

Agrovision: AI-Based Smart Farming And Precision Agriculture Platform

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ABSTRACT

AgriGenius is a comprehensive smart farming application designed to revolutionize modern agriculture through the integration of advanced technologies such as artificial intelligence (AI), machine learning (ML), Internet of Things (IoT), and real-time data analytics. The app empowers farmers by providing actionable insights on crop health, weather forecasts, soil quality, irrigation needs, and pest detection, all through an intuitive mobile interface. Leveraging sensor data, satellite imagery, and historical trends, AgriGenius enables precision farming, which optimizes resource use and maximizes crop yield while minimizing environmental impact. The app also features automated alerts, personalized recommendations, and market price tracking to support informed decision-making. By bridging the gap between traditional farming practices and cutting-edge digital solutions, AgriGenius aims to enhance productivity, sustainability, and profitability in agriculture, particularly for small to medium-scale farmers.

Keywords: Artificial Intelligence (AI), Smart Farming, Precision Agriculture, Internet of Things (IoT), Machine Learning, Crop Monitoring, Soil Health Analysis, Smart Irrigation, Agricultural Data Analytics, Yield Prediction, Remote Sensing, Decision Support Systems, Sustainable Agriculture, Climate-Smart Farming, Agricultural Automation..

I. INTRODUCTION

Agriculture remains the backbone of many economies, yet it continues to face critical challenges due to climate change, resource scarcity, unpredictable market demands, and outdated farming practices. As global food demand increases, there is a growing need to modernize agriculture with the help of technology. Smart farming—also known as precision agriculture—has emerged as a promising solution that leverages digital tools to enhance productivity, optimize resource use, and support sustainable farming practices.

AgriGenius is an innovative smart farming application designed to empower farmers with data-driven insights and real-time decision support. By integrating advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), satellite imagery, and machine learning algorithms, AgriGenius offers comprehensive features including crop monitoring, weather forecasting, pest detection, irrigation management, soil analysis, and market

price updates—all accessible from a smartphone.

This application aims to bridge the digital divide in rural areas by providing an intuitive interface that caters to farmers with varying levels of technical literacy. AgriGenius not only enhances operational efficiency but also supports sustainable agriculture by promoting optimal use of water, fertilizers, and pesticides. Through its predictive analytics and personalized recommendations, the app transforms traditional farming into a smart, resilient, and profitable enterprise.

The development of AgriGenius signifies a step forward in the agricultural revolution, bringing intelligent solutions directly into the hands of farmers and reshaping the future of food production.

II. LITERATURE SURVEY

Smart Farming Technologies and IoT Integration

Recent studies highlight the increasing role of Internet of Things (IoT) devices in modern

agriculture for real-time monitoring of soil moisture, temperature, and crop health. Apps integrating sensor data allow farmers to make precise decisions on irrigation, fertilization, and pest control, leading to improved yield and resource efficiency (Wolfert et al., 2017).

Mobile Applications for Agricultural Decision Support

Several mobile apps have been developed to provide farmers with weather forecasts, market prices, and expert advice. These apps enhance decision-making by offering timely, location-specific information. However, many lack comprehensive features that combine environmental monitoring with predictive analytics (Jha et al., 2019).

Machine Learning for Crop Disease Prediction

Machine learning models have been successfully applied to detect and predict crop diseases from images and environmental data. These predictive models, when embedded in farming apps, enable early intervention and reduce crop loss, contributing to sustainable agriculture (Mohanty et al., 2016).

Challenges in User Adoption and Technology Accessibility

Literature emphasizes barriers to technology adoption among farmers, such as limited digital literacy, poor internet connectivity, and affordability issues. Successful smart farming apps must address these challenges through user-friendly interfaces and offline functionality (Aker, 2011).

Data Security and Privacy Concerns in Agricultural Apps

With increased data collection in agriculture, concerns over data privacy and security have emerged. Ensuring secure transmission and storage of sensitive farm data is critical for building trust and encouraging widespread adoption of smart farming technologies (Wolfert et al., 2017).

III. EXISTING SYSTEM

Traditional farming practices often rely heavily on

manual labor and farmer intuition, with limited access to real-time data or advanced tools to optimize crop management. Current agricultural applications in the market tend to focus on isolated functions such as weather forecasting, basic pest identification, or fertilizer recommendations. However, these systems often lack integration, user-friendly interfaces, and advanced technologies like AI-driven analytics or IoT device support. Many existing apps provide generic advice without tailoring recommendations to specific farm conditions, resulting in suboptimal crop yields and inefficient resource usage. Additionally, data collection is often manual and inconsistent, making it difficult for farmers to track progress or predict potential issues effectively.

IV. PROPOSED SYSTEM

AgriGenius aims to revolutionize farming by providing an all-in-one smart farming app that integrates cutting-edge technologies including machine learning, IoT sensors, and real-time data analytics. The proposed system offers personalized recommendations on irrigation, pest control, fertilization, and crop selection based on continuous monitoring of soil health, weather patterns, and crop growth stages. By utilizing sensor data and satellite imagery, AgriGenius provides predictive insights to help farmers make data-driven decisions that maximize yield while minimizing resource wastage. The app also features a user-friendly interface with multilingual support and offline capabilities to ensure accessibility in rural areas with limited connectivity. Moreover, it includes a marketplace to connect farmers directly with suppliers and buyers, fostering an ecosystem that supports sustainable and profitable farming practices.

V. SYSTEM ARCHITECTURE

The system architecture of the Agrovision: AI-Based Smart Farming and Precision Agriculture Platform integrates multiple sensors, cloud infrastructure, and intelligent decision systems to monitor and manage agricultural fields efficiently. In this architecture, various IoT sensors such as soil ingredient sensors,

soil moisture sensors, air humidity sensors, temperature sensors, and ultraviolet sensors are deployed across the farmland to continuously collect environmental and soil-related data. These sensors transmit real-time data through a gateway, which acts as a communication bridge between the field devices and the central server. The server processes and analyzes the collected data using AI and machine learning techniques to generate insights about crop health, irrigation requirements, and environmental conditions. All processed information is stored in a database for further analysis and historical reference. A controller module automatically manages field operations such as irrigation and climate control based on the analyzed data. Farmers or farm owners can access the system through mobile or web devices, enabling them to monitor farm conditions remotely and make informed decisions. This architecture improves farming efficiency, optimizes resource usage, and supports sustainable agriculture through data-driven precision farming techniques.

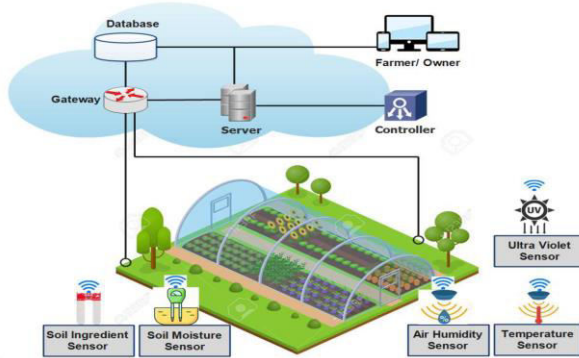


Fig 5.1: Structure of the Proposed System

VI. IMPLEMENTATION

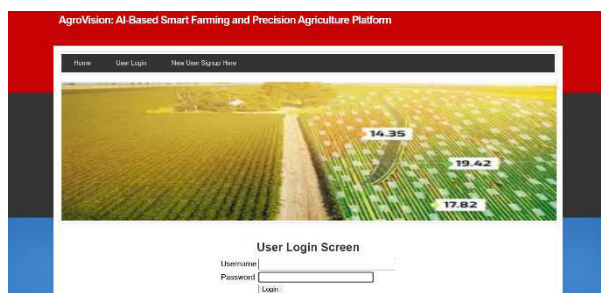


Fig 6.1: User Login Page

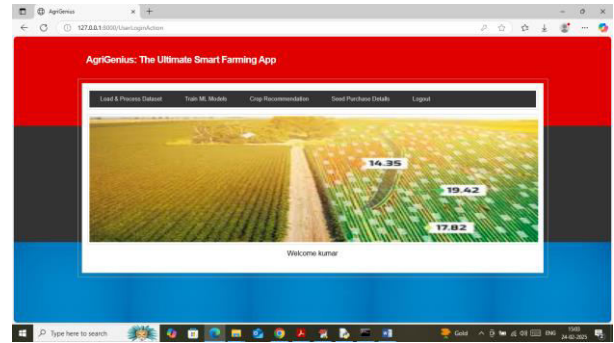


Fig 6.2: User Dashboard

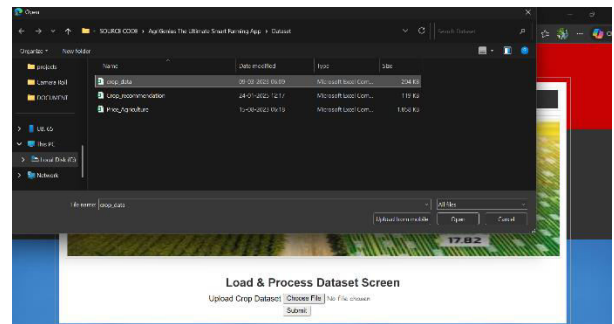


Fig 6.3: Loading and Preprocess Data



Fig 6.4: Model Training Page

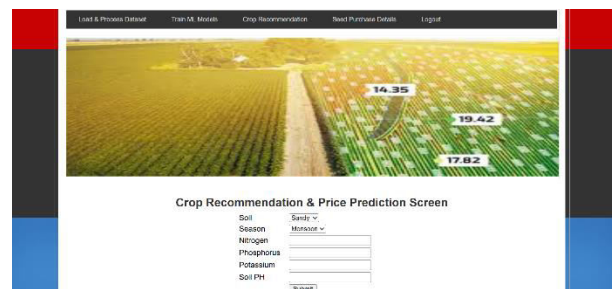


Fig 6.5: Crop Recommendation & Price Prediction



Fig 6.6: Result Page

VII. CONCLUSION

AgriGenius represents a significant step forward in leveraging modern technology to empower farmers through smart farming solutions. By integrating IoT sensors, real-time data analytics, and AI-driven decision support, the app provides personalized recommendations for irrigation, fertilization, pest control, and crop management. The platform's user-friendly interface and comprehensive features enable farmers to optimize resource usage, increase crop yields, and reduce environmental impact. The adoption of AgriGenius has the potential to transform traditional agricultural practices by making them more efficient, sustainable, and data-driven, ultimately contributing to food security and rural economic development.

VIII. FUTURE SCOPE

Future directions of this research include the integration of federated learning and edge AI to further enhance the efficiency and privacy of data security protocols. Implementing federated learning can mitigate data privacy concerns by allowing model training on decentralized data sources without direct data transmission to a central server. Furthermore, combining blockchain technology with ML models may improve auditability and trustworthiness of the data transmission process.

Another avenue for exploration involves real-time deployment and testing of these ML models in heterogeneous cloud environments, including hybrid and multi-cloud systems. Research can also focus on reducing the computational overhead of ML models,

which is critical for deployment in latency-sensitive applications. Finally, enriching the models with adversarial training and reinforcement learning could make them more resilient to sophisticated attack strategies and capable of autonomous decision-making in complex security scenarios. Looking ahead, AgriGenius can be enhanced by incorporating advanced machine learning models to improve predictive accuracy for weather forecasting, pest outbreaks, and disease detection. Integration with drone technology and satellite imagery could provide broader monitoring capabilities and enable precision farming at scale. Expanding multilingual support and offline functionality will make the app accessible to a wider demographic of farmers, including those in remote areas with limited connectivity. Additionally, incorporating blockchain for transparent tracking of agricultural produce could add value to supply chain management and ensure food safety. Continuous user feedback and collaboration with agricultural experts will be vital for iterative improvements and adaptation to diverse farming conditions worldwide.

IX. REFERENCES

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