A PROJECT REPORT ON

"Crop Prediction Using Machine Learning"

SUBMITTED TO THE

SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE

In Partial Fulfillment Of The Requirement For The Award Of The Degree

BACHELOR OF ENGINEERING

IN

INFORMATION TECHNOLOGY

Submitted by

POOJA GIRAMKAR	**B150738522**
VISHAL CHAMWAD	**B150738508**
MANTHAN TAKALKAR	**B150738572**
NIKITA HIRAVE	**B150738527**

UNDER THE GUIDANCE OF

PROF. REKHA KOTWAL

DEPARTMENT OF INFORMATION TECHNOLOGY

JSPM'S Bhivrabai sawant institute of technology & research, Wagholi, Pune-412207

[2021-22]

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NAGAR ROAD, WAGHOLI, PUNE-412207

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[2021-22]

CERTIFICATE

This is to certify that the Project Entitled

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Submitted by

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is a bonafide student of this institute and the work has been carried out by him/her under the supervision of **Prof. Rekha Kotwal** and it is approved for the partial ful- fillment of the requirement of Savitribai Phule Pune University, for the award of the degree of Bachelor of Engineering (Information Technology).

(Prof. Rekha Kotwal)
Guide
Department of Information Technology

(Prof.Vidya Jagtap)
HOD
Department of Information Technology

(Dr. T. K. Nagaraj)
Principal
JSPM’s bhivrabai sawant institute of technology & research, wagholi, pune-412207

Place:

Date:

Acknowledgments

It gives us great pleasure in presenting the preliminary project report on **"Crop Prediction Using Machine Learning"**. With due respect and gratitude we would like to take this opportunity to thank our guide **Prof. Rekha Kotwal** for giving us all the help and guidance we needed. We are really grateful for his kind support. He has always encouraged us and given us the motivation to move ahead. We thank our Head of Information Technology Department, BSIOTR College of Engineering **Prof. Vidya Jagtap** she has also put in a lot of time and effort in this project along with us and given us a lot of confidence. Also we wish to thank all the other people who have helped us in the successful completion of this project. We would also like to extend our sincere thanks to Principal **Dr. T. K. Nagaraj** for his dynamic and valuable guidance throughout the project and providing the necessary facilities that helped us to complete our dissertation work. We would like to thank my colleagues friends who have helped us directly or indirectly to complete this work.

Pooja Giramkar
Vishal Chamwad
Manthan Takalkar
Nikita Hirave
(BE IT)

Abstract

Agricultural industry plays a major role in the process of economic development as well as the Gross Domestic Product of India. The lack of scientific approaches to soil fertility has become a major challenge for the industry. Since most of the farmers are not familiar with the concepts of soil nutrients, they tend to start their cultivations by assuming myths and assumptions. The project aims at suggesting the best crop based on the soil fertility and also recommends a fertilizer plan to minimize the amount of fertilizers that are needed. The project developed a cross- platform web application to suggest the best crops according to available soil fertility. Further, a fertilizer plan will be suggested on the basis of the contents of NPK Nitrogen (N), Phosphorus (P) and Potassium (K) values to optimize fertilizer usage in order to increase profitability and avoid soil degradation.

Keywords: Crop Recommendation, Fertilizer Recommendation, Machine Learning, Agriculture.

Index

LIST OF FIGURE

1. Introduction

Farming is one of the major sectors that influences a country's economic growth.

In countries like India, the majority of the population is dependent on agriculture for their livelihood. Many new technologies, such as Machine Learning and Deep Learning, are being implemented into agriculture so that it is easier for farmers to grow and maximize their yield.

In this project, I present a website in which the following applications are implemented; Crop recommendation and Fertilizer recommendation respectively.

1. In the crop recommendation application, the user can provide the soil data from their side and the application will predict which crop should the user grow.
2. For the fertilizer recommendation application, the user can input the soil data and the type of crop they are growing, and the application will predict what the soil lacks or has excess of and will recommend improvements.

Motivation:

India is a nation in which agriculture plays a prime role. The prosperity of the farmers prospers the nation. Thus our system would help farmers in sowing the right seeds based on soil requirements to increase productivity and acquire profit. As a result, farmers can plant the right crop that will increase the yield and also increase the overall productivity of the nation. Agricultural productivity mainly depends upon the soil condition which in turn depends upon nutrients present in the soil. Based on soil analysis, crops should be recommended to the farmers to increase crop productivity and in turn, increase the financial status of the farmers. Also, farmers face huge losses due to wrong fertilizer uses, we are also building fertilizer recommendation systems which will help farmers choose the right fertilizer.

Overview:

Farming is one of the major sectors that influences a country's economic growth. In countries like India, the majority of the population is dependent on agriculture for their livelihood. Many new technologies, such as Machine Learning and Deep Learning, are being implemented into agriculture so that it is easier for farmers to grow and maximize their yield.

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Agriculture is very important because it produces food and feed which is a necessity to animals and human beings. It fulfills the basic needs of billions of people. It is one of the major contributors to the country's GDP and economic growth. Hence, it is widely practiced in India. Agriculture sector requires more workforce than any other sectors, nowadays there is a huge decrease in the agricultural workforce . So, we need to fill that huge gap by making advances in agriculture with the help of technology. Thus, agricultural advancement results in gaining more profit by the farmers.

Normally, farmers can guess the final yield by their experience of growing a particular crop again and again. Farmers yield prediction accuracy is low and not cost effective. To meet the food requirements of the entire population of the country and for the export of some agricultural products to other countries, it is important to practice modern methods of farming by using technology instead of practicing traditional farming methods. Modern methods allow the farmers to cultivate the crops in small areas with a minimum amount of water ,fertilizers and pesticides ,which finally produces good yield and profit to the farmers.

3. Literature Survey

Sr. No.	Title & year	Author	Description	Advantage
1.	Soil Classification using Machine Learning Methods and Crop Suggestion Based on Soil Series (2018)	Sk Al Zaminur Rahman, Kaushik Chandra Mitra, S.M. Mohidul Islam	In this paper, we have proposed a model that can predict soil series with land type and according to prediction it can suggest suitable crops. Using Machine learning Algorithms.	Easy to use and Time consuming.
2.	Automated Soil Classification and Identification Using Machine Vision (2017)	M van Rooyen, N Luwes, E Theron	By using an automated system implementing machine vision, more accurate results can be achieved and test durations can be decreased dramati-cally.	Easy to use and Time consuming.

3.	Soil Classification & Characterization Using Image Processing (2018)	Hemant Kumar Sharma, Shiv Kumar	In Rajasthan there are various types of soil available: sandy, saline, alkaline, calcareous soil are also present, we can classify the soil by image processing method in which we can see the color, energy, HSV etc. .	Easy to use and Time consuming.
4.	Performance of SVM Classifier For Image Based Soil Classification (2016)	Sunitha.k , Dr.S.Padmavati	This paper explains support vector machine based classification of the soil types. Soil classification includes steps like image acquisition, image preprocessing, feature extraction and classification	Easy to use and Time consuming.

3. Existing System

The productivity of agriculture is incredibly low as a result of since past 20 years yields prediction so as to figure agriculture
growth of a specific country also as future direction towards investment plans on agricultural fields has been generalized by
formers based on their previous experiences. It results in state of affairs wherever farmers fail to guage the yield knowledge. In
the implementations the developers' uses the single algorithm with the single data set so it gives single output because it find
outs the relationships with the single dataset.

3.1 Disadvantages

1. Acquire a more time for process
2. Less crop yield
3. Effect soil quality

4. Proposed System

The aim of the proposed system is to help farmers to cultivate crops for better yield. The crops selected in this work are based on important crops from selected locations.

The selected crops are Rice, Jowar, Wheat, Soyabean, and Sunflower, Cotton, Sugarcane, Tobacco, Onion, Dry Chili etc.

There are 2 process in proposed work:

- Crop Yield Prediction: Crop Yield Prediction can be done using crop yield data, nutrients and location data. These inputs are passed to Random Forest and Support Vector Machine algorithms. These algorithms will predict crops based on present inputs.
- Fertilizer Recommendation: Fertilizer Recommendation can be done using fertilizer data, crop and location data. In this part suitable crops and required fertilizer for each crop is recommended.

Third Party applications are used to get Weather information, Temperature information as well as Humidity and rainfall.

4.1 Advantages

1. Achieving the maximum crop at minimum yield is the ultimate Aim of the project.
2. Early detection of problems and management of that problems can help the farmers for better crop yield.
3. For the better understanding of the crop yield, we need to study of the huge data with the help of machine learning algorithm so it will give the accurate yield for that crop and suggest the farmer for a better crop.

4.2 Disadvantages

1. The obtained result for the crop yield prediction using Decision tree gives less accuracy when compared to Gaussian naïve Bayes, Random Forest and XGBoost.

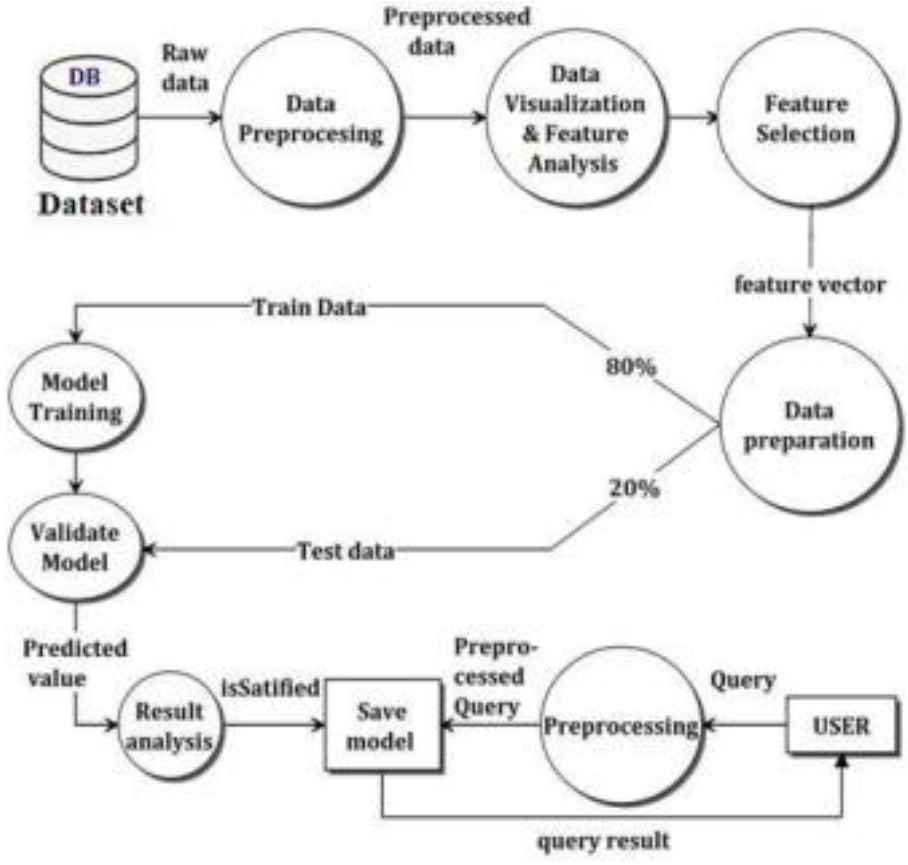
2. Previously yield is predicted on the bases of the farmers prior experience but now weather conditions may change drastically so they cannot guess the yield.

5. OBJECTIVE AND METHODOLOGY OF PROPOSED SYSTEM

5.1 Objectives:

- Agriculture is a business with risk and reliable crop yield prediction is vital for decisions related to agriculture risk management.
- The vision of meeting the world's food demands for the increasing population throughout the world is becoming more important in these recent years.
- Eventually, it helps in achieving ZERO hunger.
- Predictions could be used by crop managers to minimize losses when unfavorable conditions may occur.

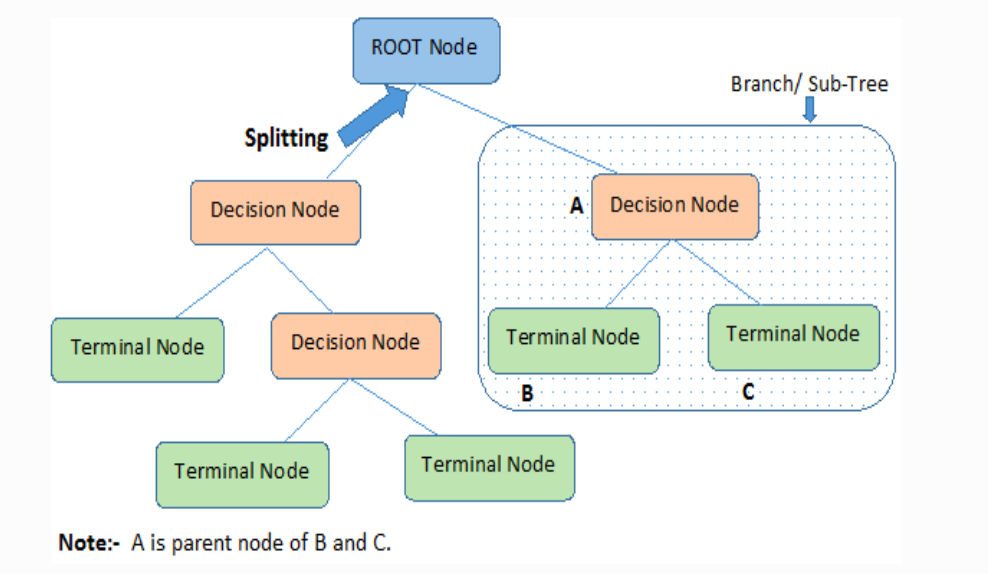
Architecture Diagram



5.2 METHODOLOGY:

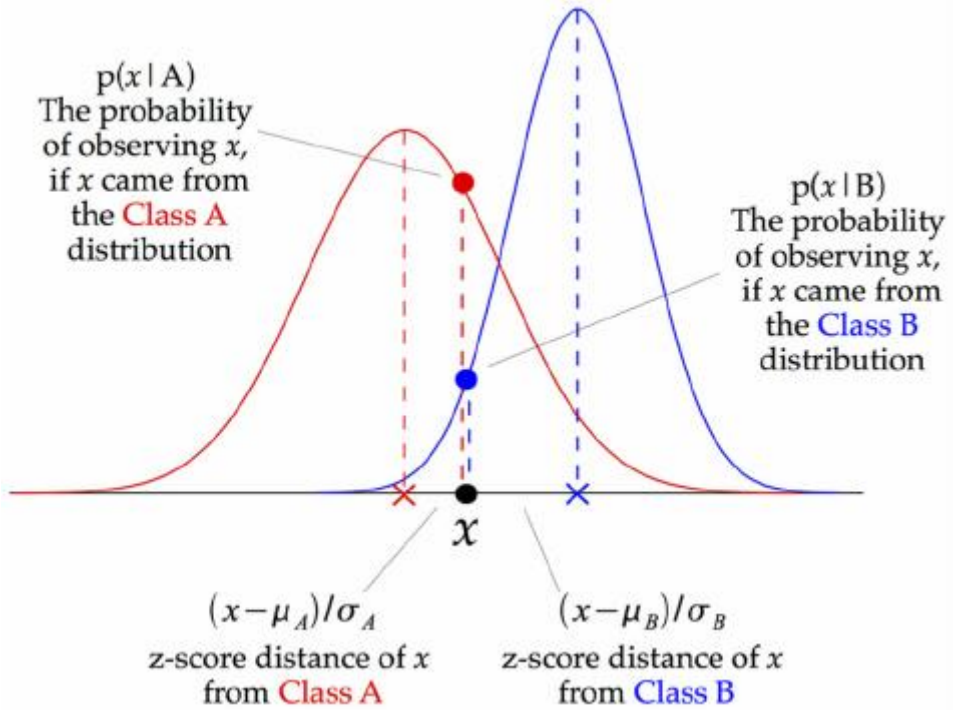
1. Decision Tree:

- The Decision Tree algorithm belongs to the family of supervised learning algorithms. The goal of using a Decision Tree is to create a training model that can be used to predict the class or value of the target variable by learning simple decision rules inferred from prior data(training data).
- Accuracy is 90.0 %



2. Gaussian Naive Bayes

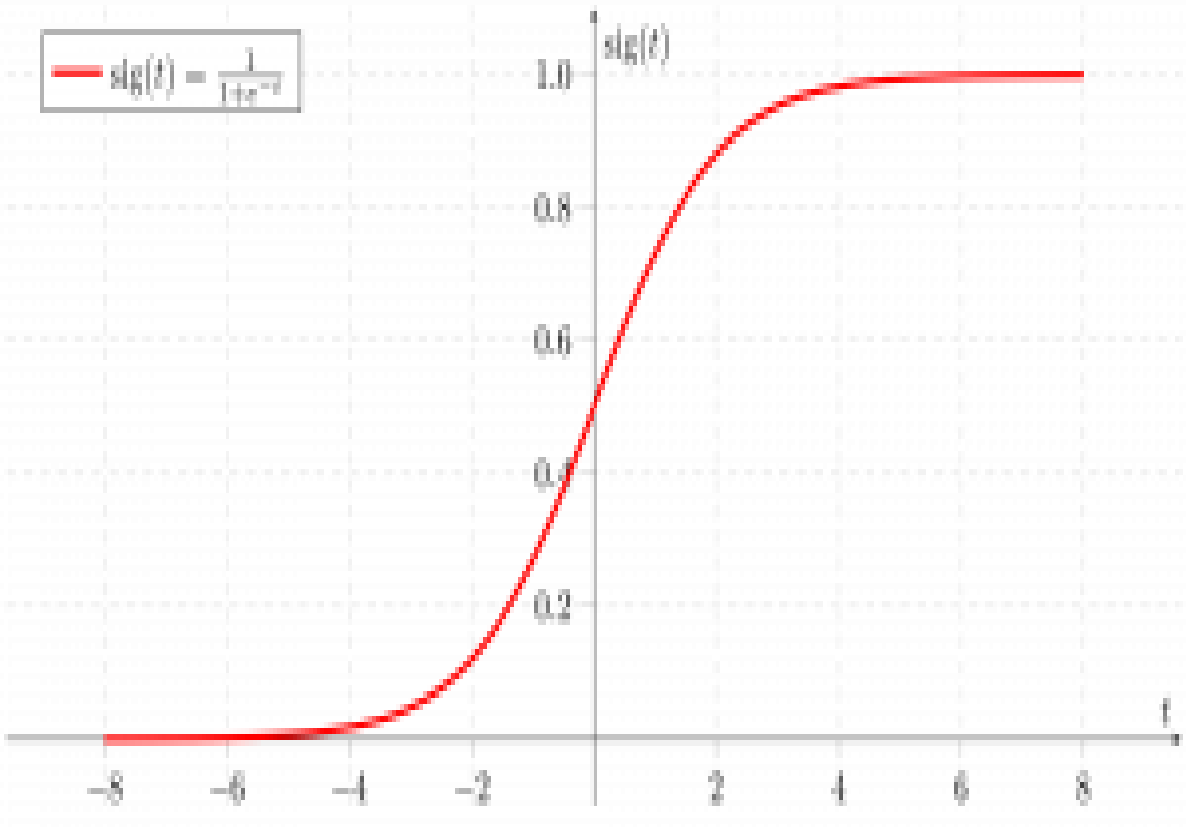
- Gaussian Naive Bayes is a variant of Naive Bayes that follows Gaussian normal distribution and supports continuous data.
- Naive Bayes are a group of supervised machine learning classification algorithms based on the Bayes theorem.
- Accuracy is 99.09 %



3. Logistic Regression:

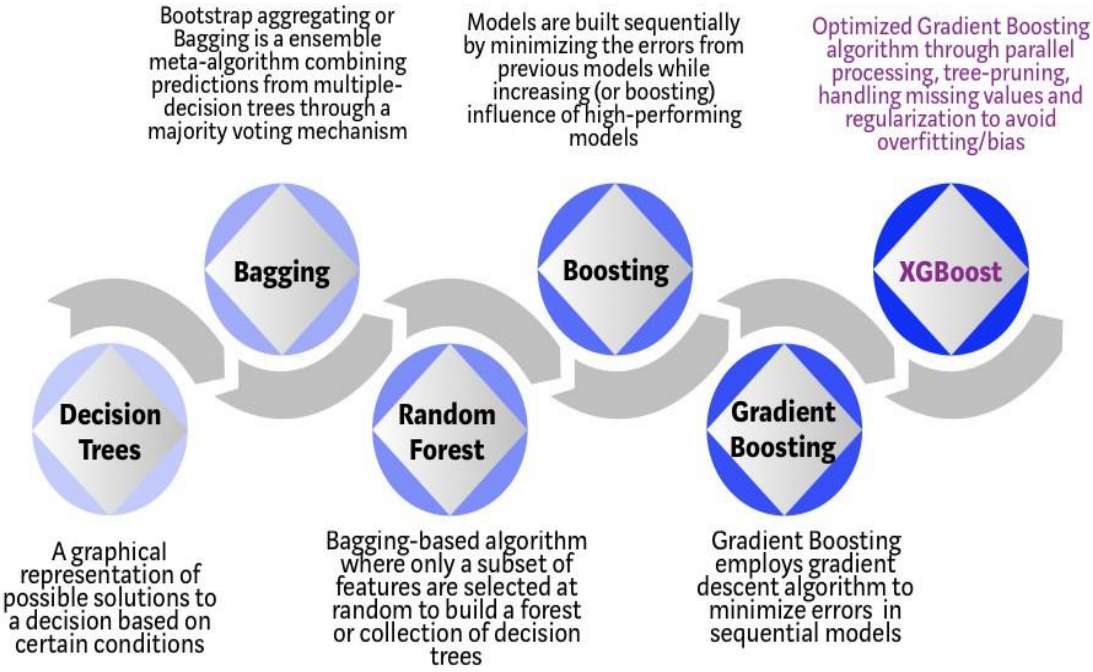
- Logistic regression is basically a supervised classification algorithm. In a classification problem, the target variable(or output), y, can take only discrete values for a given set of features(or inputs), X.
- Accuracy is 95.22 %

$$g(z) = \frac{1}{1+e^{-z}}$$



4. XGBoost:

- XGBoost is a decision-tree-based ensemble Machine Learning algorithm that uses a gradient boosting framework.
- Accuracy is 99.31 %



Dataset:

Crop Recommendation Dataset -

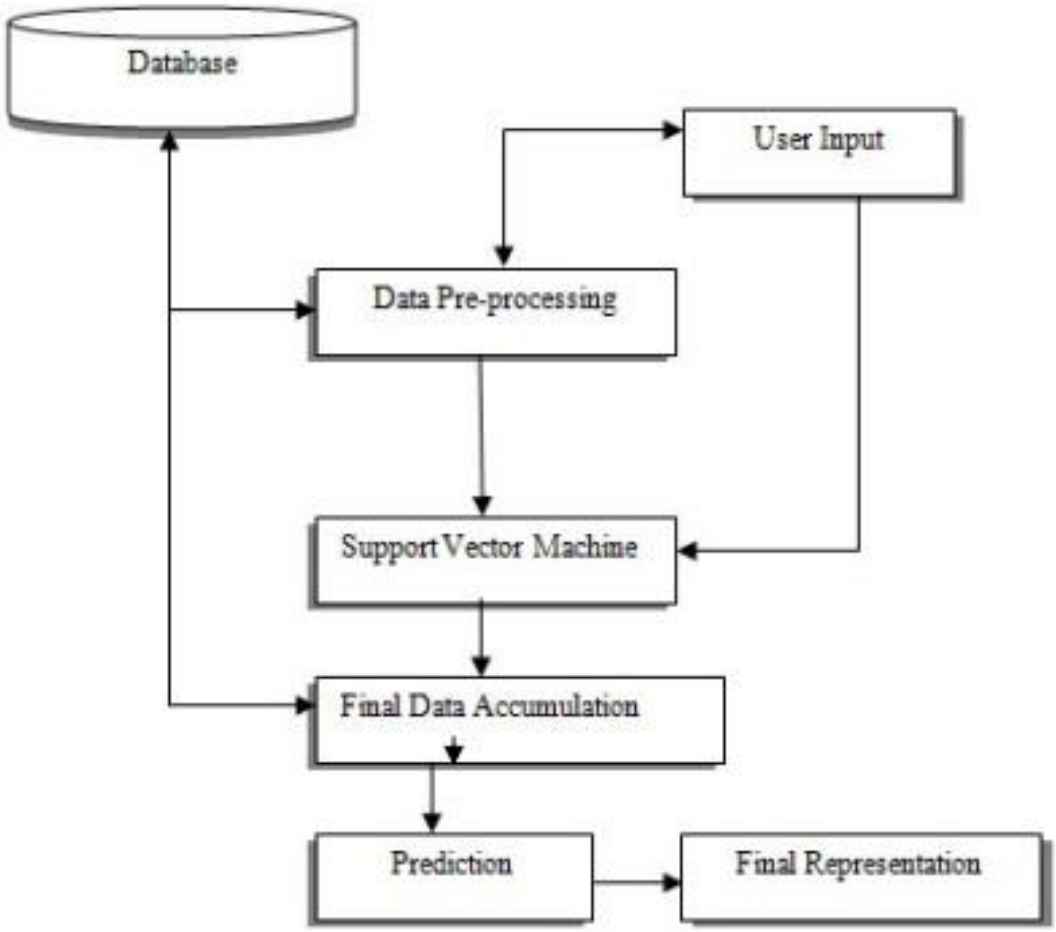
This dataset was built by augmenting datasets of rainfall, climate and fertilizer data available for India.

Data fields -

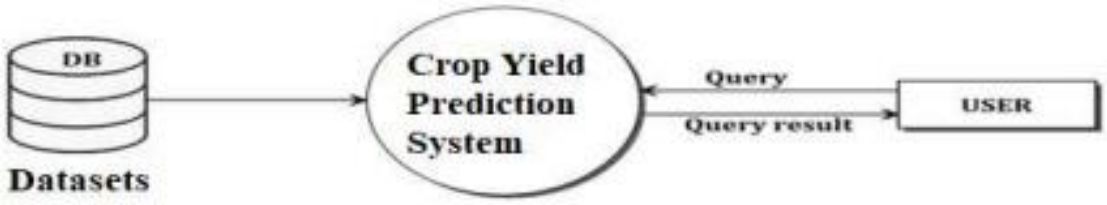
- N - ratio of Nitrogen content in soil
- P - ratio of Phosphorus content in soil
- K - ratio of Potassium content in soil
- temperature - temperature in degree Celsius
- humidity - relative humidity in %
- ph - ph value of the soil

6. System Design

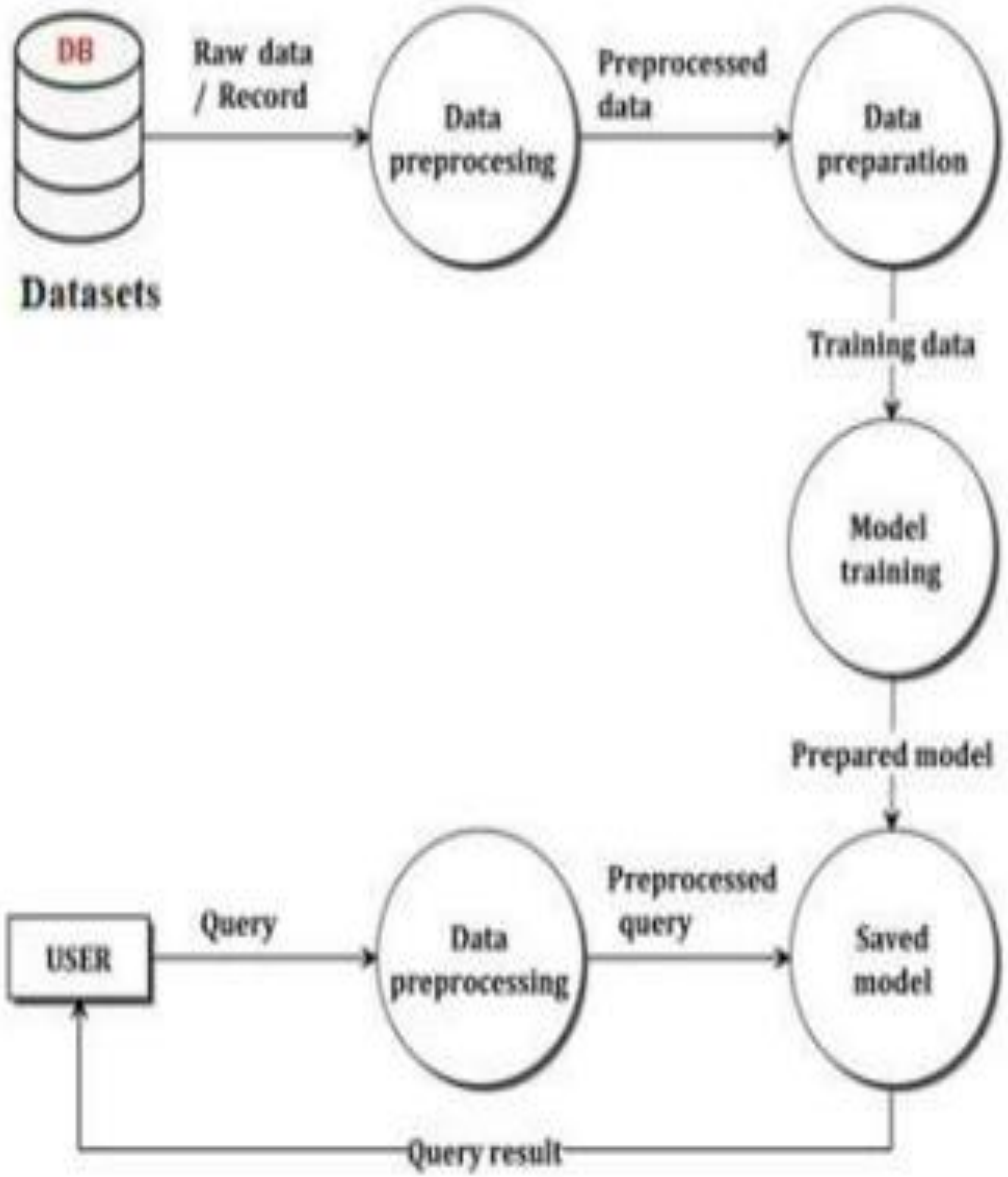
6.1 Work-flow diagram



6.2 Data Flow diagram

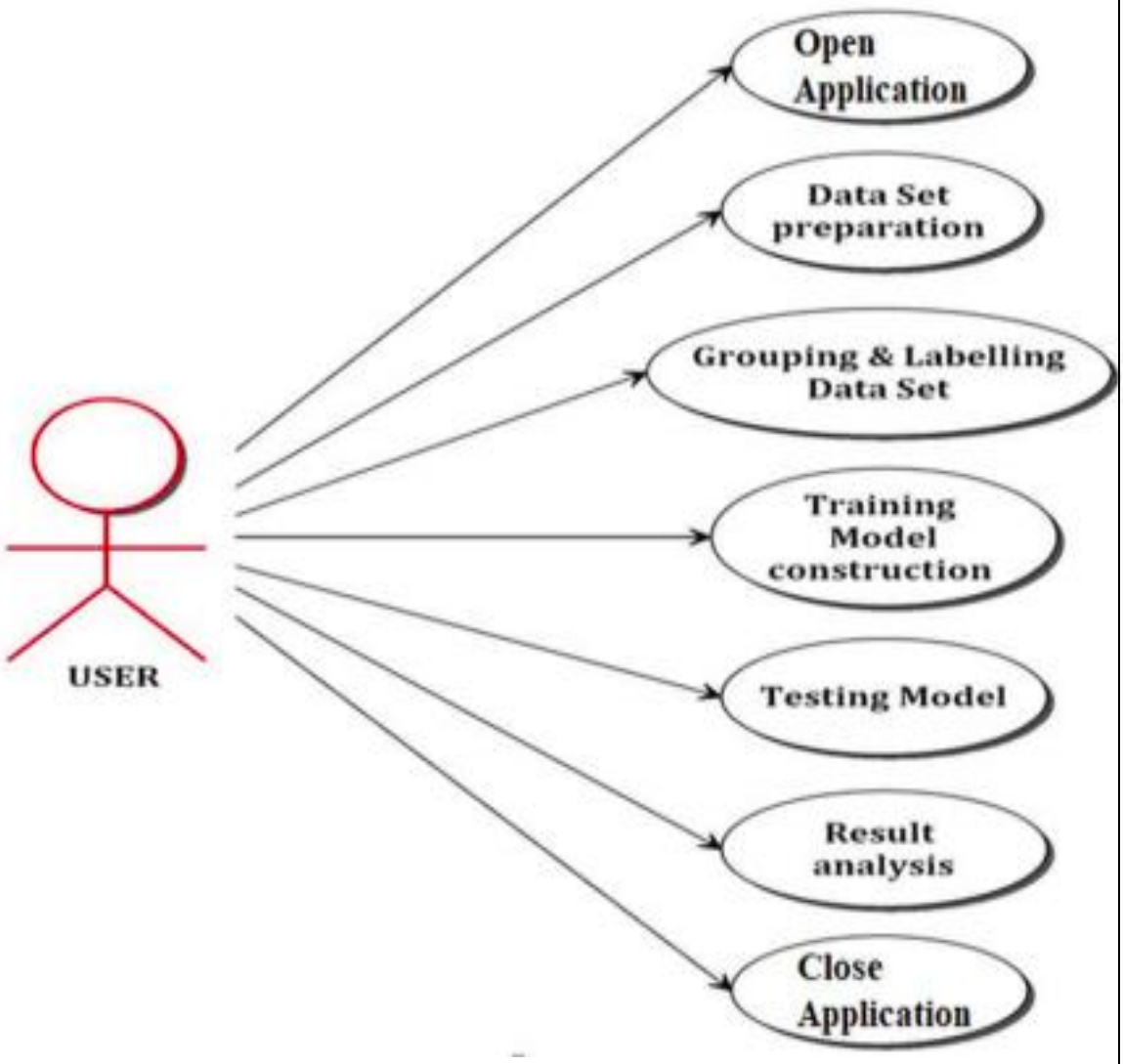


Data Flow diagram (Level 1)

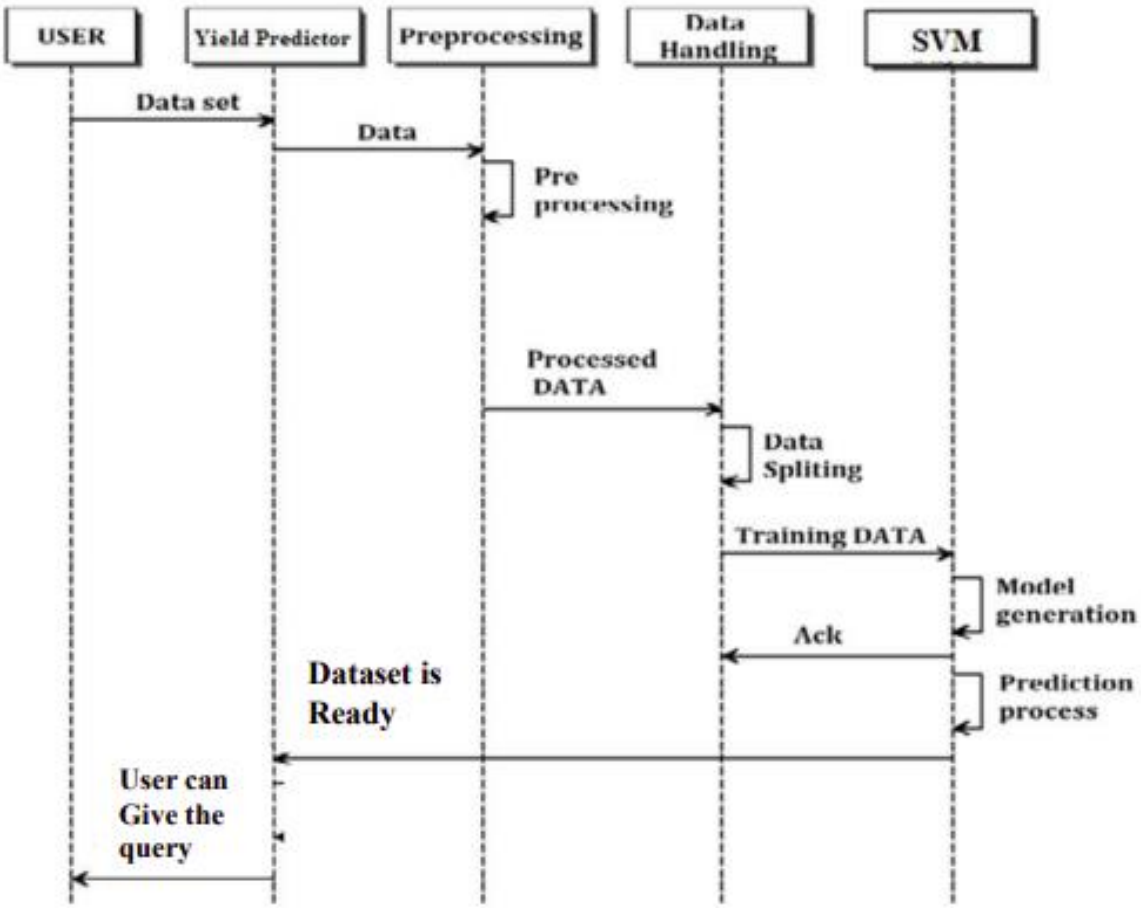


Data Flow diagram (Level 2)

6.3 Use Case diagram



6.4 Sequence diagram

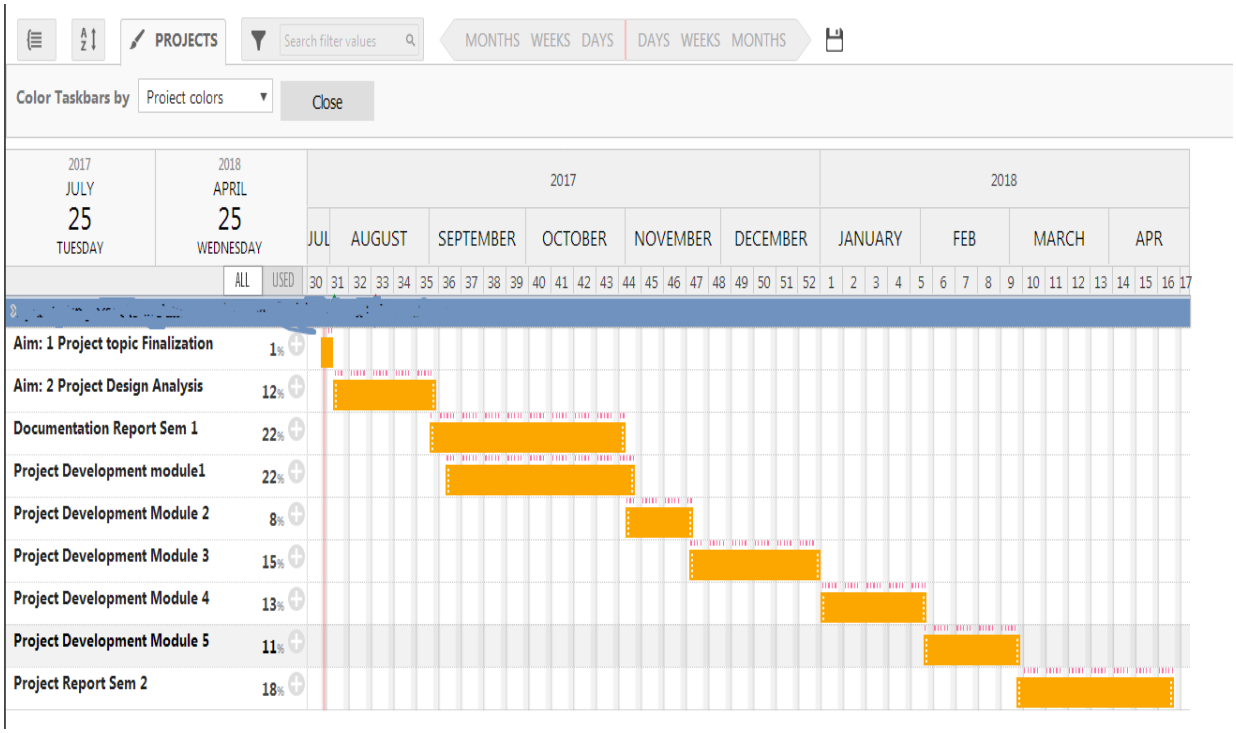


7. PLANNING AND SCHEDULING

7.1 Action Plan:

Work Task	Description	Duration
Literature Search	Related work done for conceptual data similarity	6 weeks
System analysis	Critical analysis and comparison of technologies studied and results achieved in research	4 weeks
Design and Planning	Modeling and design and dataset searching or creation	8 weeks
Implementation	Divided into phases	
Phase A	Implementation module 1	2 weeks
Phase B	Implementation module 2	2 weeks
Phase C	Implementation module 3	3 weeks
Phase D	Implementation module 4	4 weeks
System Testing	Test system quality, fix errors if any and improve if needed. Test system for differ-ent datasets	3 weeks
Intial Report	Prepare and upload Initial Report	2 weeks
Final Report	Prepare and upload Initial Report	2 weeks

7.2 PROJECT PLAN EXECUTION:



8.SOFTWARE AND HARDWARE REQUIREMENTS:

8.1 Software requirement:-

Sr.No.	Software Component	Details(Technical details with Purpose)
1	Operating System	64bit Windows 10 and on words
2	Technology	Python
3	IDE	Spyder
4	Database	DBSqlite

8.2 Hardware requirement:-

Sr.No.	Component	Details(Technical details with Purpose)
1	System Processor	Core2Duo
2	Hard Disk	150GB
3	Speed	2.4 GHz

9. FUTURE SCOPE

1. Building these particular application in the regional languages so that it would be more comfortable for farmers
2. Crop diseases detection and prevention
3. A generalized prediction module for various crops by considering other parameters like humidity and solar radiation can be developed.
4. Giving information about micronutrients also.

10. APPLICATIONS:

- We will use this system in Farming. This will help farmers to predict the crop with respect to the soil.
- Farmers can also get what Fertilizer to choose.

.

11.SOFTWARE TESTING

11.1 Types Of Testing

11.1.1 Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

11.1.2 Integration Testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration testing is specifically aimed at exposing the problems that arise from the Combination of components.

11.1.3 Regression Testing

Regression testing is a type of software testing that ensures that previously developed and tested software still performs the same way after it is changed or interfaced with other software. Changes may include software enhancements, patches, configuration changes, etc..

11.1.4.AlphaTesting

Alpha testing is a type of acceptance testing; performed to identify all possible is sues/bugs before releasing the product to everyday users or public. The focus of this testing is to simulate real users by using black box and white box techniques. The aim is to carry out the tasks that a typical user might perform. Alpha testing is carried out in a lab environment and usually the testers are internal employees of the organization. To put it as simple as possible, this kind of testing is called alpha only because it is done early on, near the end of the development of the software, and before Beta Testing.

11.1.5. Beta Testing

• Beta Testing of a product is performed by "real users" of the software application in a "real environment" and can be considered as a form of external user acceptance testing

• Beta version of the software is released to a limited number of end-users of the product to obtain feedback on the product quality. Beta testing reduces product failure risks and provides increased quality of the product through customer validation.

• It is the final test before shipping a product to the customers. Direct feedback from customers is a major advantage of Beta Testing. This testing helps to tests the product in real time environment.

11.2 TEST CASES AND TEST RESULTS

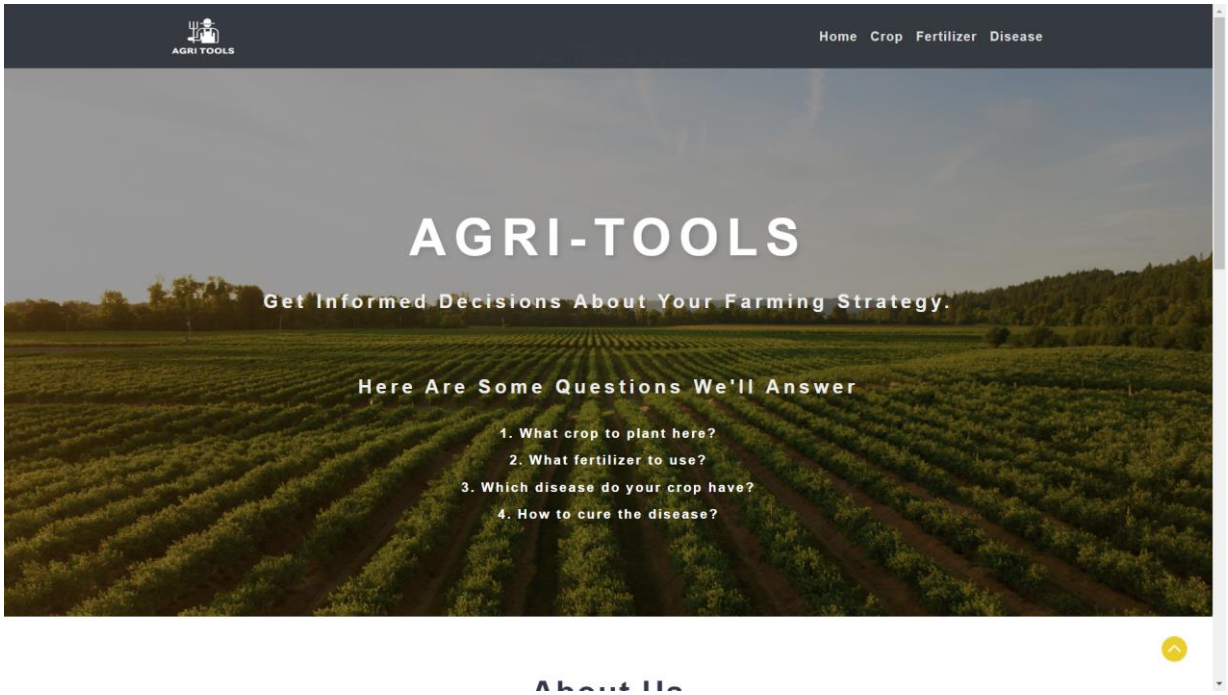
No.	Test Case	User Input	Expected Result	Actual Result	Status
1.	To verify whether the home icon is working	Click on the home icon	The home icon in navigation menu should navigate the user to home page	The home icon navigates the user to home page	Pass
2.	To verify whether the crop icon is working	Click on the crop icon	The crop icon in navigation menu should navigate the user to desired page	The crop icon navigates the user to desired page	Pass
3.	To verify whether the fertilizer icon is working	Click on the fertilizer icon	The fertilizer icon in navigation menu should navigate the user to desired page	The fertilizer icon navigates the user to desired page	Pass

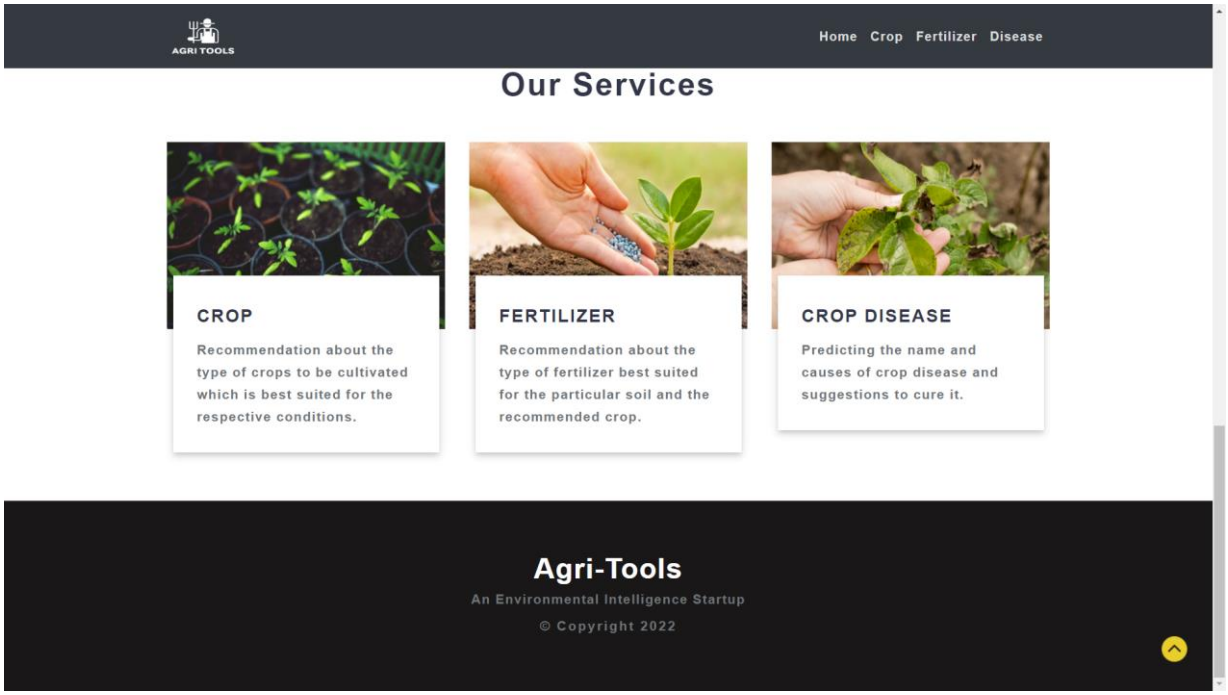
4.	To verify whether the disease icon is working	Click on the disease icon	The disease icon in navigation menu should navigate the user to desired page	The home icon navigates the user to desired page	Pass
5.	To check whether input data can be entered into the input field by the user	Enter the data into input fields	User must be able to enter the data into input filed	User is able to enter the data into input filed	Pass
6.	Prediction Button	Click on the predict button	The applicatio n shows the output to the user on clicking the predict button	The application shows the output to the user on clicking the predict button	Pass
7.	To verify whether user is able to see output page	Click on the predict button	User must be able to see the output page	User is able to see the output page	Pass
8.	To check whether user is able to see the predicted result	Click on the predict button	User must be able to see the predicted result	User is able to see the predicted result	Pass

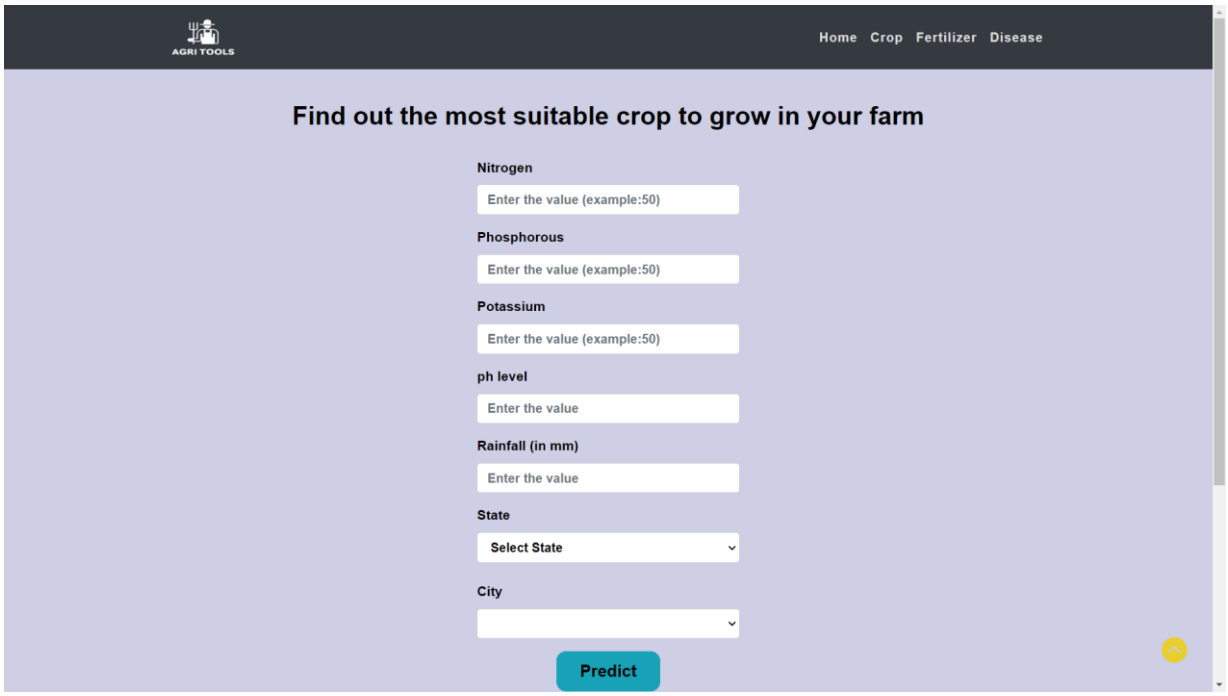
Table 10.1: Test cases

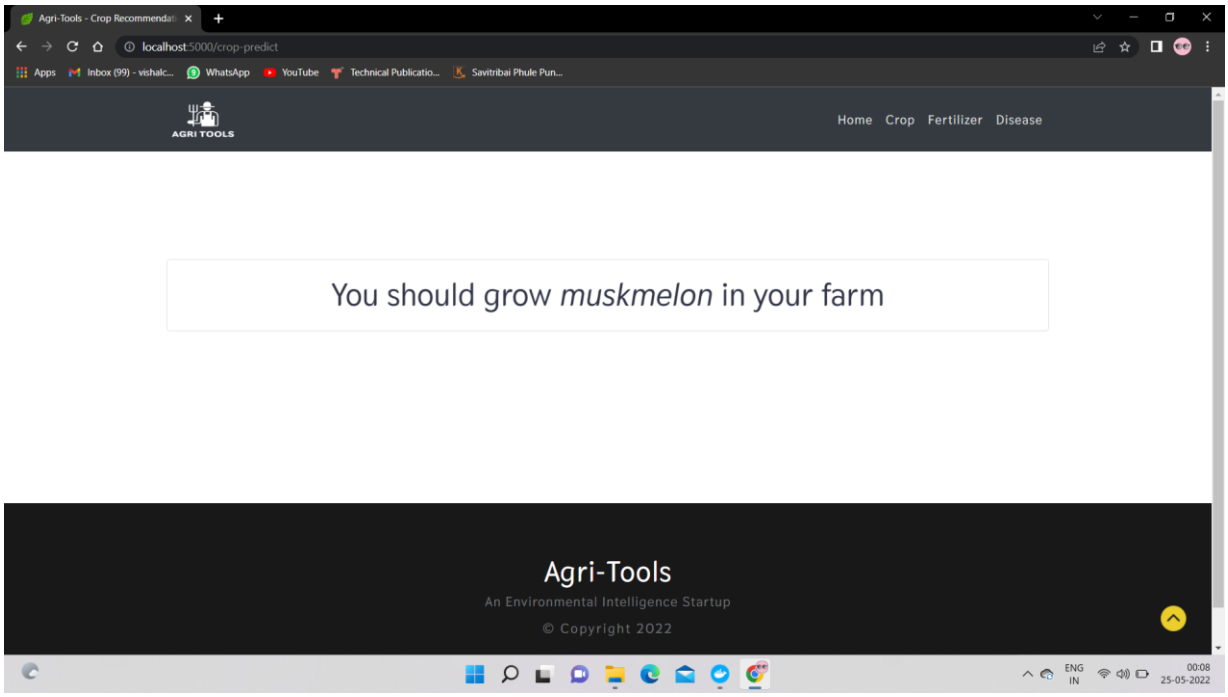
12.RESULT

HOME PAGE






AGRI TOOLS
Home Crop Fertilizer Disease
Find out the most suitable crop to grow in your farm
Nitrogen
Enter the value (example:50)
Phosphorous
Enter the value (example:50)
Potassium
Enter the value (example:50)
ph level
Enter the value
Rainfall (in mm)
Enter the value
State
Select State
City
Predict


Agri-Tools - Crop Recommendati
localhost:5000/crop-predict
Apps
Inbox (99) - vishalc...
WhatsApp
YouTube
Technical Publicatio...
Savitribai Phule Pun...
AGRI TOOLS
Home Crop Fertilizer Disease
You should grow muskmelon in your farm
Agri-Tools
An Environmental Intelligence Startup
© Copyright 2022
ENG
IN
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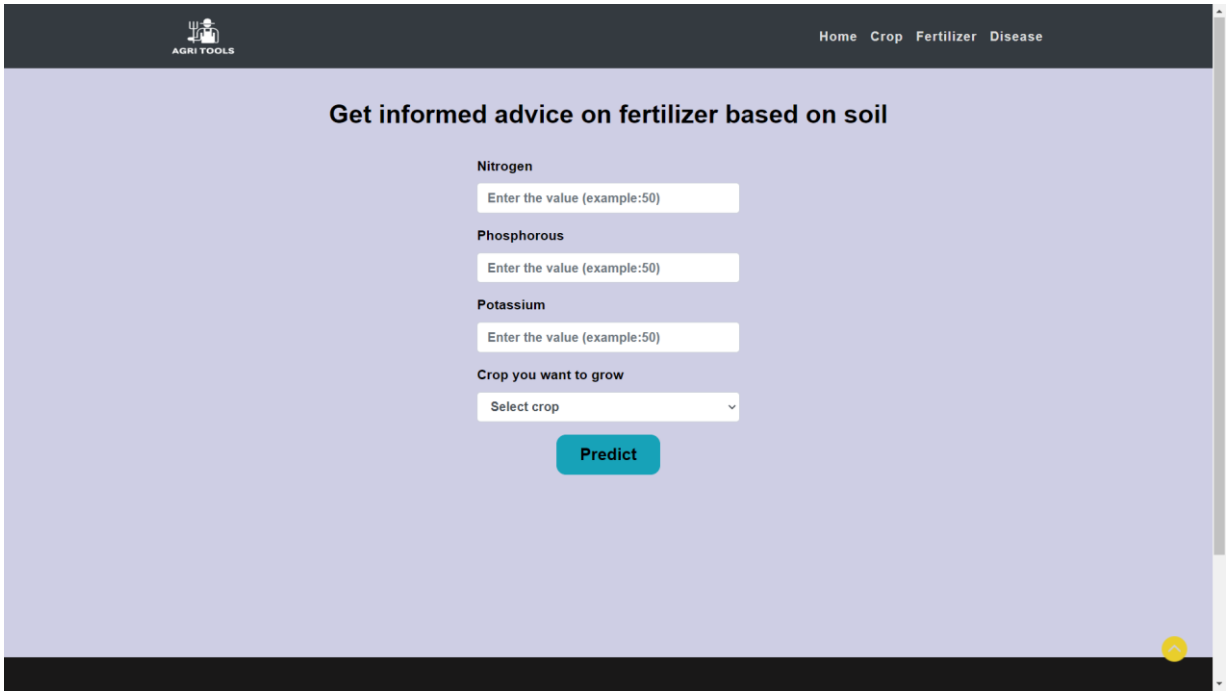
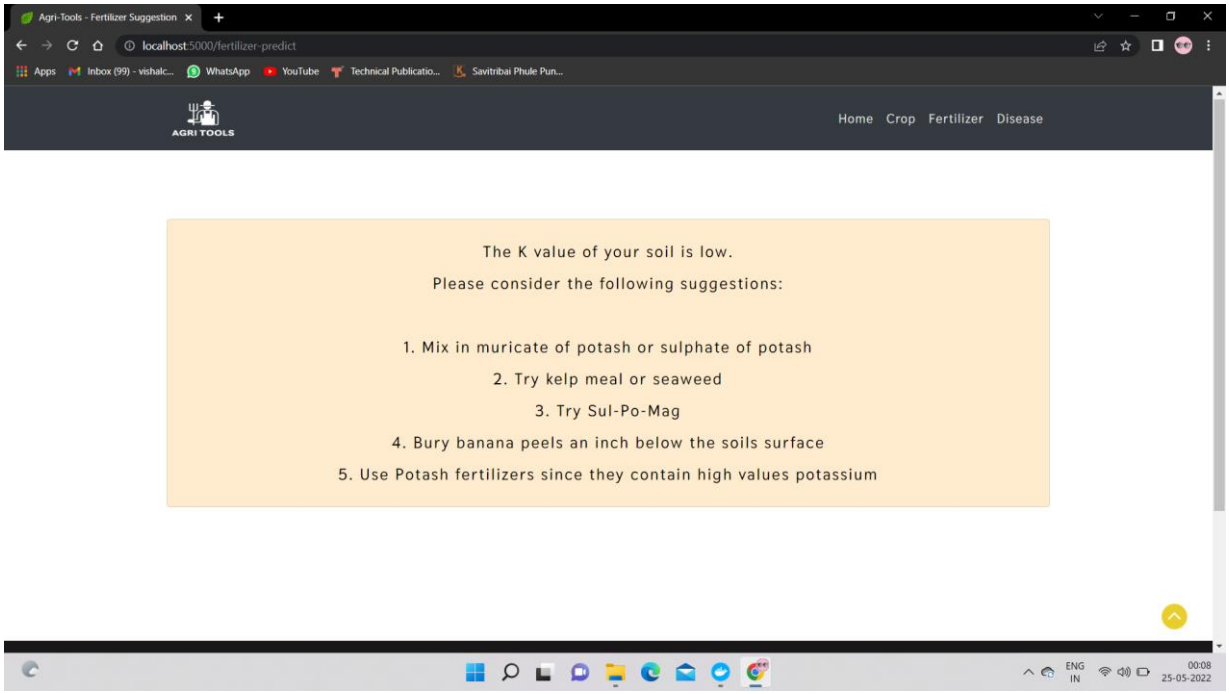
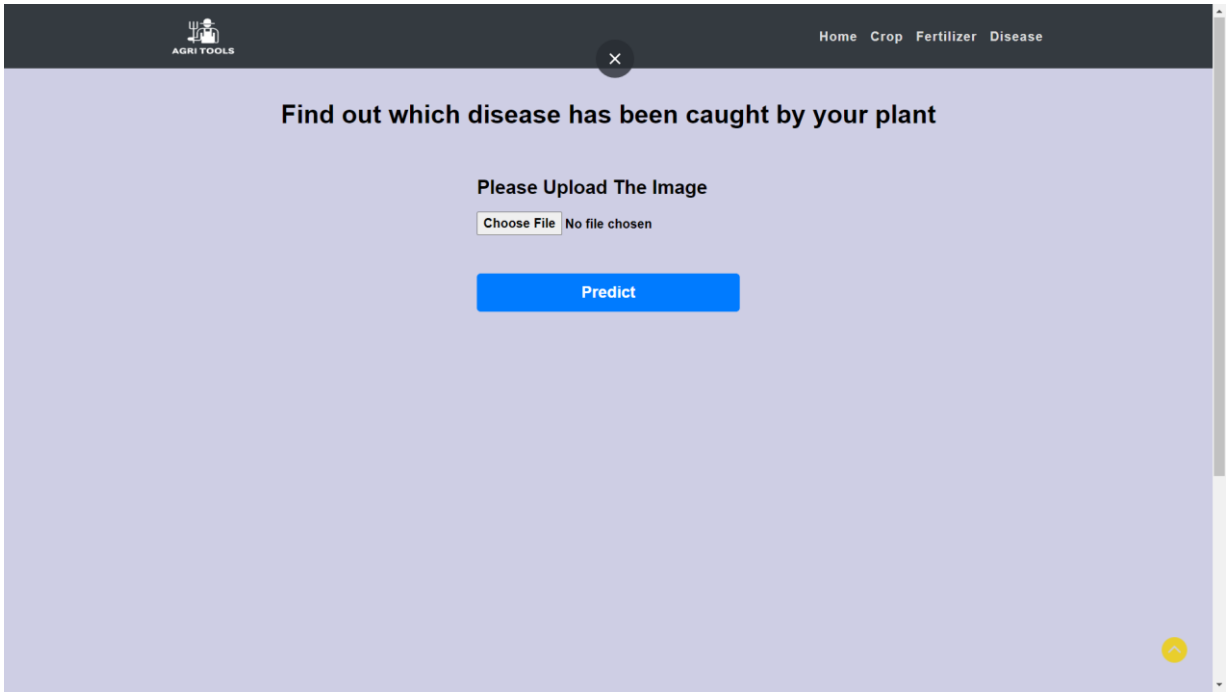
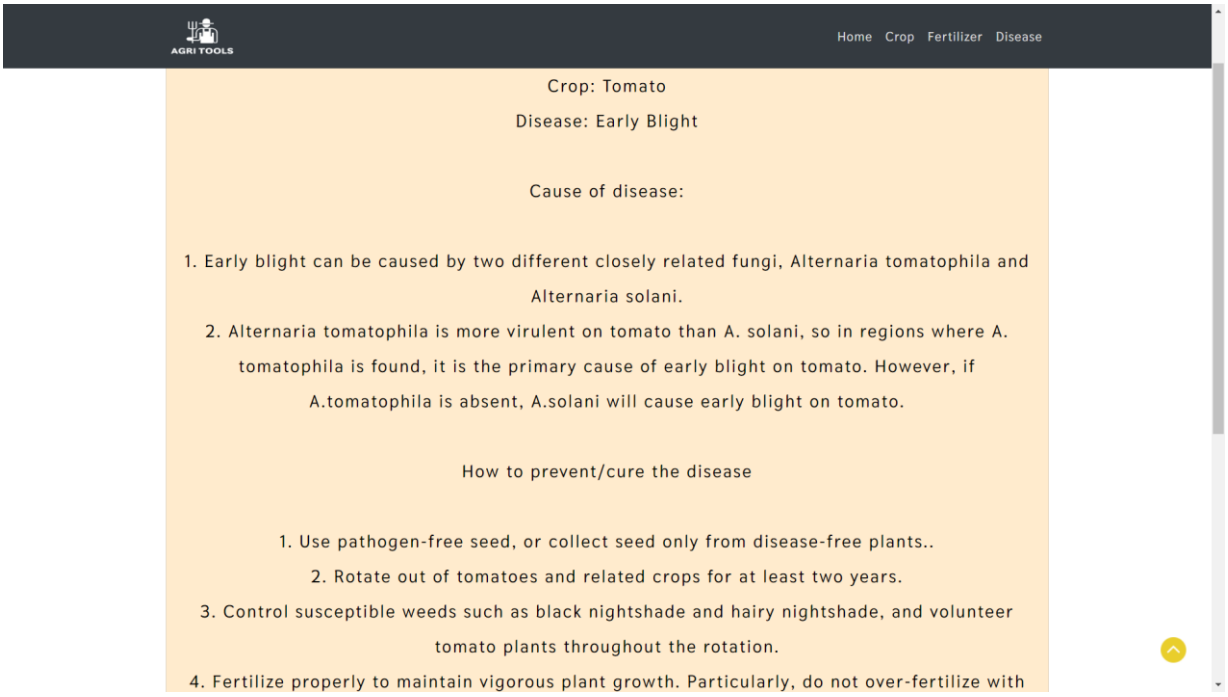

AGRI TOOLS
Home Crop Fertilizer Disease
Get informed advice on fertilizer based on soil
Nitrogen
Enter the value (example:50)
Phosphorous
Enter the value (example:50)
Potassium
Enter the value (example:50)
Crop you want to grow
Select crop
Predict


Agri-Tools - Fertilizer Suggestion
localhost:5000/fertilizer-predict
Apps
Inbox (99) - vishalc...
WhatsApp
YouTube
Technical Publicatio...
Savitribai Phule Pun...
AGRI TOOLS
Home Crop Fertilizer Disease
The K value of your soil is low.
Please consider the following suggestions:
1. Mix in muricate of potash or sulphate of potash
2. Try kelp meal or seaweed
3. Try Sul-Po-Mag
4. Bury banana peels an inch below the soils surface
5. Use Potash fertilizers since they contain high values potassium
ENG
IN
00:08
25-05-2022


AGRI TOOLS
Home Crop Fertilizer Disease
Find out which disease has been caught by your plant
Please Upload The Image
Choose File No file chosen
Predict


AGRI TOOLS
Home Crop Fertilizer Disease
Crop: Tomato
Disease: Early Blight
Cause of disease:
1. Early blight can be caused by two different closely related fungi, Alternaria tomatophila and Alternaria solani.
2. Alternaria tomatophila is more virulent on tomato than A. solani, so in regions where A. tomatophila is found, it is the primary cause of early blight on tomato. However, if A.tomatophila is absent, A.solani will cause early blight on tomato.
How to prevent/cure the disease
1. Use pathogen-free seed, or collect seed only from disease-free plants..
2. Rotate out of tomatoes and related crops for at least two years.
3. Control susceptible weeds such as black nightshade and hairy nightshade, and volunteer tomato plants throughout the rotation.
4. Fertilize properly to maintain vigorous plant growth. Particularly, do not over-fertilize with

13. CONCLUSION:

This project highlighted the limitations of current systems and their practical usage on yield prediction. Then walks through a viable yield prediction system to the farmers, a proposed system provides connectivity to farmers via a web application. The web application includes multiple features that users can leverage for the selection of a crop. The inbuilt predictor system helps the farmers to predict the yield of a given crop. The inbuilt recommender system allows a user exploration of the possible crops and their yield to make more educated decisions. For yield to accuracy, various machine learning algorithms such as Decision Tree, Gaussian Naive Bayes, Logistic Regression, Random Forest, XGBoost were implemented and tested on the given datasets. Results indicate that XGBoost gives the best result.

14. BIBLOGRAPHY :

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CodeGenix

Date: 15th December, 2021

Re: Official Sponsorship Approval letter

TO WHOM IT MAY CONCERN

Greetings from **CodeGenix Pvt. Ltd.**

We would like to confirm that
Pooja Giramkar
Vishal Chamwad
Manthan Takalkar
Nikita hirve

The Students of BE IT,
"JSPM'S Bhivarabai Sawant Institute Of Technology and Research Wagholi, Pune" are the official recipients of the scholarship, under the academic project at **CodeGenix Pvt. Ltd.**

Project name: **"Smart Crop and Fertilizer Prediction System"**

The approval consists of total expenditure required for completion of the project.

CodeGenix Pvt. Ltd. is a Software service-based company.
At CodeGenix Pvt. Ltd. we're committed to deliver speedy and cost effective services and solutions without compromising on quality.

Thank You.

Yash Gupta