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Software Requirements Specifications (SRS) and Software Design Specifications (SDS)

[Plant Identification with the Help Of Machine Learning]

[BTCS_G56]

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SRS

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1. Introduction

The main theme of The Plant Identification System is to facilitate the users with a mechanism using which plant recognition can be automated. The system makes it easier to recognize the plant with its respective information i.e. Scientific name, benefits, importance. The system can consist of many users. The client can use it for educational purposes. The system should provide a special feature of displaying the detail of plant.

1.1 Purpose

Plant identification is the system which recognizes plant automatically using image processing that diagnoses plant recognition, comparison, expert determination, condition conducive to plant poisoning and predictive and toxic factors that are relevant in the field of plant technology.

The plant identification is web based application, it is most reliable application for those people who have curiosity for plants and sightseer.

1.2 Scope

Plant Identification is a system which is able to classify different species of plants on the basis of their leaves using digital image processing techniques. The images are first pre-processed and then their shape, color and texture based features are extracted from the processed image. A data set is created using the extracted features to train and test the model.

1.3 Definitions

Species knowledge is essential for protecting biodiversity. The identification of plants by conventional keys is complex, time consuming, and due to the use of specific botanical terms frustrating for non-experts. This creates a hard to overcome hurdle for novices interested in acquiring species knowledge. Today, there is an increasing interest in automating the process of species identification. The

availability and ubiquity of relevant technologies, such as, digital cameras and mobile devices, the remote access to databases, new techniques in image processing and pattern recognition let the idea of automated species identification become reality. Following terms are in use:

- Machine Learning- Machine learning is a subfield of artificial intelligence, which is broadly defined as the capability of a machine to imitate intelligent human behavior.
- Tensor flow - Tensor Flow is a software tool of Deep Learning. It is an artificial intelligence library that allows developers to create large-scale multi-layered neural networks. It is used in Classification, Recognition, Perception, Discovering, Prediction, and Creation, etc.
- Dataset - A data set is an ordered collection of data or a collection of numbers or values that relate to a particular subject.
- Database - A database is information that is set up for easy access, management and updating. A database is a collection of connected information about people, locations, or things.
- Html - Hyper Text Mark-up Language is a system used to mark text for World Wide Web pages in order to obtain colors, style, pictures, etc.
- CSS - CSS is refers to “Cascading Style Sheets”. CSS is a computer language for laying out and designing web pages (HTML or XML).

1.4 Overview

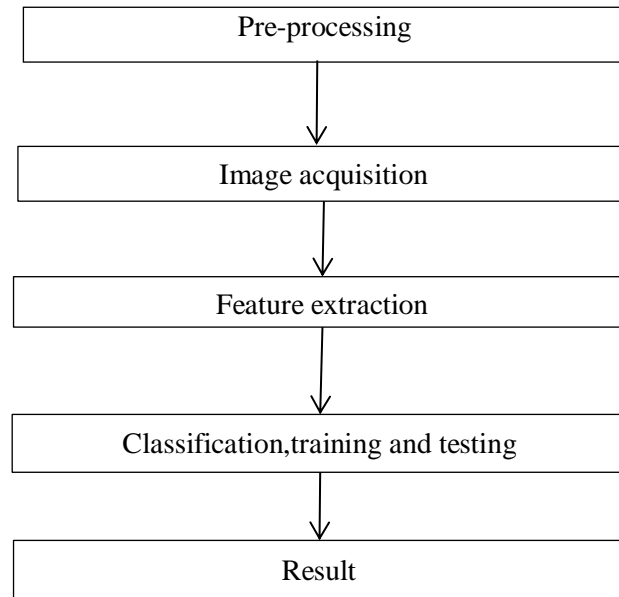
Our system is based on client-server. Firstly, the user takes a leaf or a plant photo by Android mobile. Then, this photo is sent to the server in which this photo will be analyzed in order to identify plant based on leaf/plant photo. The server contains two main modules: classification and plant identification. The identified ID of the plant will be sent to client. The client will analyze and display plant information to users. In the following sections, we will describe in detail two main modules in our system: classification module and plant identification.

2. General Description

Plant identification is not exclusively the job of botanists and plant ecologists. It is required or useful for large parts of society, from professionals (such as landscape architects, foresters, farmers, conservationists, and biologists) to the general public (like Eco tourists, hikers, and nature lovers). But the identification of plants by conventional means is difficult, time consuming, and (due to the use of specific botanical terms) frustrating for novices. This creates a hard-to-overcome hurdle for novices interested in acquiring species knowledge. In recent years, computer science research, especially image processing and pattern recognition techniques, have been introduced into plant taxonomy to eventually make up for the deficiency in people's identification abilities. We review the technical status quo on computer vision approaches for plant species identification, highlight the main research challenges to overcome in providing applicable tools, and conclude with a discussion of open and future research thrusts. One of the most obvious features of organic life is its remarkable diversity. Plant Leaf Identification is a system which is able to classify different species of plants on the basis of their leaves using digital image processing techniques. The images are first Pre-processed and then their shape, color and texture based features are extracted from the processed image. A dataset was created using the extracted features to train and test the model.

2.1 Product Function

To improve the efficiency of plant identification system, machine learning techniques can be used over human visual perception as it is more effective. It is a collection of machine learning algorithms for data mining. It contains feature selection, regression, classification and pre-processing tools.



2.2 Hardware Interfaces

For Client-

- 20 GB HardDrive space(minimum)
- Network interface software for network communication supporting TCP/IP
- Central Processing Unit
- Storage devices, input devices, output devices, internal components are the primary category of hardware.

For developer-

- Anaconda3 2022.10 (Python 3.9.13 64-bit)
- RAM 24GB for developer and evaluation use.
- Processors: CPUs, GPUs, TPUs, and FPGAs
- Modem, WAN – LAN, Ethernet Cross-Cable.

2.3 Software Interfaces

For Client-

- Browser, Internet, Operating System.

For Developer-

- Operating System-Windows 11 x64-based processor
- Deep Learning Library- Tensorflow, Keras
- Programming Language- Python, Javascript
- Frontend- HTML, CSS
- Dataset is required during development

2.4 User Characteristics

There is no such required characteristics of user using this website. The website is user-friendly and can be used by anyone.

2.5 Technologies Used

Frontend - HTML, CSS

Machine Learning - Python

3. Specific Requirements

Various interfaces for the product could be

- 1) Splash Screen
- 2) Options like Camera, Gallery

- 3) There will be a screen displaying information about product.
- 5) After capturing the plant for the Classification, the system will have popup the detail.

3.1 Functional Requirements

In Our Proposed Approach, first step is plant Image Acquisition. In this step digital plant image is captured. Then apply pre-processing step on these image. A short time later, programmed pre- handling procedures are connected to the greater part of the pictures. Pre-processing steps involves converting RGB to Grayscale Image, then apply filtering on it, then converting into binary and apply segmentation on it. After pre-processing, the important and essential task is to measure the properties of an object which is called Feature Extraction because objects have to be detected based on these computed.

3.2 Non functional Requirements

While developing any mobile application there will always be restriction to which you can implement certain features, Hence there will be often trade off during the development life cycle. So based on the app requirement the tradeoff happens. Even with all trade off there should be some minimum criteria that should be taken care for smooth performance of the application, this is where the NFR comes in to picture.

3.2.1 AVAILABILITY

Current rates of species loss triggered numerous attempts to protect and conserve biodiversity. Species conservation, however, requires species identification skills, a competence obtained through intensive training and experience. Field researchers, land managers, educators, civil servants, and the interested public would greatly benefit from accessible, up-to-date tools automating the process of species identification. Currently,

relevant technologies, such as digital cameras, mobile devices, and remote access to databases, are ubiquitously available, accompanied by significant advances in image processing and pattern recognition. The idea of automated species identification is approaching reality. We review the technical status quo on computer vision approaches for plant species identification, highlight the main research challenges to overcome in providing applicable tools, and conclude with a discussion of open and future research thrust.

3.2.2 SECURITY

Plant recognition has been gained an importance since the increment of intelligent applications in different platforms such as desktop and mobile. Each part of plant contains unique distinct pattern on it that provides effective input for neural networks in order to recognize the type of the plant correctly. In this paper, intelligent recognition system is presented to recognize and identify different types of plants using back propagation neural network and results show that the developed system is superior to recent researches .

3.2.3 RELIABILITY

Design and development of an automatic plant species identification system is a tough task. The proposed system is based on preprocessing, feature extraction and their weighted normalization and finally classification. We have surveyed contemporary technique and based on their research selected best feature set. A completely reliable system for plant species recognition is our ultimate goal.

3.2.4 PORTABILITY

The determination of growth rates in plants through portable devices has become popular, due to the advantages offered by artificial vision systems to identify and classify objects using image processing. The purpose of the research was to develop a portable system by mobile device for measuring area through image recognition.

The methodology includes 3D designs, acrylic device building, determining the area in pixels by the technique of radial basis neural networks (RBFN) directly in the RGB color space and pixel conversion to cm^2 . This system is a useful tool for the objective determination of area of particular part of plant and becomes a nationwide alternative compared to existing expensive systems. Furthermore, the system is flexible, not destructive and low cost.

3.2.5 MAINTAINABILITY

Propose texture analysis and deep learning methods for different plant recognition tasks. Texture analysis is only applied to images with unambiguous segmentation (bark and leaf recognition), whereas CNNs are only applied when sufficiently large datasets are available. The results provide an insight in the complexity of different plant recognition tasks. The proposed methods outperform the state-of-the-art in leaf and bark classification and achieve very competitive results in plant recognition “in the wild”.

SDS

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1. Introduction

In this subsection of SDS, the intended user will upload an image to the website and corresponding data will be fetched from the database and the related data will be printed as an output.

1.1 Purpose

The purpose of this SDS is to help people identify and distinguish various plants. This will collectively target Travellers, Gardners, Farmers, Nature Lovers and many others.

1.2 Scope

In this subsection:

- (1) For Frontend Designing it will use - HTML,CSS
- (2) For Backend - Machine Learning: Python.
- (3) Firstly, if the similar dataset is present in the database then the process will be continued further otherwise there will be an error.
- (4) This website will help people to recognizes a plant and its related data. The main objective of the system is to creating awareness among people regarding various benefits of plants.

1.3 Definitions, Acronyms, and Abbreviations.

Machine Learning- Machine learning is a subfield of artificial intelligence, which is broadly defined as the capability of a machine to imitate intelligent human behavior.

Tensor flow - Tensor Flow is a software tool of Deep Learning. It is an artificial intelligence library that allows developers to create large-scale multi-layered neural networks. It is used in Classification, Recognition, Perception, Discovering, Prediction, and Creation, etc.

Dataset - A data set is an ordered collection of data or a collection of numbers or values that relate to a particular subject.

Database - A database is information that is set up for easy access, management

and updating. A database is a collection of connected information about people, locations, or things.

Html - Hyper Text Mark-up Language is a system used to mark text for World Wide Web pages in order to obtain colors, style, pictures, etc.

CSS - CSS is refers to “Cascading Style Sheets”. CSS is a computer language for laying out and designing web pages (HTML or XML).

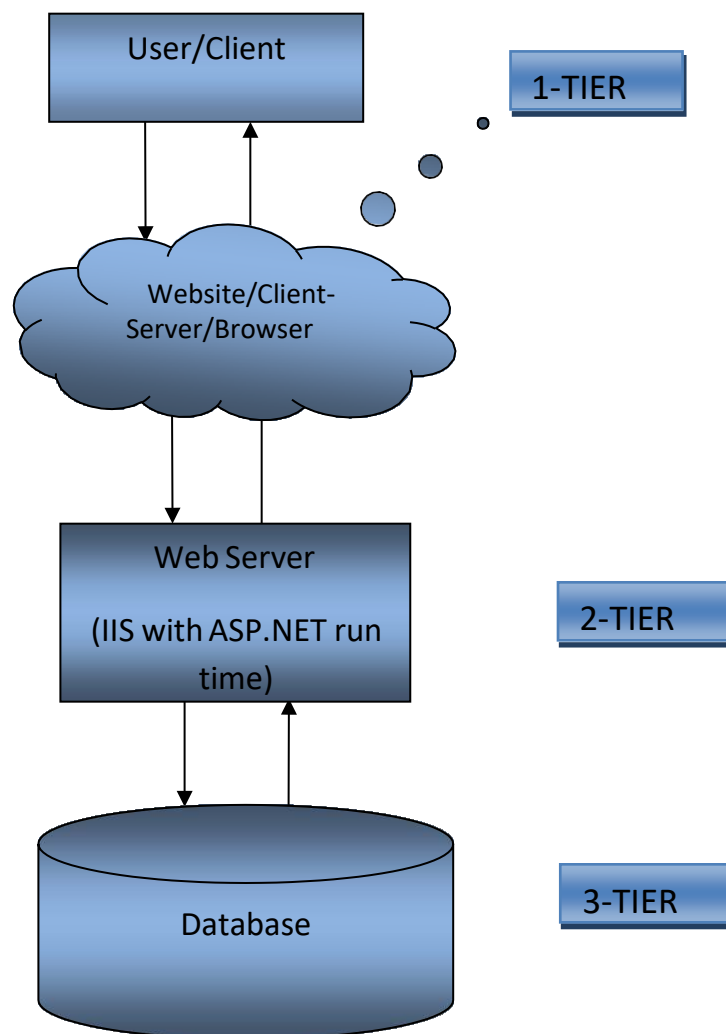
1.4 Overview

The dataset will be trained using libraries like Tensor flow and Keras in Python to find the match against the uploaded image.

2. System Architectural Design

2.1 High-level Design Overview

Pictorial representation of the system architecture is presented.



User - A user is a person or thing that uses something such as a place, facility, product, or machine.

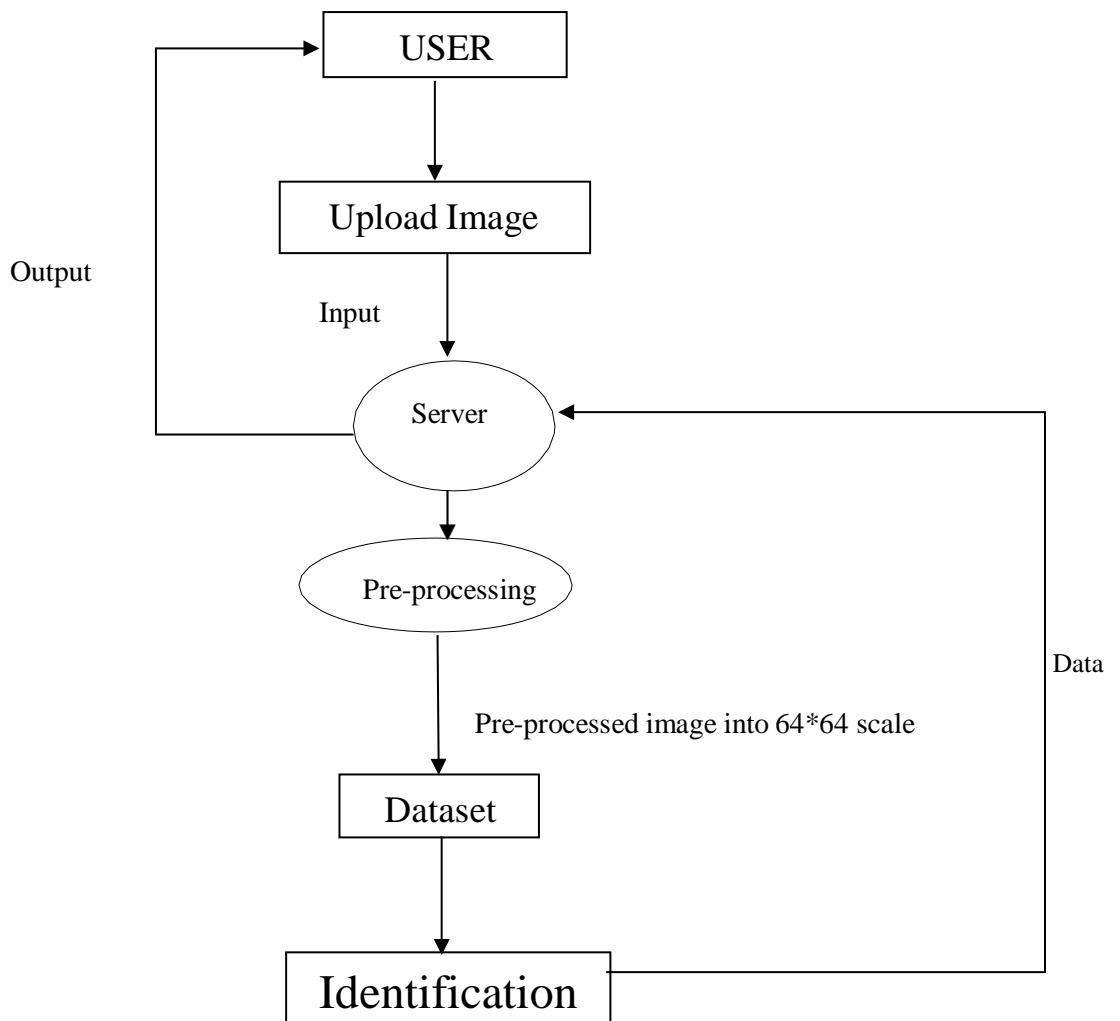
Client Server - A web client is a client-side application used for connecting to a web server over HTTP. It is typically a web browser or web app which displays web pages received from the server and allows users to interact with the web server.

Webserver - A web server is software and hardware that uses HTTP (Hypertext Transfer Protocol) and other protocols to respond to client requests made over the World Wide Web. The main job of a web server is to display website content through storing, processing and delivering web pages to users.

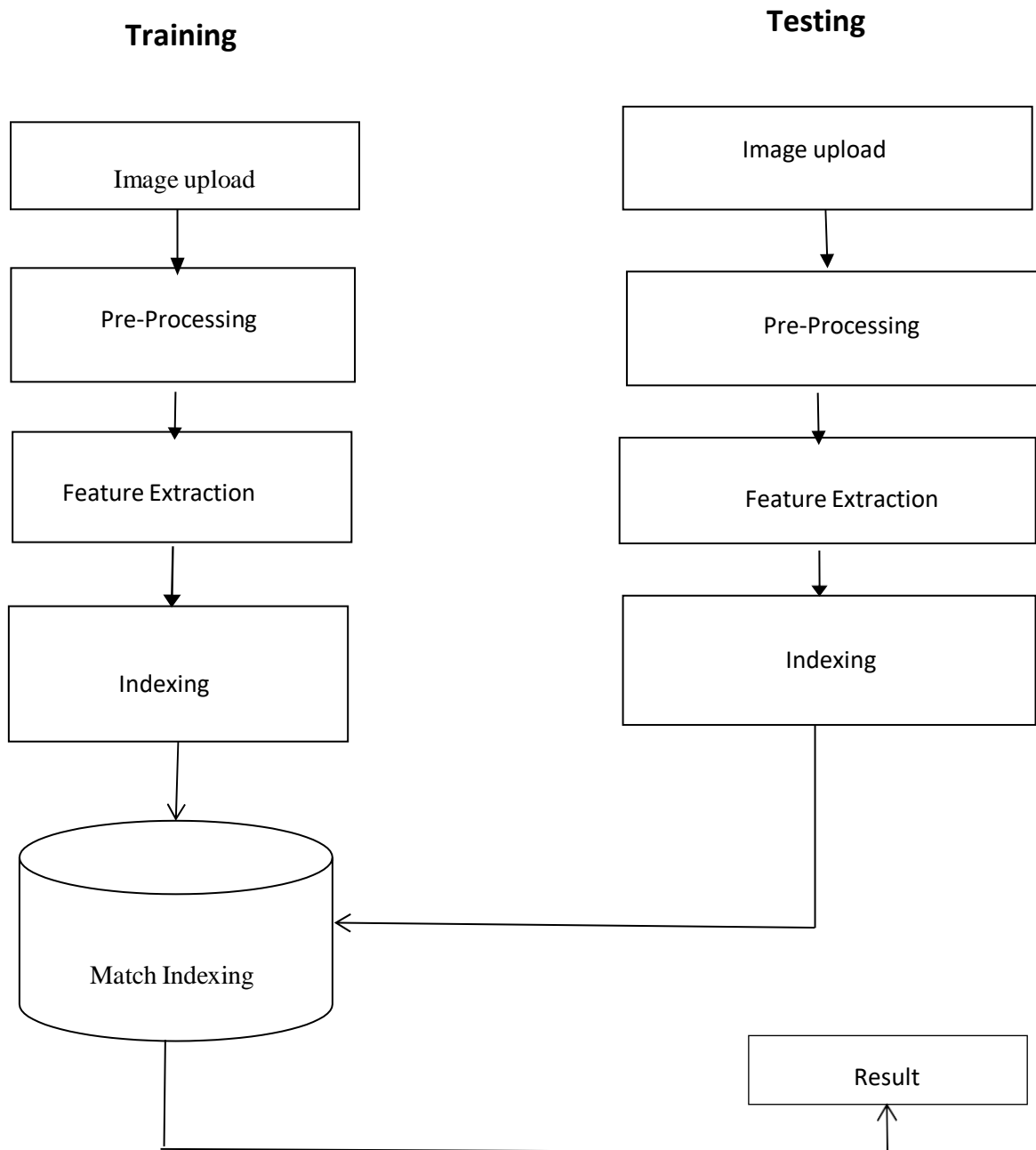
Database - A database is an organized collection of data, so that it can be easily accessed and managed.

2.2 Detailed description of components

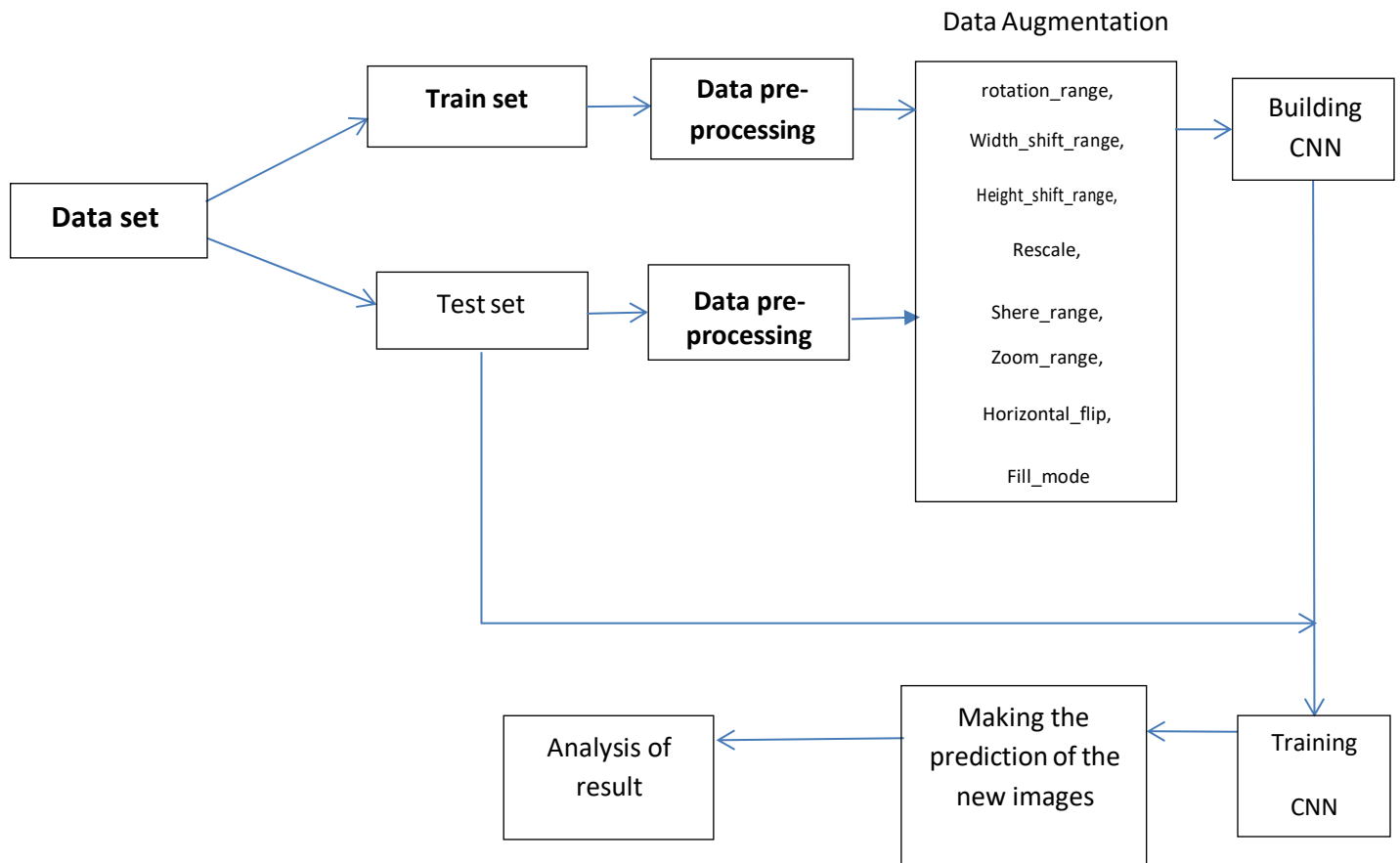
Data flow diagram-



Structure chart



Component and processing detail



3. Structure and relationships

Data Set

Crops	Fruit Plant	Industrial plant	Medicinal plant	Nuts	Tubers	Vegetable plant
Corn	Banana	Coconut	Aloe-vera	Soybeans	Cassava	Cucumber
Paddy	Guava	Tobacco	Turmeric		Sweet potato	Brinjal
	Mango		Galangal			Long beans
	Melon		Ginger			Pepper chilli
	Orange					Shallot

	Papaya					Spinach
	Pineapple					
	Water melon					

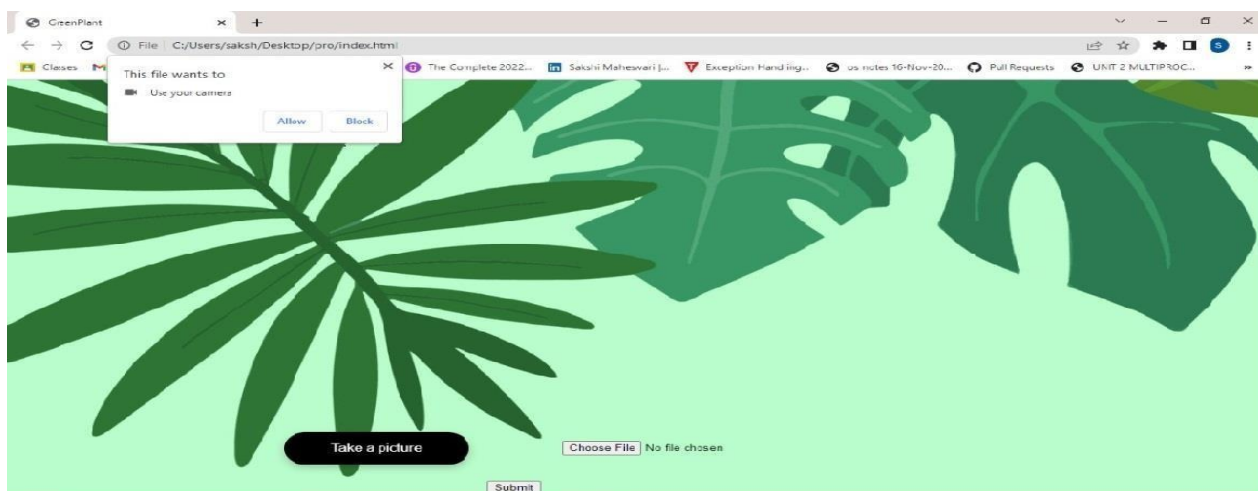
4) User Interface Design

A description of the user interface design of the software is presented.

4.1 Description of the user interface:

The web application will open with buttons named as “Take a picture” that asks the user to take the picture of the plant; “Choose a file”, that allows the user to select or upload a picture which can further be identified as a plant or not; and next is the “Submit” button that uploads the file to the server which distinguishes it.

4.2 Screen images



4. References

- <https://towardsdatascience.com/build-an-image-search-engine-using-python-ad181e76441b>
- <https://developers.arcgis.com/python/samples/train-a-tensorflow-lite-model-for-identifying-plant-species/>