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FARMGUIDE USING AI TECHNIQUES

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ABSTRACT

Farming is one of the major sectors that influences a country's economic growth. In country like India, 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, we present a website in which the following applications are implemented, Crop recommendation, Fertilizer recommendation and plant disease detection. In the crop recommendation application, the user can provide the soil data from their side and the application will recommend top three crops which are suitable for their land. 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 required fertilizer. For the last application, that is the plant disease detection application, the user can input an image of a diseased plant leaf, and the application will detect the disease. To implement this application we are using the XG Boost, Random Forest, and CNN algorithms.

KEYWORDS – *Crop Recommendation, Fertilizer Recommendation, Disease detection, XG Boost, Random Forest, CNN*

I. INTRODUCTION

In the ever-growing global agricultural landscape, the need for efficient and sustainable food production has never been more critical. Traditional farming faces challenges from climate change to resource limitations. Enter machine learning, a transformative force in agriculture. It provides innovative solutions to boost farm yield, optimize resource use, and ensure food security. These tools enable data-driven decisions based on real-time information about weather, soil conditions, and crop health. By Applying machine learning and Deep Learning algorithms, farmers can adapt and optimize practices for higher crop yields, reduced wastage, and minimal environmental impact**.**

By integrating AI-driven solutions into farming operations, FarmGuide seeks to address key challenges faced by farmers while improving productivity, sustainability, and efficiency. This project harnesses technologies such as machine learning and deep learning to provide decision support for crop management.

This project aims to aid Indian farmers by integrating Machine Learning and Deep Learning technologies into agriculture through a website offering three key applications: Crop recommendation, Fertilizer recommendation, and Plant disease detection. The Crop recommendation tool utilizes soil data provided by users to suggest the top three suitable crops for their land. The Fertilizer recommendation tool predicts soil deficiencies or excesses based on input soil data and crop type, providing tailored fertilizer recommendations. Lastly, the Plant disease detection application enables users to upload images of diseased plant leaves, with XGBoost, RandomForest, and CNN algorithms employed to accurately identify the disease. Through these applications, the project seeks to enhance the farming practices.

II. OBJECTIVES

1. Develop a system where users can input soil data to receive recommendations for the top three crops suitable for their land. This aims to assist farmers in making informed decisions about which crops to cultivate based on their specific soil conditions.
2. Create an application that utilizes soil data and the type of crop being grown to predict nutrient deficiencies or excesses in the soil. The objective is to provide personalized fertilizer recommendations to optimize crop yield and minimize resource

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wastage.

3. Implement a system capable of identifying diseases in plants by analyzing images of diseased plant leaves. This objective seeks to aid farmers in early detection and management of plant diseases, thereby reducing crop losses and ensuring healthier yields.
4. Utilizing machine learning algorithms such as XG Boost and Random Forest, as well as deep learning techniques such as Convolutional Neural Networks (CNN), to develop accurate and efficient models for crop and fertilizer recommendations, as well as plant disease detection. This objective aims to leverage advanced technologies to improve the effectiveness and reliability of agricultural decision support systems.
5. Design and develop a user-friendly website to host the aforementioned applications, making them accessible to farmers and agricultural stakeholders. The objective is to create an intuitive platform where users can easily input data and receive actionable insights to optimize their farming practices.
6. Adjust the model to make it more accurate and user-friendly.

III. LITERATURE SURVEY

1. Sharma, N., & Sharma, A. (2019). "Crop Recommendation System: A Review." International Journal of Innovative Technology and Exploring Engineering, 8(11), 2194-2198. This study reviews various crop recommendation systems implemented using machine learning techniques and highlights their effectiveness in improving crop selection for farmers.
2. Singh, A., & Patel, S. (2020). "Fertilizer Recommendation System using Machine Learning." International Journal of Recent Technology and Engineering, 9(2), 7128-7134. The paper discusses the development of a fertilizer recommendation system based on machine learning algorithms, emphasizing its role in optimizing nutrient management and enhancing crop productivity.
3. Meena, P., & Mehrotra, D. (2021). "A Review on Plant Disease Detection Techniques." International Journal of Computer Applications, 179(44), 1-5. This review article provides insights into various techniques and algorithms used for plant disease detection, including computer vision-based approaches and machine learning models.
4. Khare, P., et al. (2019). "Improvement of Prediction Accuracy in Agriculture Using XGBoost Algorithm." International Journal of Computer Applications, 182(31), 42-48. The study demonstrates the application of the XGBoost algorithm in agriculture for crop yield prediction and discusses its advantages in handling large-scale datasets and achieving high prediction accuracy.
5. Priyadarshini, S., & Sumathi, R. (2020). "Crop Recommendation System Using Machine Learning Algorithms." 2020 International Conference on Emerging Trends in Information Technology and Engineering (ICETITE), 1-5. This paper presents a crop recommendation system based on the Random Forest algorithm, highlighting its effectiveness in recommending suitable crops based on soil and climate conditions.
6. Mohanty, S. P., et al. (2016). "Using Deep Learning for Image-Based Plant Disease Detection." Frontiers in Plant Science, 7, 1419. The research explores the use of Convolutional Neural Networks (CNNs) for plant disease detection from images, demonstrating the efficacy of deep learning techniques in accurately identifying plant diseases.

IV. METHODOLOGY

During this project work the approach followed can be described in the following steps. They are

1. Data Collection
2. Data Preprocessing
3. Model Development
4. Website Development
5. Integration
6. Testing
7. Deployment
8. Monitoring & Maintenance

Data Collection

Gather relevant datasets for training machine learning models. This includes soil data, crop yield data, fertilizer composition data, and a dataset of images of diseased plant leaves along with their corresponding diseases.

Data Preprocessing

Clean and preprocess the collected data to remove outliers, handle missing values, and normalize the data for consistency. For image data, perform image preprocessing techniques such as resizing, normalization, and augmentation.

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Model Development
Develop machine learning models for crop recommendation and fertilizer recommendation using algorithms like XG Boost and Random Forest. Train the models using the preprocessed soil data and crop information.

Develop deep learning model for disease detection using convolutional neural networks (CNN) and train the model using preprocessed leaf images of infected plants.

Website Development
Design and develop a user-friendly website with interfaces for each application: crop recommendation, fertilizer recommendation, and plant disease detection. Implement features for users to input soil data, select crop types, upload images of diseased plant leaves, and receive recommendations and diagnosis results.

Integration
Integrate the trained machine learning and deep learning models into the website's backend. Develop APIs or scripts to handle user inputs, invoke the appropriate models, and generate recommendations or diagnosis results.

Testing
Test the functionality and performance of the website and its applications. Conduct unit tests, integration tests, and user acceptance tests to ensure that the system functions correctly and provides accurate recommendations and diagnoses.

Deployment
Deploy the website and its applications on a web hosting platform or server. Ensure that the website is accessible to users over the internet and that it can handle concurrent user requests and data processing tasks.

Monitoring & Maintenance
Clean Implement monitoring tools to track website performance, user interactions, and model accuracy over time. Regularly update the models with new data and improvements to ensure the effectiveness of recommendations and diagnoses.
Provide ongoing maintenance and support for the website, addressing any issues or bugs that arise and incorporating user feedback for further enhancements.

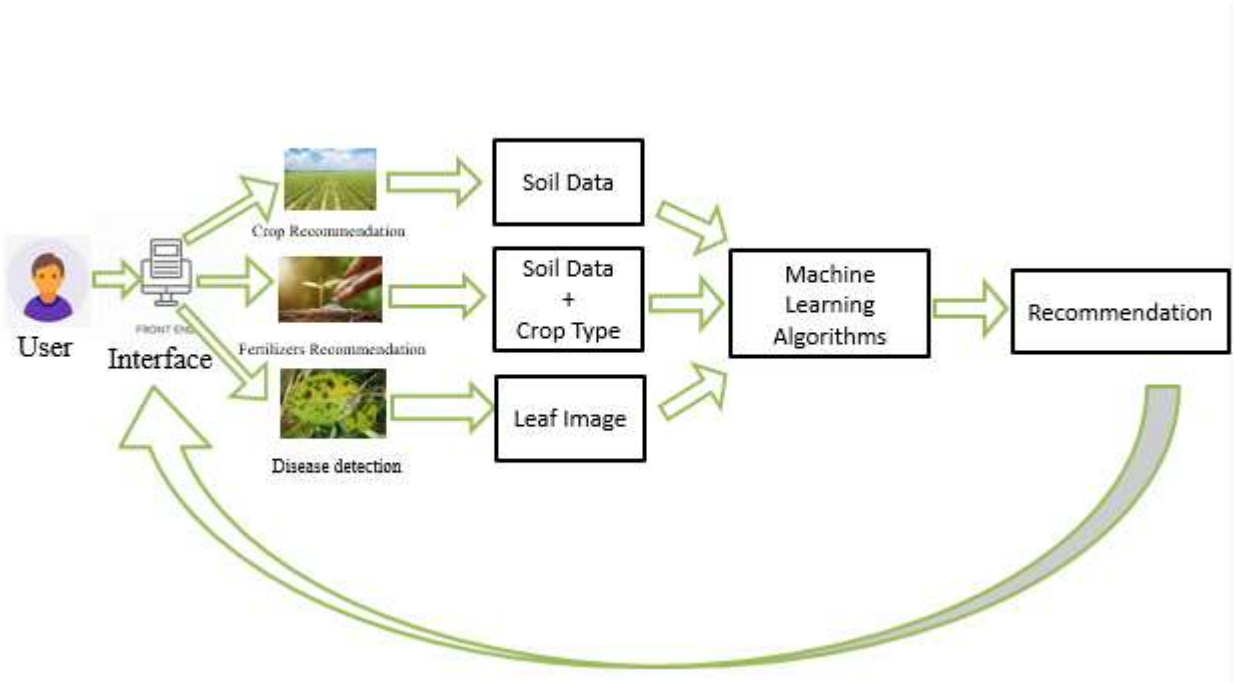

Fig.1: System Architecture

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V. RESULTS

Our output screens are as follows:

1. Welcome Page

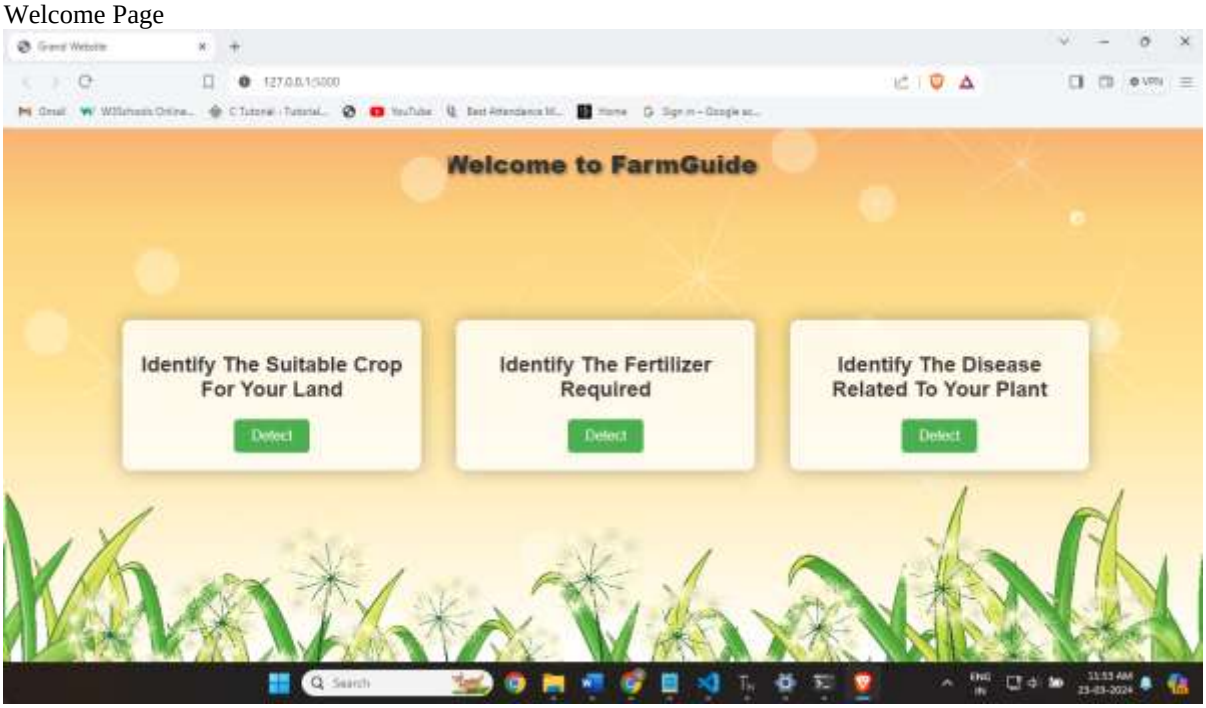

Fig.2: Welcome Page

2. Input page for Crop Recommendation

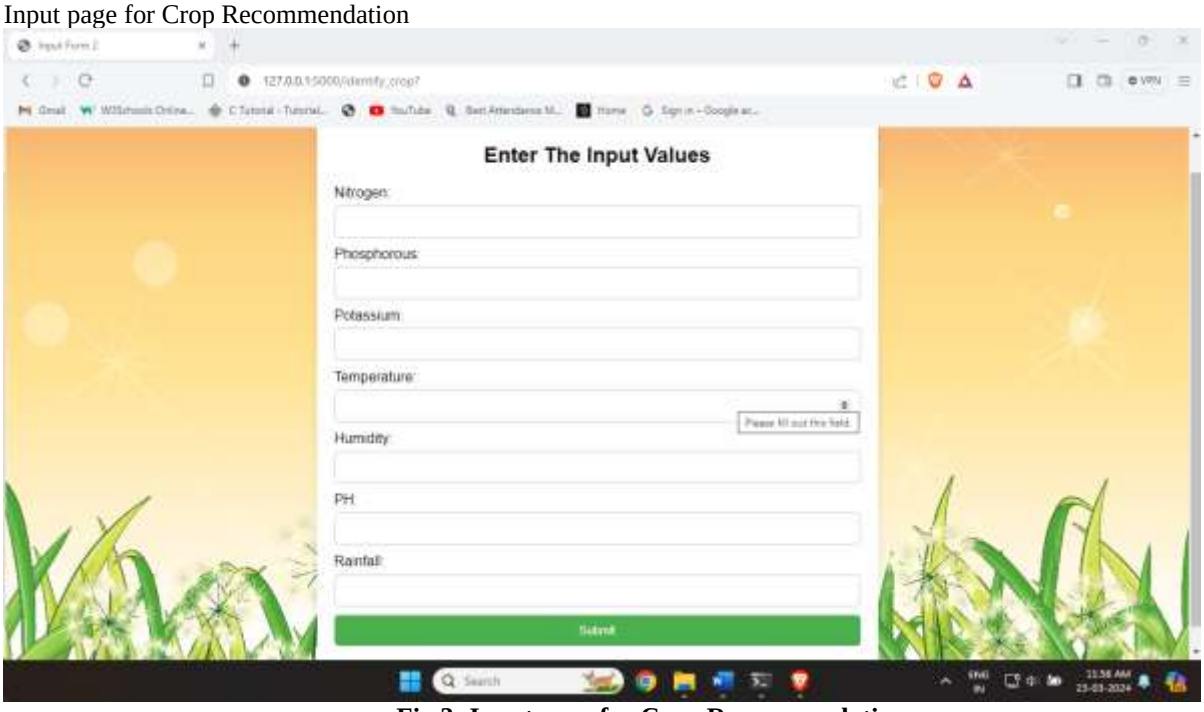

Fig.3: Input page for Crop Recommendation

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3. Crop Recommendation

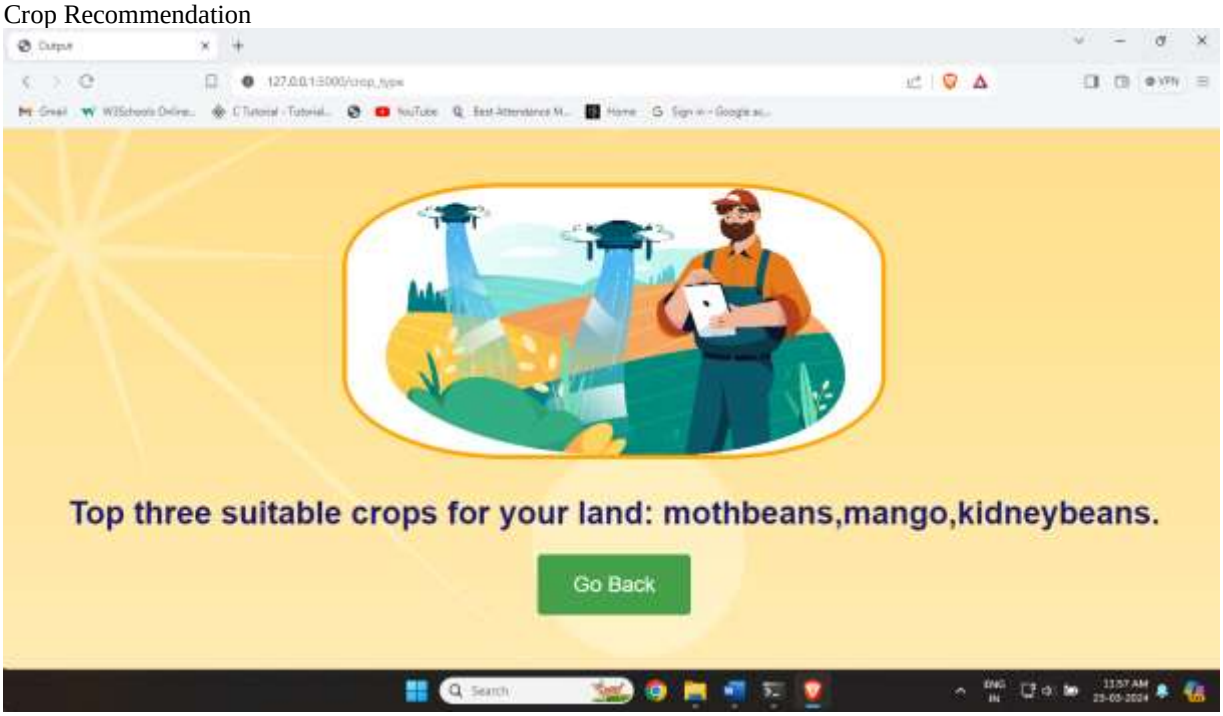

Fig.4: Crop recommendation

4. Input page for Fertilizer Recommendation

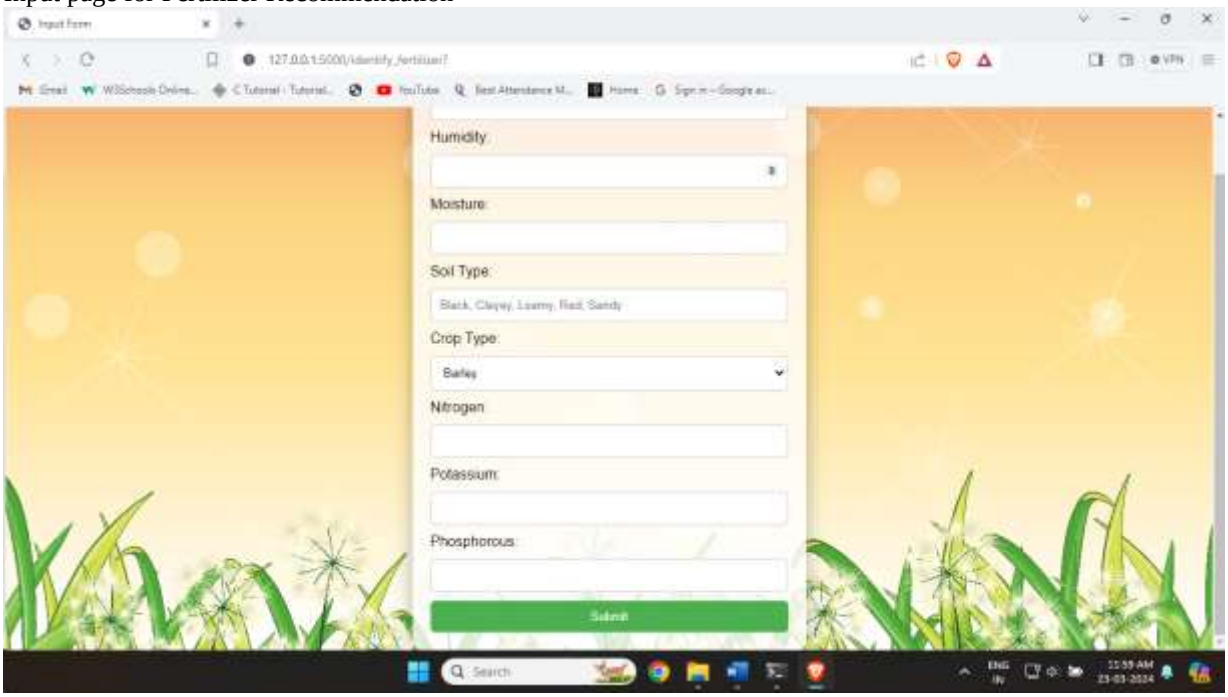

Fig.5: Input page for Fertilizer Recommendation

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5. Fertilizer Recommendation

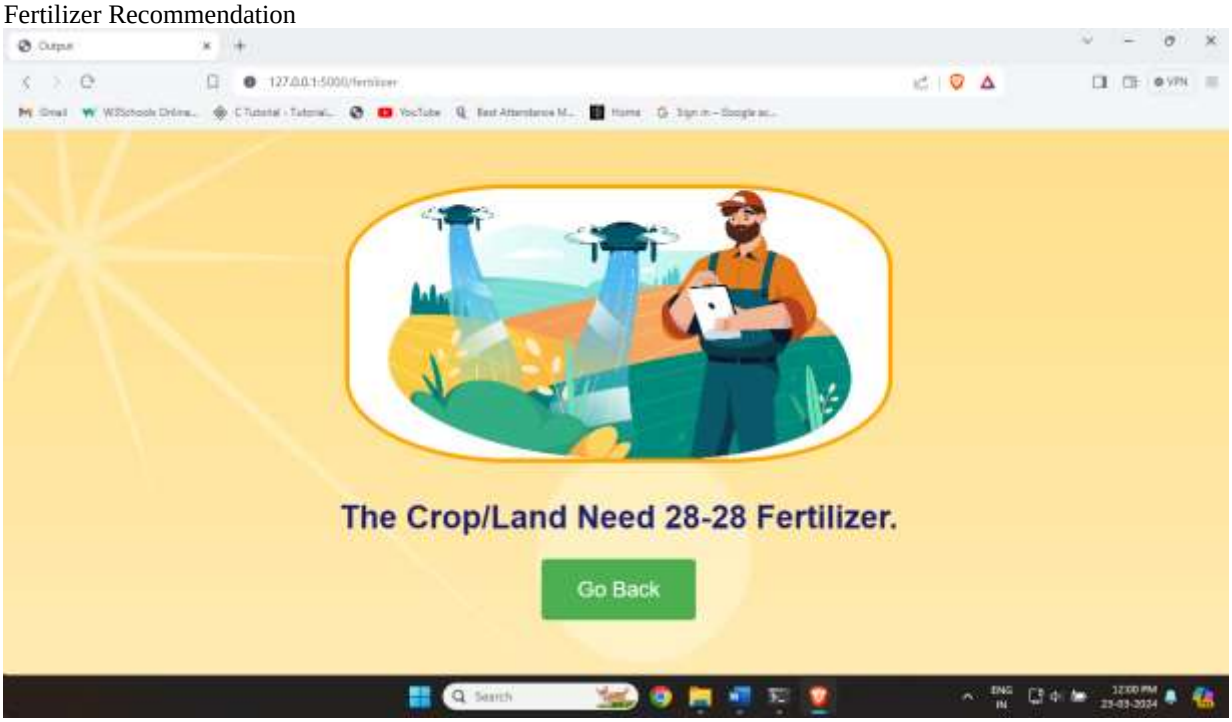

Fig.6: Fertilizer Recommendation

6. Input page for disease identification

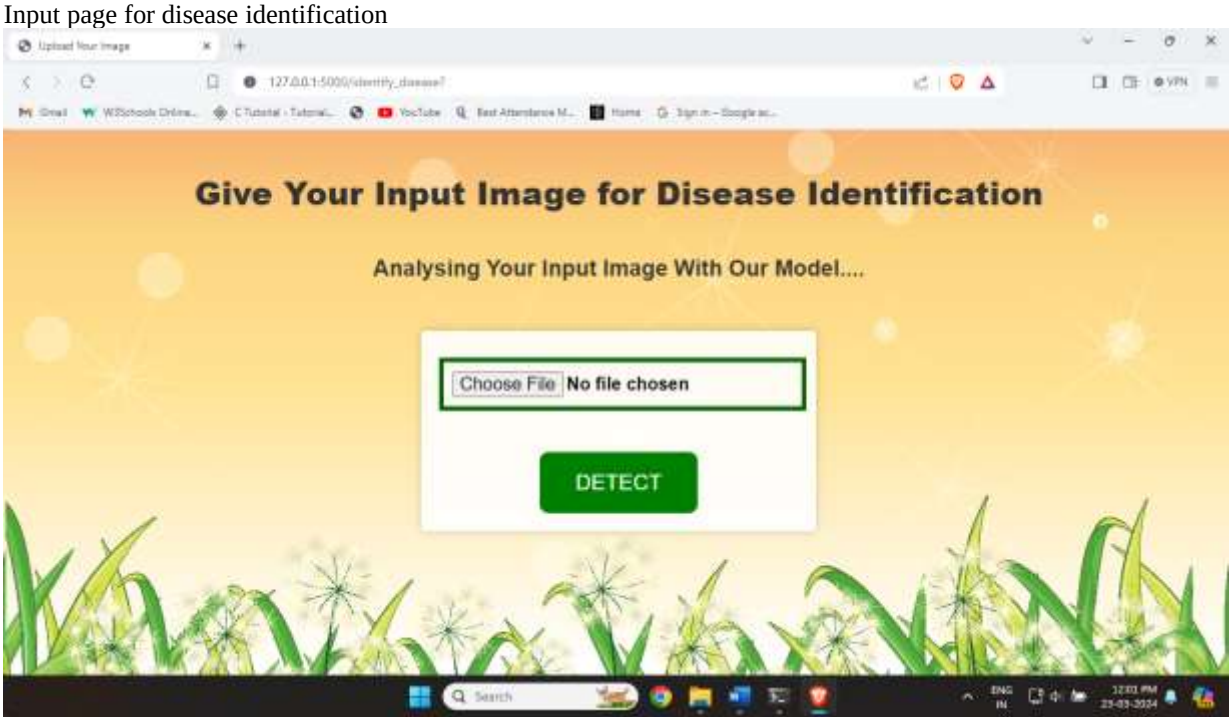

Fig.7: Input page for disease identification

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7. Disease identification

Fig.8: Disease Identification

VI. CONCLUSION

- Through crop recommendation, farmers can make informed decisions about which crops to cultivate based on soil characteristics, maximizing yields and profitability.
- The fertilizer recommendation application further assists farmers by identifying soil deficiencies or excesses and providing tailored recommendations to improve soil health and optimize crop growth.
- Additionally, our plant disease detection application accurately diagnose plant diseases from images of diseased leaves.

VII. FUTURE SCOPE

Expansion of Crop Database:
Continuously update and expand the crop database to include a wider variety of crops, considering regional and seasonal variations.
Mobile Application Development:
Develop a mobile application for greater accessibility, allowing farmers to interact with the system using smartphones.
Feedback Mechanism:
Implement a feedback mechanism to collect user input and experiences for continuous improvement.

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