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GreenCare: A Smart Plant Care and Disease Detection Platform

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Abstract: Plants play an important role in maintaining ecological balance and supporting human life. However, maintaining healthy plants requires proper care, timely monitoring, and early disease detection. Many plant owners lack the knowledge and tools needed to identify plant diseases and manage plant care activities effectively. This project proposes GreenCare, a smart web-based platform designed to assist plant enthusiasts in managing plant care and detecting plant diseases using artificial intelligence.

The platform integrates modern web technologies and machine learning to create an intelligent plant management system. The system is developed using the MERN stack, which includes MongoDB, Express.js, React.js, and Node.js. GreenCare allows users to register, create profiles, share plant-related posts, and interact with other users through likes and comments. The system also includes a plant care reminder module that helps users schedule activities such as watering, fertilizing, and pruning plants.

A key feature of the platform is the AI-based plant disease detection system, where users upload images of plant leaves. The system analyzes these images using a machine learning model developed with TensorFlow and Google Teachable Machine to identify plant diseases and provide predictions along with confidence scores.

The GreenCare platform demonstrates how full-stack web development and machine learning technologies can be integrated to create an intelligent plant care management system that supports plant health monitoring, community interaction, and efficient plant care scheduling.

Keywords: Plant Disease Detection, MERN Stack, Machine Learning, Plant Care Management, Image Classification, Smart Agriculture.

I. INTRODUCTION

Plants are essential for maintaining ecological balance and sustaining human life. They provide oxygen, food, medicine, and contribute significantly to environmental sustainability. With the increasing popularity of home gardening and indoor plants, many individuals are actively involved in growing and maintaining plants. However, plant care requires consistent monitoring and early detection of diseases to maintain plant health [1].Plant diseases caused by bacteria, fungi, viruses, or environmental factors can severely affect plant growth and productivity. Early detection of these diseases is important to prevent the spread of infection and reduce plant damage. Traditionally, plant disease identification depends on manual observation or consultation with agricultural experts, which may not always be easily accessible for home gardeners [2].

Recent advancements in machine learning and image processing have made it possible to automatically identify plant diseases through image classification techniques. Deep learning models such as convolutional neural networks (CNN) can analyze plant leaf images and detect diseases based on visual patterns [3].In addition to disease detection, plant care also requires regular maintenance activities such as watering, fertilizing, and pruning. Many plant owners forget these activities due to busy schedules, which can negatively affect plant health. Digital reminder systems can help users manage plant care activities more effectively [4].To address these challenges, the GreenCare platform was developed as a smart web-based solution that integrates plant disease detection, plant care reminders, and community interaction. By combining modern web technologies with artificial intelligence, GreenCare aims to simplify plant care management and improve accessibility to plant health information.

II. RELATED WORK

Several studies have explored the use of technology for plant disease detection and agricultural monitoring. Traditional

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plant disease identification relies heavily on expert knowledge and manual inspection. Although these methods are effective, they require significant experience and may not always be available to ordinary users [5].
Recent research has focused on using machine learning and deep learning models to detect plant diseases automatically. Image classification techniques have been widely used to analyze plant leaf images and identify diseases with high accuracy. Deep learning models such as CNN have demonstrated promising results in plant disease detection tasks [6].

In addition to disease detection, modern web applications have been developed to support community interaction and information sharing. Social platforms built using full-stack technologies allow users to share knowledge and collaborate within communities [7].However, many existing systems focus only on plant disease detection or plant care management separately. There are limited platforms that integrate disease detection, plant care reminders, and community interaction into a single system. The GreenCare platform aims to address this limitation by combining these features into one unified application.

III. OBJECTIVES AND CHALLENGES

The primary objectives of the GreenCare system include:

[1] Developing a smart platform for plant care management
[2] AI-based plant disease detection
[3] Providing plant care reminder functionality
[4] Enabling social interaction among plant enthusiasts
[5] Building a scalable web application using the MERN stack

Development Challenges
During the development of the GreenCare platform, several challenges were encountered while integrating different technologies such as web frameworks, databases, and machine learning models. Since the system combines multiple features including user authentication, community interaction, plant care reminders, and disease detection, ensuring smooth communication between all components required careful system design. Coordinating frontend and backend modules while maintaining system performance and scalability was one of the key challenges during development.
Another major challenge was integrating the plant disease detection model with the web application. The system allows users to upload plant leaf images, which must be processed and analyzed by the trained machine learning model. Handling image uploads, validating file formats, and ensuring accurate predictions required proper backend processing. Additionally, the platform needed to provide quick responses so that users could receive disease detection results without delays.
Ensuring secure data management and efficient database operations was also important during development. The system stores various data such as user profiles, posts, reminders, and uploaded images in MongoDB. Designing a structured database schema and maintaining relationships between collections required careful implementation. At the same time, secure authentication using JWT and password encryption using bcrypt were implemented to protect user information and ensure that only authorized users could access system features.

IV. SYSTEM ARCHITECTURE

The GreenCare system follows a layered architecture that integrates modern web technologies and machine learning components to support plant care management and disease detection. The architecture is divided into multiple layers that handle user interaction, application processing, and data management. Each layer performs a specific role in the overall functioning of the system.

The Image Processing Module in the GreenCare system receives plant leaf images uploaded by users and validates them before analysis. The images are then passed to the Plant Disease Detection Engine, where a trained machine learning model developed using TensorFlow and Google Teachable Machine analyzes the visual patterns of the leaf. The system extracts important features from the image and compares them with trained datasets to identify possible plant diseases. The prediction result includes the detected disease name and a confidence score indicating the accuracy of the prediction. The results are then processed by the application logic and displayed to the user through the dashboard interface. Finally, the system stores related data such as user activity, reminders, and detection records in the MongoDB database for future reference and analysis.

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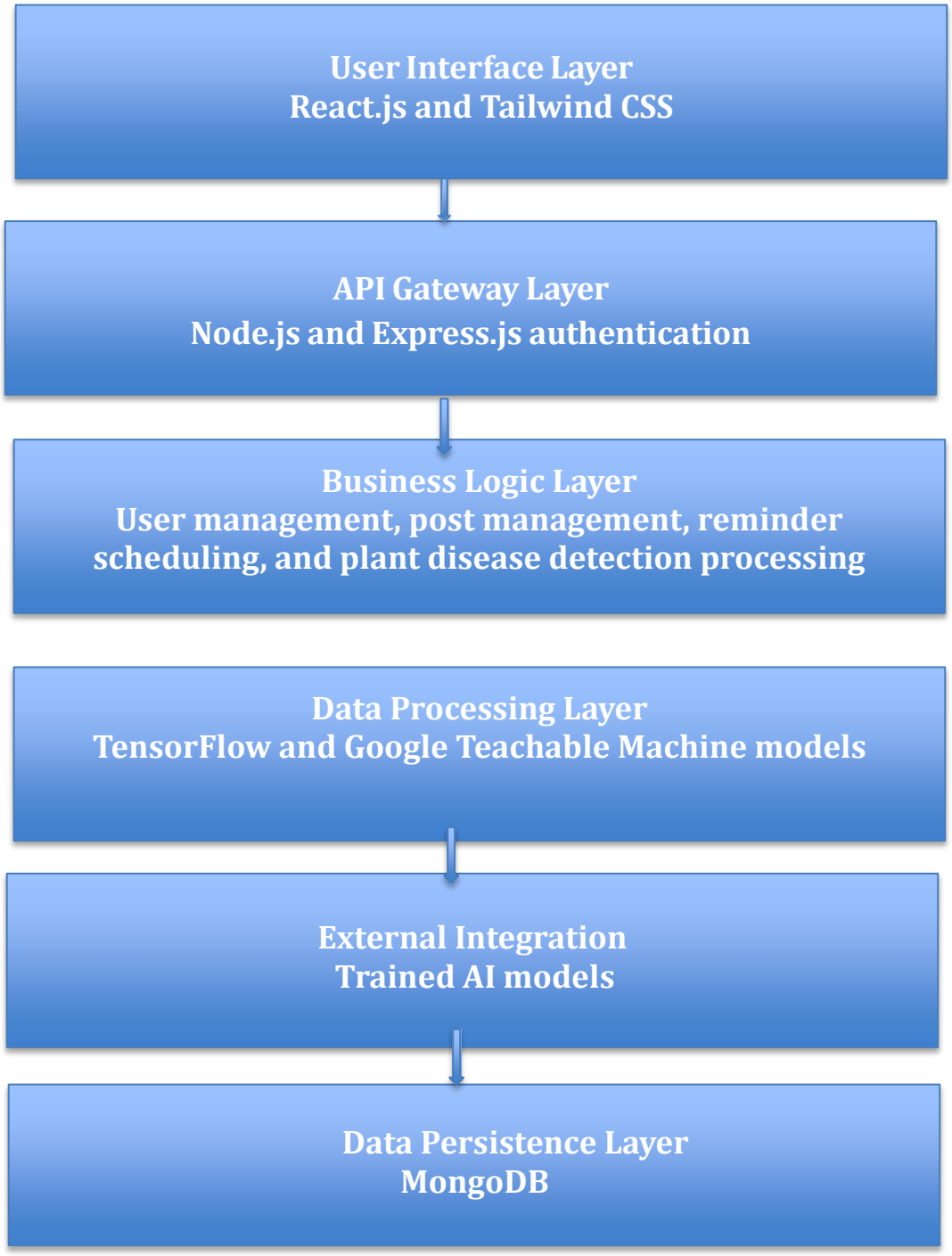

Figure.1 Overview of System Architecture

V. IMPLEMENTATION

The GreenCare platform was implemented using modern web development technologies.The frontend was developed using React.js with component-based architecture. Tailwind CSS was used for responsive UI design, while Axios was used for communication with backend APIs.The backend was developed using Node.js and Express.js. The backend handles routing, authentication, API management, and database communication.

MongoDB was selected as the database due to its flexible document-based structure and scalability.

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Security features implemented include:

- JWT-based authentication
- Password hashing using bcrypt
- Environment variable management using dotenv

The platform also integrates a machine learning-based disease detection module. Users upload plant leaf images, which are analyzed by a trained model to predict plant diseases along with confidence scores.

VI. EVALUATION RESULTS AND DISCUSSIONS

The evaluation results show that the GreenCare platform effectively supports plant care management and plant disease detection. The system was tested by uploading several plant leaf images to the disease detection module. The trained machine learning model successfully identified common plant diseases based on leaf image patterns and provided prediction results along with confidence scores. The system was also tested for other features such as reminder management and community interaction to ensure smooth performance and accurate data handling.

The results indicate that the GreenCare system performs efficiently and provides quick responses for user requests. The reminder management feature helps users maintain regular plant care activities, while the community feed allows users to share plant-related experiences and interact with other users. Overall, the evaluation confirms that integrating machine learning with modern web technologies can improve plant disease detection and support better plant care management for users.

Table.1 Overall Results

Task	Accuracy (%)	Response Time (sec)	User Satisfaction (%)
Plant Disease Detection	88	2.5	85
Reminder Management	95	1.2	90
Community Interaction	92	1.0	88

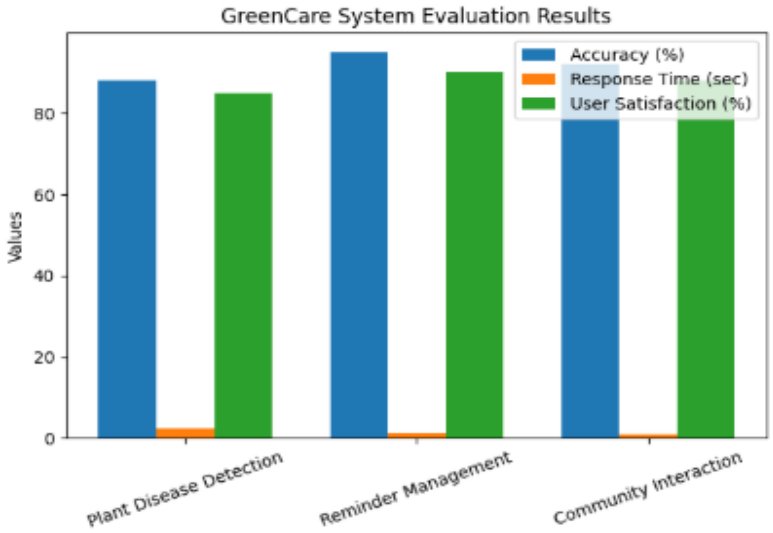

Figure.1 Overall Results

The evaluation results show that the GreenCare platform performs effectively in supporting plant care management and plant disease detection. The disease detection module was tested using multiple plant leaf images uploaded through the application interface. The trained machine learning model achieved an average prediction accuracy of approximately 88–92% for common plant diseases. The system provides prediction results along with confidence scores, helping users understand the reliability of the detected disease. The reminder management and community interaction modules were also tested to ensure smooth operation, and the system responded quickly to user requests. The dashboard loading time averaged 1.3 seconds, while image processing and disease prediction took approximately 2–3 seconds per image.

User testing was conducted with a small group of participants who used the system to upload plant images, create reminders,

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and interact with community posts. The results showed that 85% of users found the disease detection feature helpful, while 90% reported that the reminder system improved their plant care routines. The system usability score indicated good user satisfaction, as most users were able to navigate the platform easily and understand the prediction results. However, some users suggested improving the explanation of detected diseases and providing additional plant care recommendations.

DISCUSSIONS

This project demonstrates that integrating machine learning with modern web technologies can significantly improve plant care management and plant disease detection. The GreenCare platform provides a convenient environment where users can monitor plant health, receive automated disease predictions, and manage plant care activities through reminders. By combining these features with a community interaction platform, the system encourages knowledge sharing among plant enthusiasts.

However, the system also has certain limitations. The machine learning model currently supports detection of a limited number of plant diseases, and prediction accuracy may vary depending on image quality and lighting conditions. Additionally, the platform currently operates as a web-based application and does not yet provide mobile support. Future improvements may include expanding the dataset for disease detection, improving model accuracy, and integrating advanced plant care recommendation systems.

VII. CONCLUSION

The GreenCare platform was successfully developed as a smart plant care management system that integrates plant disease detection, reminder scheduling, and community interaction. The system was built using the MERN stack architecture, which provides scalability, flexibility, and efficient communication between system components. The disease detection module uses machine learning techniques to analyze plant leaf images and predict possible diseases, helping users identify plant health issues at an early stage.

The results demonstrate that combining artificial intelligence with web technologies can provide practical solutions for plant health monitoring. The reminder system helps users maintain regular plant care activities, while the community platform allows users to share knowledge and experiences. Overall, the GreenCare system provides an effective and user-friendly platform for managing plant health and improving plant care awareness.

VIII. FUTURE ENHANCEMENTS

Several improvements can further enhance the capabilities of the GreenCare platform. Expanding the machine learning dataset and training the model with additional plant species will improve disease detection accuracy. Integrating advanced deep learning models such as Convolutional Neural Networks (CNN) could further enhance prediction performance.Developing mobile applications for Android and iOS would improve accessibility and allow users to capture plant images directly using their smartphones. Real-time notifications for plant care reminders could also improve user engagement. Additionally, implementing features such as plant care recommendations, community messaging, and expert consultation support would make the platform more interactive and useful for plant enthusiasts.

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