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GrowSmart: An AI-Based Smart Agriculture Platform for Crop Recommendation, Disease Detection, and Market Intelligence

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Abstract: *GrowSmart: An AI-Based Smart Agriculture Plat- form for Crop Recommendation, Disease Detection, and Market Intelligence*

Agriculture is a critical sector in developing countries like In- dia, yet farmers face persistent challenges such as unpredictable weather conditions, inefficient crop selection, plant diseases, and lack of access to market intelligence and government schemes [3], [9]. This paper presents GrowSmart, an AI-driven smart agriculture platform designed to assist farmers through data- driven decision-making.

The proposed system integrates machine learning models, real- time weather intelligence, crop recommendation systems, plant disease detection, and an AI-powered marketplace into a unified platform [1], [2], [9]. Random Forest algorithms are used for rainfall prediction, neural networks for crop recommendation, and Convolutional Neural Networks (CNNs) for image-based disease detection [1], [10].

Unlike existing systems that focus on isolated functionalities, GrowSmart provides a comprehensive ecosystem that supports farmers throughout the agricultural lifecycle [4], [8]. The system aims to improve productivity, reduce losses, and enhance farmer income through intelligent automation and predictive analytics.

Keywords: Smart Agriculture, Machine Learning, Crop Recommendation, Disease Detection, Precision Farming, AI in Agriculture

I. INTRODUCTION

Agriculture continues to be the backbone of the Indian econ- omy, supporting a large portion of the population. However, farmers face multiple challenges including climate variability, lack of access to expert guidance, inefficient crop planning, and limited market transparency [3], [9].

Traditional farming practices rely heavily on experience rather than data-driven insights, which often leads to sub-optimal decisions and reduced productivity. With the rapid advancement of Artificial Intelligence (AI) and Machine Learning (ML), there is a significant opportunity to transform agriculture into a more precise and efficient domain [1], [2].

Existing agricultural solutions typically address individual problems such as weather forecasting or disease detection [1], [10]. However, there is a lack of integrated systems that provide end-to-end support [4], [8]. To address this gap, this paper proposes GrowSmart, a unified smart agriculture platform that combines multiple intelligent modules including crop recommendation, disease detection, weather prediction, and market intelligence.

The proposed system aims to empower farmers by providing actionable insights and improving decision-making processes through AI-driven technologies [9].

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II. RELATED WORK

Recent advancements in artificial intelligence have led to the development of various smart agriculture systems [1], [9]. Machine learning techniques such as Decision Trees, Support Vector Machines, and Random Forest algorithms have been widely used for crop prediction based on soil and environmental parameters [2], [4].

Similarly, plant disease detection systems using image pro- cessing and deep learning models such as CNNs have shown promising results in identifying diseases at early stages [1], [10]. These systems help in reducing crop loss by enabling timely intervention.

Weather prediction models using ensemble learning tech- niques have also been implemented to forecast rainfall and climate conditions [2]. Additionally, digital agricultural mar- ketplaces have been introduced to connect farmers directly with buyers, reducing dependency on intermediaries [9].

Despite these advancements, most existing systems operate independently and do not provide a unified solution [4], [8]. The integration of multiple AI-driven modules into a single platform remains a significant research gap. GrowSmart addresses this limitation by combining multiple functionalities into a cohesive system.

III. LITERATURE REVIEW

Artificial Intelligence in agriculture has evolved signifi- cantly due to advancements in machine learning, deep learn- ing, and data analytics [1], [9]. Crop recommendation systems typically use supervised learning techniques to analyze soil nutrients and environmental conditions [2], [4]. Neural net- works have proven effective in capturing complex relationships between input parameters such as Nitrogen (N), Phosphorus (P), Potassium (K), pH, temperature, and rainfall [2]. Plant disease detection has been enhanced through the use of Convolutional Neural Networks (CNNs), particularly models like MobileNetV2, which enable efficient image classification even with limited computational resources [1], [10]. These models analyze visual patterns in plant leaves to identify diseases accurately. Recent studies also highlight the im- portance of integrating multiple AI techniques into a single platform to improve usability and impact [4], [8]. However, most systems lack real-time integration and personalization [3]. GrowSmart builds upon these concepts by integrating crop recommendation, disease detection, weather prediction, and market intelligence into a unified architecture, thereby improving efficiency and accessibility.

IV. PROPOSED ARCHITECTURE

The proposed system, GrowSmart, is designed as a com- prehensive smart agriculture platform that integrates multiple AI-based modules.

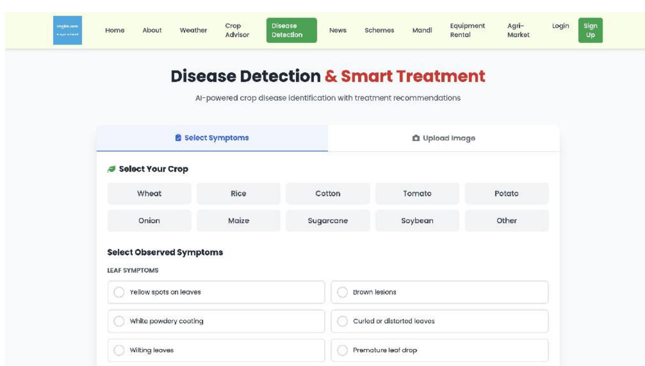

Fig. 1. Application Home Page

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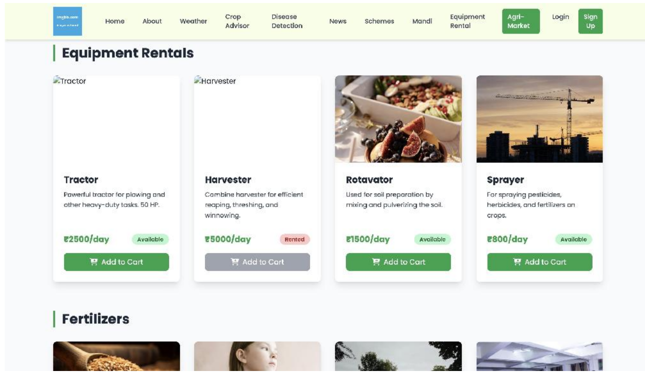

Fig. 2. Buy Functionality

1) System Overview The platform consists of the following key components:
a) Smart Weather Intelligence
b) Crop Recommendation System
c) Disease Detection System
d) Smart Marketplace
e) Equipment Recommendation
f) Government Scheme Recommender
g) Personalized News Feed

Each module is interconnected and contributes to pro- viding a holistic solution for farmers [4], [8].

a) Smart Weather Intelligence The weather module utilizes a Random Forest algorithm to predict rainfall and generate actionable alerts [2]. Unlike traditional systems that only display weather data, this module provides decision-based insights such as precautionary measures for farming activities.

b) Crop Recommendation System The crop recom- mendation system uses a neural network model to analyze soil nutrients, pH level, temperature, rainfall, and season [2], [4]. Based on these inputs, it provides a ranked list of suitable crops along with confidence scores and expected yield.

c) Disease Detection System The disease detection module operates in two modes:
• Symptom-based detection using neural networks [1]
• Image-based detection using CNN (MobileNetV2) [1], [10]

The system provides disease identification along with treatment and prevention recommendations, enabling early intervention.

d) Smart Marketplace The platform includes a digital marketplace where farmers can sell crops directly to buyers [9]. AI-based price prediction models help farmers determine fair prices and improve profitability.

e) Additional Modules The system also includes:
• Equipment recommendation based on land size and crop type
• Government scheme recommendation based on farmer profile
• Personalized agricultural news feed

V. METHODOLOGY

The proposed GrowSmart system utilizes multiple ma- chine learning models, each designed for specific agricultural tasks. The system is built using both TensorFlow-based deep learning models and Scikit-learn models, ensuring efficient and accurate predictions [1], [9].

a) Crop Recommendation Model (TensorFlow Neu- ral Network) The crop recommendation system is implemented using a Dense Neural Network developed with TensorFlow/Keras [2], [4]. The model takes the following inputs:
• Nitrogen (N)

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• Phosphorus (P)
• Potassium (K)
• pH level
• Temperature
• Rainfall
The architecture consists of:
• Input layer (6 features)
• Hidden layer (32 neurons)
• Dropout layer (to prevent overfitting)
• Hidden layer (16 neurons)
• Output layer (multiple crop classes)
The model predicts the most suitable crops along with confidence scores and expected yield.
b) Disease Detection Model (TensorFlow CNN - MobileNetV2) The disease detection system uses a Convolutional Neural Network (CNN) imple- mented in TensorFlow, based on the MobileNetV2 architecture using transfer learning [1], [10]. Key features:
• Input: Plant leaf image (resized to 224×224)
• Pre-trained MobileNetV2 base model
• Fine-tuned classification layers
• Output: Disease class with confidence score This model enables accurate identification of plant diseases and provides treatment recommendations.
c) Rain Prediction Model (Random Forest – Scikit-
learn) Rainfall prediction is performed using a Random Forest algorithm, which analyzes histor- ical weather data such as temperature, humidity, and rainfall patterns to predict future rainfall prob- ability [2].
d) Price Prediction Model (Regression Model) A regression-based model is used to estimate crop prices based on [9]:
• Crop type
• Location Seasonal demand
This helps farmers make better selling decisions.

VI. ADVANTAGES

• Supports early disease detection, reducing potential crop losses [1], [10]
• Provides real-time weather-based alerts for proac- tive farming decisions [2]
• Integrates multiple AI models into a single unified platform [4], [8]
• Offers predictive analytics for better planning and risk management [9]
• Reduces manual effort through automation of key agricultural tasks [1]
• Enhances decision accuracy using trained machine learning models [2]
• Facilitates better price discovery through AI-based market insights [9]
• Adaptable to different crops, regions, and environ- mental conditions [3]

VII. LIMITATIONS

• Performance may degrade in regions with insuffi- cient or noisy data [3]
• Model predictions may not generalize well across different geographical regions [2]
• High computational requirements for training deep learning models [1]
• Dependency on accurate sensor and input data for reliable outputs [9]
• Limited accuracy in extreme or unexpected weather conditions [2]
• Potential bias in training datasets affecting predic- tion outcomes [3]
• Requires periodic retraining to maintain model ac- curacy [1]

• User adoption may be challenging for farmers with low digital literacy

VIII. FUTURE SCOPE

The GrowSmart platform can be further enhanced by integrating advanced technologies to improve real-time decision-making, scalability, and practical deployment in diverse agricultural environments. Future developments can focus on combining AI with IoT, edge comput- ing, and large-scale data systems to create a more autonomous and intelligent agricultural ecosystem [9]. Integration of IoT-based soil sensors can enable continu- ous monitoring of soil parameters such as moisture, nu- trient levels, and temperature, allowing more precise and real-time crop recommendations. Additionally, drone- based crop monitoring can be utilized for large-scale field analysis, enabling early detection of diseases, pest infestations, and crop stress conditions.

Blockchain technology can be incorporated to ensure transparency and traceability in the agricultural supply chain, reducing fraud and improving trust between farm- ers and buyers [8]. Furthermore, the inclusion of voice- based interfaces in regional languages can significantly improve accessibility for farmers with limited digital literacy, making the platform more user-friendly.

The system can also be enhanced by integrating satel- lite data for large-scale crop health monitoring and weather analysis, enabling macro-level agricultural in- sights. Future versions of GrowSmart may also incorpo- rate real-time data streaming, personalized recommen- dations based on farmer behavior, and adaptive learning models that continuously improve with new data.

• IoT-based soil sensors for real-time field monitoring [9]
• Drone-based crop monitoring for large-scale analy- sis
• Blockchain for secure and transparent supply chain management [8]
• Voice-based interfaces for multilingual accessibility
• Satellite data integration for crop health and climate analysis

IX. CONCLUSION

GrowSmart represents a significant step toward trans- forming traditional agriculture into a smart, data-driven ecosystem [1], [9]. By integrating multiple AI-based modules into a single platform, the system provides comprehensive support to farmers throughout the agri- cultural lifecycle [4], [8]. The use of machine learning, predictive analytics, and real-time data enables better decision-making, improved productivity, and increased profitability [2], [9]. With further development and real-world deployment, GrowSmart has the potential to become a scalable and impactful solution for modern agriculture.

REFERENCES

[1] Ibrahim, A.S., Mohsen, S., Selim, I.M. et al. AI-IoT based smart agriculture pivot for plant diseases detection and treatment. Sci Rep 15, 16576 (2025).

[2] Dhanke, J.A., Srivastava, D., Menaga, D. et al. Climate-Based AI-Powered Precision Irrigation: Sustainably Smart Agriculture Frameworks for Maximum Crop Yields. Remote Sens Earth Syst Sci 8, 161–172 (2025).

[3] Nawaz, M., Babar, M.I.K. IoT and AI for smart agriculture in resource-constrained environments: challenges, opportunities and solutions. Discov Internet Things 5, 24 (2025).

[4] A. Khaliq et al., ”AI-Driven Smart Agriculture: An Integrated Approach for Soil Analysis, Irrigation, and Crop-Fertilizer Rec- ommendations,” in IEEE Access, vol. 13, pp. 141124-141138, 2025.

[5] “Smart Agriculture System Using IoT with Help of AI- Techniques”, IJCTEC, vol. 9, no. 2, pp. 479–487, Mar. 2026.

[6] Wang X (2025) RETRACTED: The artificial intelligence-based agricultural field irrigation warning system using GA-BP neural network under smart agriculture.

[7] Dhanaraj, R.K., Maragatharajan, M., Sureshkumar, A. et al. On-device AI for climate-resilient farming with intelligent crop yield prediction using lightweight models on smart agricultural devices. Sci Rep 15, 31195 (2025).

[8] Kaushik, I., Prakash, N. & Jain, A. An AI-blockchain-assisted smart agriculture framework for enabling secure and effi- cient data transaction: a hybrid approach. Knowl Inf Syst 67, 10087–10135 (2025).

[9] X. Luo, S. Xiong, X. Jia, Y. Zeng and X. Chen, "AIoT-Enabled Data Management for Smart Agriculture: A Comprehensive Review on Emerging Technologies," in IEEE Access, vol. 13, pp. 102964-102993, 2025,

[10] Zeng, Z., Mahmood, T., Wang, Y. et al. AI-driven smart agri- culture using hybrid transformer-CNN for real time disease detection in sustainable farming. Sci Rep 15, 25408 (2025).