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AGROSCAN: A DEEP LEARNING-DRIVEN PLANT DISEASE DETECTION AND AGRICULTURAL SUPPORT FRAMEWORK

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ABSTRACT
Agriculture plays a vital role in sustaining economies and ensuring food security, yet farmers continue to face critical challenges such as plant diseases, unpredictable climate conditions, improper crop selection, and lack of timely expert guidance. These issues often lead to reduced crop yield, financial losses, and inefficient farming practices. Early and accurate detection of plant diseases, along with intelligent agricultural support, is essential to improve productivity and assist farmers in making informed decisions.
This paper presents AGROSCAN: A Deep Learning-Driven Plant Disease Detection and Agricultural Support Framework, an integrated smart agriculture system designed to address these challenges using advanced artificial intelligence techniques. The proposed system utilizes Convolutional Neural Networks (CNN) to detect plant diseases from leaf images with high accuracy. In addition to disease detection, the framework incorporates multiple intelligent modules, including crop recommendation based on soil and climate parameters, real-time weather analysis, market price prediction, and an AI-powered chatbot for farmer assistance. The system also includes voice-based interaction features such as speech-to-text and text-to-speech, making it accessible to farmers with varying levels of digital literacy.
The framework is implemented using modern web technologies and machine learning tools to provide a user-friendly and efficient platform. By integrating multiple agricultural services into a single system, AGROSCAN enables real-time decision-making, reduces dependency on manual expertise, and improves overall farming efficiency. The results demonstrate that the proposed system enhances disease detection accuracy, supports better crop planning, and contributes to increased agricultural productivity and sustainability.

Keywords: Smart Agriculture, Deep Learning, Plant Disease Detection, CNN, Crop Recommendation, Agricultural Support System, AI Chatbot, Precision Farming.

I. INTRODUCTION

Agriculture remains one of the most important sectors in the global economy, particularly in developing countries where it serves as the primary source of livelihood for millions of people. Despite its significance, the agricultural sector faces numerous challenges such as plant diseases, unpredictable weather conditions, improper crop selection, and lack of access to timely expert guidance. These issues often result in reduced crop yield, financial instability, and increased risk for farmers. One of the most critical problems is the late detection of plant diseases, which can spread rapidly and cause severe damage to entire crops if not identified and treated at an early stage.
Traditionally, farmers rely on manual observation, personal experience, or consultation with agricultural experts to identify plant diseases and make farming decisions. However, this approach is often time-consuming, inaccurate, and not easily accessible, especially for farmers in rural or remote areas. In many cases, by the time the disease is correctly identified, significant damage has already occurred. Similarly, decisions related to crop selection, irrigation, and harvesting are often based on traditional practices rather than data-driven insights, leading to suboptimal productivity and economic losses.
With the advancement of artificial intelligence, machine learning, and deep learning technologies, it has become possible to develop intelligent systems that can assist farmers in real time. Deep learning models, particularly Convolutional Neural Networks (CNN), have shown remarkable performance in image classification tasks and can be effectively used to detect plant diseases from leaf

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images. By analyzing visual symptoms such as spots, discoloration, and texture variations, these models can provide accurate and instant disease diagnosis, enabling farmers to take timely action.

To address these challenges, this paper proposes AGROSCAN: A Deep Learning-Driven Plant Disease Detection and Agricultural Support Framework, an integrated smart agriculture system designed to support farmers with multiple intelligent services. The system not only detects plant diseases using CNN-based image analysis but also provides crop recommendations based on soil and environmental conditions, real-time weather insights, market price predictions, and an AI-powered chatbot for agricultural guidance. Additionally, the inclusion of voice-based features such as speech-to-text and text-to-speech ensures accessibility for farmers with limited digital literacy.

The AGROSCAN framework aims to bridge the gap between advanced agricultural technologies and practical farming needs by providing a unified, user-friendly platform. By integrating disease detection, crop planning, climate awareness, and decision support into a single system, the proposed solution enhances agricultural productivity, reduces crop losses, and empowers farmers to make informed and timely decisions.

II. LITERATURE SURVEY

Mohanty et al. (2016) conducted one of the pioneering studies in plant disease detection using deep learning techniques. They applied Convolutional Neural Networks (CNN) on a large dataset of plant leaf images and achieved high accuracy in classifying multiple plant diseases. Their work demonstrated the effectiveness of deep learning models in identifying diseases directly from images, reducing the need for manual inspection.

Sladojevic et al. (2016) proposed an image-based plant disease recognition system using deep neural networks. Their approach focused on automatically extracting features from leaf images and classifying diseases with improved accuracy. The study highlighted the advantage of deep learning over traditional image processing methods, which rely heavily on handcrafted features.

Ferentinos (2018) developed a CNN-based model for plant disease detection using various plant species and disease classes. The model achieved high classification accuracy and proved that deep learning can generalize well across different crops and environmental conditions. This research emphasized the scalability of deep learning solutions in agriculture.

Ramesh et al. (2018) explored machine learning techniques for crop recommendation based on soil and climatic conditions. Their system used algorithms such as Decision Trees and Random Forest to suggest suitable crops, helping farmers improve productivity and make better agricultural decisions.

Kamilaris and Prenafeta-Boldú (2018) reviewed the applications of deep learning in agriculture and identified key areas such as crop monitoring, disease detection, and yield prediction. Their study provided a comprehensive overview of how AI technologies can transform traditional farming practices into data-driven systems.

Shamshiri et al. (2019) discussed the role of smart farming technologies, including IoT, AI, and climate monitoring systems, in improving agricultural efficiency. Their research emphasized the importance of integrating multiple technologies to provide a complete agricultural support system rather than isolated solutions.

Zhang et al. (2020) proposed a smart agriculture framework that integrates machine learning, sensor data, and decision support systems. Their work highlighted the importance of combining real-time data with predictive models to improve crop management and reduce losses.

III. SYSTEM ANALYSIS

EXISTING SYSTEM

Existing agricultural support systems mainly focus on individual functionalities such as plant disease detection, crop recommendation, or weather forecasting. Many systems use Convolutional Neural Networks (CNN) for disease detection or machine learning algorithms like Random Forest and Support Vector Machines for crop recommendation. Some mobile applications provide basic disease identification by analyzing plant leaf images, while others offer weather updates or market price information.

However, these systems are generally developed as standalone solutions and lack integration with other important agricultural services. Most of them do not provide a unified platform where farmers can access multiple features simultaneously. Additionally, many systems require technical knowledge, internet access, or expensive tools, making them less accessible to small and marginal farmers.

Disadvantages of Existing System

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1. Lack of Integrated Services
Most systems provide only a single functionality such as disease detection or crop recommendation, without combining multiple agricultural support features in one platform.
2. Limited Real-World Performance
Many disease detection models perform well in controlled environments but may give inaccurate results in real-world conditions due to variations in lighting, image quality, and background noise.
3. Poor Accessibility for Farmers
Existing systems often lack user-friendly interfaces, regional language support, and voice interaction features, making them difficult for farmers with low digital literacy to use.

PROPOSED SYSTEM

The proposed system, AGROSCAN: A Deep Learning-Driven Plant Disease Detection and Agricultural Support Framework, introduces a comprehensive and integrated solution for modern agriculture. The system combines deep learning-based plant disease detection with multiple intelligent modules such as crop recommendation, weather forecasting, market price prediction, and an AI-powered chatbot. Farmers can upload plant images to detect diseases, receive treatment suggestions, and access additional agricultural insights through a single platform. The system also incorporates voice-based interaction features like speech-to-text and text-to-speech, enabling farmers to interact with the system easily. By leveraging modern web technologies and AI models, the platform provides real-time, accurate, and user-friendly support for agricultural decision-making.

Advantages of Proposed System

1. Integrated Smart Agriculture Platform
The system combines multiple features such as disease detection, crop recommendation, weather analysis, and chatbot assistance into a single unified platform.
2. High Accuracy and Real-Time Results
The use of deep learning models like CNN ensures accurate disease detection, while AI-based modules provide real-time recommendations and insights.
3. User-Friendly and Accessible Design
The inclusion of voice interaction, simple interface design, and automated guidance makes the system easy to use for farmers with varying levels of digital literacy.

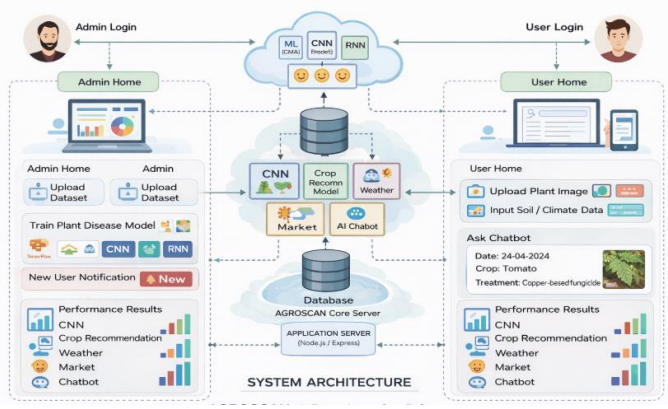

Fig 1: System Architecture

IV. RESULTS

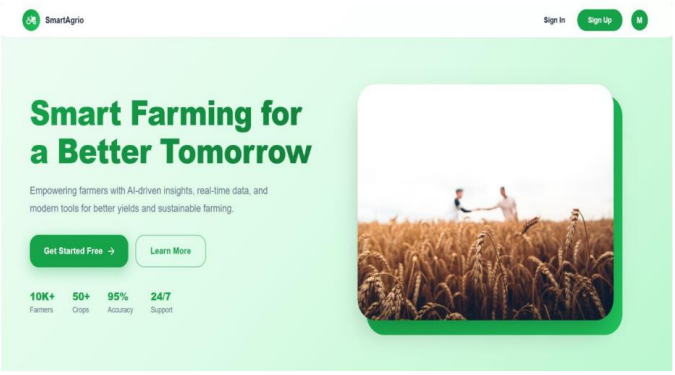

Fig 2: Home page

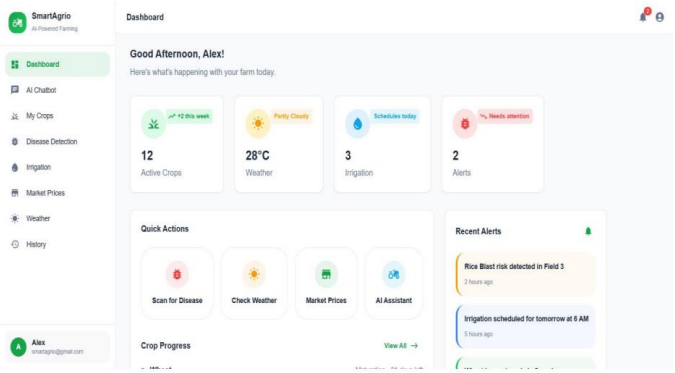

Fig 3: Dashboard

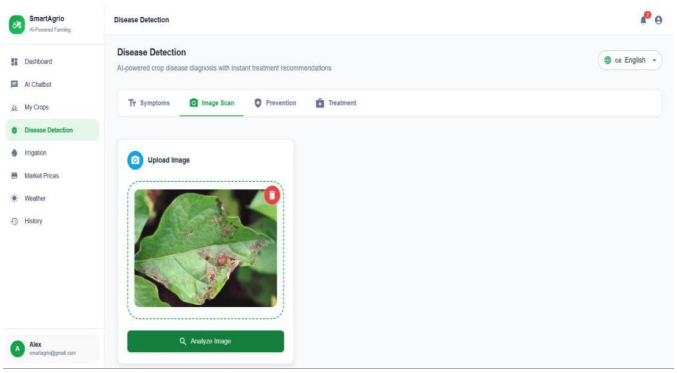

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Fig 4: Disease Detection

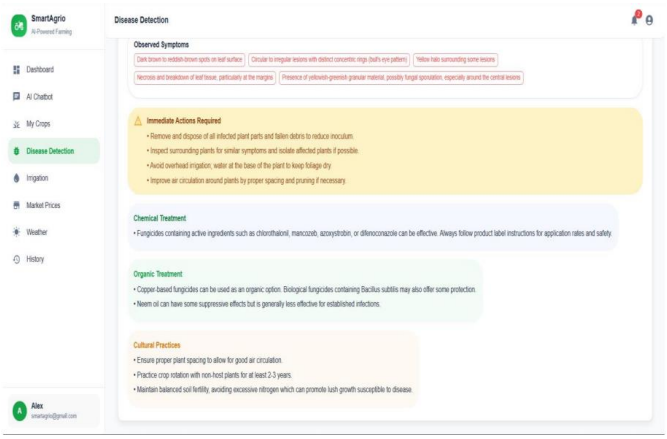

Fig 5: Output of Disease Detection

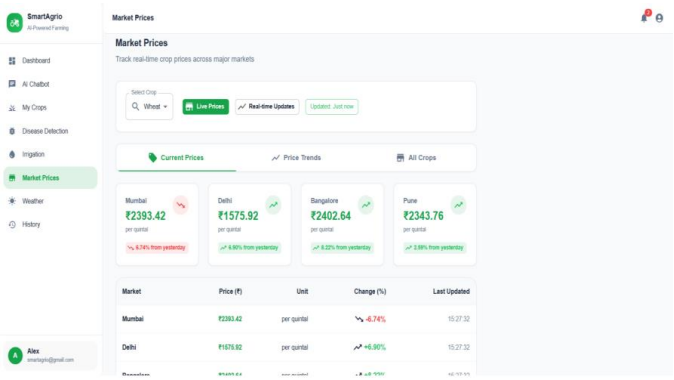

Fig 6: Market Price Prediction

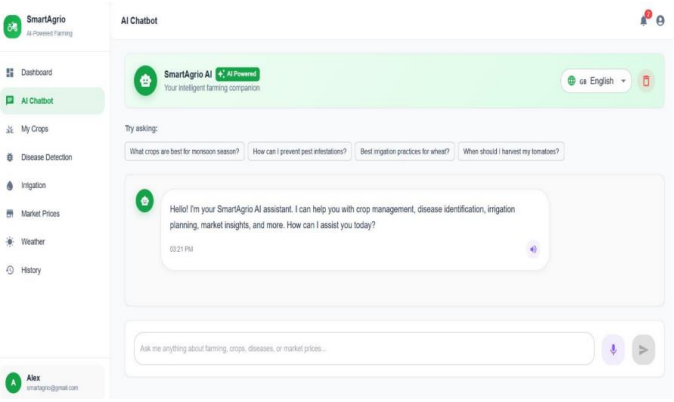

Fig 7: Chatbot for farmers

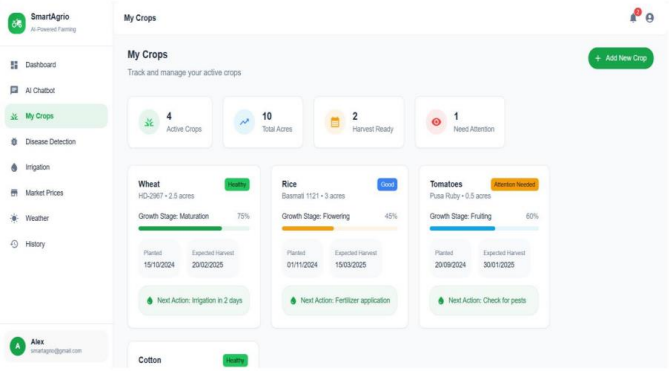

Fig 8: Crop Recommendation

V. CONCLUSION

The proposed system AGROSCAN: A Deep Learning-Driven Plant Disease Detection and Agricultural Support Framework presents an effective and intelligent solution to address the major challenges faced in modern agriculture. Traditional farming practices often rely on manual observation and limited access to expert guidance, leading to delayed disease detection, poor crop selection, and reduced productivity. These limitations highlight the need for a smart, integrated system that can assist farmers in making timely and informed decisions.

AGROSCAN leverages advanced technologies such as deep learning, particularly Convolutional Neural Networks (CNN), to accurately detect plant diseases from leaf images. In addition to disease detection, the system integrates multiple agricultural support modules including crop recommendation, weather analysis, market price prediction, and an AI-powered chatbot. This integration provides a comprehensive platform that supports farmers at every stage of the agricultural cycle.

The system is designed to be user-friendly and accessible, incorporating features such as voice interaction and simple interfaces to ensure usability for farmers with varying levels of digital literacy. By providing real-time insights and intelligent recommendations, AGROSCAN helps reduce crop losses, improve yield, and enhance overall agricultural efficiency.

In conclusion, the proposed framework demonstrates how the integration of deep learning and smart technologies can transform traditional agriculture into a data-driven and efficient system. It not only improves decision-making but also contributes to sustainable farming practices and economic stability for farmers. Future enhancements can focus on expanding crop coverage, improving model accuracy, and integrating IoT-based sensors for even more precise and automated agricultural solutions.

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