Crop Disease Detection and Soil Analysis

Department : Information Technology

Group ID: 18

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Problem Definition

- This project aims to develop a computer vision-based website that can automate the identification of diseases in maize cultivation. The objective is to provide farmers with an efficient and accurate tool to protect their crops and minimize potential losses.
- Additionally, the project proposes the use of machine learning algorithms to estimate agricultural output, which can assist farmers in selecting suitable crops based on soil type and weather conditions.
- The website aims to provide a user-friendly portal that offers farmers a one-stop-shop for information about crop selection and soil type, facilitating informed decision-making.
- Ultimately, the project aims to improve crop yield and increase profitability for farmers by providing them with advanced technology and data-driven insights.

Literature Survey

Sr. No	Title	Authors	Year	Abstract
1	OPNN: Optimized Probabilistic Neural Network based Automatic Detection of Maize Plant Disease Detection	E. Akanksha, N. Sharma and K. Gulati.	2021	The proposed method uses an optimized probabilistic neural network (OPNN) to classify the maize plant images into healthy or diseased categories. The OPNN model is optimized using a particle swarm optimization (PSO) algorithm to improve its accuracy. Experimental results demonstrate that the proposed OPNN model achieves high accuracy in detecting maize plant diseases, outperforming traditional machine learning algorithms.
2	Plant diseases detection using image processing techniques	S. K. Tichkule and D. H. Gawali	2016	This project provides a survey of various methods used for plant leaf disease detection using image processing techniques. The k-nearest-neighbor method is simple but slow, while neural networks are tolerant to noise but have complex structures. Support vector machines (SVM) were found to be competitive with other machine learning algorithms for classifying high-dimensional data sets.

Literature Survey

Sr. No	Title	Authors	Year	Abstract
3	Identification of Maize Leaf Diseases Using Improved Deep Convolutional Neural Networks	X. Zhang, Y. Qiao, F. Meng, C. Fan and M. Zhang.	2018	This research paper proposes an improved CNN model to identify maize leaf diseases. The model consists of convolutional and pooling layers, fully connected layers, and a soft-max classifier. To enhance performance, techniques like data augmentation, dropout regularization, and transfer learning were applied. Experimental results show that the proposed model achieved an accuracy of 96.5%, outperforming several deep learning and traditional machine learning models.
4	Soil Analysis Using Visible and Near Infrared Spectroscopy	Wetterlind, Johanna & Stenberg, Bo & Viscarra Rossel, Raphael.	2013	Soil nutrient content, including nitrogen, phosphorus, and potassium were estimated using near-infrared (NIR) spectroscopy and machine learning algorithms. The authors achieved good prediction accuracy using partial least squares regression (PLSR) and random forest algorithms.

Literature Survey

Sr. No	Title	Authors	Year	Abstract
5	Soil analysis and crop fertility prediction using machine learning	Jagdeep Yadav, Shalu Chopra, Vijayalakshmi M	2021	A model for predicting soil fertility, crop prediction, and crop yield based on soil and crop datasets from the Indian region using machine learning algorithms. The model was tested using different algorithms and found that the Artificial Neural Network (ANN) had the highest accuracy in all three predictions. .
6	Soil moisture prediction using machine learning	S. Prakash, A. Sharma and S. S. Sahu	2018	This paper presents a study on the use of machine learning methods to predict soil moisture in advance. The study utilized multiple linear regression, support vector regression, and recurrent neural network models for the prediction. The results showed that multiple linear regression outperformed support vector regression and recurrent neural network.

Scope (Functional Requirements)

Disease Detection and Diagnosis

The website should be able to analyze images of crops and accurately identify the presence of diseases.

Customized Treatment Options

The website should be able to provide information on the type of disease identified and recommend appropriate treatment options.

Smarter Crop Selection

The website should provide farmers with information on crop selection based on soil type and weather conditions.

Predictive Yield Analysis

The website should be able to estimate agricultural output based on various factors such as weather, soil type, and crop characteristics.

User-Friendly Design

The website should provide a user-friendly interface for farmers to access and interact with the different features and functionalities.

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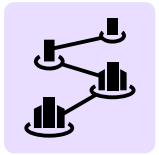
Scope (Non-Functional Requirements)

Security and Privacy

The website should be secure and protect the privacy of users.



Scalability and Performance

The website should be able to handle a large volume of data and user requests without experiencing downtime or performance issues.

Cross-Platform Compatibility

The website should be accessible from different devices and platforms.

Speed and Responsiveness

The website should be fast and responsive to ensure a seamless user experience.

Easy Maintenance

The website should be easy to maintain and update, with minimal downtime required for maintenance activities.

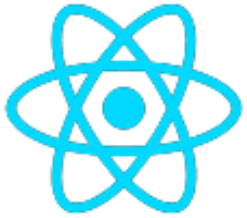
Data Set Description

- The Maize and Corn Disease dataset, available on Kaggle, contains images of healthy maize and corn plants, as well as plants infected with four different diseases: Gray Leaf Spot, Common Rust, Northern Leaf Blight, and Healthy. The dataset consists of a total of 4,000 images, with 1,000 images for each class. The images were collected from different regions in Uganda, Africa. The dataset can be used for developing and testing machine learning models for the detection and classification of maize and corn diseases.
  Link: https://www.kaggle.com/datasets/smaranjitghose/corn-or-maize-leaf-disease-dataset

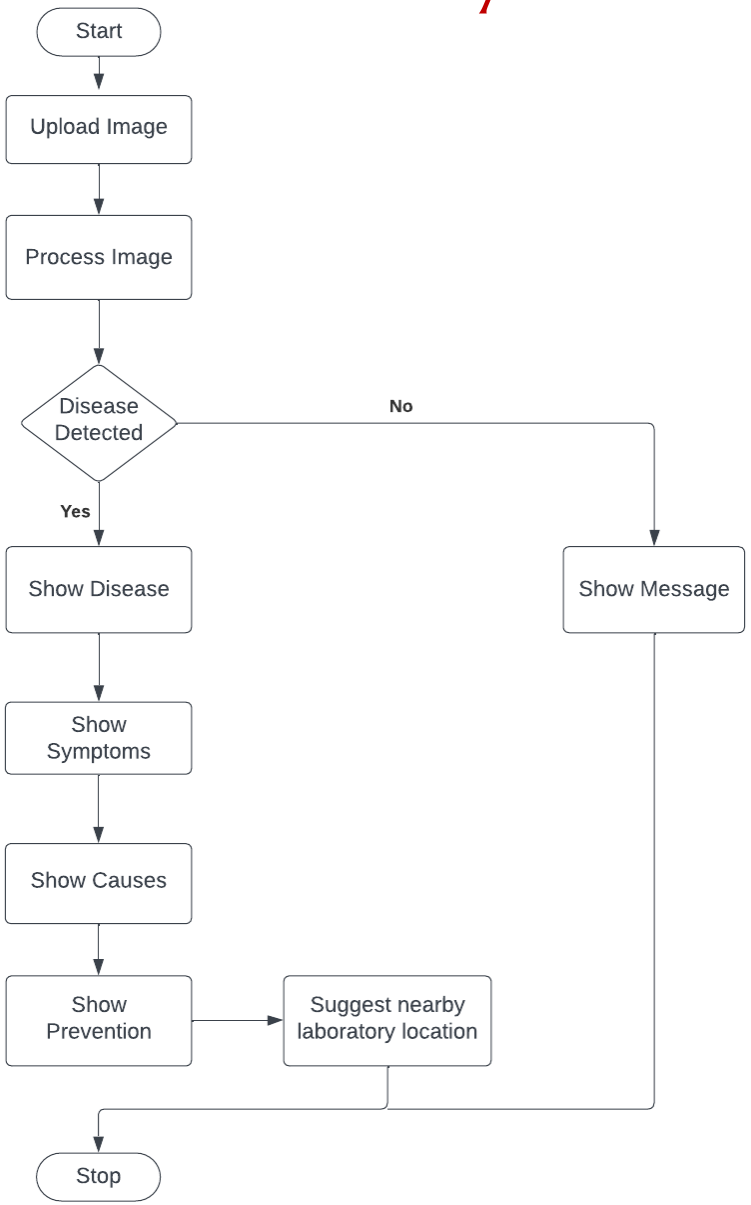
- The dataset is about precision agriculture and aims to help farmers make informed decisions about the most suitable crops to grow in a particular farm based on various parameters. The dataset includes parameters such as N, P, and K, which are ratios of Nitrogen, Phosphorous, and Potassium content in the soil, as well as temperature, humidity, pH value of the soil, and rainfall in millimeters. The data was built by augmenting datasets of rainfall, climate, and fertilizer data available for India.
  Link: https://www.kaggle.com/datasets/atharvaingle/crop-recommendation-dataset

Technology used

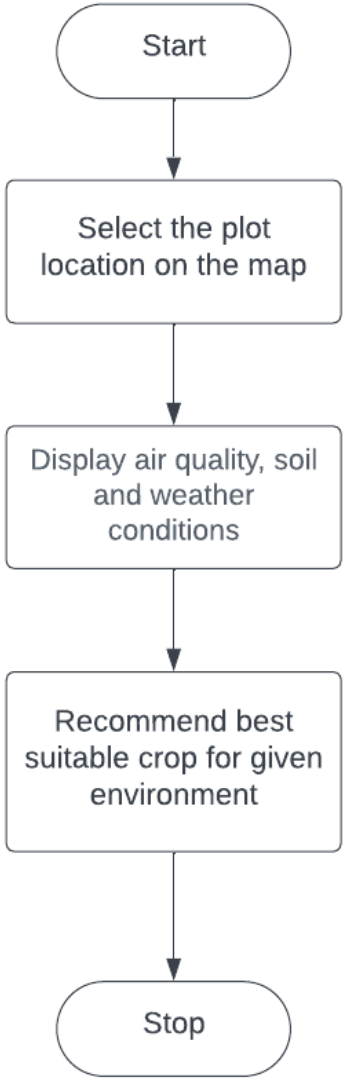
1. **Front-end Development:** React.
2. **Back-end Development:** Flask.
3. **Model Development:** Gradient boosting trees, EfficientNetB2.



Maize Disease Detection System Flowchart



Soil Analysis Flowchart



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REFERENCES

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[1] E. Akanksha, N. Sharma and K. Gulati, "OPNN: Optimized Probabilistic Neural Network based Automatic Detection of Maize Plant Disease Detection," 2021 6th International Conference on Inventive Computation Technologies (ICICT), Coimbatore, India, 2021, pp. 1322-1328, doi: 10.1109/ICICT50816.2021.9358763.

[2] S. K. Tichkule and D. H. Gawali, "Plant diseases detection using image processing techniques," 2016 Online International Conference on Green Engineering and Technologies (IC-GET), Coimbatore, India, 2016, pp. 1-6, doi: 10.1109/GET.2016.7916653.

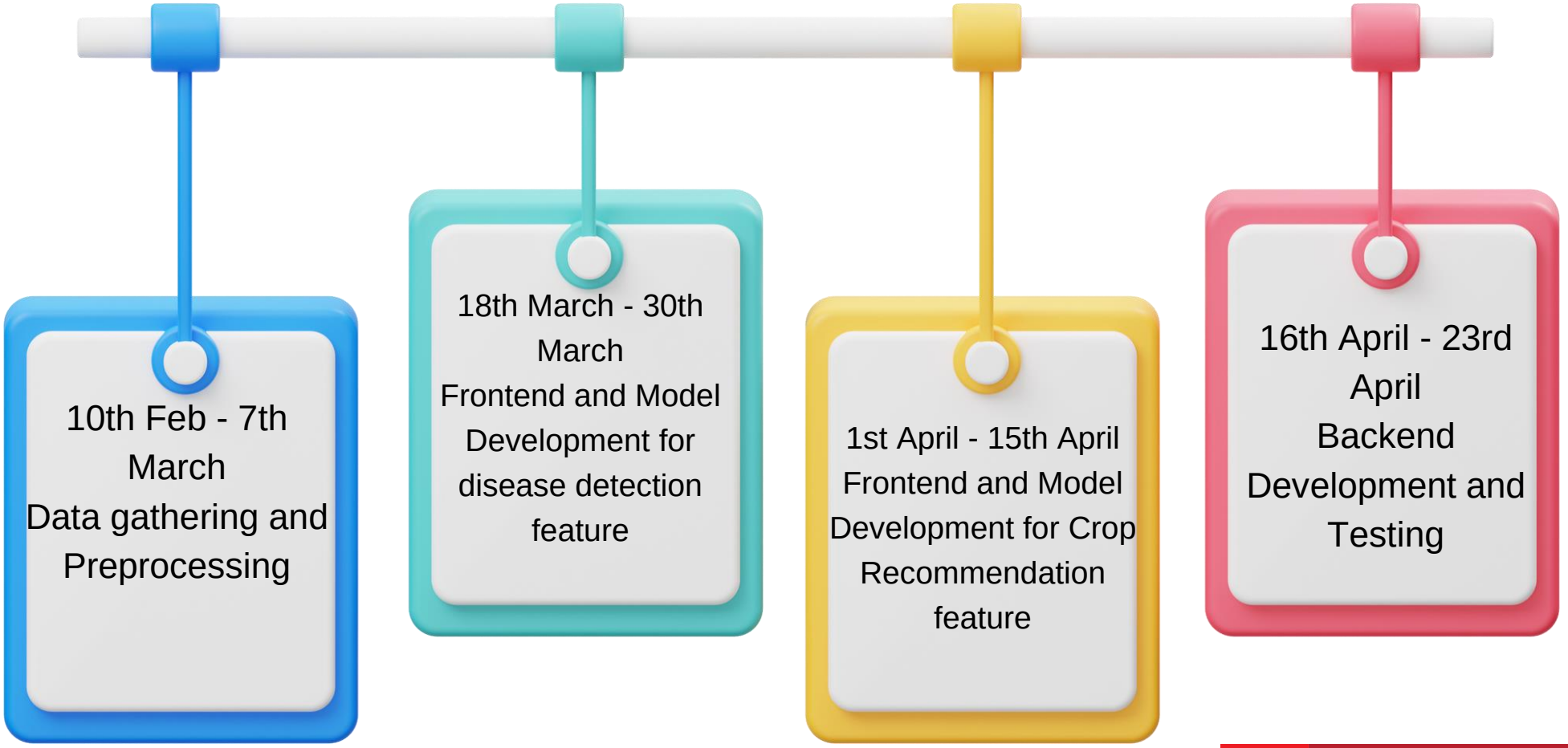
[3] X. Zhang, Y. Qiao, F. Meng, C. Fan and M. Zhang, "Identification of Maize Leaf Diseases Using Improved Deep Convolutional Neural Networks," in IEEE Access, vol. 6, pp. 30370-30377, 2018, doi: 10.1109/ACCESS.2018.2844405.

[4] Wetterlind, Johanna & Stenberg, Bo & Viscarra Rossel, Raphael. (2013). Soil Analysis Using Visible and Near Infrared Spectroscopy. Methods in molecular biology (Clifton, N.J.). 953. 95-107. 10.1007/978-1-62703-152-3_6.

[5] Yadav, Jagdeep, Shalu Chopra, and M. Vijayalakshmi. "Soil analysis and crop fertility prediction using machine learning." *Machine Learning* 8.03 (2021).

[6] S. Prakash, A. Sharma and S. S. Sahu, "Soil Moisture Prediction Using Machine Learning," 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), Coimbatore, India, 2018, pp. 1-6, doi: 10.1109/ICICCT.2018.8473260.

Timeline


10th Feb - 7th March
Data gathering and Preprocessing
18th March - 30th March
Frontend and Model Development for disease detection feature
1st April - 15th April
Frontend and Model Development for Crop Recommendation feature
16th April - 23rd April
Backend Development and Testing

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Thank You!!!