Report

Fertilizers Recommendation System For Disease Prediction

Project Objective:

Agriculture plays an Essential role in economic growth of our Country. Selection of crops plays an important role in agricultural land. Major issue is that crops are being affected or destroyed in various stages of its growth. And the reasons are unavoidable and disrespectable. As a result, farmers do not gain a considerable output. Identifying the disease is one of the huge hurtles in agriculture. Most of the plants are affected by leaf disease and it's hard to find to correct fertilizer to cure. Our Agriculture department is undergoing much research to overcome all these hurtles in agriculture. We the team PNT2022TMID04159 has chosen one such problem statement and came up with the solution for it. The main objective of this project is to identify the disease in the plants and suggest suitable fertilizer for the particular disease in the early stage. In recent years, the number of diseases on plants and the degree of harm caused has increased due to the variation in pathogen varieties, changes in cultivation methods and inadequate plant protection techniques. An automated system is introduced to identify different diseases on plants by checking the symptoms shown on the leaves of the plant. Deep learning techniques are used to identify the diseases and suggest the precautions that can be taken for those diseases. The main Deep Learning algorithm used here is CNN (Convolutional Neural Network).

Project flow:

A web Application is built where

- Farmers can interact with the portal build
- Interacts with the user interface to upload images of diseased leaf
- Our model-built analyses the Disease and suggests the farmer with fertilizers are to be used

To accomplish the above task, you must complete the below activities and tasks

- Download the dataset.
- Classify the dataset into train and test sets.
- Add the neural network layers.
- Load the trained images and fit the model.
- Test the model.
- Save the model and its dependencies.
- Build a Web application using a flask that integrates with the model built.

Prior knowledge:

Prerequisites:

Hardware Specifications:

● Windows (minimum 10), Mac & Linux

● Ram - 4GB (minimum)

● Hard Disk - 100GB (minimum)

● Processor - Intel i3 (minimum), Mac M1

Software Specifications:

● Anaconda Navigator - https://www.anaconda.com/products/distribution

● Jupyter notebook.

● Google Colab - https://colab.research.google.com/

● Spyder / VS Code / Pycharm

IBM:

Build Account Creation)

● IBM Skill Build - https://www.ibm.com/academic/home

● Webmail - https:// IBM Account Creation - https://vimeo.com/742609168/1824d26a5b (Follow this video for IBM Skill sg2plmcpnl492529.prod.sin2.secureserver.net:2096/

● IBM Cloud - https://cloud.ibm.com/login

Data Collection

The first step is to download the dataset

Create Train and Test folders with each folder having subfolders with leaf images of different plant diseases. You can collect datasets from different open sources like kaggle.com, data.gov, UCI machine learning repository, etc. The folder contains the provided in the project structure section has the link from where you can download datasets that can be used for training. Two datasets will be used, we will be creating two models one to detect vegetable leaf diseases like tomato, potato, and pepper plants and the second model would be for fruits diseases like corn, peach, and apple.

Image Pre-processing

Image data augmentation is a technique that can be used to artificially expand the size of a training dataset by creating modified versions of images in the dataset.

The Keras deep learning neural network library provides the capability to fit models using image data augmentation via the Image Data Generator class.

The first step is usually importing the libraries that will be needed in the program.

Import Keras library from that library import the Image Data Generator Library to your Python script

After each code block in this tutorial, you should type ALT + ENTER or SHIFT+ENTER to run the code and move into a new code block within your notebook.

Let us import the Image Data Generator class from Keras

Import Image Data Generator Library and Configure it

Image Data Generator class is used to load the images with different modifications like considering the zoomed image, flipping the image and rescaling the images to range of 0 and 1.

There are five main types of data augmentation techniques for image data; specifically:

- Image shifts via the width shift range and height shift range arguments.
- The image flips via the horizontal flip and vertical flip arguments.
- The image rotates via the rotation range argument
- Image brightness via the brightness range argument.
- The image zooms via the zoom range argument.

An instance of the Image Data Generator class can be constructed for train and test.

Apply Image Data Generator functionality to Train and Test set.

Model Building For Fruit Disease Prediction

We are ready with the augmented and pre-processed image data, Lets begin our model building, this activity includes the following steps

- Import the model building Libraries.
- Initializing the model.
- Adding CNN Layers.
- Adding Hidden Layer.
- Adding Output Layer.
- Configure the Learning Process.
- Training and testing the model.
- Saving the model.

Model Building For vegetable Disease Prediction

We are ready with the augmented and pre-processed image data, Lets begin our model building, this activity includes the following steps

- Import the model building Libraries
- Initializing the model
- Adding CNN Layers
- Adding Hidden Layer
- Adding Output Layer
- Configure the Learning Process
- Training and testing the model
- Saving the model

Application Building

After the model is built, we will be integrating it into a web application so that normal users can also use it. The new users need to initially register in the portal. After registration users can log in to browse the images to detect the disease.

In this section, you have to build

- HTML pages - front end
- Python script - Server-side script

LITERATURE SURVEY :

S. No.	Title & Author	Year	Proposed System
1	Soil Based Fertilizer Recommendation System for Crop Disease Prediction System - P.PandiSelvi, P.Poornima	2021	The proposed system was able to analyse the soil nutrient type efficiently, kind of leaf disease present in the crop and predict the fertilizer in a proficient manner. The approach was flexible, and can be extended to the needs of the users in a better manner
2	Farmer's Assistant: A Machine Learning Based Application for Agricultural Solutions- ShlokaGupta, Aparna Bhonde, AkshayChopade , Nishit Jain	2022	A user-friendly web applicationsystem based onmachine learning and web-scraping called the 'Farmer's Assistant'. Withour system, we are successfullyable to provideseveral features -crop recommendationusing Random Forest algorithm, fertilizer recommendationusing arule based classification system, and crop disease detection usingEfficient Net mode on leaf images
3	IOT based Crop Recommendation, Crop Disease Prediction and Its Solution - Rani Holambe, Pooja Patil, Padmaja, Pawar, Hrushikesh Joshi, Saurabh Salunkhe	**2020**	The ML and IoT based suggestions will significantly educate the farmer and help them minimize costs and make strategic decisions by replacing intuition and passed-down knowledge with far more reliable data-driven ML models.

Problem statement:

In today's world agriculture plays an essential role in economic growth of our country. Cultivation is very hard in current scenario because of many natural disasters are happening every day. crop are being affected or destroyed in various stages of its growth and the reasons are unavoidable and irresectable. As a result, farmers do not gain a considerable profit. Identifying the disease is one of the huge hurtles in agriculture. Most of the plants are affected by leaf disease and it's hard to find to correct fertilizer to cure. Identifying the disease in early stage is very important and easy to cure that.

EMPATHY MAP:


EMPATHY MAP FOR FERTILISER RECOMMENDATION
What do they THINK and FEEL?
1. Why farmers suffer for not getting a considerable profit ?
2. How To Identiify the disease being affected?
3. And What Fertilizer Can be used ?
What do they HEAR?
What we here about it
What Friend say
What Influences us.
1. How to identify disease
2. Is it easy to identify solution?
What do they SEE?
What the Farmer Sells and What the Market Offers.
Environment Friends.
User Friendly
Fertilizer Recommendation
Provide Better Support
What do they SAY and DO?
Attitude in Public Experience Behavior On Others
1. What is the name of the disease?
2. How Can I choose Fertilizer For It?
3. What will happen if I dont consider hurtle serious?
PAINS
1. What happens if crop affected by disease?
What fertilizer can be used?
GAINS
1. Analyse the disease easy and early?
2. Correct fertilizer recommendation.
3. Easy to identify the disease

Project Design Phase – I

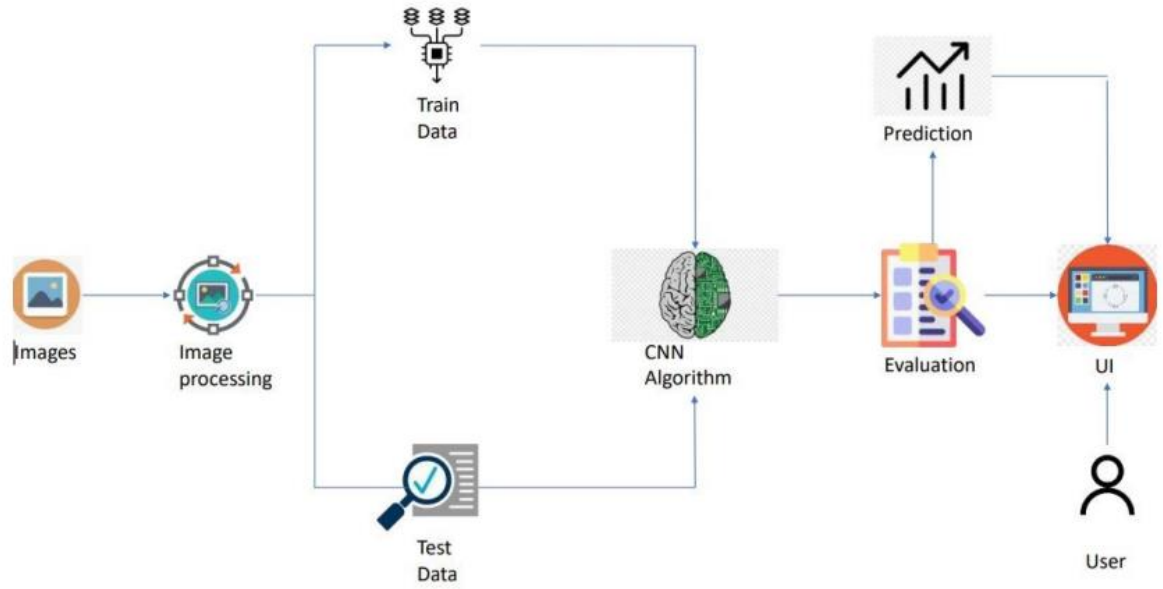
Proposed Solution Template

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	•Farmers are unable to detect crop diseases due to a lack of knowledge and old practices • Growing only certain crops depletes the soil and if the crops are harmed by illnesses
2.	Idea / Solution description	•Plant disease reduces the production and quality of food, fibre and biofuel crops. It has been a major factors that influencing the farmers life as well as our life. •To overcome this problem we develop this project to predict the plant if the crop is affected with which disease, and a viable remedy is then offered to the user.
3.	Novelty / Uniqueness	• Crop diseases detection using image processing in which user get pesticides based on disease images. • To predict the accurate disease for plant and crops we add more image dataset with wider variations are trained. •Most of the farmers are uneducated so we develop the system which is easily accessible by anyone.
4.	Social Impact / Customer Satisfaction	• Providing Complete irrigation data through cloud computing. • It helpful for farmers to increase productivity. Increase the usability of natural manure. • Efficient utilization of existing knowledge through artificial intelligence.
5.	Business Model (Revenue Model)	•As long as this system is beneficial to users, subscribtions will increase which gives benefits to industry.
6.	Scalability of the Solution	•Useful for those who don't know the basic about cultivation.

Problem – Solution Fit Template

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioural patterns and recognize what would work and why Purpose: θ Solve complex problems in a way that fits the state of your customers. θ Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behaviour. θ Sharpen your communication and marketing strategy with the right triggers and messaging. θ Increase touch-points with your company by finding the right problem-behaviour fit and building trust by solving frequent annoyances, or urgent or costly problems. θ Understand the existing situation in order to improve it for your target group.

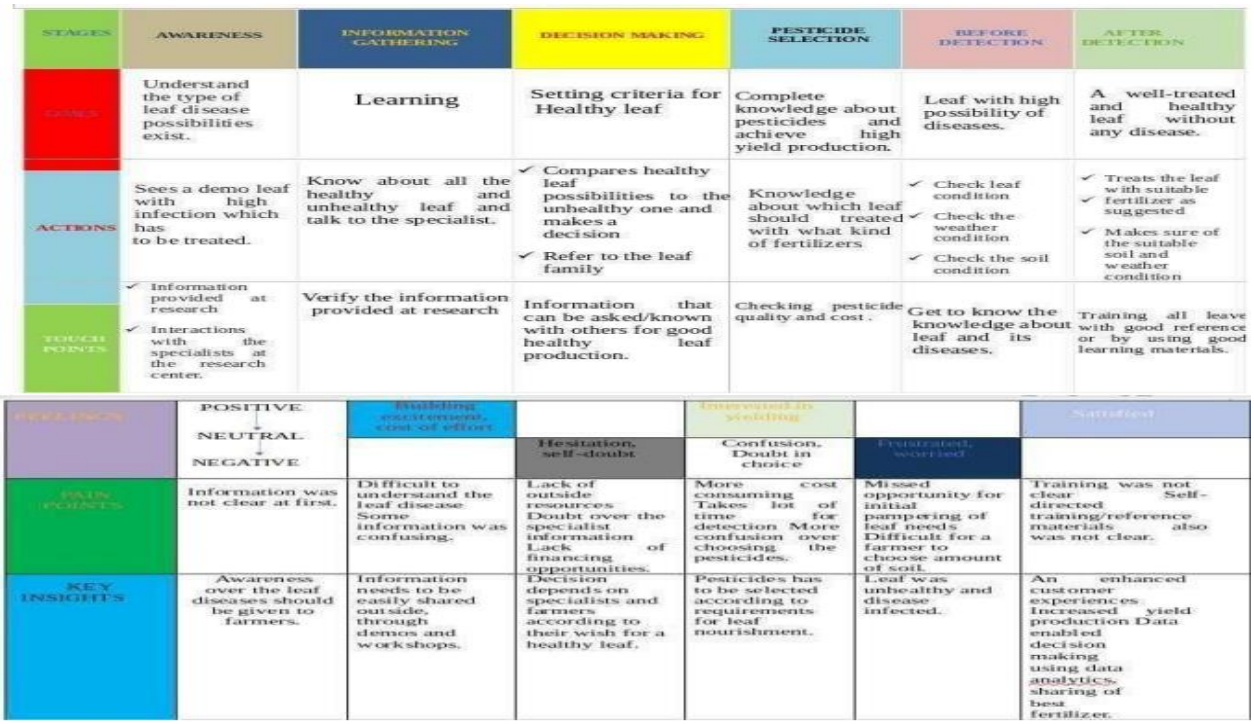
SOLUTION ARCHITECTURE:



Architecture for Fertilizers Recommendation System for Disease Prediction

PROJECT DESIGN PHASE – II

CUSTOMER JOURNEY MAP:



STAGES	AWARENESS	INFORMATION GATHERING	DECISION MAKING	PESTICIDE SELECTION	BEFORE DETECTION	AFTER DETECTION
GOALS	Understand the type of leaf disease possibilities exist.	Learning	Setting criteria for Healthy leaf	Complete knowledge about pesticides and achieve high yield production.	Leaf with high possibility of diseases.	A well-treated and healthy leaf without any disease.
ACTIONS	Sees a demo leaf with high infection which has to be treated.	Know about all the healthy and unhealthy leaf and talk to the specialist.	✓ Compares healthy leaf possibilities to the unhealthy one and makes a decision ✓ Refer to the leaf family	Knowledge about which leaf should treated with what kind of fertilizers	✓ Check leaf condition ✓ Check the weather condition ✓ Check the soil condition	✓ Treats the leaf with suitable ✓ fertilizer as suggested ✓ Makes sure of the suitable soil and weather condition
TOUCH POINTS	✓ Information provided at research ✓ Interactions with the specialists at the research center.	Verify the information provided at research	Information that can be asked/known with others for good healthy leaf production.	Checking pesticide quality and cost .	Get to know the knowledge about leaf and its diseases.	Training all leave with good reference or by using good learning materials.
FEELINGS	POSITIVE NEUTRAL NEGATIVE	Building excitement, cost of effort	Hesitation, self-doubt	Interested in yielding Confusion, Doubt in choice	Frustrated, worried	Satisfied
PAIN POINTS	Information was not clear at first.	Difficult to understand the leaf disease Some information was confusing.	Lack of outside resources Doubt over the specialist information Lack of financing opportunities.	More cost consuming Takes lot of time for detection More confusion over choosing the pesticides.	Missed opportunity for initial pampering of leaf needs Difficult for a farmer to choose amount of soil.	Training was not clear Self-directed training/reference materials also was not clear.
KEY INSIGHTS	Awareness over the leaf diseases should be given to farmers.	Information needs to be easily shared outside, through demos and workshops.	Decision depends on specialists and farmers according to their wish for a healthy leaf.	Pesticides has to be selected according to requirements for leaf nourishment.	Leaf was unhealthy and disease infected.	An enhanced customer experiences Increased yield production Data enabled decision making using data analytics. sharing of best fertilizer.

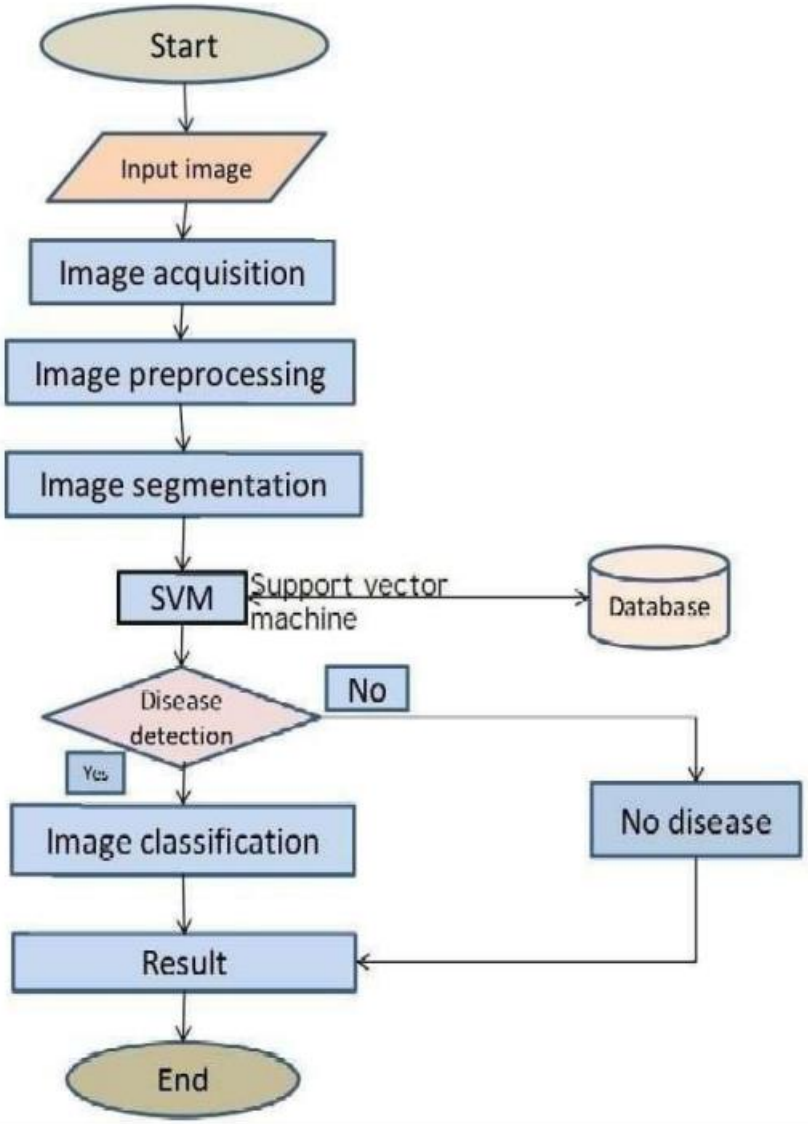
Functional Requirement

Following are the functional requirements of the proposed solution.

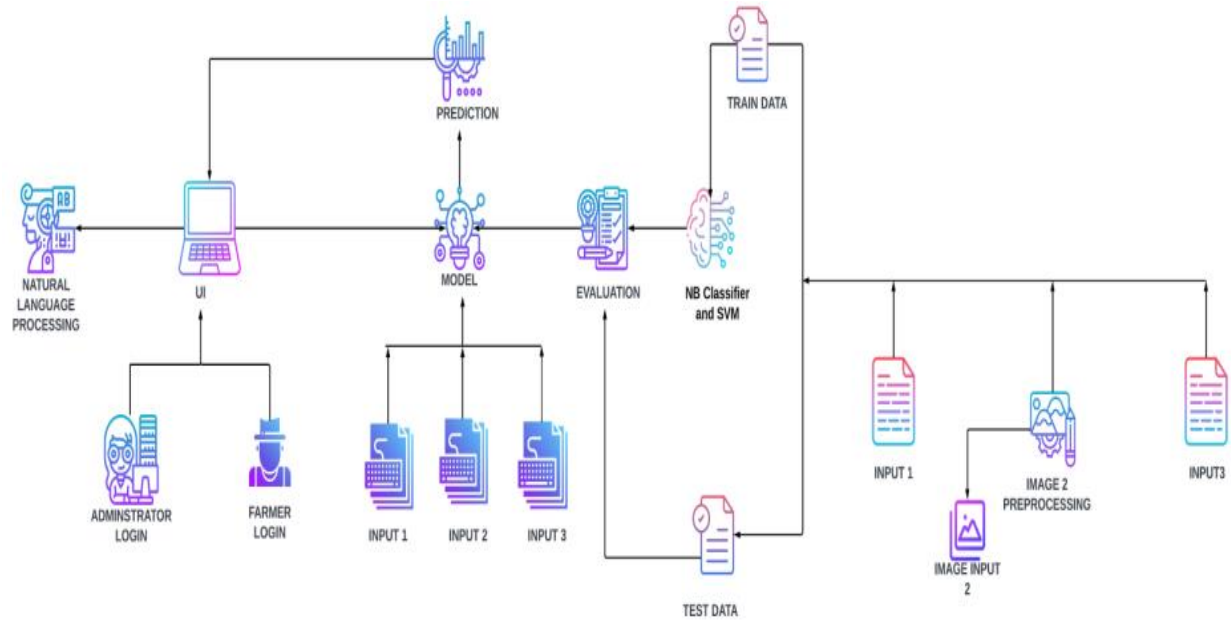
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail
FR-2	User Confirmation	Confirmation via Email
FR-3	User Profile	Filling the profile page after logging in
FR-4	Uploading Dataset (Leaf)	Images of the leaves are to be uploaded
FR-5	Requesting Solution	Uploaded images is compared with the pre-defined Model and solution is generated.
FR-6	Downloading Solution	The Solution in Excel format which contains the recommendations of fertilizers and the possible diseases.

DATA FLOW DIAGRAMS AND USER STORIES:

Data Flow Diagrams and User Stories:



Technology Stack (Architecture & Stack):



Project Outcome: