A

PROJECT REPORT

ON

Intelligent Digital Platform for Farmers

SUBMITTED TO

SHIVAJI UNIVERSITY, KOLHAPUR

IN THE PARTIAL FULFILLMENT OF REQUIREMENT FOR THE AWARD OF DEGREE BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING

SUBMITTED BY

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UNDER THE GUIDANCE OF

Prof. V. G. Khetade

DKTE

Promoting Excellence in Teaching, Learning & Research

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

DKTE SOCIETY'S TEXTILE AND ENGINEERING INSTITUTE,

ICHALKARANJI 2022-23

D.K.T.E. SOCIETY'S

TEXTILE AND ENGINEERING INSTITUTE, ICHALKARANJI
(AN AUTONOUMOUS INSTITUTE)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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CERTIFICATE

This is to certify that, project work entitled

Intelligent Digital Platform for Farmers

Is a bonafide record of project work carried out in this college by

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DECLARATION

We hereby declare that the project work report entitled "Intelligent Digital Platform for Farmers" which is being submitted to D.K.T.E. Society's Textile and Engineering Institute Ichalkaranji, affiliated to Shivaji University, Kolhapur is in partial fulfillment of degree B.Tech.(CSE). It is a bonafide report of the work carried out by us. The material contained in this report has not been submitted to any university or institution for the award of any degree. Further, we declare that we have not violated any of the provisions under Copyright and Piracy / Cyber / IPR Act amended from time to time.

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Thank you,

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ABSTRACT

Leaf disease detection is the basis of leaf disease prevention to guarantee crop quality. Traditional detection methods for crop disease mainly depend on manual observation and consequently lead to low detection efficiency and poor reliability. Farmers lack professional knowledge, and agricultural experts cannot always serve the field so that they miss the best time for prevention. The first step in preventing leaf diseases and ensuring crop quality is leaf disease identification. Traditional agricultural disease detection techniques primarily rely on manual observation, which has a low detection effectiveness and low dependability. Farmers lack specialised knowledge, and agricultural professionals are frequently unable to assist the field, causing them to miss the ideal window for prevention.

In recent years, image processing, pattern recognition, computer vision and other technologies have developed rapidly. Computer automatic detection of diseases provides a method for effectively solving agricultural problems. The traditional machine vision method for the detection of crop leaf diseases follows three steps:

(1) image pre-processing,

(2) researchers manually designing complex disease features for feature extraction, and

(3) Machine learning algorithms for classifying crop diseases.

When the leaf of a plant had been infected or attacked by some disease, the other areas had been exposed to be infected. Thus, it will decrease leaf yield and it also reduces farmer's income. Currently, the farmer determines the type of disease manually. The errors might occur to determine the type of diseases. Farmers also must spend a lot of time detecting the type of disease. It also takes time as the farmers manually check the disease since the field is in a wide area.

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1. Introduction

Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise in the plant diseases, and require the excessive processing time. Hence, image processing and Machine learning techniques are used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification.

Farmers face a major problem to detect diseased leaves. Leaf testing has been developed to aid agriculture to avoid some of the hazards of crop production by furnishing the needed information. Leaf diseases are not only a threat to food security at the global scale but can also have disastrous consequences for smallholder farmers whose livelihoods depend on healthy crops. In the developing world, more than 80 % of the agricultural production is generated by smallholder farmers and reports of yield loss of more than 50% due to pests and diseases.

With the rapid development of deep learning, the accuracy of image classification and object detection has greatly improved, and it can accurately classify large datasets, even better than humans in many aspects. Deep learning has the advantage of directly extracting classification features. Additionally, the deep learning feature extraction method is suitable for classification on various occasions and has a strong generalization ability. With the continuous improvement of many researchers, deeper neural networks have been proposed. Therefore, the general trend has been to use deep learning to detect crop diseases in agriculture.

Plant diseases is crucial for preventing losses in agricultural yield and ensuring sustainable agriculture. Traditional manual methods of monitoring plant diseases are time-consuming and require expertise in plant diseases. To overcome these challenges, image processing and machine learning techniques are being used for disease detection in plants. The process of disease detection typically involves several steps. First, images of the plants or their leaves are acquired using cameras or other imaging devices. These images then undergo pre-processing to enhance the quality and remove any noise or artifacts. Image segmentation techniques are applied to separate the regions of interest (diseased areas) from the background.

Once the images are pre-processed and segmented, features are extracted from the diseased regions. These features can include color, texture, shape, or any other relevant characteristics that can help distinguish between healthy and diseased plant parts. Feature extraction is an important step as it provides meaningful information for subsequent classification. After feature extraction, machine learning algorithms are employed for classification. Deep learning, a subfield of machine learning, has shown significant advancements in image classification and object detection. Deep learning models, such as convolutional neural networks (CNNs), can automatically learn and extract discriminative features from images. They are capable of accurately classifying large datasets and have demonstrated superior performance compared to traditional machine learning methods.

The use of deep learning in plant disease detection offers several advantages. Deep neural networks can directly extract relevant features from images, reducing the need for manual feature engineering. These models can generalize well to different types of plant diseases and achieve high accuracy. Furthermore, researchers have continuously improved deep neural networks, proposing deeper architectures that further enhance performance. By leveraging deep learning techniques, farmers and researchers can develop automated systems for detecting plant diseases. This technology can aid in timely identification of diseases, enabling prompt intervention and mitigation measures. It has the potential to benefit smallholder farmers who heavily rely on crop production for their livelihoods, reducing yield losses and enhancing food security.

Overall, the integration of image processing and machine learning, particularly deep learning, is transforming the field of plant disease detection and providing valuable tools for sustainable agriculture.

a. Problem Definition

Design and develop a system to detect the diseased leaves and suggest the appropriate cure.

Finding sick leaves is a big difficulty for farmers. By providing the necessary information, leaf testing has been established to help farmers to avoid some of the risks associated with crop production. In addition to posing a threat to global food security, leaf diseases can have catastrophic effects for smallholder farmers whose livelihoods depend on robust harvests. More than 80% of agricultural production in the developing countries is produced by smallholder farmers, and claims of yield losses of more than 50% due to pests and diseases are common.

b. Aim and Objective of the project

Aim:

- To propose a system which will detect the disease on leaf and provide pesticide suggestion on disease.

- To develop a web application based on the proposed system.

Objective:

- To enhance the given input image by Image acquisition and Image preprocessing.
- Identify the affected part through texture analysis and Segmentation.
- Classify the healthy and affected leaf part by feature extraction and classification.
- Train the model by using testing data for accurate result.

c. Scope and Limitations of the project

Scope:

- Use of image processing techniques in detection and identification of leaf diseases in the earlier stages and thereby the quality of the crop could be increased.
- Here we are going to detect disease names and we can provide extra information about that disease.
- We can attempt to increase the accuracy of the model by expanding the dataset.

Limitations:

The proposed system can deliver the image of the leaf and detect if the leaf is contaminated or not and if yes, the system will provide appropriate treatment for the detected disease however like all other systems there are a few limitations. Since this detection model is dependent on the network of that region and the quality of the image captured.

The user must upload the image with proper internet connection and the image should be clear and of proper dimensions. For example, the proposed system works well with regions having a good network area and good quality image, but in regions with a low-speed network the model might not function as expected. In case of bad image quality or the blurry image the user must wait for the result for a long time as the system takes more time to process the image and predict the output.

d. Timeline of the project

We started the project by gathering the related documents to the project at the end of July 2022. Gathering the requirements and all the analysis tasks was done by mid of August 2022. After that System design was started in the month of September 2022 and completed by the start of November 2022 along with the UML diagrams and Synopsis with a rough idea of the project. In November 2022 we started making the detailed SRS documents along with deciding the methodology for the project which was completed by mid-December 2022. By the start of January 2023, we started coding and completed the 1st part by mid-January 2023. Other part was completed by the end of February 2023. By the end of March 2023, the remaining. We started testing the project alongside designing the GUI which was completed in the first week of April 2023.

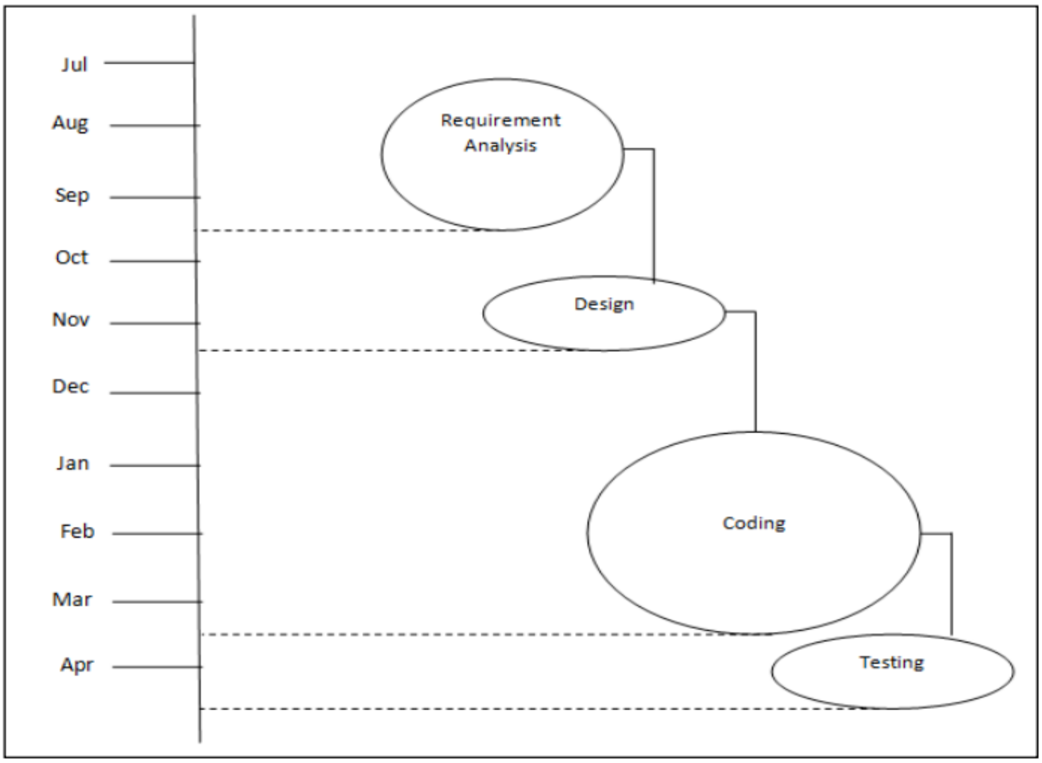

Fig. 1

e. Project Management Plan

1. **Project initiation**:
During this stage, the project's parameters were established. We also clarified the project's objectives, goals, and restrictions.

2. Project planning:
During this stage, a thorough project plan was created. The project scope must be specified, the deliverables must be determined, a work breakdown structure must be made, and a project timetable must be developed. We also determined the tools and supplies that were needed for the endeavor.

3. Project execution:
During this stage, the project plan is put into action. All the process that was planned during project planning phase were carried out step by step. Begin by taking image of tomato leaf from dataset, leaf first preprocessed using image processing technique and precise disease was then determined and preventions techniques were suggested.

4. Project monitoring and control:
In this phase, we regularly monitored the project's progress against the project plan. Prof. V. G. Khetade sir, our project guide oversaw overseeing and directing the complete project execution. Sir solicited our feedback at each point. Sir was informed of the project status by us.

5. Project closure:
In this phase, it includes conducting a final review of the project to ensure that all project deliverables have been completed, and all project goals and objectives have been met.
Finally, after completing our project objectives, our model was able to determine the disease on tomato leaf and if the disease found model was able to give the prevention methods.

f. Project Cost

Line of code: To develop the system lines of codes are required.
KLOC: KLOC is the estimated size of the software product indicated in Kilo Lines of Code.

KLOC = LOC / 1000
= 964 / 1000
= 0.964

Effort: The effort is only a function of the number of lines of code and some constants evaluated according to the different software systems.

E = a (KLOC)^ b
= 2.4 (0.964) ^1.05
= 2.4 * 0.9622
= 2.3093

Time: The amount of time required for the completion of the job, which is, of course, proportional to the effort put in. It is measured in the units of time such as weeks, months.
Time = c (Efforts) ^ d
= 2.5 (2.3093) ^ 0.38
= 2.5 * 1.37
= 3.4360

Persons Required: Persons required are nothing, but effort divided by time.
Persons Required = Efforts / Time
= 2.3093 / 3.4360
= 0.67

2. Background and Literature overview

a. Literature Overview

1. A survey on crop disease detection using image processing technique for economic growth of rural area. Yashpal Sen, Chandra Shekar Mithlesh, Dr. Vivek Baghel.

Describes an approach for disease detection of crop for economic growth of rural area. This paper discussed about an automated system for identifying and classifying different diseases of the contaminated plants is an emerging research area in precision agriculture. This paper describes the approach to prevent the crop from heavy loss by careful detection of diseases. The region of internet is leaf because most of the diseases occur in leaf only. Histogram equalization is used to pre-process the input image to increase the contrast in low contrast image, K-mean clustering algorithm which classifies objects. Disease in crop leaf is detected accurately using image processing technique it is used to analyze the disease which will be useful to farmers.

2. "Detection and classification of leaf diseases using K- means based segmentation and neural-networks-based classification. Elangoran, S. Nalini,2011.

Presented a concept of plant disease classification using image segmentation and SVM techniques. This paper describes an image processing technique that identifies the visual symptoms of plant diseases using an analysis of colored images, work of software program that recognizes the color and shape of the leaf image. LABVIEW software was used to capture the image of plant RGB color model and MATLAB software is used to enable a recognition process to determine the plant disease through the leaf images. The color model respectively was used to reduce effect of illumination and distinguish between leaf colors efficiently and the resulting color pixels are clustered to obtain groups of color in the images.

3. Deep Learning-Based Object Detection Improvement for Tomato Disease YANG ZHANG, CHENGLONG SONG, AND DONGWEN ZHANG-2020.

This paper improves the Faster RCNN algorithm to detect tomato leaves, which can both recognize tomato diseases and detect tomato leaf locations. We use the k-means algorithm to cluster the bounding boxes of tomato disease images and improve the anchors based on the results. This paper uses ResNet101, which can extract the in-depth features of tomato disease, was chosen to replace VGG16 for feature extraction. The experimental results show that the method can effectively detect and recognize tomato diseases and has higher detection accuracy than the original Faster RCNN.

b. Critical appraisal of the other people's work

- Madhulatha and Ramadevi (2020), conducted a study on the recognition of plant diseases in which a deep Convolution Neural Network model was used and the proposed work was shown to produce an accuracy of 96.50%. The study makes use of the famous AlexNet architecture to classify the different plant diseases. The AlexNet architecture is a Neural Network that consists of eight layers of learnable features that is famously used in most image classification use case scenarios. The dataset used in this study makes use of all the images from the plant village dataset which consists of 54,323 images of plant diseases and 38 different disease categories.

- A study conducted by Agarwal et al. (2020) on the recognition of diseases in tomato leaves using Convolutional Neural Network showed that the proposed CNN model scored an accuracy of 91.2% in comparison to pre-trained CNN models such as, VGG16 which scored 77.2%, Mobilenet which scored 63.75% and finally the Inception model which scored 63.4%. The proposed CNN model in this study consists of three Convolution layers and three Max pooling layers. This study by (Agarwal et al., 2020) also sheds light on the benefits of not using a pre-trained model in which it finds that the proposed model needed very less storage space of 1.5 MB in comparison to the pre-trained models which needed 100 MB.

c. Investigation of current project and related work

We started this project with the aim of creating an efficient leaf disease detection system. So, we decided to create a system where people could easily detect the disease without much time waste. A leaf disease detection system is developed in our project. Farmers can also see if the leaf is defected or not. However, it is not possible for new farmers and younger generation peoples. Detection of diseased leaf is vital for farmers, for the system to succeed; it must be able to provide information based on the detection process. The goal of this research is to propose a suitable method for use in a Disease Detection System Based.

Our first goal when starting this project was to develop a reliable approach for identifying leaf diseases. Therefore, we made the decision to develop a method that would allow individuals to diagnose the sickness quickly and easily. In our project, a mechanism for detecting leaf illness is created. Farmers can also determine whether a leaf is defective. For new farmers and members of the younger age, it is not feasible. For the system to be successful, it must be able to deliver information based on the detection process, which is essential for farmers to identify damaged leaves. The purpose of this study is to recommend a workable approach for a disease detection system based.

3. Requirement Analysis

a. Requirement Gathering

1. USER REQUIREMENT

1. As a user, I want to detect the diseased leaves.
2. As a user, I want to reduce my detecting time manually.
3. As a user, I want the name of the disease with one click.
4. As a user, I want the system to work fast and reduce human efforts.

2. USER STORIES

- Users can sign up in the system.
- Users can login into the system.
- Users can upload the image of the leaves.
- Users can log out from the system.

b. Requirement Specification

Software Requirement

1. Anaconda3 5.3.1
2. Tensor Flow

Hardware Requirement

1. Processor: Intel(R) Core (TM) i5
2. RAM: 8.00 GB
3. Windows 10 with MS-Office

Dataset

Plant Village Dataset (For Tomato Leaf)

c. Use Case Diagram

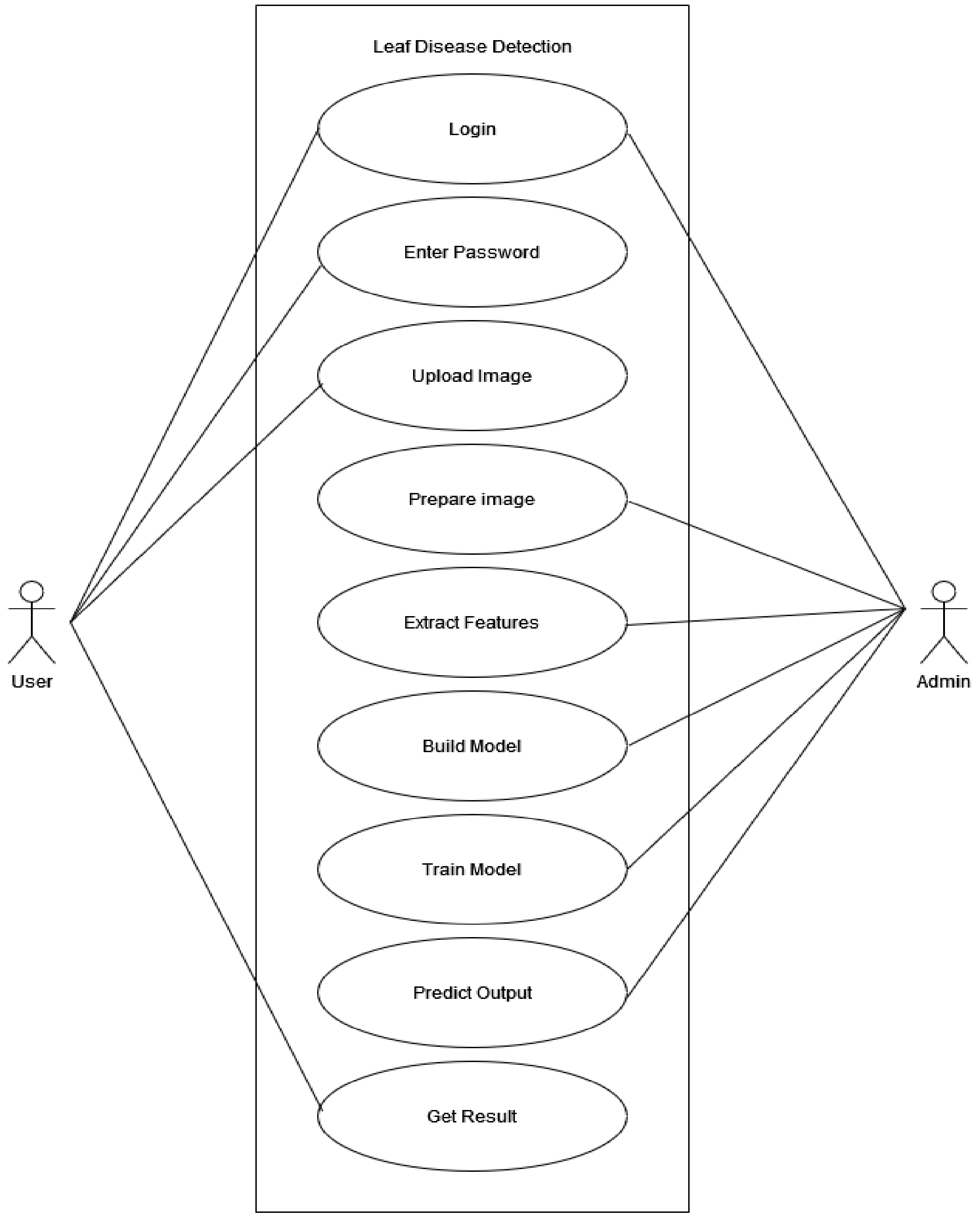

Fig. 2

4. System Design

a. Architectural Design

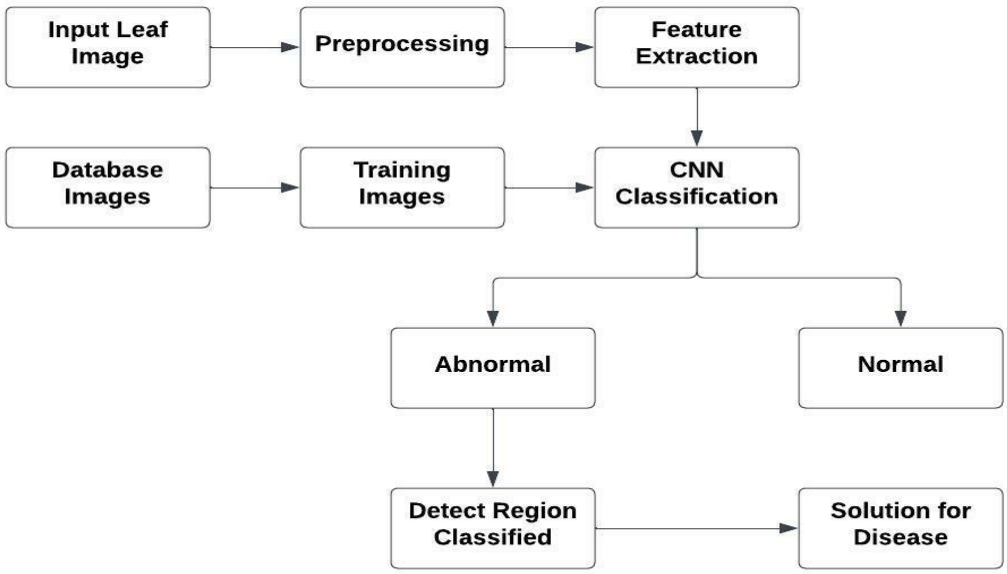

Fig. 3

b. System Modeling

1. Dataflow Diagram

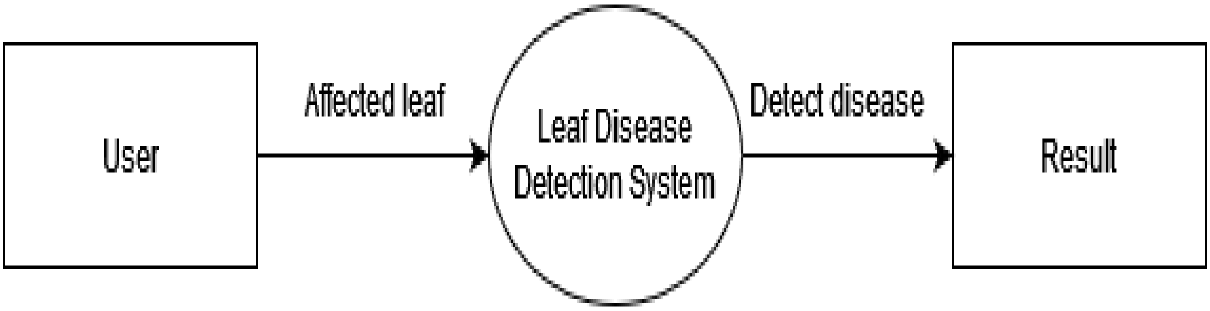

Fig. 4

DFD 0

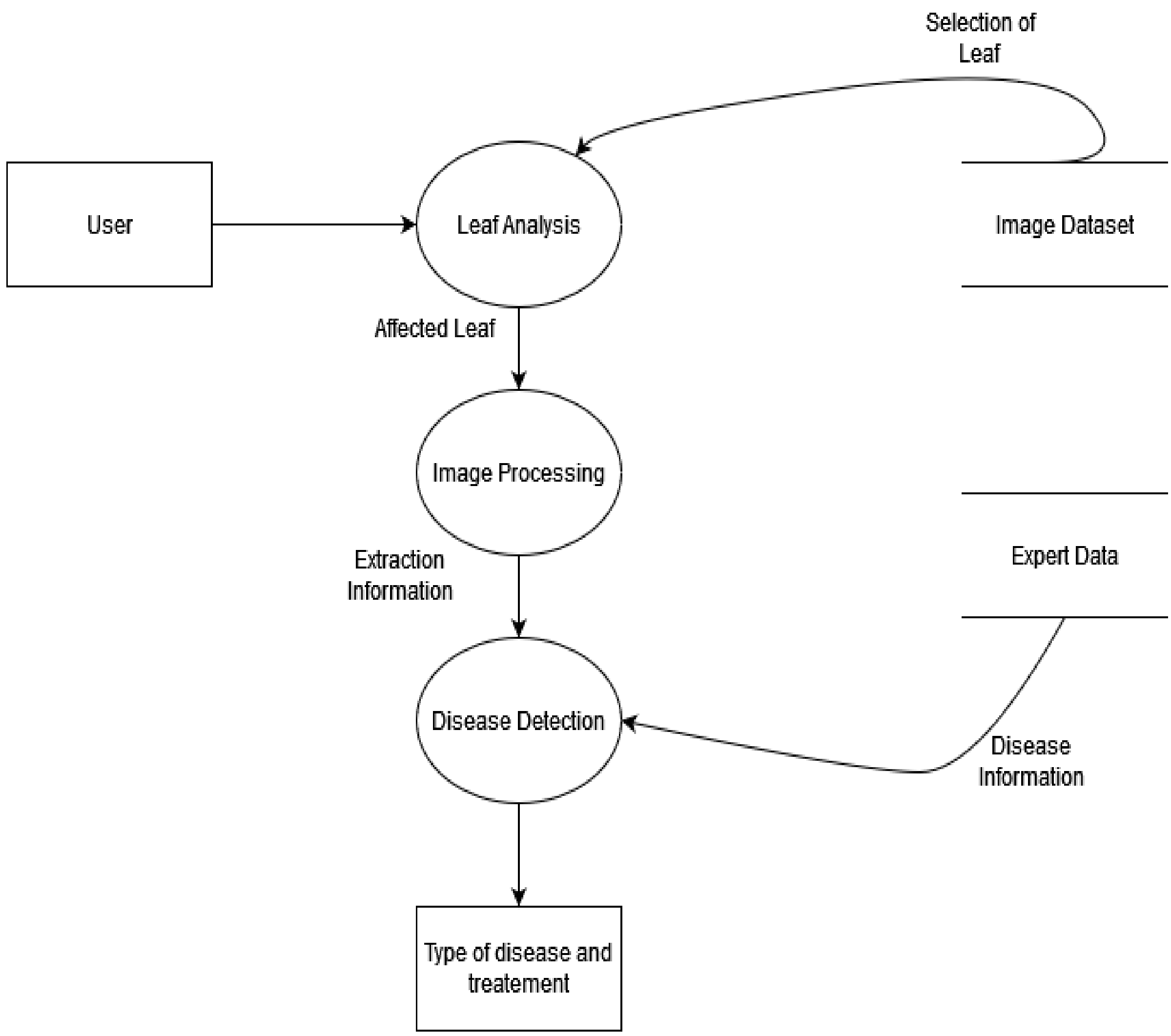
Selection of
Leaf
User
Leaf Analysis
Image Dataset
Affected Leaf
Image Processing
Extraction
Information
Expert Data
Disease Detection
Disease
Information
Type of disease and
treatement

Fig.5

DFD 1

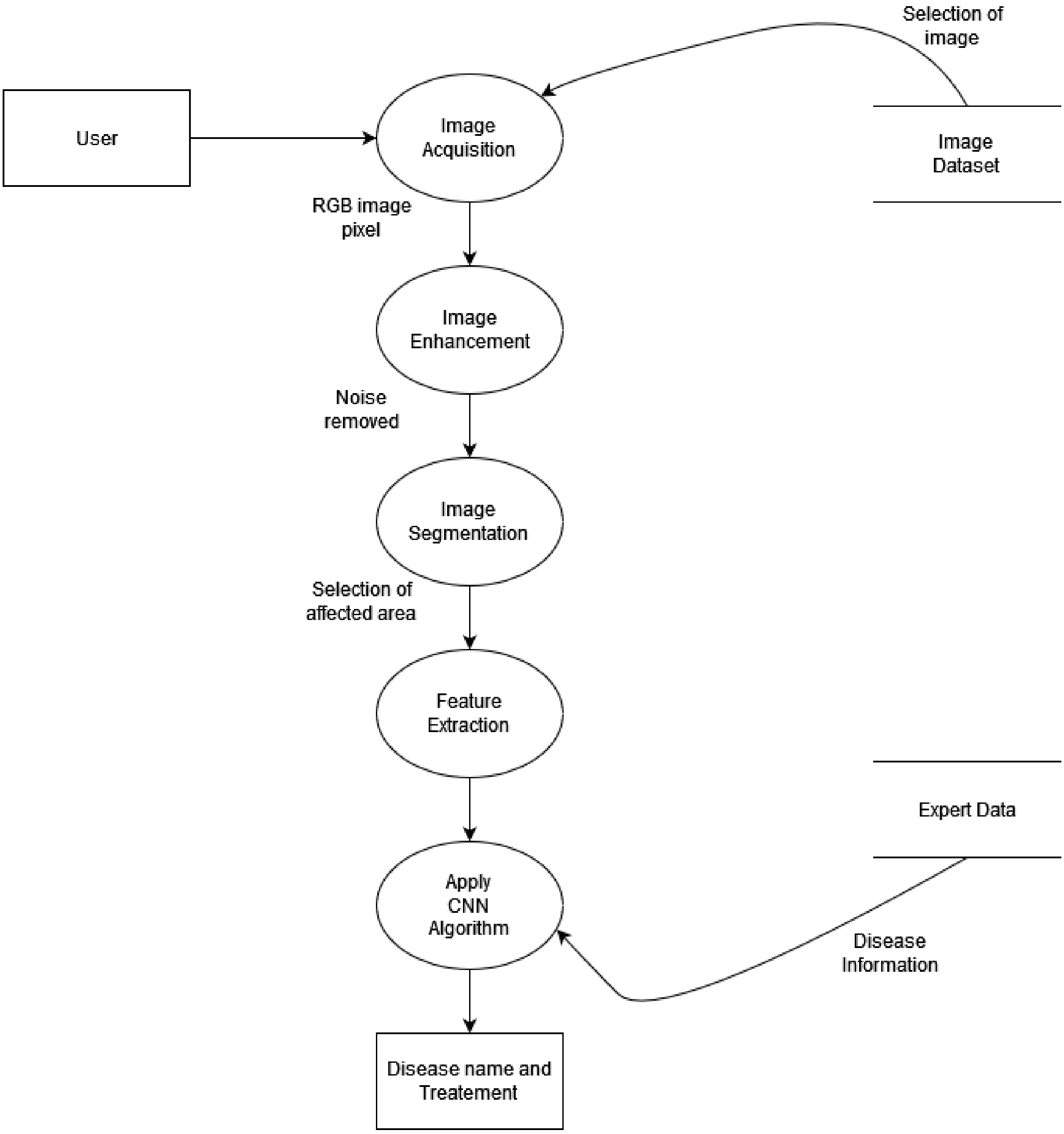
Selection of
image
User
Image
Acquisition
Image
Dataset
RGB image
pixel
Image
Enhancement
Noise
removed
Image
Segmentation
Selection of
affected area
Feature
Extraction
Expert Data
Apply
CNN
Algorithm
Disease
Information
Disease name and
Treatement

Fig. 6

DFD 2

2. Sequence Diagram

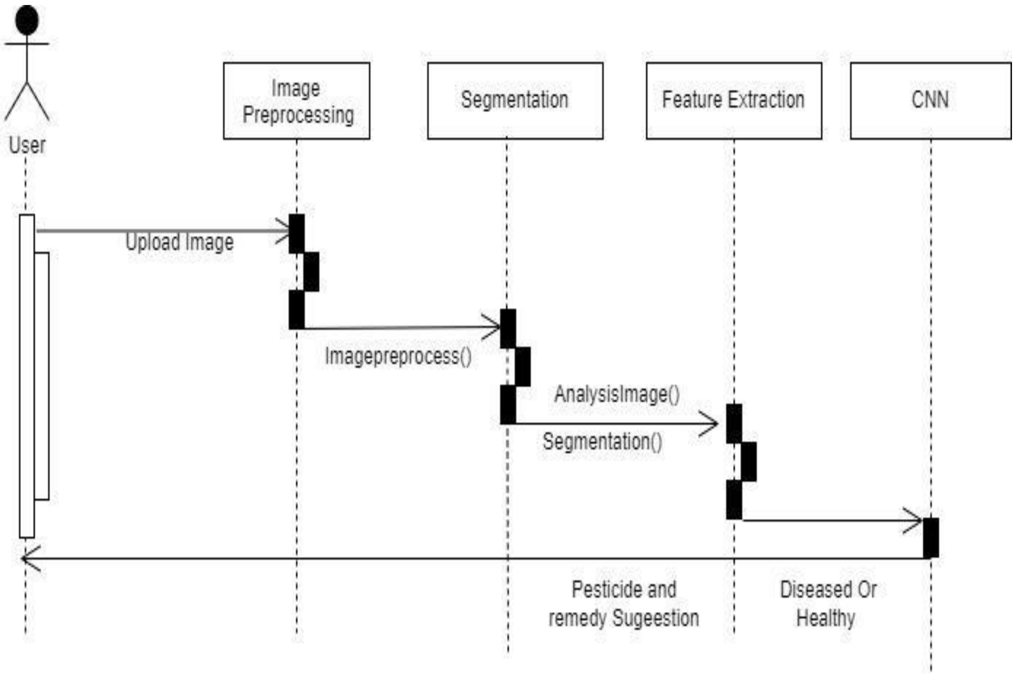

Fig. 7

3. State Diagram

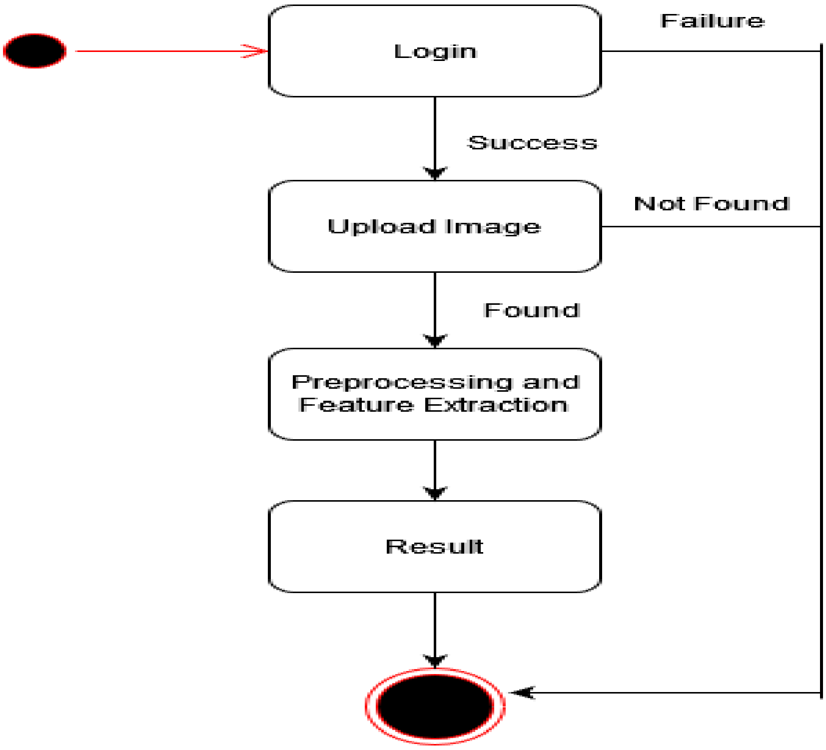

Fig. 8

4. Component Diagram

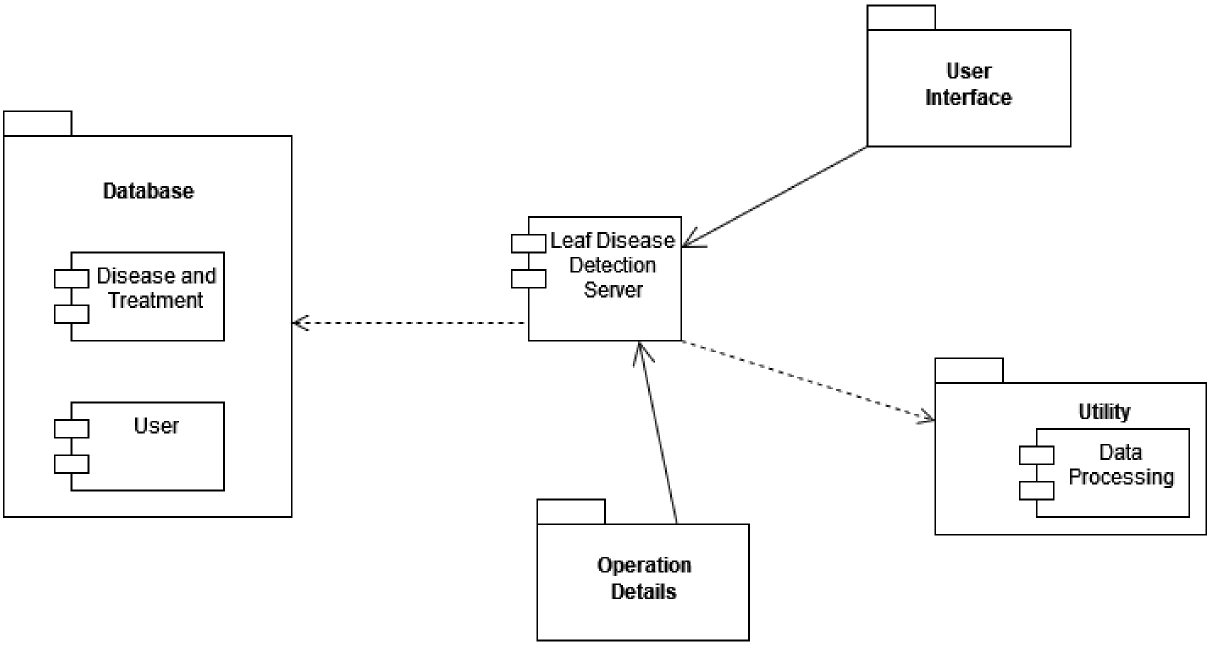

Fig. 9

5. Deployment Diagram

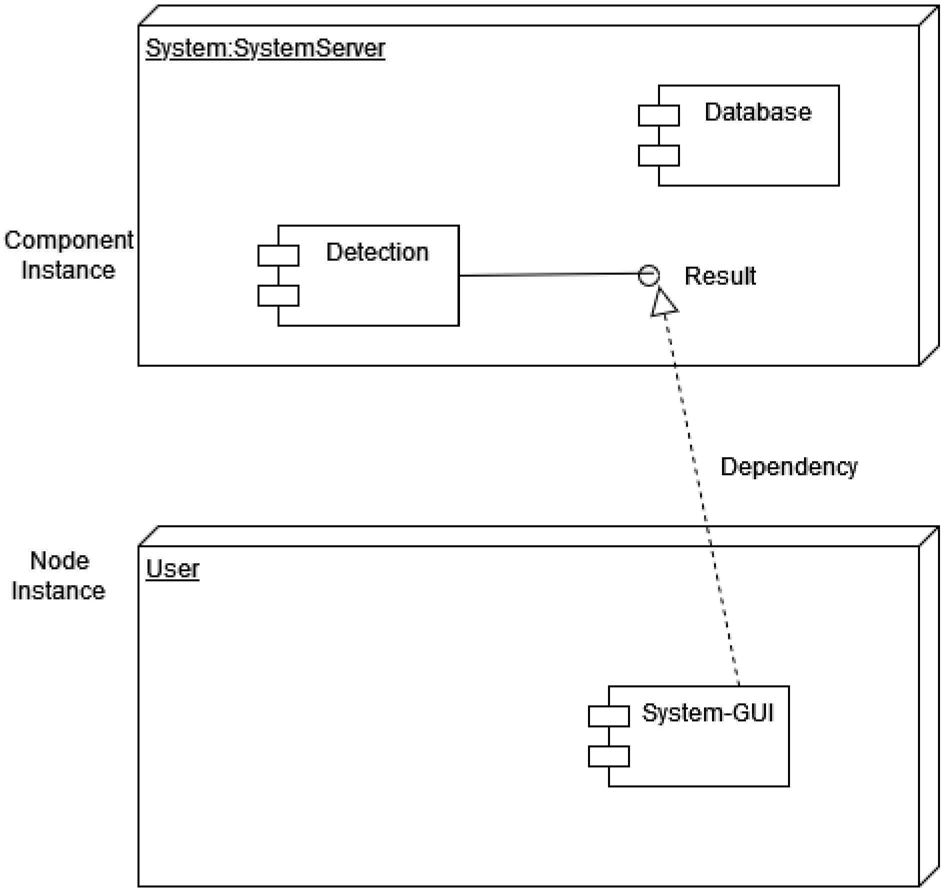

Fig. 10

5. Implementation

a. Environmental Setting for Running the project

Sr no.	Technology Specifications
1	Operating System Windows 7 and Higher.
2	Application Development Various Programming Languages.
3	Google Chrome or Mozilla Firefox browser

b. Detailed Description of Methods

1) Name: Signup
   Input: User credentials.
   Output: Signed up successfully.

2) Name: Login
   Input: User credentials.
   Output: logged in successfully.

3) Name: Detection
   Input: Leaf image.
   Output: Detected disease name.

c. Implementation Details

The initial step of the leaf disease detection system involves requesting users to login. As for the primary objective of the project, which is disease detection, we have conducted the detection process using our developed model. Following the completion of leaf disease detection, the system will display the identified disease to the user along with its corresponding treatment.

1. User Login: The first step involves requesting users to register by providing their username and password. User registration allows for personalized access to the system and facilitates convenient login in the future.
2. Disease Detection: The primary objective of the project is disease detection. Using a developed model, the system conducts the detection process. It's important to understand the specific details of how the disease detection is performed. This typically involves processing the acquired leaf images, applying image processing techniques, and utilizing machine learning algorithms to classify and identify diseases.
3. Disease Identification and Treatment: After the disease detection process is completed, the system displays the identified disease to the user. The identified disease could be shown through text, images, or any other suitable means. Additionally, the system provides information on the corresponding treatment for the detected disease. This information can include recommended pesticides, cultural practices, or any other relevant measures to manage or mitigate the disease.

6. Integration and Testing

Unit Testing:

Test cases	**Expected output**	**Actual output**	**pass/ fail**
Signup	Signup successful.	Signup successful	Pass
Signup	Sign Up unsuccessful.	Sign Up unsuccessful.	Pass
Login	Login successful	Login successful	Pass
Login	Login unsuccessful.	Login unsuccessful.	Pass
Upload image	Uploaded image successfully.	Uploaded image successfully.	Pass
Upload image	Uploaded image unsuccessfully.	Uploaded image unsuccessfully.	Pass

Integration Testing:

Test cases	**Expected output**	**Actual output**	**pass/fail**
Verify if the user can sign up.	Signup successful.	Signup successful	Pass
Verify if the user can sign up with wrong credentials.	Sign Up unsuccessful.	Sign Up unsuccessful.	Pass
Verify if the user can login.	Login successful	Login successful	Pass
Verify if the user can login with wrong credentials.	Login unsuccessful.	Login unsuccessful.	Pass
Verify if the user can go to next page.	Users can access next web page.	Users can access next page.	Pass
Verify If the user can upload the image.	Uploaded image successfully.	Uploaded image successfully.	Pass
Verify if the user gets the result.	Result displayed successfully.	Result displayed successfully.	Pass
Test to verify user can logout.	User logout successfully.	User logout successfully.	pass

7. Performance Analysis

User Interface - The interface offered for interacting with the system is significantly more straightforward, understated, and responsive. It is accessible to everyone with a reliable internet connection. This improves the usability and user-friendliness of the system.

User Time - When a user first visits the website, filling out the login information won't take more than one or two minutes. Users can upload a picture for use in detecting after logging in. It will only take a few minutes after the photograph has been uploaded for the results to appear.

The system's performance analysis is as follows:

1. Based on the tests and criteria, we can state that our system operates effectively.
2. It will successfully identify the illness on the leaves.
3. Depending on the project's goals and objectives, our system operates effectively and performs as expected.

8. Future Scope

- **Use of Artificial Intelligence:** With the increasing availability of data, advanced algorithms, and machine learning models, AI-based systems can be developed to accurately identify and diagnose leaf diseases. AI can analyze complex patterns in the images captured by cameras and provide quick and accurate results.

- **Integration with Precision Agriculture**: Leaf disease detection systems can be integrated with precision agriculture technologies, such as drones, sensors, and GPS mapping, to help farmers identify the areas of their fields that are affected by diseases and take targeted action to mitigate the damage.

- **Development of Portable Devices:** Portable devices, such as smartphone apps and handheld devices, can be developed for farmers to detect leaf diseases in real-time. These devices can be equipped with cameras and AI algorithms to provide quick and accurate diagnoses.

9. Applications

The existing methodology for leaf disease detection is just an optic observation by specialists. For doing this, an oversized team of continuous watching of specialists is needed, that prices will be terribly high for massive farms. At an equivalent time, in some countries, farmers don’t have correct facilities or maybe concept that they will contact specialists. Because of that consulting specialists even price high still as time overwhelming too. Thus, the system that we are developing will be useful for farmers and it will be helpful to detect the disease on the leaves of the plant with pesticide suggestion for the disease.

The applications of a leaf disease detection system can be diverse and useful in various fields. Here are some examples:

1. Agriculture: Farmers can use leaf disease detection systems to identify and treat crop diseases early, which can help prevent crop loss and increase yield.
2. Environmental monitoring: Researchers can use leaf disease detection systems to monitor the health of trees and other plant life in natural environments. This can provide valuable data on the health of ecosystems and the impact of environmental factors such as climate change.
3. Horticulture: Leaf disease detection systems can be used in horticulture to diagnose diseases in ornamental plants and ensure their continued health.
4. Forestry: Forestry professionals can use leaf disease detection systems to monitor the health of trees in forests, detect outbreaks of disease, and manage forest health more effectively.
5. Botany: Leaf disease detection systems can be used by botanists and other plant experts to identify and study various diseases and their effects on different plant species.

Overall, a leaf disease detection system can be a powerful tool for anyone working with plants, whether it be for agricultural, environmental, horticultural, forestry, or research purposes. By providing accurate and timely disease detection, these systems can help ensure the health and longevity of plants and ecosystems.

10. Installation Guide and User Manual

Step 1: Users need a good internet connection and any web browser like google chrome, Microsoft edge, etc.

Step 2: User should have to give a link or just copy paste that link on the available browser.

Step 3: The user needs to login to the system using login credentials.

a] If the user enters the correct email ID and password then it logs in successfully and redirects to the menu page.

b] If the user enters invalid email ID and password then it gives a response as Invalid details and says try again and redirects to the same page.

Step 4: User will see a home page where there are four menus – Login, New Registration, About us.

a] If the user selects Login, then he will be directed to the Login page.

b] If the user selects the New Registration menu, then he will be directed to the New Registration page.

c] If the user selects the About us menu, he will be directed to the About us page.

Step 5: When the user uploads image he will be able to see the result.

11. Plagiarism Report

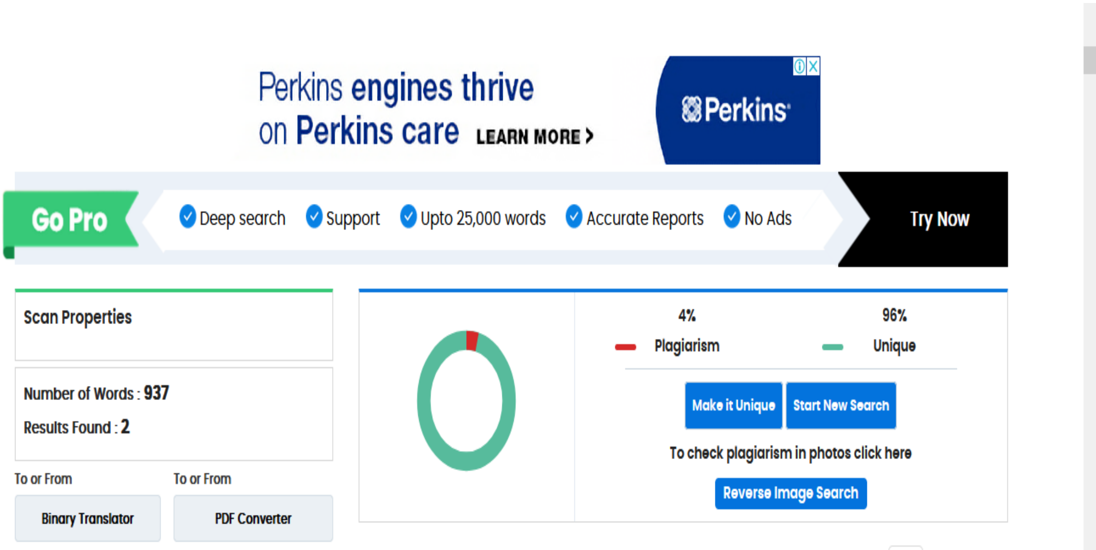

Fig. 11

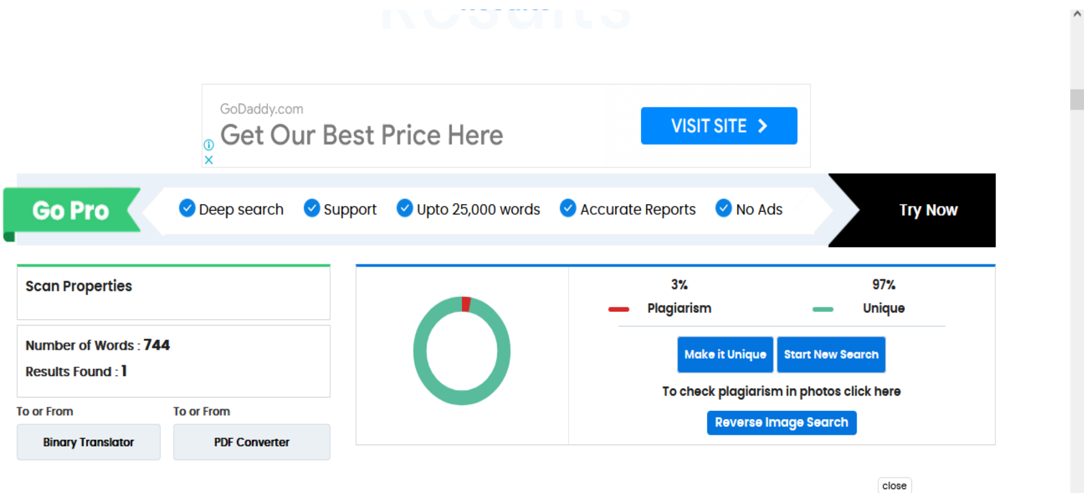

Fig. 12

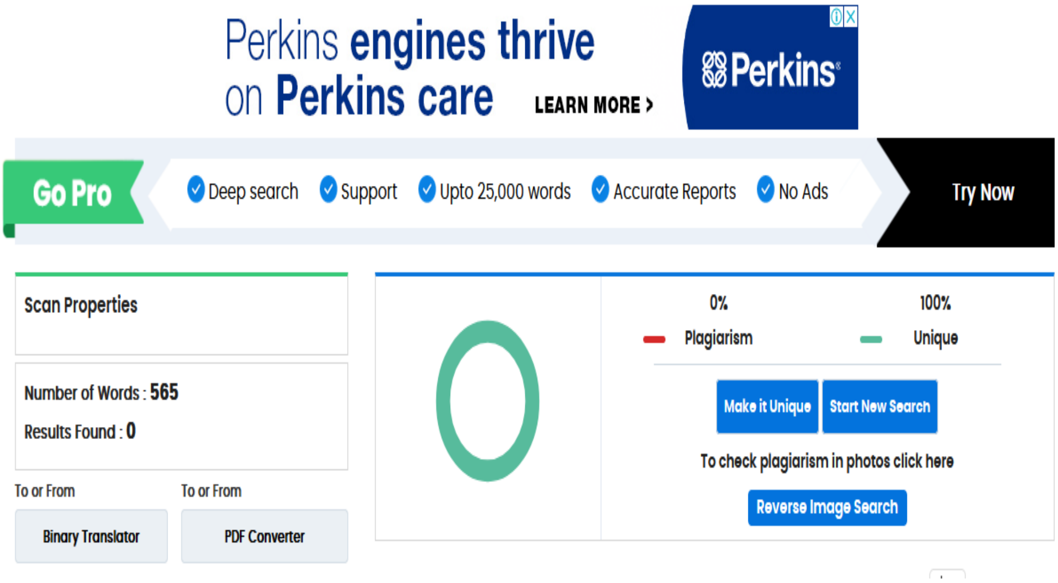
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Fig. 13

12.Ethics

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