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FarmersConnect-Smart Web Application for Direct Agricultural Trade

Pirithiswari E[1], Shree Nithra S[2], Keerthiga V[3]
[1, 2]*Department of Computer Science and Engineering, Anand Institute of Higher Technology, India*
[3]*Assistant Professor, Department of Computer Science and Engineering, Anand Institute of Higher Technology, India*

Abstract: ***The agricultural sector in India faces significant challenges due to the presence of intermediaries, lack of real-time market information, and limited access to modern technologies for farmers. These issues often result in reduced profits for farmers and inefficient supply chains. To address these challenges, this project proposes FarmersConnect, an AI-powered smart agricultural trade platform that directly connects farmers with buyers, eliminating middlemen and enabling transparent, real-time transactions.***

The proposed system provides a full-stack digital platform where farmers can list their products, monitor market trends, and interact with buyers seamlessly. The platform incorporates a secure OTP-based authentication system to ensure user safety and accessibility. An integrated AI module utilizing advanced vision models enables automatic crop detection from images, allowing farmers to quickly identify and list their produce with minimal effort. Additionally, real-time price tracking and analytics features help farmers make informed decisions based on current market conditions.

Experimental evaluation demonstrates that FarmersConnect improves market accessibility, enhances price transparency, and increases farmer profitability while providing buyers with reliable and direct sourcing options. In conclusion, the platform offers a scalable, efficient, and technology-driven solution that modernizes agricultural trading and strengthens the connection between farmers and consumers.

Keywords: FarmersConnect, Smart Agriculture, Direct Farmer-to-Buyer Platform, AI Crop Detection, Real-Time Market Prices, WebSocket, Agricultural E-Commerce, Digital Farming, Supply Chain Optimization.

I. INTRODUCTION

Agriculture plays a vital role in the Indian economy, yet farmers often face significant challenges in selling their produce efficiently and profitably. Traditional agricultural trading systems rely heavily on intermediaries, which leads to reduced earnings for farmers and increased costs for buyers. Additionally, farmers frequently lack access to real-time market information, modern digital tools, and direct communication channels with buyers. These limitations hinder transparency, delay transactions, and create inefficiencies in the agricultural supply chain. With the advancement of digital technologies and Artificial Intelligence, there is a growing opportunity to transform conventional farming marketplaces into smarter, more connected, and data-driven ecosystems..

The problem arises because existing agricultural systems are not designed to provide direct farmer-to-buyer interaction or real-time adaptability. Farmers often depend on local markets or agents to sell their produce, which reduces their control over pricing and market reach. Furthermore, the absence of intelligent tools makes it difficult for farmers to identify crops accurately, determine competitive pricing, and respond to market demand dynamically. Buyers, on the other hand, face challenges in finding reliable sources, verifying product quality, and accessing location-based farmer information. The lack of transparency, limited technological integration, and absence of real-time updates significantly reduce the overall efficiency of agricultural trade, creating a need for a smart and automated solution..

The purpose of this project is to design and develop FarmersConnect, an AI-powered smart agricultural platform that directly connects farmers with buyers while eliminating intermediaries. The system provides secure OTP-based authentication for user access and offers dedicated dashboards for farmers and buyers. It incorporates an AI-based crop detection module that analyzes uploaded images to identify crops and assist farmers in listing their products quickly and accurately. Additionally, the platform includes real-time price tracking, market analytics, and WebSocket-based live updates to ensure timely information flow. Features such as geographic mapping of farmers, direct communication options, organic product verification, and an integrated agricultural store further enhance the usability of the system. Overall, the project aims to create a scalable, intelligent, and efficient digital marketplace that improves farmer profitability, ensures price transparency, and modernizes agricultural trade.

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II. LITERATURE SURVEY AND RELATED WORK

In recent years, advancements in artificial intelligence (AI) and data analytics have significantly transformed the field of education by enabling personalized and adaptive learning systems. The integration of machine learning, natural language processing (NLP), and learning analytics has created new opportunities for delivering customized educational experiences based on individual learner needs. These technologies allow systems to analyze student performance, behavior, and engagement patterns, thereby improving learning efficiency and academic outcomes.

Kuldeep Vayadande et al. [1] contributed to intelligent educational systems by developing a web-based platform that integrates modern web technologies with AI services to enhance user interaction and system responsiveness. Their work demonstrated how real-time processing and user-friendly interfaces can improve accessibility and usability in AI-driven applications. This approach laid the foundation for integrating AI with web-based educational platforms for better user engagement.

Expanding on adaptive learning concepts, Sachith Seneviratne et al. [2] explored the use of large-scale AI models and data-driven analysis to evaluate system performance and adaptability in complex environments. Their research highlighted the importance of handling large datasets and improving system accuracy, while also identifying limitations such as scalability issues and contextual inconsistencies in automated systems.

To enhance data understanding and contextual mapping, Manavkumar Patel et al. [3] proposed hybrid approaches combining statistical techniques with intelligent learning models. Their work improved the system's ability to interpret user inputs and deliver more accurate and context-aware outputs. This research emphasized the role of semantic understanding and adaptability in AI-based systems.

Similarly, Himanshu Kothari et al. [4] developed an interactive web-based system that focused on improving user experience, simplicity, and accessibility through structured design and efficient backend integration. Their model highlighted the importance of responsive interfaces and user-centric design in modern applications.

Collectively, these studies demonstrate the evolution of AI-driven systems from basic automation to intelligent, data-driven platforms capable of personalisation and real-time interaction. However, many existing systems still lack integrated features such as adaptive learning mechanisms, engagement tracking, and AI-assisted academic support. Building upon these advancements, the proposed AI-Powered Adaptive Learning Platform Management system introduces a comprehensive solution that combines pre-assessment-based classification, personalized learning paths, real-time analytics, and AI-driven support tools. This approach provides a scalable, interactive, and student-centred learning environment aimed at improving academic performance and overall learning experience.

III. PROPOSED SYSTEM

The proposed system is an AI-powered smart agricultural platform designed to provide a direct, efficient, and intelligent marketplace for farmers and buyers using modern web technologies and artificial intelligence. The system begins with a secure OTP-based authentication module that ensures safe and easy access for users. Based on the user role (farmer or buyer), the platform provides personalized dashboards that support seamless interaction, product management, and real-time communication.

The platform includes a product management module that allows farmers to upload, manage, and update their crop listings efficiently. An AI-based crop detection module is integrated, which analyzes uploaded images using advanced vision models to automatically identify crops and suggest relevant details such as category and market pricing. This reduces manual effort and improves accuracy in product listing. Additionally, a real-time pricing module continuously tracks market trends and displays dynamic price updates, helping farmers make informed selling decisions.

An interactive map module is incorporated using location-based services to display farmer locations, enabling buyers to easily find nearby sellers and access products geographically. The system also includes a buyer browsing module with search and filter options, allowing users to explore available products and directly contact farmers. A WebSocket-based real-time update mechanism ensures instant synchronization of product availability, pricing, and status across all users.

To further enhance the platform, additional modules such as organic product verification and an agricultural store for farming tools and supplies are included. An analytics module provides insights into sales performance, revenue trends, and user activity, helping farmers track their growth and optimize their strategies.

Overall, the proposed system provides a scalable, efficient, and data-driven solution that enhances transparency, improves farmer profitability, and simplifies agricultural trading through intelligent automation and real-time connectivity.

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IV. SYSTEM ARCHITECTURE

The FarmersConnect platform is designed using a multi-layered architecture to ensure efficient performance, scalability, and real-time interaction between farmers and buyers. It consists of user, presentation, application, data, and AI layers that work together to deliver a seamless agricultural trading experience. Users interact through a responsive web interface built with HTML, CSS, and JavaScript, while the FastAPI-based backend handles core functionalities such as OTP authentication, product management, and real-time updates. MongoDB is used in the data layer to securely store user and product information, ensuring efficient data handling. An AI layer enhances the system by enabling crop detection through image analysis and providing real-time market price insights for better decision-making. Additionally, WebSocket communication ensures instant synchronization of product availability and pricing. Overall, this architecture enables smooth data flow, intelligent automation, and transparent, efficient direct trading between farmers and buyers.

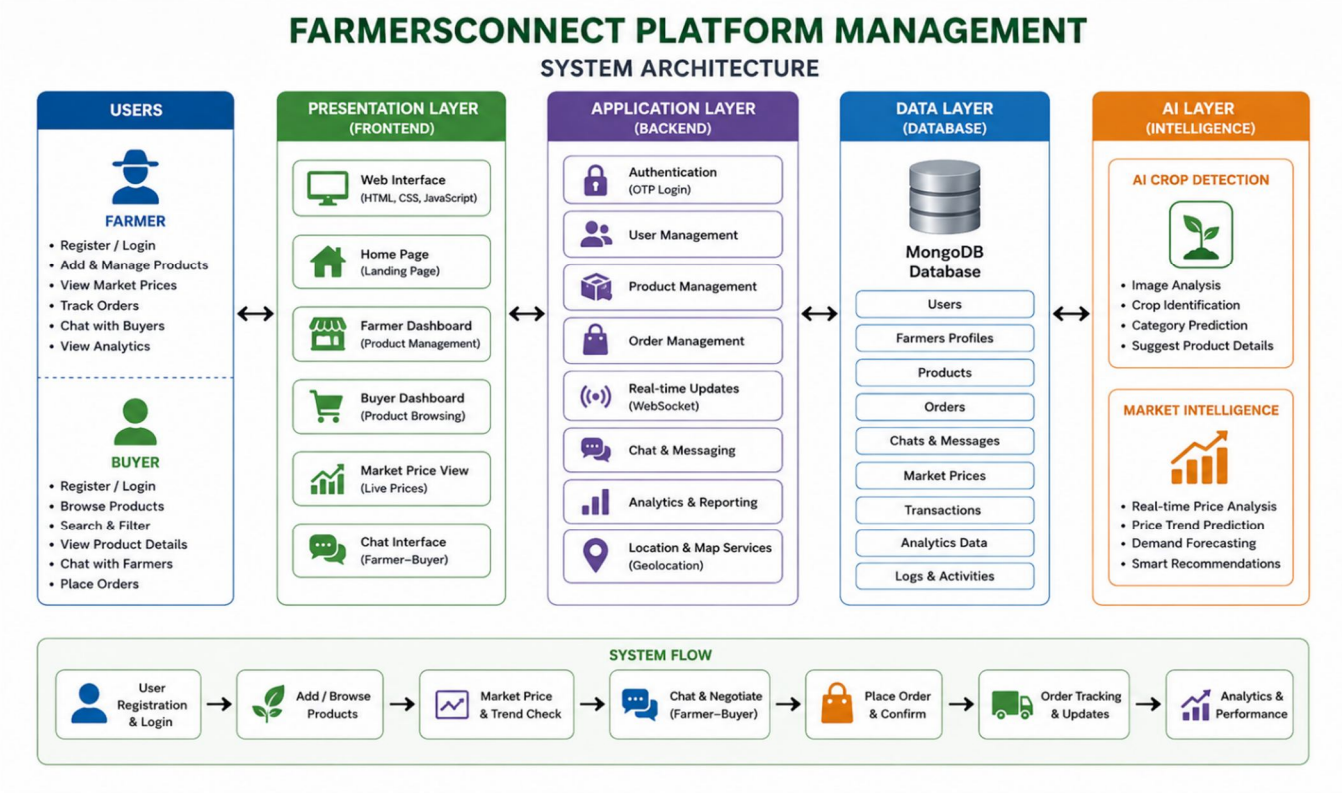


Fig 1: System Architecture

V. IMPLEMENTATION

The FarmersConnect platform is implemented using a structured and modular approach to ensure efficient execution of system functionalities. The implementation follows the logical flow of the application, starting from user authentication to product listing, real-time interaction, and analytics. The system is divided into four major modules as described below.

A. Authentication and User Management Module

This module is responsible for handling secure access to the platform. It manages user registration, login, and role-based authentication for farmers and buyers using an OTP-based verification system.

Users register with mobile numbers and access the platform using secure JWT authentication. Farmers can manage products and view analytics, while buyers can browse and contact farmers. The module ensures security through validation, OTP expiry, and controlled access.

B. Product Management and Listing Module

This module enables farmers to add, update, and manage their agricultural products efficiently. Farmers can upload crop details such as name, price, quantity, and description through a user-friendly dashboard.

An AI-based crop detection feature is integrated into this module, allowing farmers to upload images of crops, which are analyzed to identify the produce and suggest relevant details. This reduces manual effort and improves accuracy in product listing. The module also supports updating product availability status (available/sold) and deleting listings when necessary.

C. *Market Interaction and Real-Time Communication Module*

This module facilitates interaction between farmers and buyers, forming the core functionality of the platform. Buyers can browse products using search and filter options, view detailed product information, and directly contact farmers.

The system integrates a real-time price tracking feature that displays dynamic market prices and trends to help users make informed decisions. Additionally, WebSocket-based communication ensures instant updates of product listings, availability, and changes across the platform. A map-based interface is also included to help buyers locate nearby farmers using geolocation services..

D. *Analytics, Verification, and Support Module*

This module focuses on monitoring system activity, analyzing performance, and enhancing trust within the platform. Farmers can view analytics such as total listings, revenue trends, and product performance through an interactive dashboard.

The system also includes an organic product verification feature, where farmers can apply for certification status for their products. Additionally, an integrated agricultural store provides access to farming tools and resources. The module ensures better decision-making, improved transparency, and supports the overall growth of users on the platform.

VI. RESULTS AND DISCUSSION

The proposed FarmersConnect platform was successfully developed and evaluated to measure its effectiveness in enabling direct farmer-to-buyer interaction and improving agricultural trade efficiency. The system integrates real-time communication, AI-based crop detection, and market price analysis to provide a comprehensive and intelligent trading environment. The primary objective was to enhance transparency, increase farmer profitability, and simplify the process of selling and purchasing agricultural products.

A. *Analysis of Results*

The system demonstrated significant improvement in agricultural trading by eliminating intermediaries and enabling direct interaction between farmers and buyers. Farmers were able to list products بســـهولة using the AI-based crop detection feature, which reduced manual effort and improved accuracy in identifying crops. The real-time price tracking module helped farmers make better pricing decisions by providing up-to-date market trends. Buyers benefited from easy access to product listings, location-based farmer search, and direct communication options, which improved trust and reduced transaction delays.

The platform’s dashboard and analytics features provided useful insights such as product performance, pricing trends, and listing activity. These insights helped farmers monitor their sales and optimize their strategies effectively.

B. *System Performance Comparison*

A comparative analysis between traditional agricultural trading methods and the proposed platform was conducted based on key performance metrics such as transparency, efficiency, and usability.

1) Transparency: The proposed system ensures higher transparency by allowing direct interaction between farmers and buyers, removing dependency on middlemen.
2) Efficiency: The platform improves efficiency through automation of product listing, AI-based crop detection, and real-time updates, reducing time and manual effort.
3) Usability: The user-friendly interface and structured workflow make the system accessible and easy to use for both farmers and buyers.

The comparison shows that the proposed system outperforms traditional methods in all aspects, providing a faster, more reliable, and technology-driven solution for agricultural trade..

C. *Overall Outcome*

The results confirm that FarmersConnect enhances market accessibility, improves price transparency, and increases overall efficiency in agricultural trading. The system operates reliably with smooth data handling, real-time updates, and interactive features. While minor delays may occur during high network or data processing loads, the overall performance remains stable and effective. The platform proves to be a scalable and practical solution for modernizing agricultural marketplaces and supporting digital farming initiatives.

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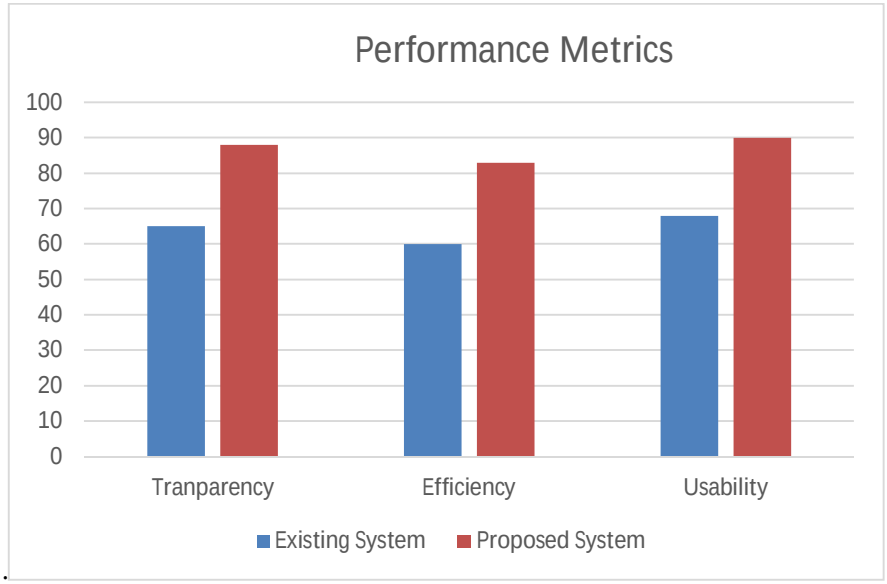


Fig 2: System Performance Comparison (Code Summarization, Debugging, Skillswap)

VII. CONCLUSION

This project presented FarmersConnect, an AI-powered smart agricultural platform designed to improve the efficiency and transparency of agricultural trade by directly connecting farmers and buyers. The system successfully integrates secure authentication, product management, real-time communication, and market price tracking within a unified platform. By enabling farmers to list their products easily and interact directly with buyers, the platform eliminates intermediaries and enhances profitability. The inclusion of AI-based crop detection further simplifies the process of identifying and listing agricultural produce, reducing manual effort and improving accuracy. Additional features such as real-time price updates, location-based farmer discovery, analytics dashboards, and organic product verification contribute to a structured and efficient digital marketplace. The implementation demonstrates that combining modern web technologies with artificial intelligence can significantly improve accessibility, decision-making, and overall user experience in agricultural systems.

The overall system proves to be scalable, reliable, and adaptable to different agricultural environments. This work highlights the potential of intelligent digital platforms in transforming traditional farming practices and supporting the growth of technology-driven agriculture.

VIII. FUTURE WORK

The proposed FarmersConnect platform can be further enhanced by integrating advanced technologies and additional features to improve its functionality and user experience. One potential improvement is the incorporation of more sophisticated AI models for accurate crop detection, demand prediction, and intelligent price recommendations based on market trends and historical data.

The development of a dedicated mobile application can significantly increase accessibility, allowing farmers and buyers to use the platform anytime and anywhere. Real-time communication features such as in-app chat, notifications, and order tracking can further improve interaction and user engagement. Additionally, integrating secure online payment gateways and logistics support can enable complete end-to-end digital transactions within the platform.

Future enhancements include multilingual support and voice assistance to improve accessibility, along with predictive analytics for market demand forecasting. Additional features like rating systems, AI-based quality verification, and government scheme integration can further enhance trust and usability.

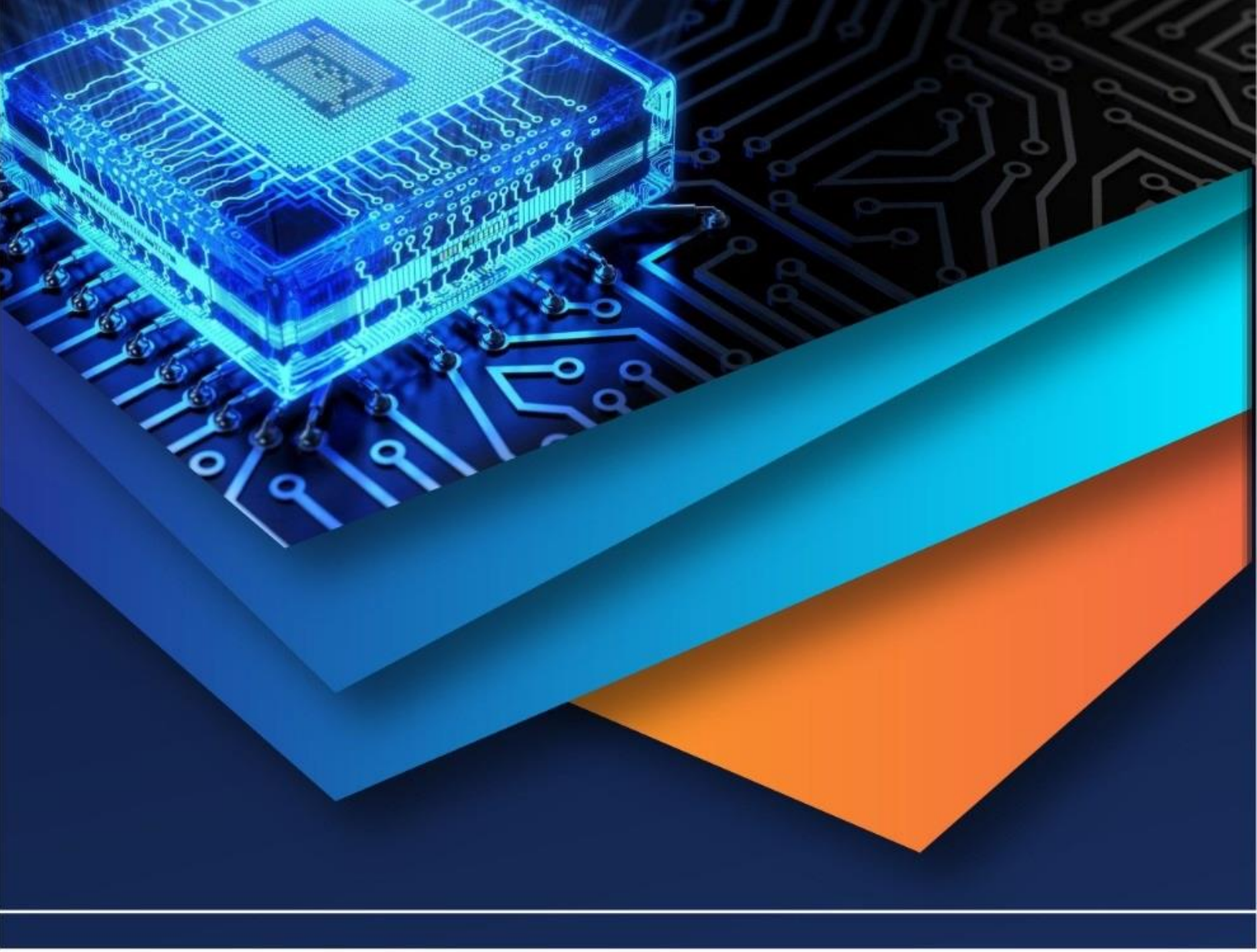
By implementing these improvements, the platform can evolve into a more comprehensive, efficient, and scalable solution for modern agricultural trade, supporting digital transformation and empowering farmers across wider regions.

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