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AgriMesh: AgriRent and the Farmer Support Platform

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Abstract- The increasing complexity of malware-based network attacks poses a serious challenge to modern communication systems. Traditional signature-based intrusion detection systems struggle to detect novel or evolving attack patterns. This paper presents a comprehensive machine learning framework for classifying malware network traffic using flow-based features. The study uses a dataset of 60,938 instances spanning six classes: normal traffic and five malware types (worm, rootkit, buffer overflow, ipsweep, and sqlattack). The dataset exhibits extreme class imbalance, with normal traffic comprising 99.43% of samples. To address this, we apply label encoding, one-hot encoding, stratified sampling, and feature standardization, and evaluate performance using accuracy, precision, recall, F1-score, confusion matrix, ROC analysis, and training time. Seven supervised classifiers from different learning paradigms—Logistic Regression, Decision Tree, K-Nearest Neighbors, Random Forest, Gradient Boosting, XGBoost, and LightGBM—are developed and compared. Experimental results show that ensemble methods significantly outperform single classifiers in detecting minority attack classes. XGBoost achieves the highest overall performance: 99.95% accuracy, 99.96% precision, 99.95% recall, and 99.95% F1-score, with a training time of 3.70 seconds. LightGBM provides the best trade-off between accuracy (99.79%) and speed (3.25 seconds), while Gradient Boosting requires substantially longer training (82.99 seconds). The findings confirm that ensemble learning is highly effective for malware traffic classification under severe class imbalance.

Keywords- Smart Agriculture, Machine Learning, Blockchain, Equipment Rental, Crop Prediction, Sustainable Farming, Artificial Intelligence Quiz System.

I. INTRODUCTION

Agriculture plays a crucial role in ensuring food security and supporting the livelihoods of millions. However, the industry faces major challenges such as unpredictable climate conditions, low productivity, and limited access to resources. Small and marginal farmers often lack the financial capacity to purchase modern equipment or leverage digital technologies, leading to inefficient practices.

The AgriRent and Farmer Support Platform aims to address these issues by merging technology with accessibility. AgriRent focuses on providing a digital marketplace where farmers can rent essential machinery at affordable rates, reducing operational costs. Simultaneously, the Farmer Support Platform integrates AI-based technologies to deliver real-time recommendations for crop management, soil analysis, and disease detection.

Together, these platforms provide a holistic ecosystem that empowers farmers to make data-driven decisions, ensuring greater productivity, transparency, and sustainability in agriculture.

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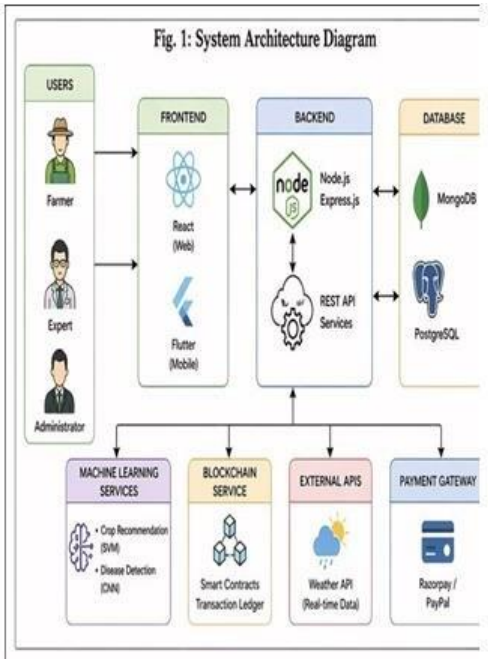
II. PROBLEM STATEMENT

Farmers face several persistent challenges that hinder agricultural productivity and efficiency. These include limited access to modern farming equipment due to high costs, lack of timely agricultural insights, and absence of integrated digital platforms that address multiple farming needs simultaneously. Additionally, inefficient resource utilization, lack of predictive analysis for crop management, and insecure transaction systems further complicate the agricultural process.

There is a need for a unified, technology-driven solution that provides equipment accessibility, intelligent advisory services, and secure transactions to improve overall farming efficiency and sustainability.

III. SYSTEM ARCHITECTURE



IV. SYSTEM OVERVIEW

The AgriRent and Farmer Support Platform is designed as an integrated system consisting of two primary modules:

- AgriRent Module – A digital platform that allows farmers to rent agricultural equipment easily, reducing the financial burden of purchasing machinery.
- Farmer Support Platform – A smart advisory system that uses machine learning models to provide crop recommendations, disease detection, and farming insights.

The system includes user-friendly dashboards for farmers, experts, and administrators. Farmers can browse equipment, make bookings, and perform secure payments through integrated payment gateways. Experts can analyze agricultural data and provide recommendations, while administrators manage system operations.The backend uses Node.js and Express.js, while the frontend is developed using React and Flutter. Data is stored securely in MongoDB and PostgreSQL, ensuring scalability and efficiency.

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V. PROPOSED WORK

The proposed system integrates advanced machine learning techniques and blockchain technology to improve agricultural practices. The crop recommendation module uses Support Vector Machine (SVM) algorithms, while disease detection is performed using Convolutional Neural Networks (CNN).The system also incorporates real-time data inputs such as weather conditions and soil parameters through external APIs, enabling accurate predictions and recommendations. Blockchain technology ensures secure, transparent, and tamper-proof transactions within the platform. This integrated approach enhances decision-making capabilities, improves resource utilization, and provides farmers with reliable and actionable insights.

VI. RESULT ANALYSIS

The system demonstrates strong performance in agricultural prediction and analysis tasks. The crop recommendation model achieved an accuracy of 99.59%, while the disease detection model achieved a test accuracy of 92.42%.These results validate the effectiveness of machine learning techniques in improving agricultural outcomes. Additionally, the platform enables efficient equipment utilization and reduces operational costs for farmers. The integration of real-time data further enhances the accuracy of predictions, leading to better decision-making and improved productivity

VII. CONCLUSION

This research highlights the transformative potential of digital agriculture through the AgriRent and Farmer Support Platform. By integrating AI, machine learning, and blockchain technologies, the system provides farmers with access to modern tools, intelligent insights, and secure transactions. The modular architecture ensures scalability and adaptability across different agricultural scenarios. Future enhancements may include integration of satellite data, advanced weather forecasting, and multilingual interfaces to improve accessibility for rural users. Overall, the platform establishes a strong foundation for sustainable and technology-driven agricultural development.

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