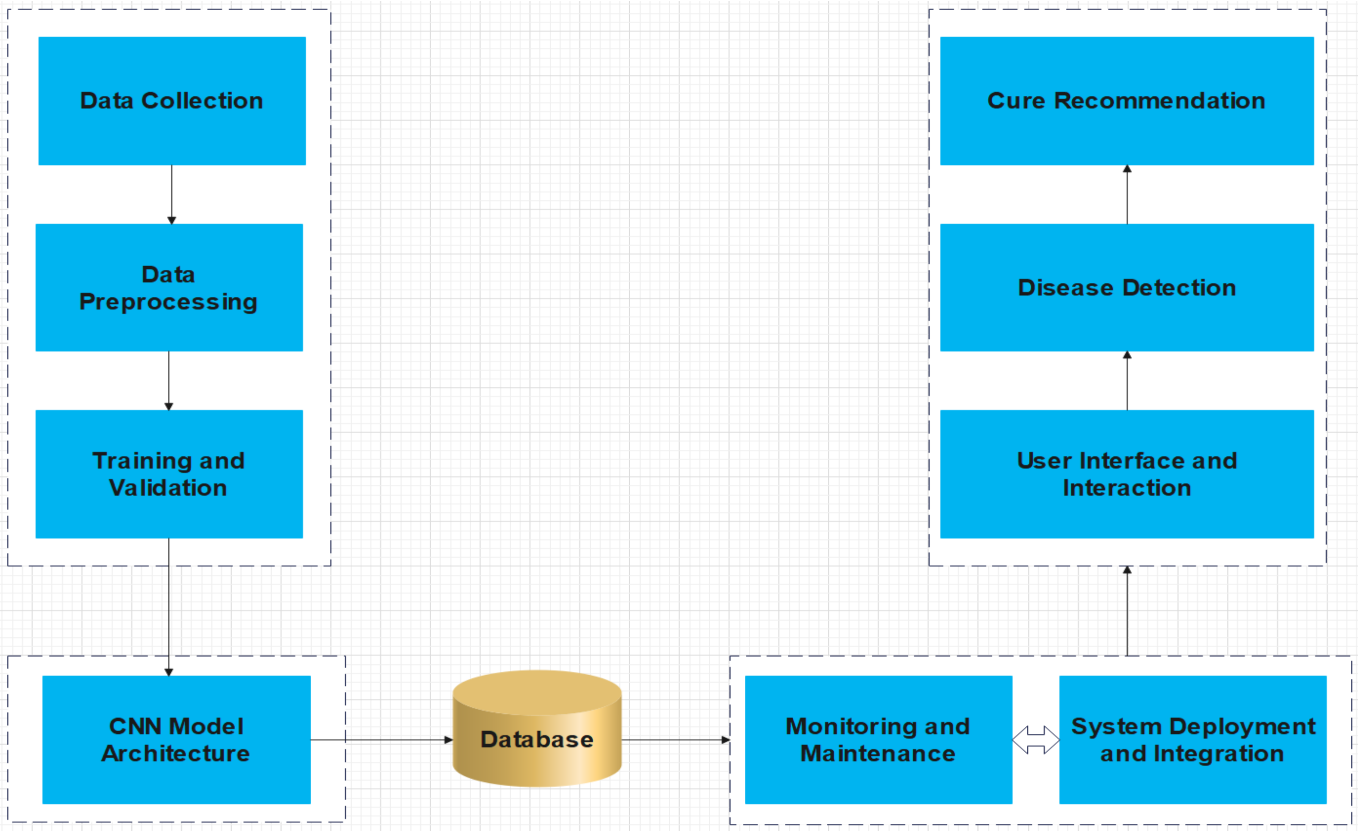

Figure 5: Crop Disease Detection System

4.1 SYSTEM ARCHITECTURE

The system architecture for Crop Disease Detection and Cure Recommendation using Convolutional Neural Networks (CNNs) typically involves several key components and stages. The architecture should aim to provide an efficient, accurate, and user-friendly solution for crop disease detection and cure recommendation using CNNs.Here is a high-level overview of the system architecture:

1. **Data Collection and Preprocessing:**
   Gather a dataset of snap shots that consists of each wholesome flora and plants suffering from diverse sicknesses. Preprocess the accumulated photos to enhance their exceptional and facilitate powerful education.

Figure 6: Different types of defected crops

2. **CNN Model Architecture:**
   Design the In the domain of plant disease diagnosis, CNN models are meant to automatically learn and extract useful information from photos. They can categorise plants into different disease groups and apply transfer learning to recognise disease-specific patterns. They are appropriate for real-time or high-throughput plant disease detection systems and can rapidly analyse several photos at the same time. They have shown great accuracy in plant disease diagnosis when compared to standard approaches, lowering the likelihood of miss-classification and false-positive or false-negative findings. Regular three-layer neural networks.

3. **Training and Validation:**
   During training, the model learns to extract relevant features from the pictures and optimize its parameters to reduce the type mistakes. Evaluate the skilled model the usage of the testing set to assess its performance in crop disease detection. Metrics together with accuracy, precision, keep in mind, and F1-rating can be used to assess the version's category overall performance.

4. **Disease Detection:**
   Use the trained CNN version to discover ailments within the enter images. To generate predictions for the presence and categorization of illnesses, procedure the enter photograph through the model. To confirm the chance and severity of the recognized contamination, use thresholding or probabilistic tactics.

5. **Treatment Suggestion:**
   Give the person personalized treatment hints based on the disorder that turned into found. Take into account elements like the particular crop, the disorder kind, the neighborhood weather, and the resources which are accessible. Encourage the usage of effective treatment plans, management techniques, and preventative movements to reduce the outcomes of the illness.

6. **User Interface and Interaction:**
   Create an intuitive person interface so that people can have interaction with the system. Users must be able to add or take pictures of their crops to check for infection. Display the detection findings and suggested treatment alternatives in an comprehensible way.

7. **System Deployment and Integration:**
   Include the created system in a stand-alone programme or an internet or cellular application. Make that the gadget is strong, scalable, and capable of coping with many simultaneous queries from several users. Test the gadget's capability, responsiveness, and accuracy below diverse conditions. 8. Maintenance and Monitoring:

8. **Monitoring and Maintenance:**
   Implement tools for amassing user input and tracking device performance. Continue adding fresh facts to the CNN model and incorporating enhancements in infection detection strategies. Maintain the machine by way of solving any flaws, enhancing its functionality, and extending it to satisfy consumer demands.

4.2 MATHEMATICAL MODEL

The mathematical version for crop disease detection and remedy advice using Convolutional Neural Networks (CNNs) includes several components and equations. Here's an outline of the important thing mathematical standards involved.

1. **Convolution layer:**
   CNNs employ convolution to recognise local patterns or features in images, such as edges, textures, or other visual structures.

   Convolution operation: The convolutional layer applies a set of filters to the input image.

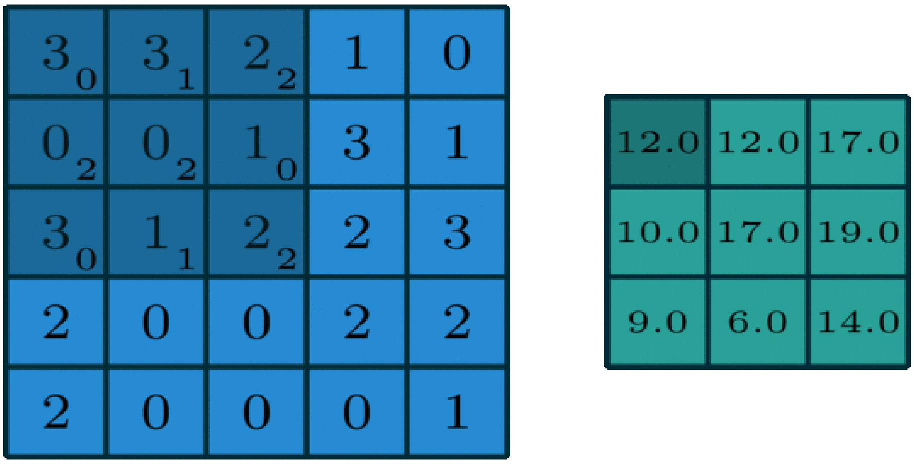

Figure 7: Convolution Layer

The mathematical operation for convolution can be represented as:

$$x_{ij}^{\ell} = \sum_{a=0}^{m-1} \sum_{b=0}^{m-1} \omega_{ab} \, y_{(i+a)(j+b)}^{\ell-1}.$$

Figure 8: Convolution Operation

where x represents the input image, w represents the filter/kernel, and b represents the bias term.

2. **Activation Function:**

It introduces non-linearity by producing the maximum of zero and the input value. It aids the network in learning complicated linkages and detecting non-linear patterns in data.Common activation functions include ReLU(Rectified Linear Unit) which removes the negative value and replaces it with zero.

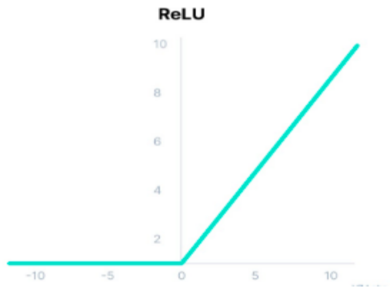

Figure 9: Relu Activation Function

The mathematical equations for these activation functions are:

$$\mathit{ReLU}$$

$$f(x) = max\,(0, x)$$

Figure 10: Relu Formula

3. **Pooling Layer:**

Max Pooling Layer: When max-pooling is applied to a model, maximal pools minimise picture dimensions by lowering the amount of pixels in the preceding convolution layer's output.

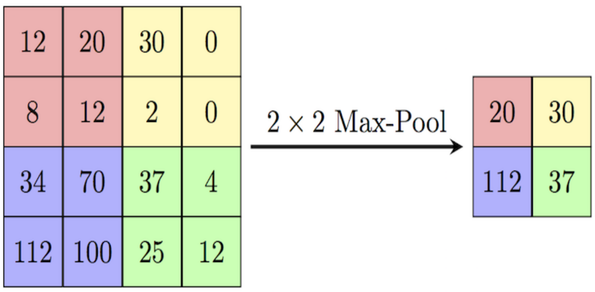

Figure 11: Max Pooling

4.3 DATA FLOW DIAGRAM

The User Interface component gets input picture statistics, preprocesses it, then passes it to the CNN Model method, which in flip passes it to the Cure Recommendation process. This is illustrated graphically through a DFD. Those are Data glide diagram has four layers.

1. **Level 1:**

   As shown in figure 8 at level 1, the person recognizes the plant leaves disease and able to classify it.

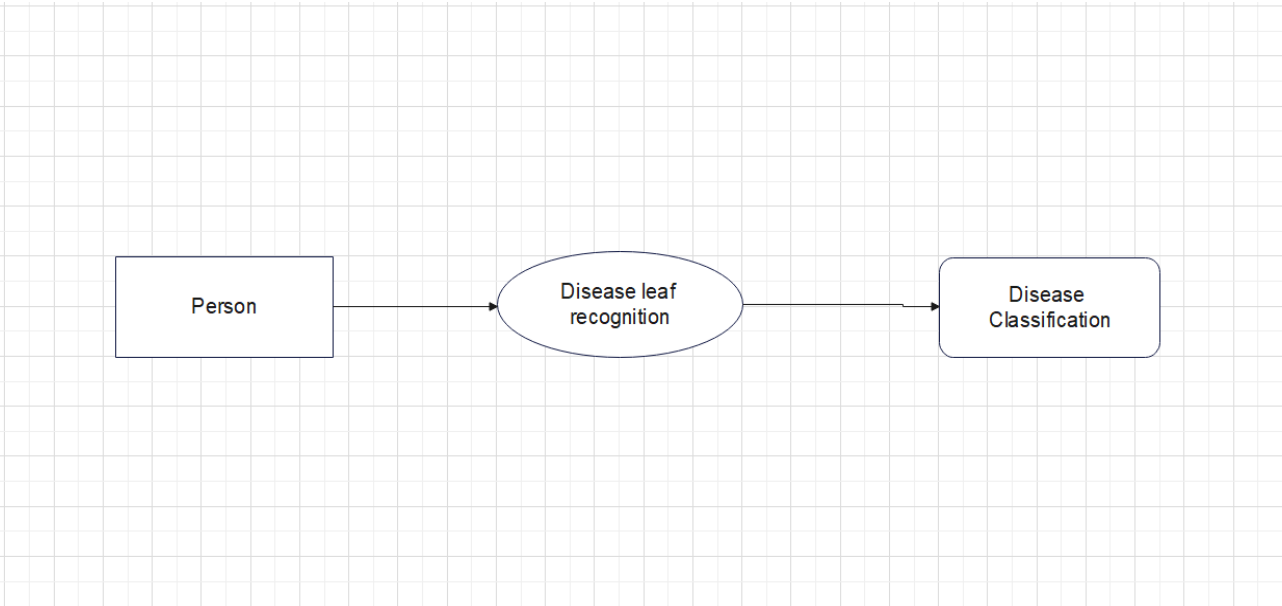

Figure 12: DFD Level1

2. **Level 2:**
   As shown in figure 9 at level 2, a test image is given and it is tested with using the trained dataset. The features are extracted and gets compared. Then we can able to predict the leaf disease.

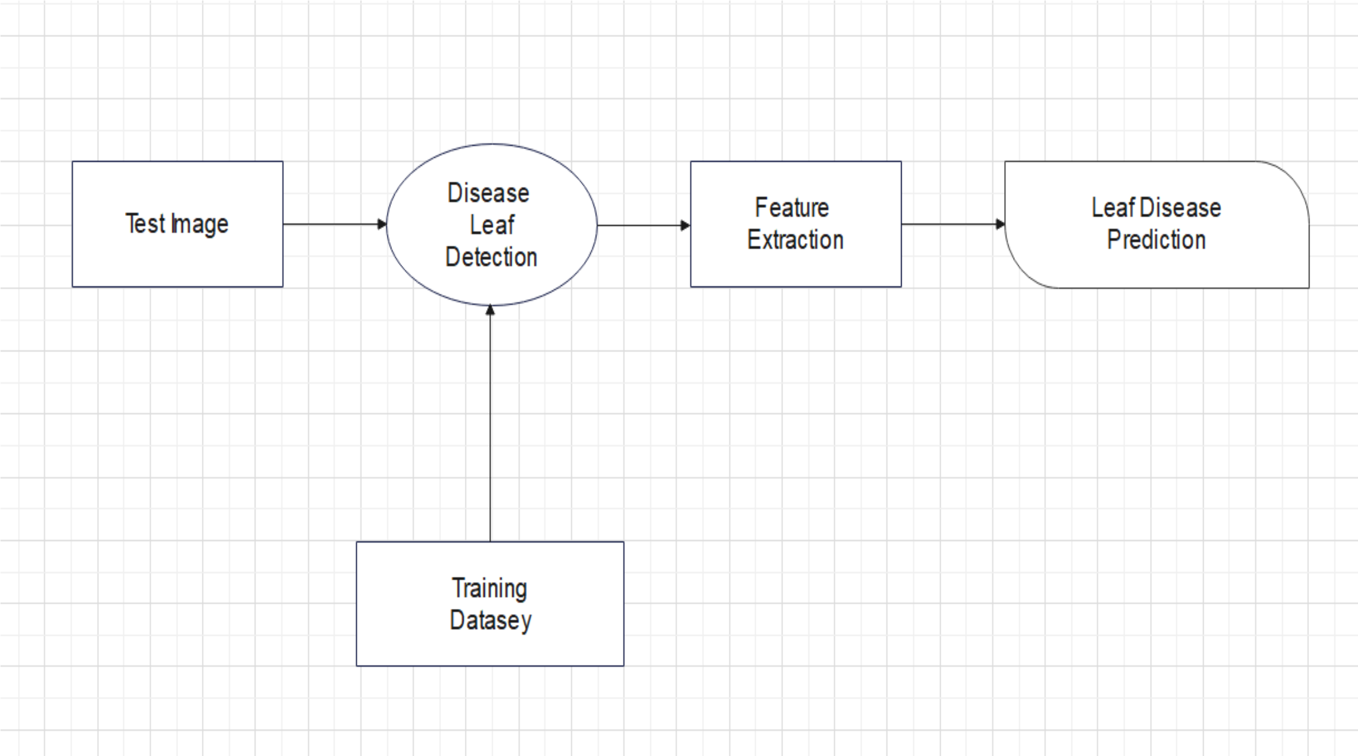

Figure 13: DFD Level2

3. **Level 3:**
   As shown in figure 10, at level3, testing and training dataset are used in CNN model to predict the leaf disease

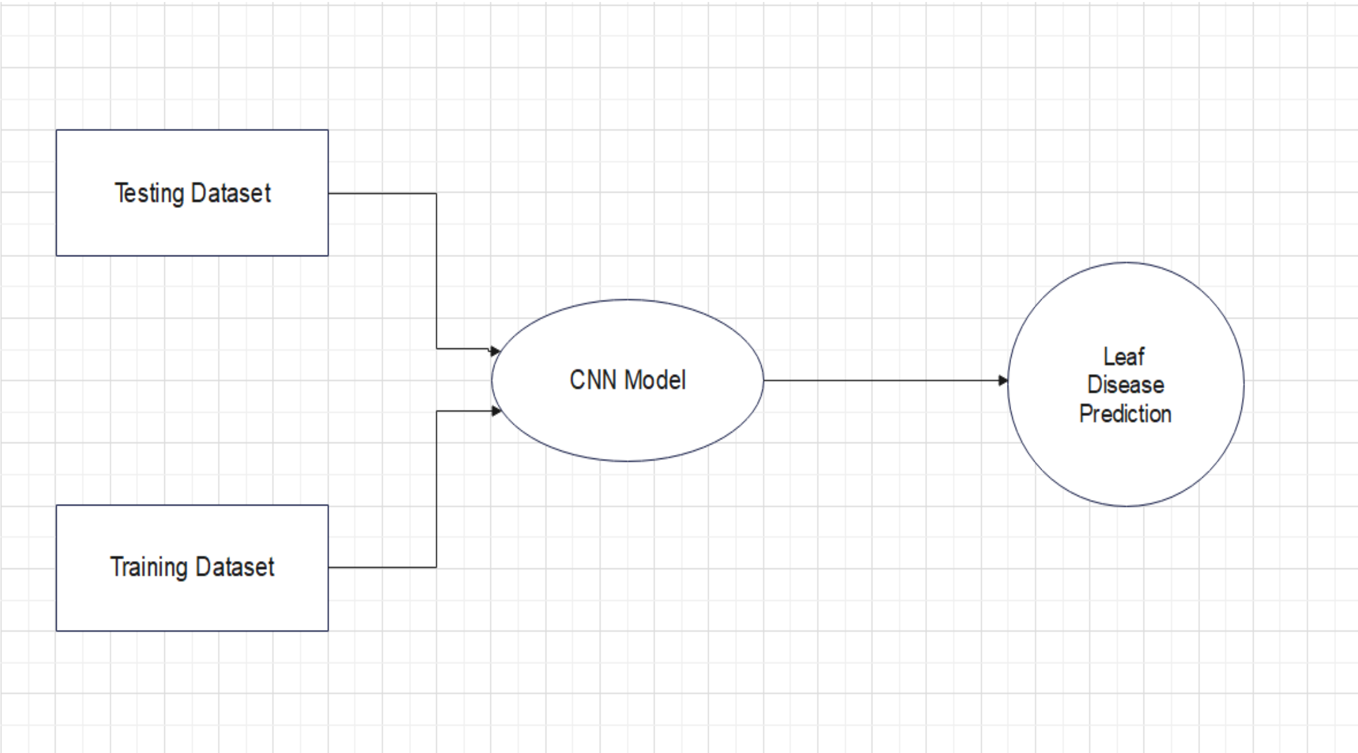

Figure 14: DFD Level3

4. **Level 4:**
   As shown in figure 11, at level 4 The last level comprises of both CNN and dense CNN model. It is used to gain more accuracy

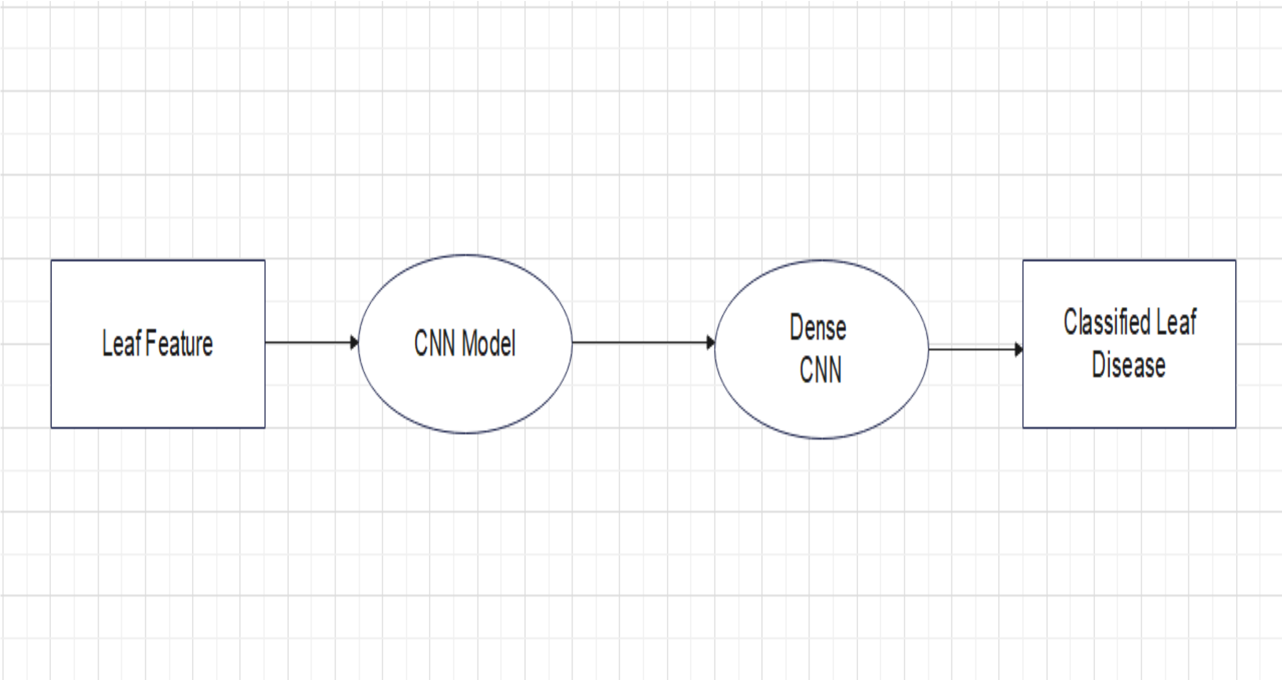

Figure 15: DFD Level 4

4.4 ENTITY RELATIONSHIP DIAGRAM

A pictorial depiction of the entities, traits, and connections among entities in a system is known as an entity-courting (ER) diagram.
User, Image, Disease, and Recommendation are the 4 entities in this ER diagram.

1. User: Represents the users of the Crop Disease Detection and Cure Recommendation device who engage with it.
2. Image: Displays crop snap shots provided by means of customers as enter for infection identity.
3. Disease: This category represents the diverse illnesses that might affect crops.
4. Recommendation: Displays the suggestions the gadget makes for managing ailments in mild of those which have been recognized.

The following are the relationships between those entities:

1. User-Image: Represents the connection that exists among a consumer and the pics that they add or deliver as input for infection analysis. A user may be related with several pictures.
2. Image-Disease: Denotes the relationship between a picture and the disease(s) found in that picture. A illness may be connected to several photographs, and an photo can be connected to a couple of diseases.
3. Disease-Recommendation: Represents the connection among a disease and the advice(s) produced to cope with it. A circumstance can be related with many recommendations, and a recommendation may be related with numerous diseases.

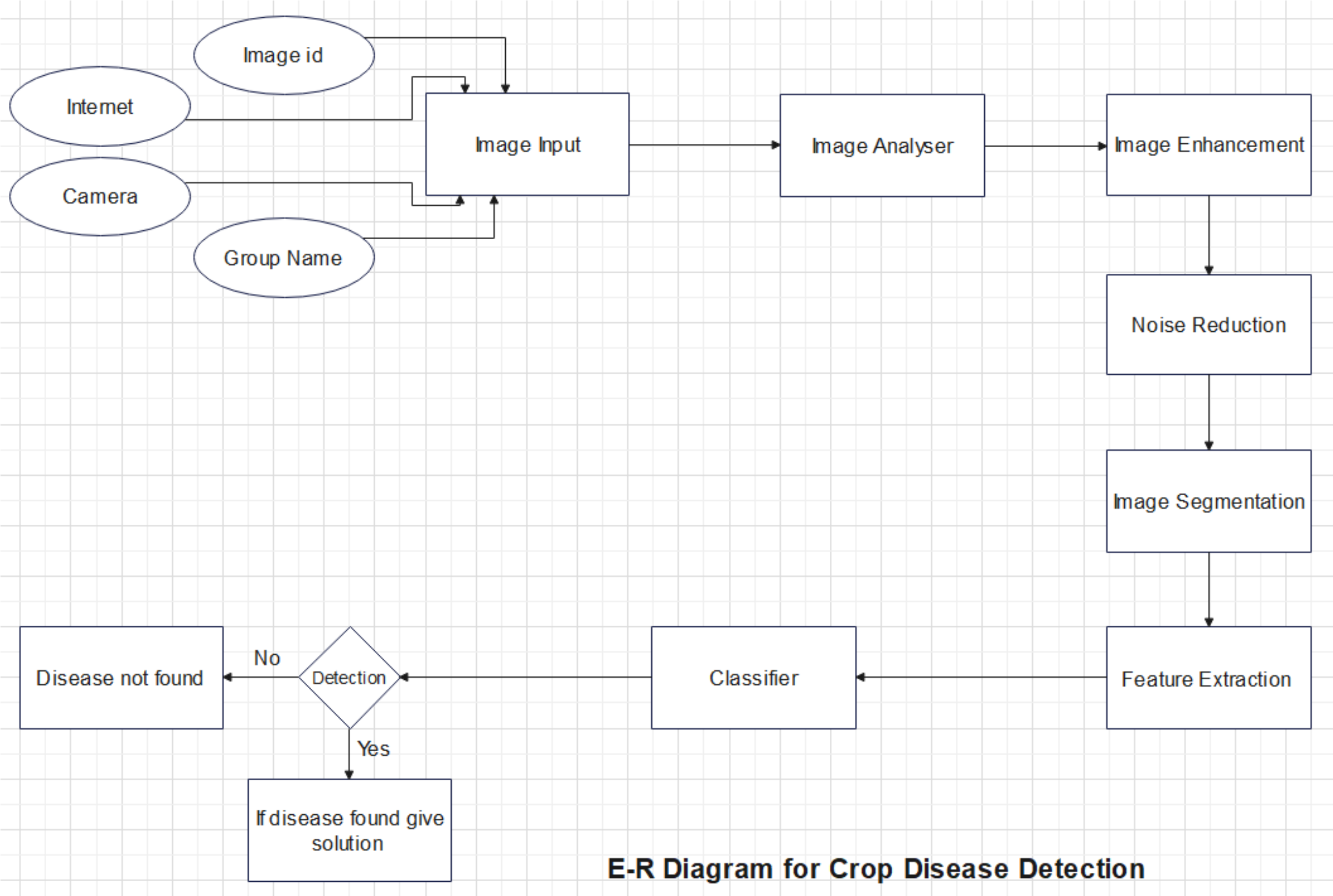

Figure 16: ER Diagram

4.5 UML Diagram

1. **USE CASE DIAGRAM:**
   In this Use Case Diagram, the main actors are the User and the Crop Image. The User interacts with the User Interface to provide the Crop Image for disease detection and cure recommendation.

   Figure 13 shows you the USE CASE DIAGRAM

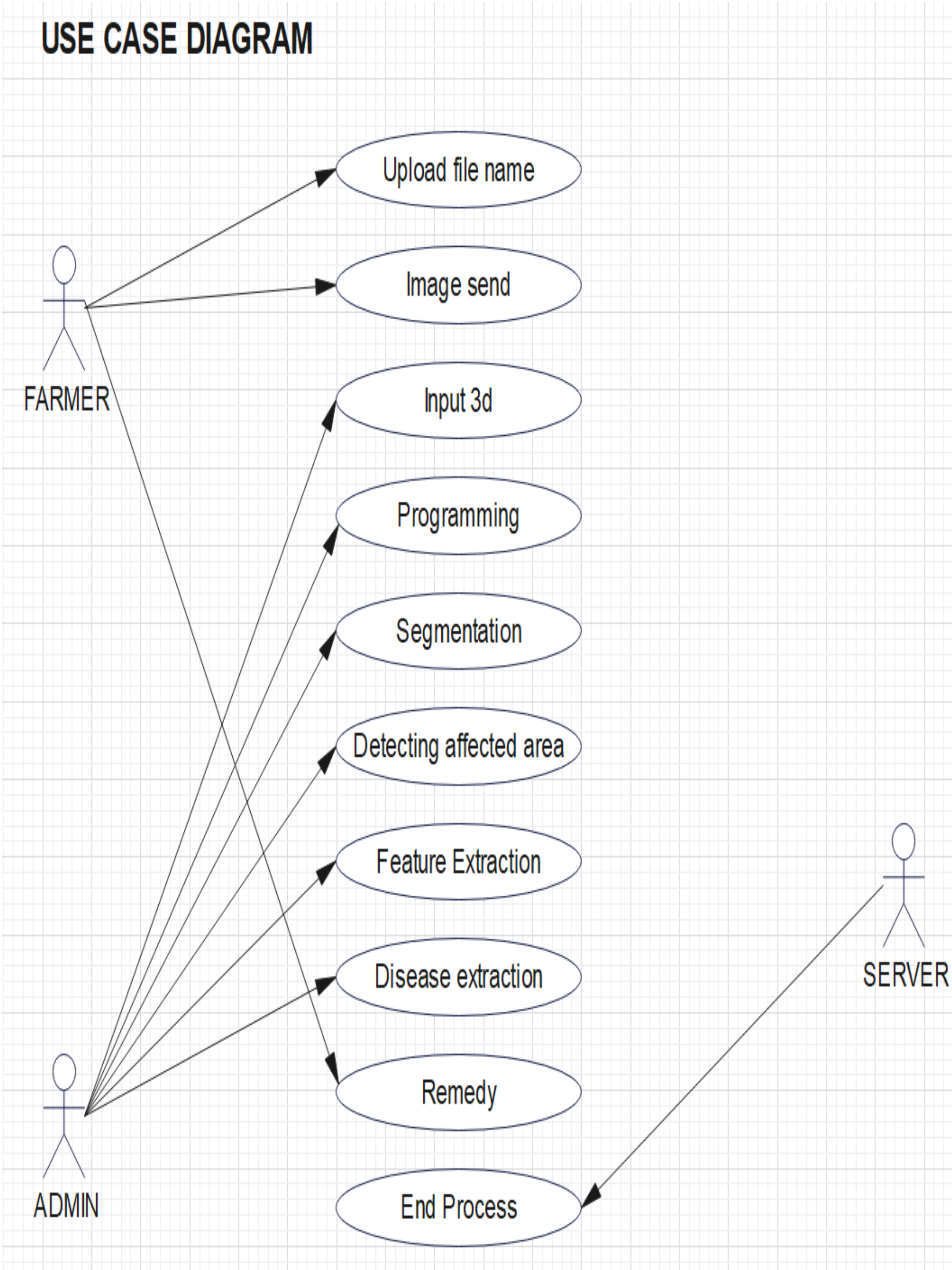

Figure 17: Use Case Diagram

- The Use Case ”Crop Image” represents the user action of providing the image of the crop to the system.

- The Use Case ”Preprocessing” represents the preprocessing of the input image to enhance its quality and suitability for analysis.

- The Use Case ”CNN Model” represents the process of applying the Convolutional Neural Network model to the preprocessed image for disease detection.

- The Use Case ”Disease Detection” represents the process of detecting diseases in the crop image using the CNN model.

- The Use Case ”Cure Recommendation” represents the process of generating recommendations for disease management based on the detected diseases.

- The Use Case ”Output” represents the presentation of the detection results and cure recommendations to the user.

2. **SEQUENCE DIAGRAM:**

In this Sequence Diagram, the User interacts with the User Interface to provide the Crop Image. The steps involved in the system's processing are as follows:

- The User provides the Crop Image to the User Interface.
- The User Interface processes the image and prepares it for further analysis.
- The System preprocesses the image, applying techniques such as resizing, normalization, and noise removal.
- The System applies the Convolutional Neural Network (CNN) Model to the preprocessed image for disease detection.
- The System detects diseases in the image using the CNN Model and generates the detection results.
- The System generates cure recommendations based on the detected diseases.
- The System presents the detection results and cure recommendations to the User through the User Interface.

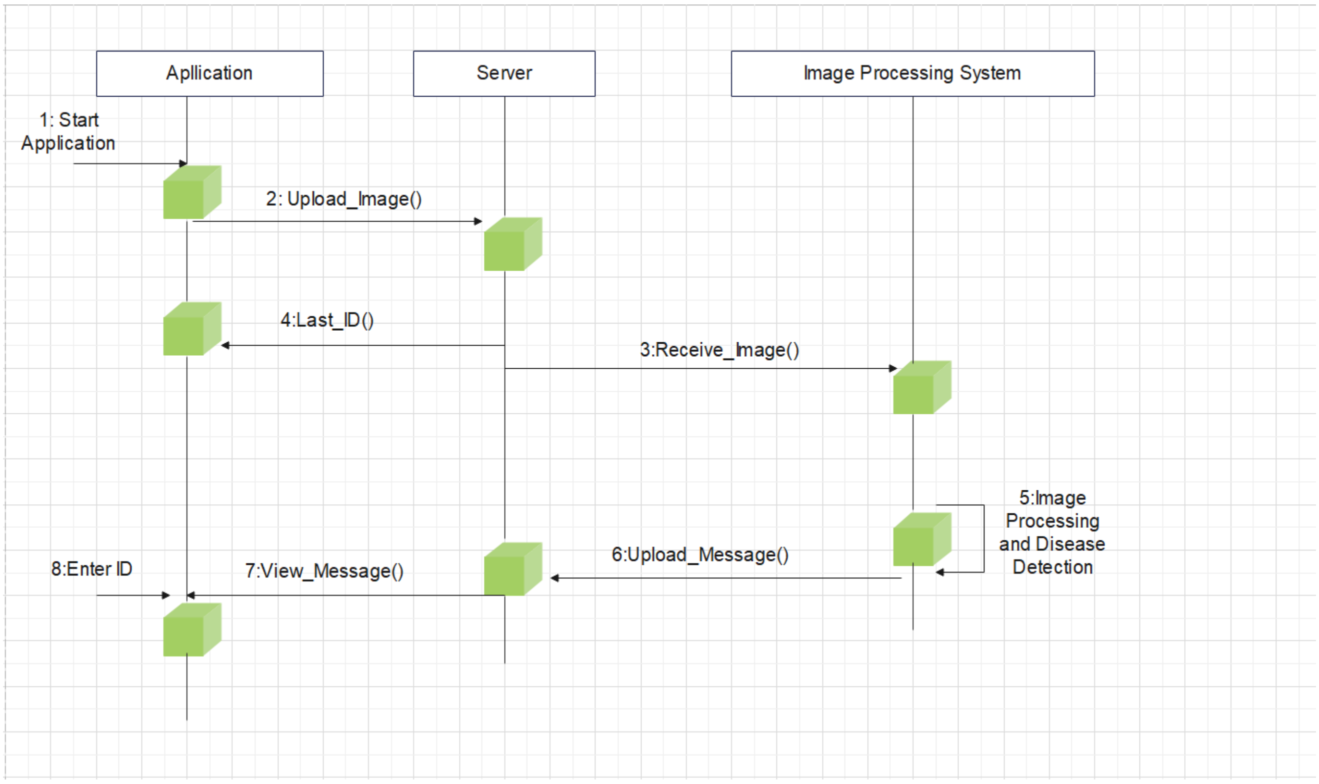

Figure 18: Sequence Diagram for Crop Disease Detection and Classification

5 PROJECT PLANNING

5.1 RISK MANAGEMENT

5.1.1 Risk Identification

i. Data Quality and Availability

ii. Model Accuracy

iii. Generalization

iv. Computational Resources

v. User Acceptance and Adoption

vi. Integration with Existing Systems

vii. Regulatory and Ethical Considerations

5.1.2 Prevention Of Risk

i. Data Quality Assurance

ii. Model Validation and Evaluation

iii. Continuous Model Improvement

iv. Adequate Computational Resources

v. User Training and Support

vi. System Integration and Compatibility

vii. Regulatory Compliance and Ethical Considerations

viii. Regular System Maintenance and Updates

5.1.3 Analysis Of Risk

i. Impact : High, Medium, Low

ii. Likelihood : High, Medium, Low

iii. Mitigation : High, Medium, Low

5.2 PROJECT SCHEDULE

TIMELINE	TASK	DESCRIPTION
JULY 2022	Research for the Topic	Initially, we survey different domain and, in each domain, we surveyed different topic and research paper.
AUGUST 2022	Presentation for the Topic Selection	Later, we gave presentation on 3 topics with slide, where we explain the aim, objectives, a small brief of method to the project community.
SEPTEMBER 2022	Topic Selection	Topic selected i.e., CROP DISEASE DETECTION AND CURE RECOMMENDATION USING AI
OCTOBER 2022	Requirement Analysis	Further, we studied different aspects that are required for our project. We survey many researched papers based on which we selected our hardware and software required for our system
OCTOBER 2022	REVIEW-1	As we have completed the literature survey and initial phase of the project, we started preparing for review 1 presentation.
NOVEMBER 2022	Poster Presentation	Preparation of our project poster
NOVEMBER 2022	Designing	In this task, we started designing abstract view of our system. We studied about the hardware and their expenses. Designed the flow diagram of our model. As we completed the initial part of designing, we presented the designing phase of our project.
NOVEMBER 2022	Project Stage-I Completion	We completed with the project synopsis, progress book 10%of implementation part .
DECEMBER 2022	Completion of Model	We created a final module which will be 1000% ready to implement and test the dataset.
JANUARY 2023	Preparation for Implementation	After designing the whole system architecture, we moved towards preparing implementation plans and selecting the algorithms required for our system.
JANUARY 2023	Final Poster Presentation	Preparation of our project poster

February 2023	Evaluation	Evaluation of the model.
March 2023	Poster Presentation - 2	2nd Poster presented by the group members
April 2023	Working on 2nd research paper	Started with the 2nd research Paper and completed as well.
May 2023	Black Book	Started with the black book work
June 2023	Project Stage 2	Project stage 2 report preparation and completion

Figure 19: Task Table

5.3 TEAM ORGANIZATION

Guide : Dr.V.A. Suryawanshi
Team Leader:Gayatri Gaikwad
Other Members: Mihir Bhattad, Sanyukta Holkar, Pritamsingh Solanki

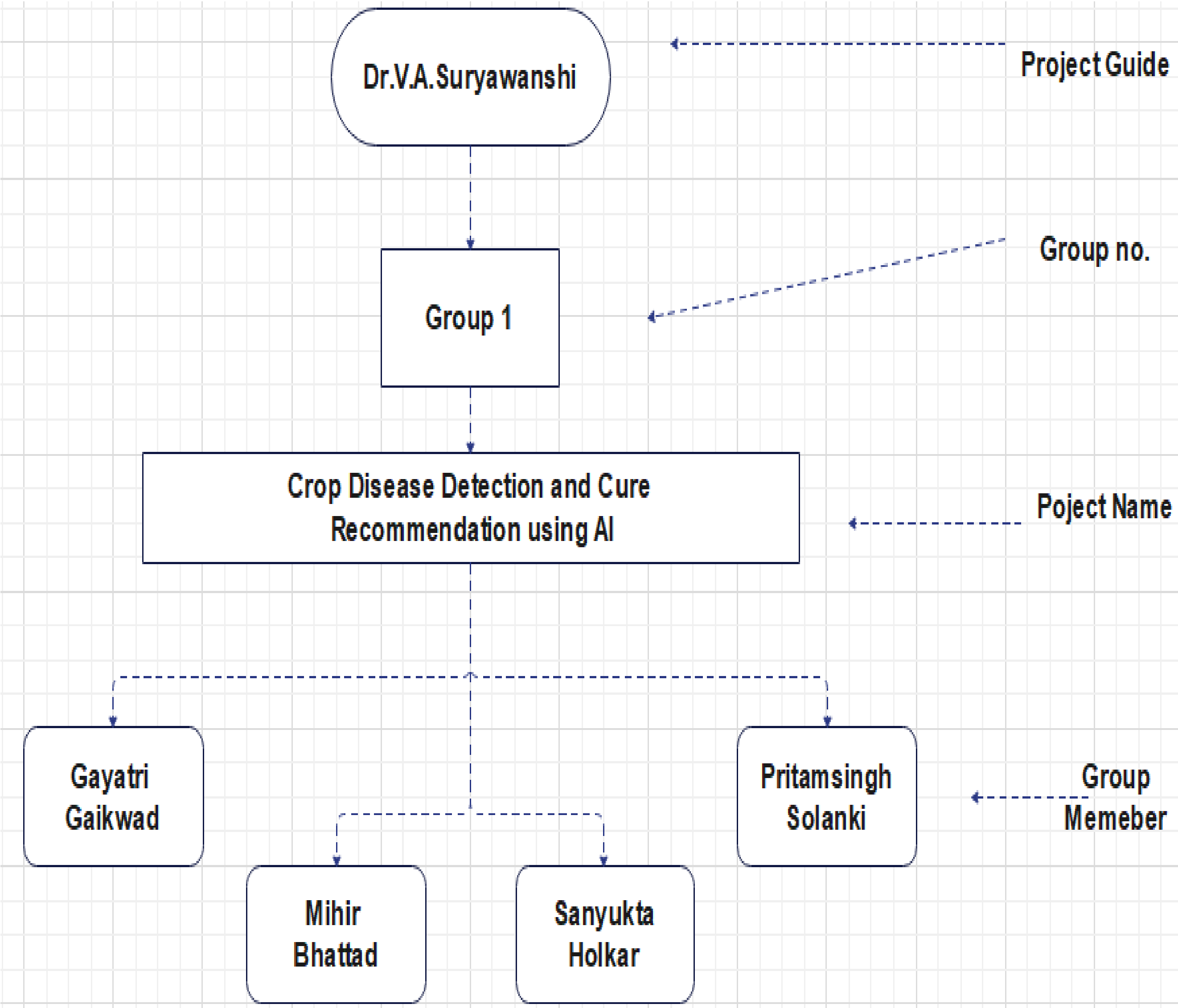

Figure 20: Team Organization

6 PROJECT IMPLEMENTATION

6.1 OVERVIEW OF PROJECT MODULES

The basic architecture of the crop disease detection and remedy suggestion is shown below:

1. The input test image is acquired and pre-processed in the next stage and then it is converted into array form for comparison.
2. The selected database is properly segregated and pre-processed and then renamed into proper folders.
3. The model is properly trained using CNN and then classification takes place.
4. The comparison of the test image and the trained model take place followed by the display of the result.
5. If there is a defect or disease in the plant the software displays the disease along with the remedy.

Figure 21: Monitering Field

6.2 TOOLS AND TECHNOLOGIES USED

6.2.1 Image Pre-processing technique

Image preprocessing performs a crucial position in crop sickness detection and cure rec- ommendation structures. It entails a chain of techniques applied to crop images to enhance their satisfactory, lessen noise, and enhance the effectiveness of subsequent analysis. Here are some commonplace photo preprocessing strategies used in crop disease detection:

i. **Image Resizing and Scaling:**
Resizing the crop images to a standardized resolution or scale guarantees consistency and reduces computational complexity at some point of further analysis. It helps convey pictures to a common length, making them compatible for feature extraction and class algorithms.

Figure 22: Resizing and Scaling for image

ii. **Smoothening** :
The smoothening of the photograph renders the pixel values to steadily even out to all of the factors of the photo with a purpose to permit a easy picture. Along with this the photo additionally receives converted from colored to grayscale image using the feature RGB2GRAY().

Figure 23: Smoothening for image

iii. **Noise Filtering**:

The noise is the unwanted extras which can be gift within the pictures that make characteristic willpower and extraction difficult. Thus the technique of noise filtering entails elimination or averaging of the pixel values that upload noise to the photo. The method utilized in our device to make certain noise elimination is ”Median Filter”.

Figure 24: Noise Filtering for Image

6.2.2 Feature Extraction technique

Feature extraction is a dimensionality reduction technique that helps to represent the features of the parts of interest in an image in a compact vector. This operation is very useful when the image size is large and Feature renders are scaled for faster image matching and retrieval required to complete tasks quickly

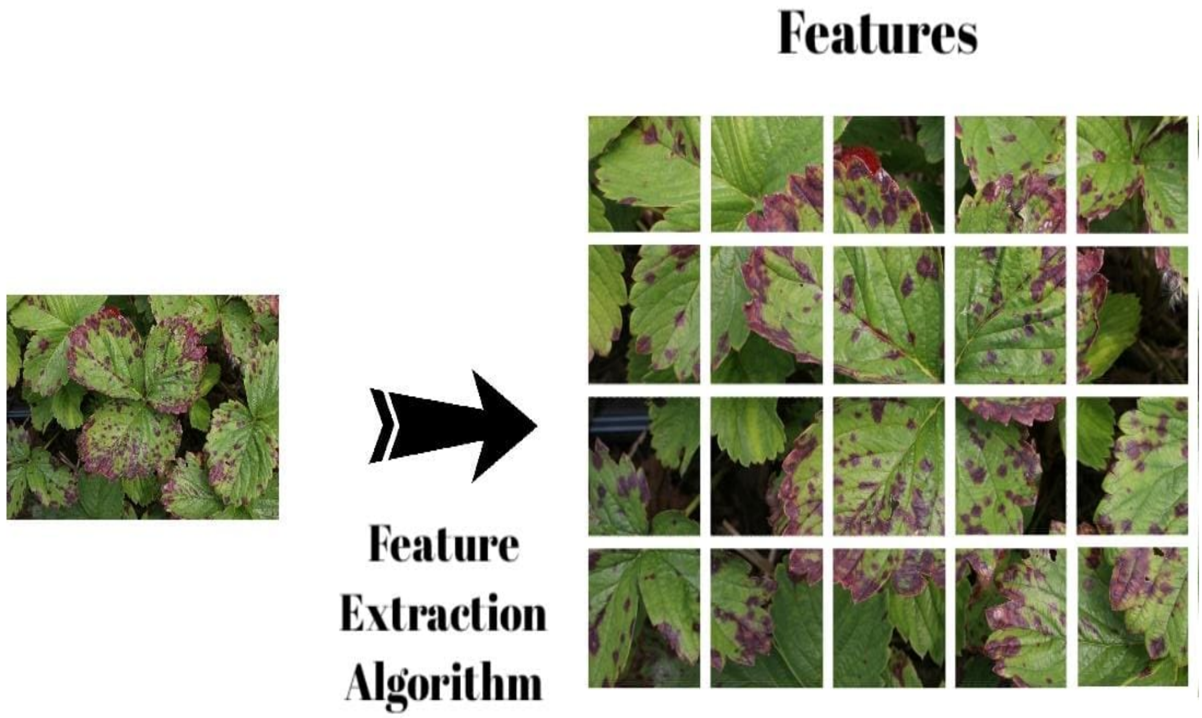

Figure 25: Feature Extraction

These models can then classify crops as healthy or diseased, and provide recommendations for disease management, including appropriate treatments or preventive measures.

The Feature Extraction technique used in our model are as follow:

a. **Gray Scale Co-occurrence Matrix (GLCM):**

GLCM stands for Gray-Level Co-incidence Matrix. It is a texture analysis method used to capture the spatial relationships of pixel intensities inside an image. GLCM calculates the frequency of occurrence of pairs of pixel intensities at diverse spatial offsets in an photo. It presents statistical statistics approximately the distribution of pixel intensity values and their spatial relationships, which may be used as texture capabilities for duties together with crop ailment detection. GLCM-based capabilities provide precious facts about the feel characteristics of an picture, which may be used to distinguish special crop diseases or abnormalities.

2	2	3	4
4	3	4	2
3	4	3	4
3	2	3	2

Image

$i \backslash j$	2	3	4
2	#(2,2)	#(2,3)	#(2,4)
3	#(3,2)	#(3,3)	#(3,4)
4	#(4,2)	#(4,3)	#(4,4)

Corresponding GLCM layout

Figure 26: GLCM

6.3 CONVOLUTION NEURAL NETWORK ALGORITHMS

In the domain of plant disease diagnosis, CNN models are meant to automatically learn and extract useful information from photos. They can categorise plants into different disease groups and apply transfer learning to recognise disease-specific patterns. They are appropriate for real-time or high-throughput plant disease detection systems and can rapidly analyse several photos at the same time. They have shown great accuracy in plant disease diagnosis when compared to standard approaches, lowering the likelihood of miss-classification and false-positive or false-negative findings. Regular three-layer neural networks :

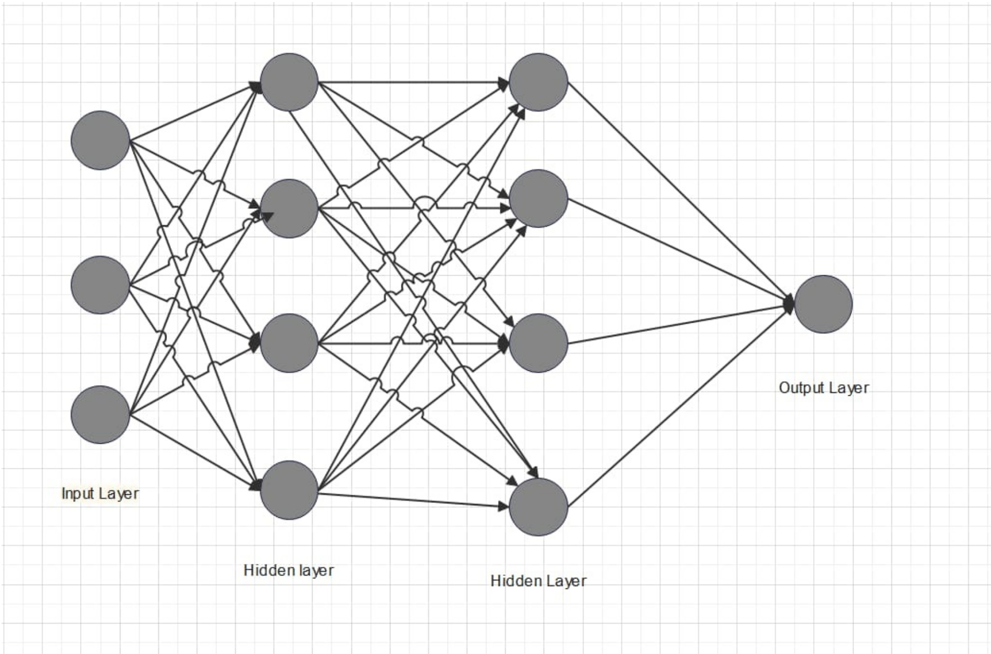

Figure 27: Layer of CNN

Here are the key components and characteristics of CNNs:

1. **Convolution Layer:**
   (a) Convolutional layers include multiple filters that carry out convolution operations on input pics.
   (b) These filters extract relevant features by sliding over the photo, acting element-wise multiplications and summations.

2. **Pooling Layers:**
   (a) Pooling layers reduce the spatial dimensionality of the function maps obtained from convolutional layers.
   (b) They combination the neighborhood facts via choosing the most price (MaxPooling) or common price (AveragePooling) within a region.

3. **Activation Functions:**
   (a) Activation capabilities introduce non-linearity to the CNN version, permitting it to examine complex relationships.
   (b) Common activation capabilities used in CNNs encompass ReLU (Rectified Linear Unit), sigmoid, and tanh.
4. **Fully Connected Layers:**
   (a) Fully linked layers are conventional neural network layers in which each neuron is hooked up to every neuron within the previous and subsequent layers.
   (b) They integrate the extracted capabilities from the convolutional and pooling layers to make final predictions.
5. **Backpropagation and Training:**
   (a) CNNs are trained the use of backpropagation, in which the version's weights are adjusted iteratively primarily based at the calculated mistakes.
   (b) Training is commonly executed with classified statistics, where the model's predictions are as compared to the floor truth labels the usage of a loss characteristic..
6. **Transfer Learning:**
   (a) Transfer gaining knowledge of is a technique in which pre-skilled CNN fashions, trained on huge datasets like ImageNet, are utilized as a starting point.
   (b) The pre-skilled CNN models can be high-quality-tuned on a specific mission or usedas characteristic extractors to enhance performance on smaller datasets.
7. **Dropout and Regularization:**
   (a) Dropout is a regularization method utilized in CNNs to prevent overfitting.
   (b) It randomly drops out a percent of neurons in the course of schooling, forcing the model to learn extra robust and generalized representations.

CNNs have revolutionized various fields, which includes crop ailment detection, by using mechanically getting to know and spotting patterns in photographs.

Their capability to capture spatial dependencies in visible facts makes them noticeably appropriate for obligations like identifying illnesses in vegetation and supplying recommendations for their control.

```
training started...Wait for ~200 seconds...
training started...
Elapsed time is 2.033151 seconds.
Elapsed time is 2.239313 seconds.
...training finished.
testing started....
test error is
Elapsed time is 1.085832 seconds.
CNN Accuracy  =99.0909
CNN Precision   =0.9913
CNN Sensitivity   =0.99091
CNN Specificity   =0.99773
CNN Confutionmatrix   =

confmatrix =

    22     1     0     0     0
     0    21     0     0     0
     0     0    22     0     0
     0     0     0    22     0
     0     0     0     0    22
```

Figure 28: Accuracy of CNN

7 SOFTWARE TESTING

TYPE OF TESTING USED

7.1 Unit Testing

Unit testing for crop sickness detection and cure advice using CNN involves trying out man or woman components or gadgets to make certain their correctness and functionality. Unit trying out can help validate the functionality of man or woman components within a crop sickness detection and therapy advice gadget the usage of CNN, providing confidence in the correctness of the code.

7.2 Integration Testing

Integration testing out for crop disorder detection and treatment advice using CNN entails identifying integration factors, test scenarios, statistics float checking out, and an integration test surroundings. Integration testing enables perceive capability issues and enhances the machine's reliability and performance through verifying records waft, interactions, and integration points.

7.3 System Test

User Test for crop sickness detection and therapy recommendation the usage of CNN involves accumulating feedback and insights from give up users to assess the device's usability, effectiveness, and user satisfaction. User testing allows for valuable insights into the user revel in, ensuring the crop ailment detection and treatment recommendation system meets the needs and expectancies of its intended customers.

7.4 White-Box Testing

White-box trying out for crop disease detection and treatment recommendation the use of CNN entails checking out the inner structure, logic, and code implementation of the system to make certain its correctness and effectiveness. White-box checking out enables ensure the accuracy, correctness, and robustness of the crop ailment detection and cure recommendation system using.

7.5 Black-Box Testing

Black-box checking out for crop disease detection and treatment advice using CNN specializes in checking out the machine's capability with out considering its internal implementation info. Blackbox checking out makes a speciality of validating the device's outside conduct and functionality, offering an impartial assessment of its effectiveness, usability, and reliability.

Test cases Test Results:

Test Case ID	Test Case	Test Case I/P	Actual Result	Expected Result	Test case criteria(P/F)
001	Enter the number in username, middle name, last name field	Number	Error Comes	Error Should Comes	P
001	Enter the character in username, middle name, last name field	Character	Accept	Accept	p
002	Enter the invalid email id format in email id field	Kkgmail,com	Error comes	Error Should Comes	P
002	Enter the valid email id format in email id field	kk@gmail.com	Accept	Accept	P
003	Enter the invalid digit no in phone no field	99999	Error comes	Error Should Comes	P
003	Enter the 10 digit no in phone no field	9999999999	Accept	Accept	P

Figure 29: Registration Test Case

Test Case ID	Test Case	Test Case I/P	Actual Result	Expected Result	Test case criteria(P/F)
001	Enter The Wrong username or password click on submit button	Username or password	Error comes	Error Should come	P
002	Enter the correct username and password click on submit button	Username and password	Accept	Accept	P

Figure 30: Login Test Case

Test Case ID	Test Case	Test Case I/P	Actual Result	Expected Result	Test case criteria(P/F)
001	Store Xml File	Xml file	Xml file store	Error Should come	P
002	Parse the xml file for conversion	parsing	File get parse	Accept	P
003	Attribute identification	Check individual Attribute	Identify Attributes	Accepted	P
004	Weight Analysis	Check Weight	Analyze Weight of individual Attribute	Accepted	P
005	Tree formation	Form them-Tree	Formation	Accepted	P
006	Cluster Evaluation	Check Evaluation	Should check Cluster	Accepted	P
007	Algorithm Performance	Check Evaluation	Should work Algorithm Properly	Accepted	P
008	Query Formation	Check Query Correction	Should check Query	Accepted	P

Figure 31: System Test Case

8 RESULT(SCREENSHOT)

Figure 32: Start Page

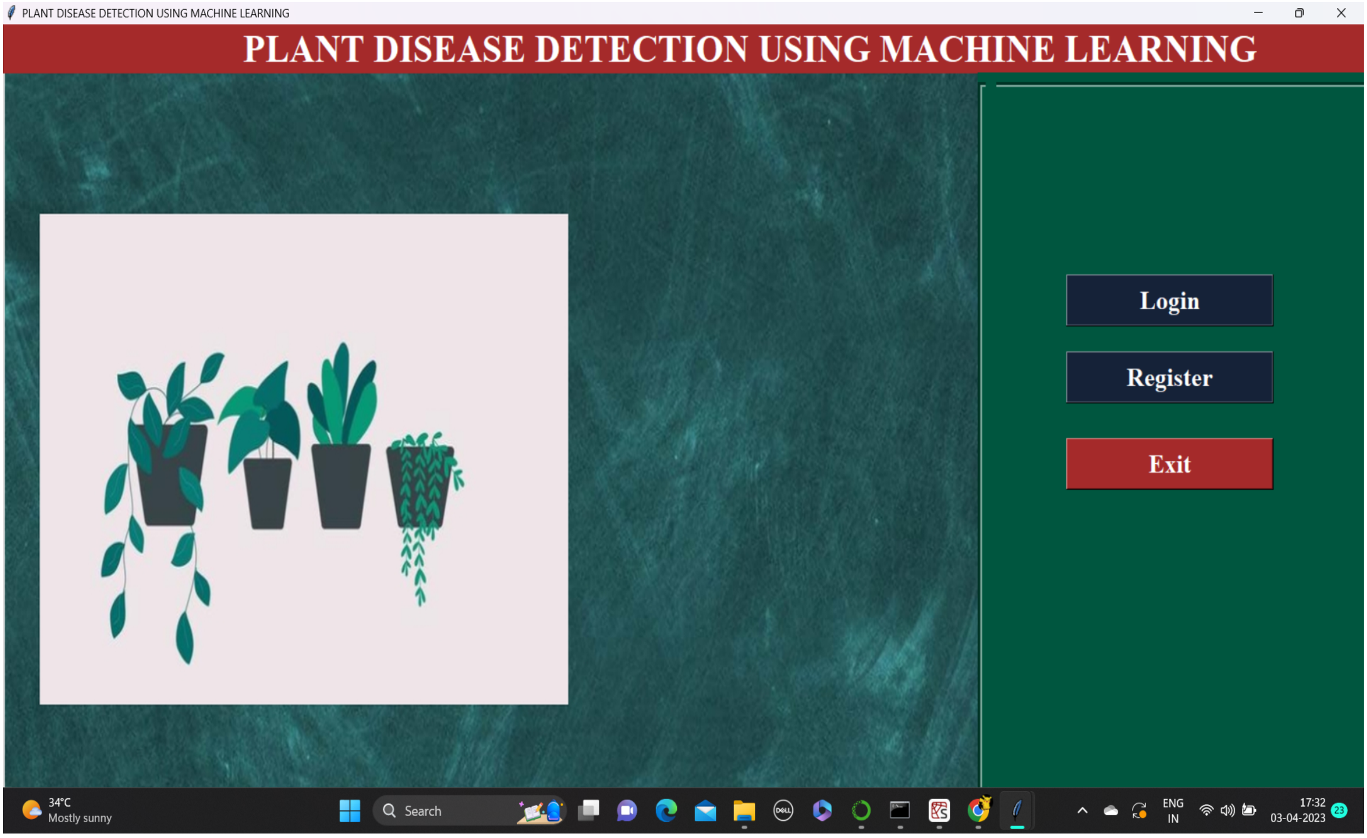

Figure 33: Main GUI

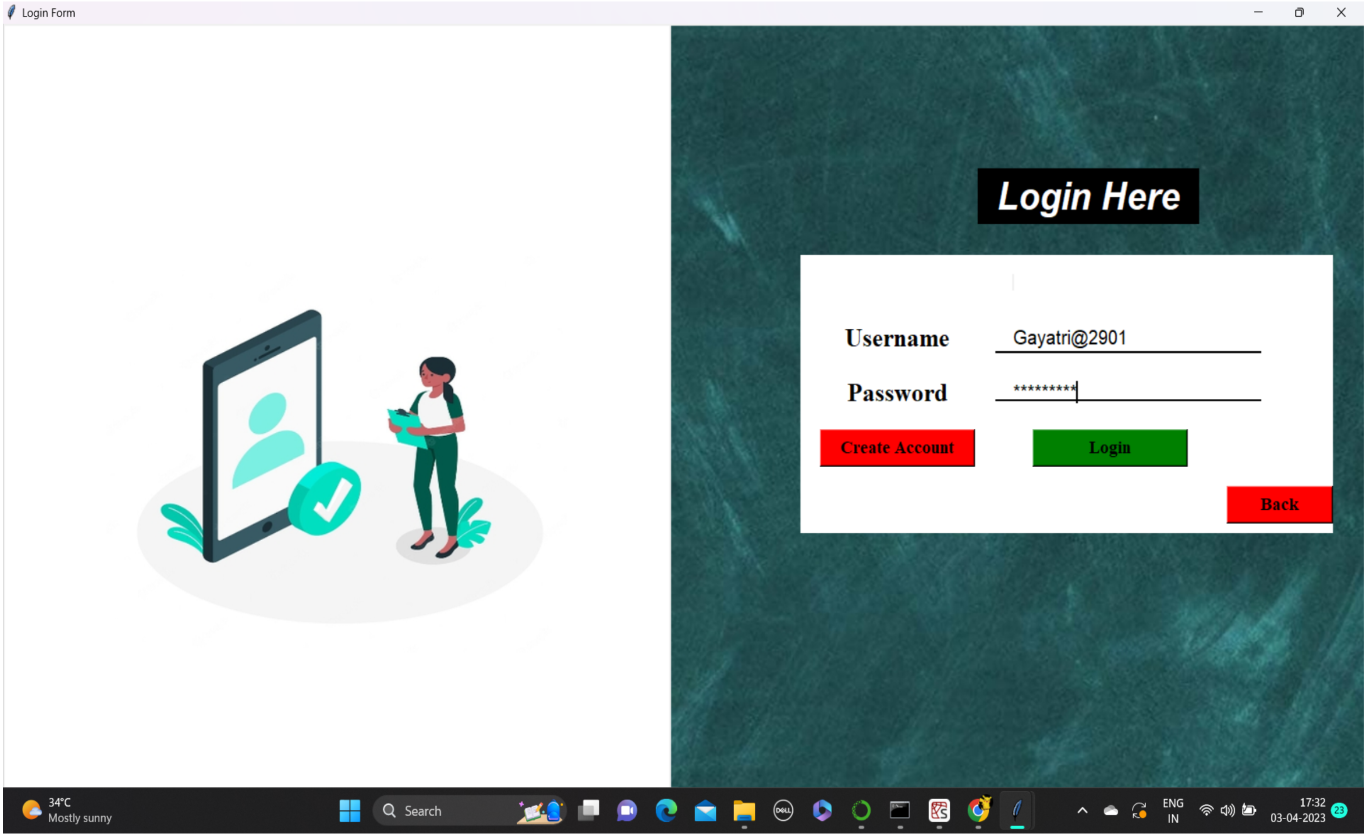

Figure 34: Login Page

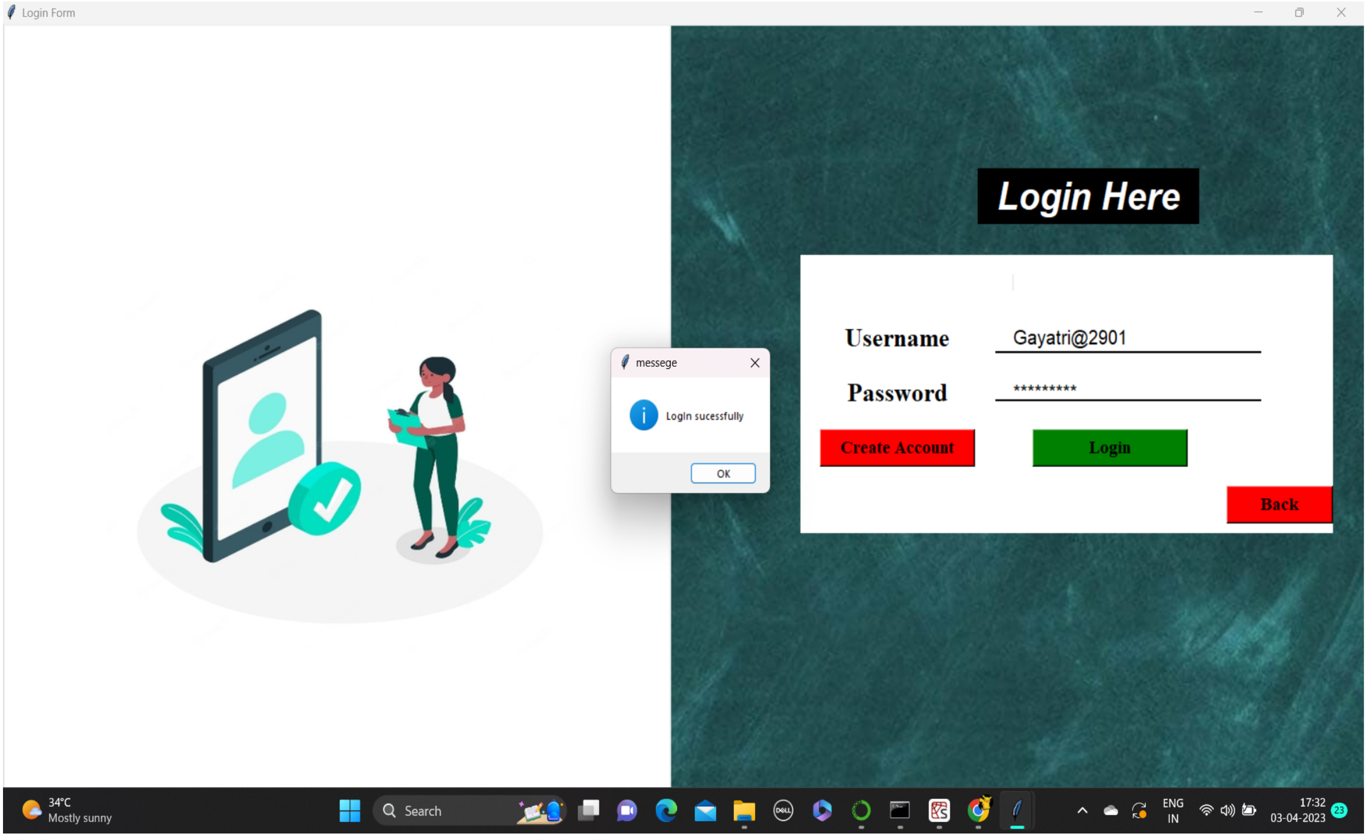

Figure 35: Registration Page

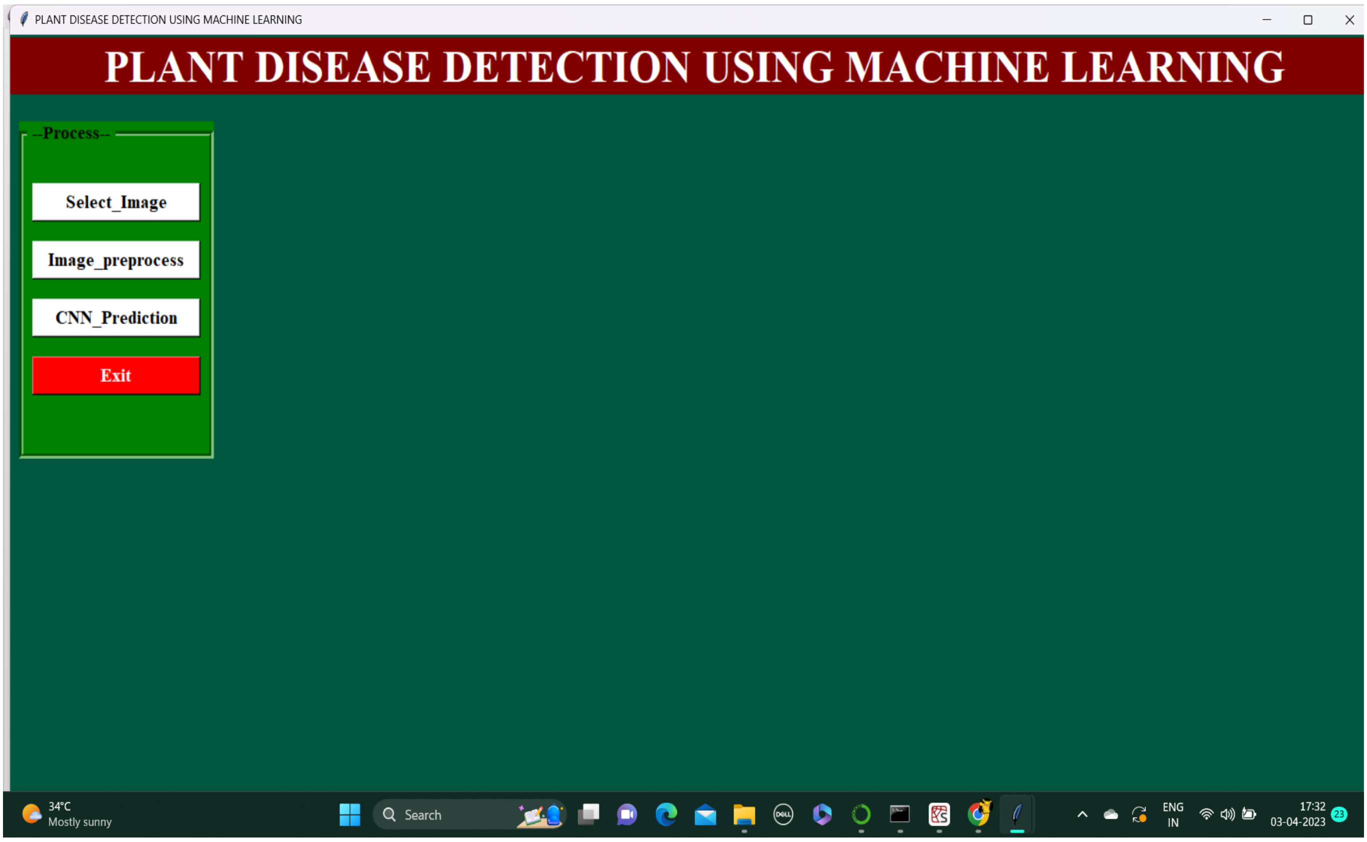

Figure 36: Model Main Page

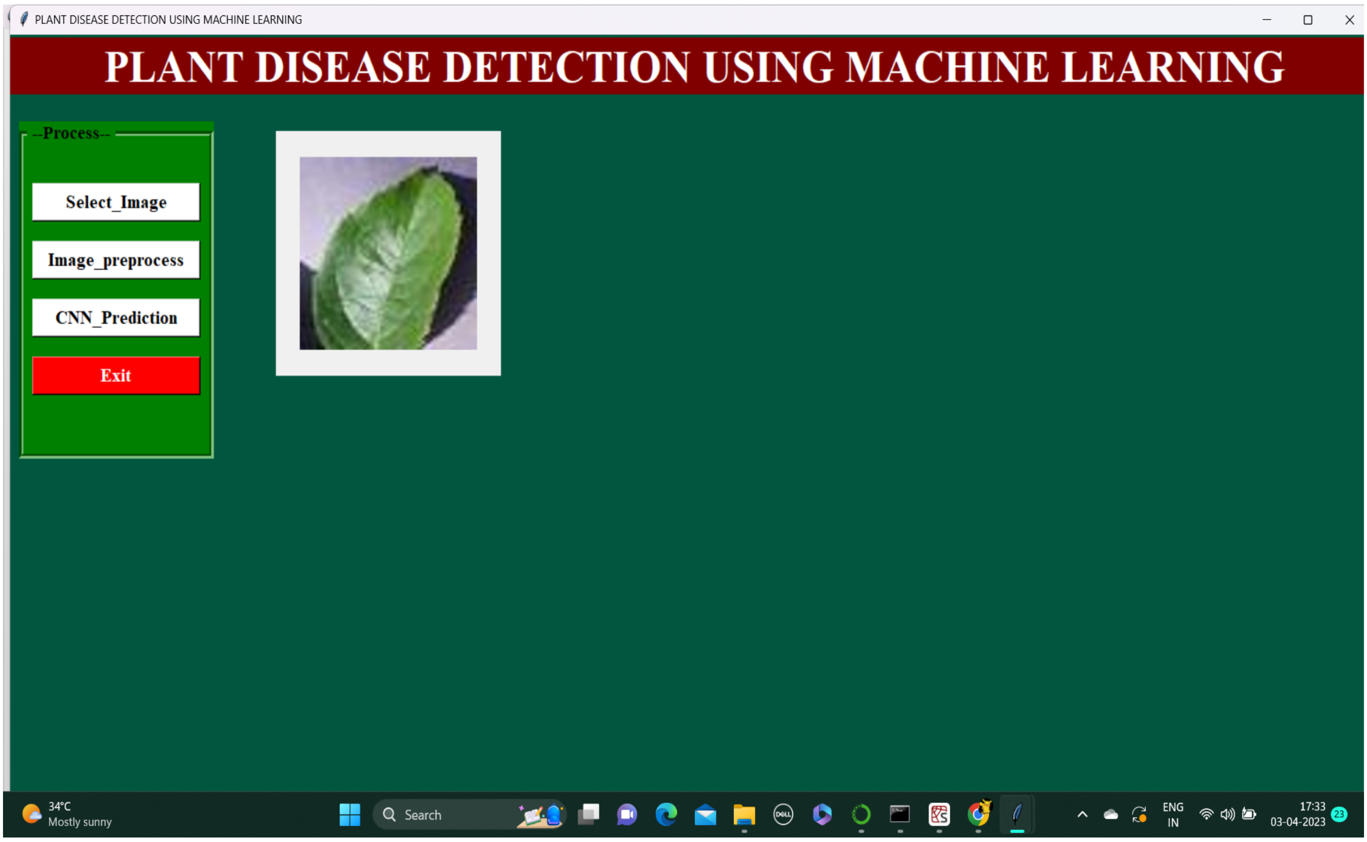

Figure 37: Input Page

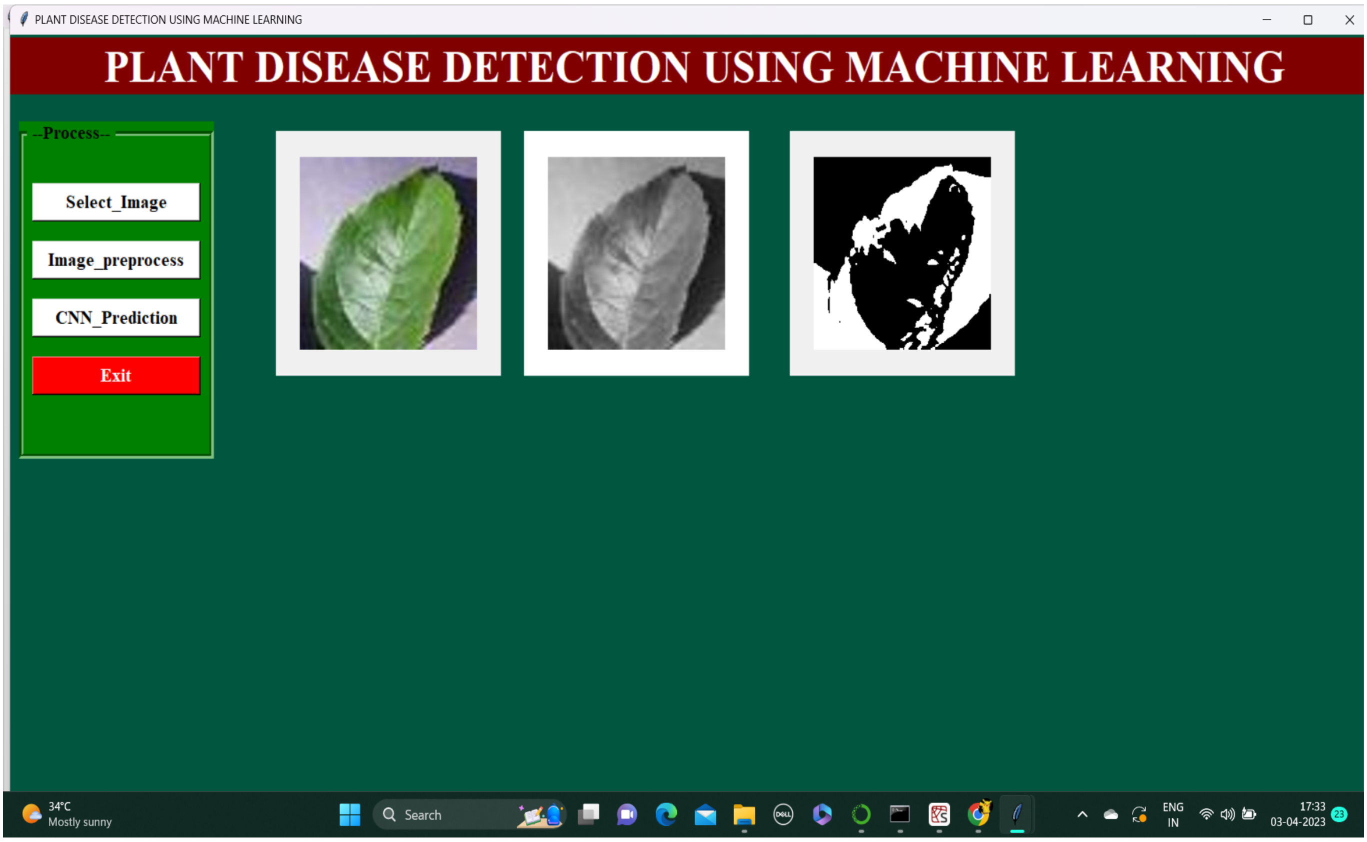

Figure 38: Pre-processing and Feature Extraction

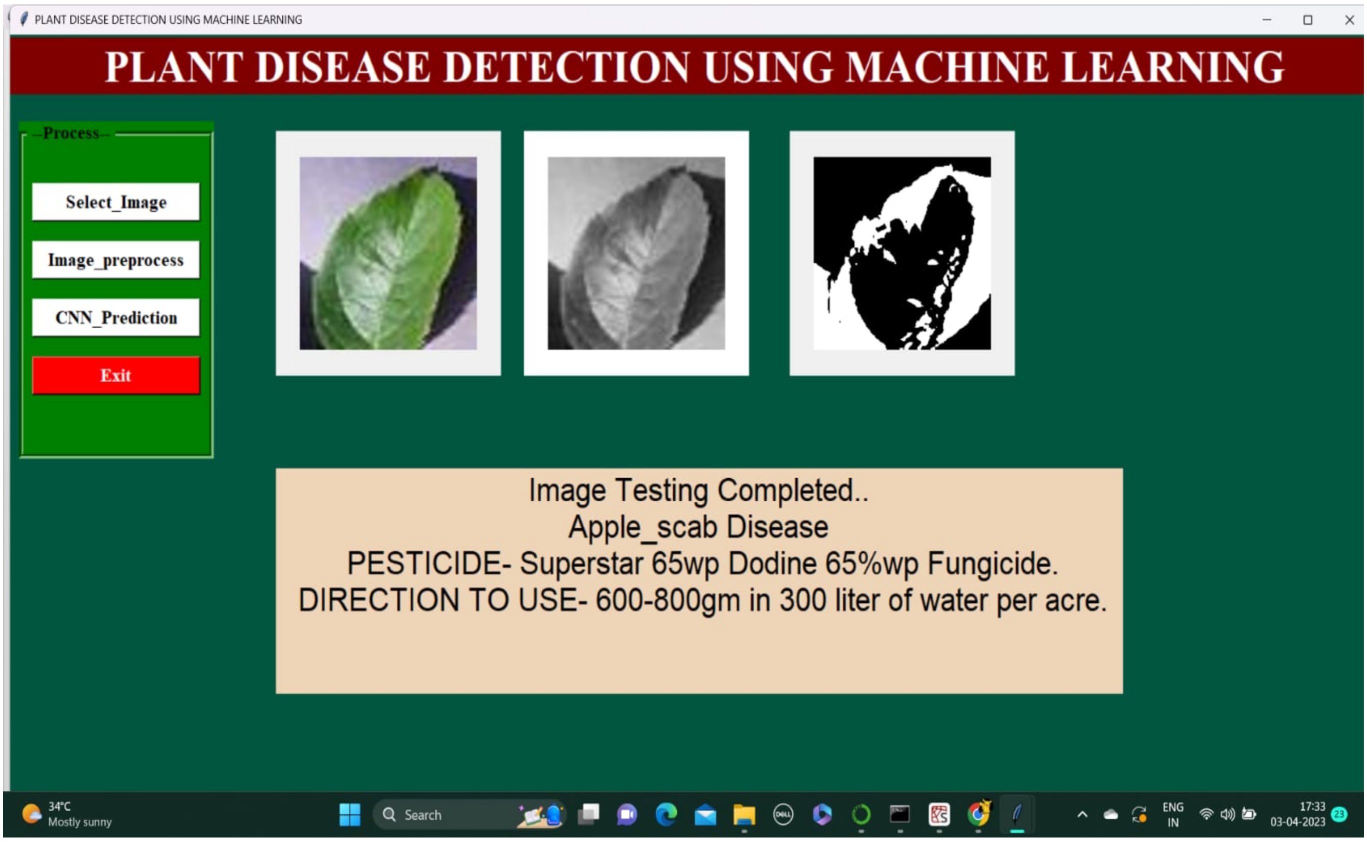

Figure 39: CNN

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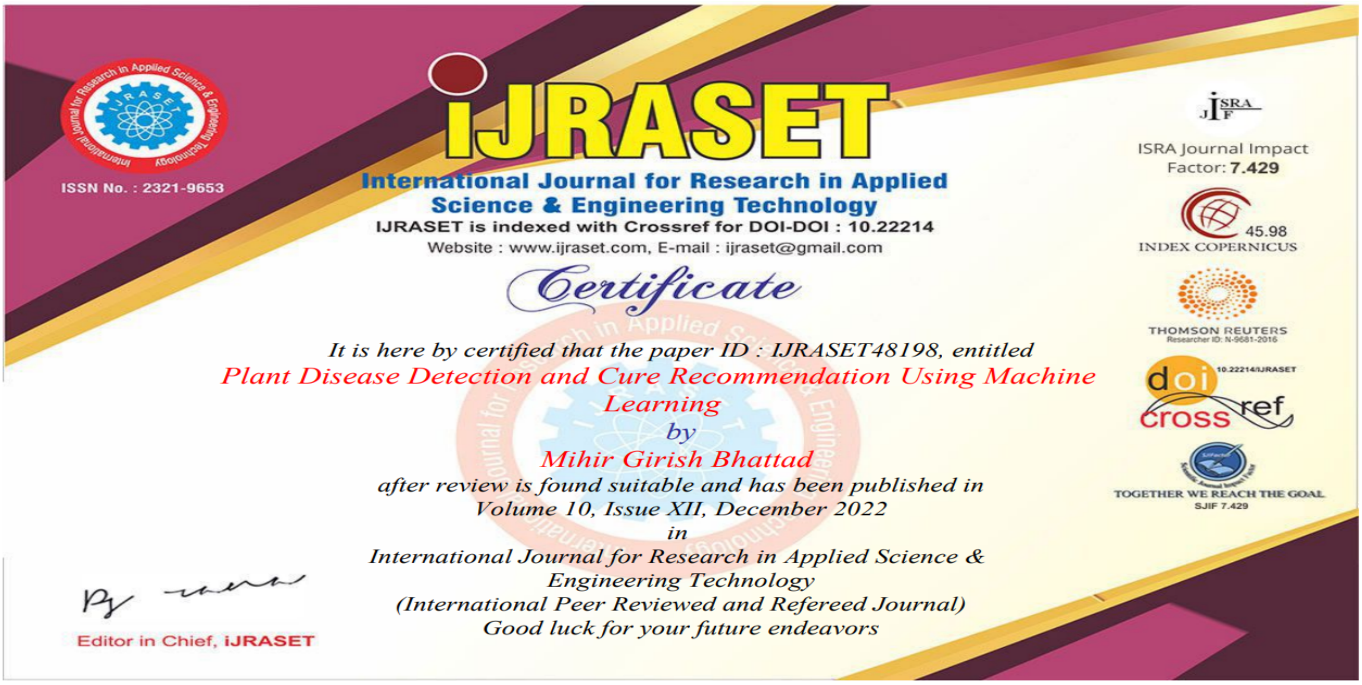

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10 PLAGIARISM ACCURACY

PLANT DISEASES DETECTION AND PESTICIDE RECOMMENDATION USING MACHINE LEARNING

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11 CONCLUSION AND FUTURE SCOPE

11.1 Conclusion

Finally, the crop disease detection and cure suggestion project is critical in agricultural practises. The initiative intends to enhance agricultural disease identification and management by integrating sophisticated technologies such as computer vision and machine learning. Early disease diagnosis can avoid extensive infections, decrease yield losses, and boost overall crop output. Furthermore, offering accurate and timely disease management suggestions helps farmers to apply suitable measures and minimise the negative impact on their crops. To accomplish precise and economical crop disease diagnosis, the research employs Convolutional Neural Networks (CNNs) and picture preprocessing approaches. It also employs feature extraction techniques such as GLCM to extract significant texture information from photos in order to enhance illness categorization.
Then the developers need to do a aggregate of unit testing, integration testing, consumer testing, white-box testing, and black-box testing to ensure their reliability, accuracy, and. Continuous testing and improvement are required to assure accuracy, dependability, and application in real-world circumstances. These technologies have the potential to transform agriculture by allowing for earlier disease identification, more focused treatments, and more sustainable agricultural practices.

11.2 Future Scope

The future scope for crop disease detection and cure recommendation systems using Convolutional Neural Networks (CNN) is promising and offers several avenues for further development. These include improved accuracy, real-time monitoring, multi-crop support, and mobile and web applications. These applications can provide intuitive interfaces for uploading images, receiving disease predictions, and accessing relevant cure recommendations. Integrating crop disease detection and cure recommendation systems with existing agricultural management tools and platforms can further enhance their usability and adoption. Automated decision support, collaborative platforms, explainability and interpretability of CNN-based models, and integration with precision agriculture technologies can help build trust and understanding among users. Continuous research, collaboration, and innovation are needed to make significant contributions to sustainable agriculture, improved crop productivity, and global food security.

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