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AgroSetu - Bridging Farmers with Digital Agriculture

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Abstract: ***AgroSetu is a digital AgriTech platform that aims to improve decision-making, market transparency, and real-time support for farmers. The platform connects farmers, buyers, agricultural experts, and service providers in one system to promote effective information sharing, communication, and trading. It offers real-time updates on crop prices to help farmers understand market trends and reduce their need for middlemen. The Farmer Activity Calendar helps farmers plan for each season by providing timely reminders and advice for sowing, irrigation, fertilization, and harvesting. The system includes modules for Crop Disease Prediction and Soil-Based Crop Recommendation, which assist in identifying risks early and choosing the right crops. An AI Chat Assistance module provides smart advisory support and connects users to experts for more complex questions. There is also an online marketplace for clear digital trading, while WhatsApp, Email, and Voice Notifications send important alerts to help farmers make timely and informed decisions.***

Keywords: AgriTech Platform, Smart Farming, Farmer Activity Calendar, CropPrice Monitoring, Soil-Based Crop Recommendation, Crop Disease Prediction, AI Chat Assistant, Digital Marketplace.

I. INTRODUCTION

Agriculture has been the foundation of human civilization since ancient times. In India, agriculture has not only served as a source of food but has also played a crucial role in economic stability, employment generation, and rural development. Traditional Indian farming practices, such as crop rotation, natural irrigation, and soil conservation, were developed through centuries of experience and knowledge passed down across generations. The importance of agriculture has always been widely recognized, and Mahatma Gandhi rightly referred to it as the “backbone of the Indian economy.

After independence, India faced severe food shortages, which led to the introduction of the Green Revolution in the 1960s. This phase brought significant changes through the use of high-yielding seed varieties, improved irrigation facilities, chemical fertilizers, and farm mechanization. As a result, India achieved self-sufficiency in food grain production and increased overall agricultural output. Over time, government initiatives such as Minimum Support Price (MSP), crop insurance schemes, subsidies, and farmer welfare programs further strengthened the agricultural sector.

Despite these developments, Indian farmers continue to face several challenges. Limited access to real-time market information, dependence on middlemen, unpredictable weather conditions, crop diseases, soil degradation, and rising input costs place constant pressure on farmers’ incomes. In many rural areas, farmers still rely on traditional farming methods, which can sometimes result in uncertain yields and financial losses. The presence of intermediaries further reduces farmers’ profits by creating a wide gap between farm-gate prices and market prices.

With rapid advancements in information technology, agriculture is now entering a new phase known as digital agriculture, where technologies such as artificial intelligence, data analytics, and mobile platforms offer opportunities to address these challenges.

II. LITERATURE REVIEW

In recent years, several researchers have explored the application of advanced technologies to improve agricultural productivity and farmer decision-making. R. Mahesh et al. [1] proposed an AI-powered crop advisory system that provides decision support to farmers for enhancing crop productivity and overall farm management. Similarly, P. Rao and K. Singh [2] developed a mobile-based platform that delivers real-time crop price information, enabling farmers to make informed decisions regarding the sale of their produce.

R. Patil et al. [3] introduced a smart farming assistant that utilizes a chat-based interface to efficiently resolve farmers’ queries. In addition, A. Sharma and P. Gupta [4] designed a soil-based crop recommendation tool that suggests suitable crops based on soil parameters, thereby aiding in better crop selection. D. Kumar et al. [5] developed a digital marketplace for agricultural products, allowing farmers to directly connect with buyers and eliminate intermediaries.

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Furthermore, S. Mishra et al. [6] proposed an AI-driven decision support system aimed at promoting sustainable agricultural practices. M. Khan et al. [7] emphasized the integration of ICT and IoT technologies in precision agriculture to enhance farming efficiency and real-time monitoring. L. Thomas and R. Bansal [8] presented an AI-based pest detection framework using image processing techniques, while G. Choudhary and N. Sharma [9] proposed a machine learning-based model for predicting soil fertility and crop yield.

V. Srivastava et al. [10] developed a farmer–merchant digital trading platform that provides real-time notifications to users. Similarly, A. Verma and S. Kulkarni [11] worked on crop disease detection using image processing techniques to identify plant diseases accurately. R. Singh et al. [12] proposed a weather-driven crop advisory system that assists farmers in making decisions based on climatic conditions.

Moreover, N. Agarwal and P. Malhotra [13] introduced a cloud-based farm management system designed specifically for small-scale farmers to improve operational efficiency. S. Yadav et al. [14] presented a machine learning approach for crop yield and price forecasting, helping farmers plan their production and sales strategies. Finally, K. Meena and R. Saxena [15] proposed a secure digital payment and order management framework for agricultural marketplaces, ensuring safe and reliable transactions.

Despite these advancements, most existing systems focus on specific aspects of agriculture such as advisory services, disease detection, or market access. There is still a lack of an integrated platform that combines all these features into a single system, highlighting the need for a comprehensive smart farming solution.

A. Problem Definition

Agriculture in India is still largely dependent on traditional methods, limited market access, and manual decision-making processes. Farmers often face several critical challenges such as lack of real-time crop price information, delayed or incorrect crop advisory, insufficient knowledge about soil suitability, and dependency on middlemen for selling produce. These issues result in financial losses, reduced productivity, and uncertainty in farming operations.

Farmers also struggle with irregular access to agricultural experts and lack of timely notifications about weather changes, pest attacks, and seasonal farming activities. This leads to poor crop planning, improper use of fertilizers and pesticides, and increased crop damage.

Moreover, the absence of a secure and transparent online marketplace restricts farmers from reaching potential buyers directly. Middlemen dominate the trading process, leading to unfair pricing and reduced income for farmers. The lack of a centralized system for data management, advisory history, and transaction records also makes it difficult to analyze farming trends and make data-driven decisions.

The existing agricultural ecosystem lacks a unified digital platform that can provide real-time information, AI-based advisory, secure trading, and efficient communication in a simple and accessible manner for rural farmers.

Therefore, there is a need to develop AgroSetu, a comprehensive digital platform that bridges the gap between farmers, buyers, experts, and service providers. The platform should provide real-time market and price awareness, AI-based disease prediction, soil-based crop recommendations, dynamic farming calendar, secure online marketplace, and effective communication through notifications. It must also ensure user security, data management, and scalability to support future enhancements. Learning support further reduces the learning effectiveness of existing solutions.

III. PROPOSED SYSTEM

AgroSetu is an AI-enabled digital agricultural platform designed to connect farmers, buyers, agricultural experts, and service providers through a unified and intelligent system. The main goal of AgroSetu is to replace traditional manual farming practices with a data-driven and user-friendly solution that improves decision-making, productivity, and income for farmers.

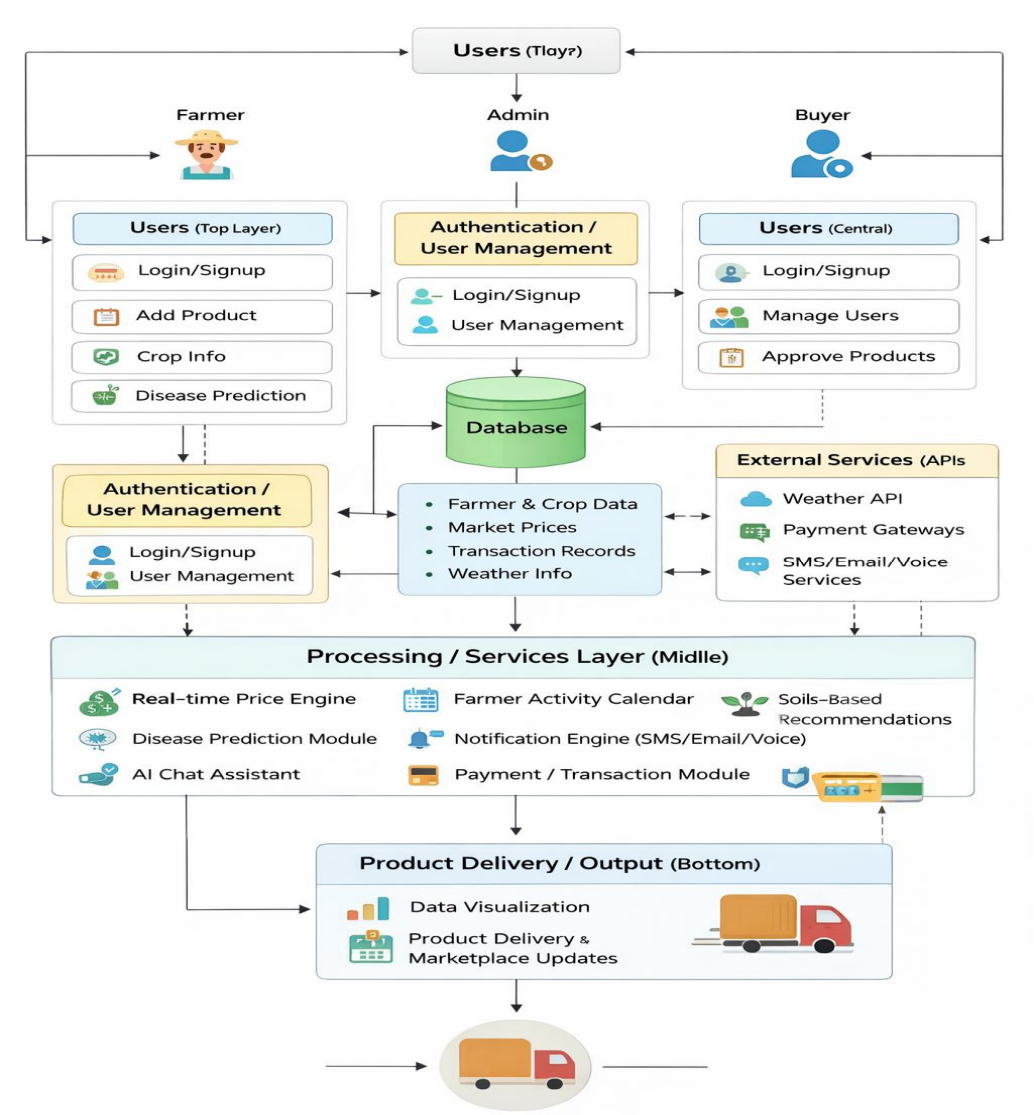

Fig. 1. Overview of the proposed system of AgroSetu.

Agro Setu is designed as a layered digital platform that seamlessly connects farmers, buyers, and administrators through a centralized and intelligent system. At the top layer, farmers can register, add products, access crop information, and use AI-based disease prediction and soil recommendations, while buyers can browse products, search catalogs, place orders, and track deliveries. Administrators manage user accounts, approve products, and monitor system activities. All user interactions are secured through a robust authentication and user management layer that ensures role-based access, password encryption, and safe data handling. The core of the system is a centralized database that stores farmer profiles, crop details, market prices, transaction records, weather information, and advisory history. This database supports all processing modules, enabling reliable data retrieval and analytics. The processing layer includes a real-time price engine that updates market rates from various mandis, a dynamic farmer activity calendar for seasonal task planning, and an AI-based disease prediction module for early detection and treatment recommendations. Additionally, soil-based crop recommendations help farmers choose suitable crops based on soil type and nutrient content. An integrated notification engine delivers timely alerts via SMS, email, and voice calls, while an AI chat assistant provides instant support and escalates complex queries to experts. Payment and transaction modules manage secure purchases and order tracking. External APIs such as weather services, payment gateways, and messaging systems enhance functionality. Finally, data visualization and marketplace updates provide clear insights and enable efficient decision-making, making Agro Setu a comprehensive digital solution for modern agriculture. alerts to help users monitor selected stocks.

IV. SYSTEM ARCHITECTURE

The AgroSetu platform was developed using a systematic and iterative methodology to ensure usability, reliability, and scalability. The process began with a comprehensive requirement analysis to understand the challenges faced by farmers, buyers, and administrators. Farmers lacked access to timely crop advisory, pest alerts, weather updates, and market price information, while buyers faced difficulty in finding a transparent marketplace for direct procurement. Administrators required a scalable system to manage user profiles, advisory models, listings, and notifications. Based on these findings, core modules such as Marketplace & Product Listings and Buyer Profile & Order Management were defined. The design phase adopted a three-tier architecture comprising a responsive frontend developed using HTML, CSS, Bootstrap, and JavaScript; a backend built on Java Spring Boot providing authentication, advisory processing, and transaction management through RESTful APIs; and a MySQL database layer to store structured data, ensuring normalization for consistency and redundancy reduction. Implementation was carried out incrementally, including farmer registration, AI-driven crop recommendations, marketplace listing and ordering, automated SMS/email alerts, and feedback mechanisms restricted to completed transactions. The system underwent unit testing, integration testing, and user acceptance testing, with stakeholder feedback guiding UI and functionality improvements. Finally, AgroSetu was deployed on cloud platforms such as AWS, Railway, or Render, enabling real-time updates, secure backup, and scalable multi-user access to support future expansion.representation and supports efficient retrieval of user-specific information. Data security measures such as controlled access and validation are enforced to protect user information.

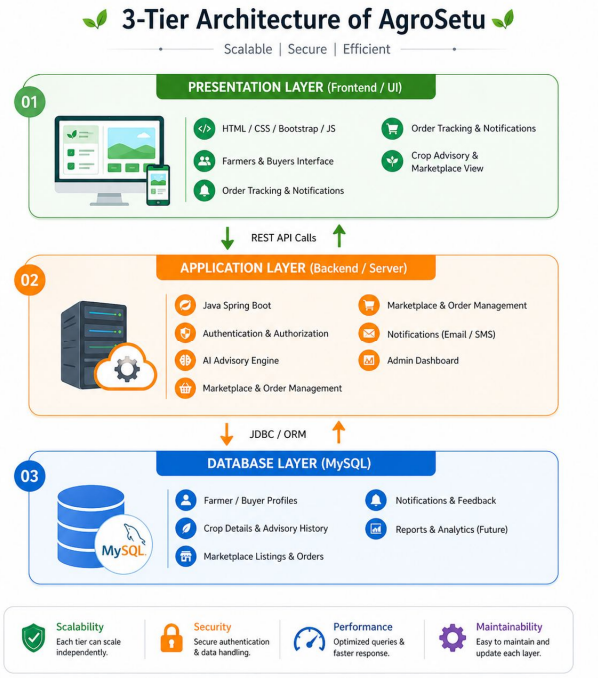

Fig. 2. Three-tier system architecture of AgroSetu

The AgroSetu platform was evaluated through multiple simulated scenarios to assess its effectiveness in providing agricultural advisory and marketplace services. During testing, farmers were able to register, upload crop details, and receive AI-driven recommendations, while buyers could browse listings, place orders, and track deliveries. The system successfully maintained real-time updates of crop availability, ensuring that stock levels were automatically adjusted to prevent overbooking or duplicate orders. This enhanced transparency and improved the overall efficiency of transactions. The AI-based advisory module played a crucial role in guiding farmers toward better crop management practices. By analyzing crop data, weather alerts, and pest information, the system generated timely and relevant suggestions. Farmers reported improved understanding of crop care, pest control, and harvesting decisions. However, the recommendations were designed to support decision-making rather than predict exact outcomes, which helped maintain reliability and trust. User acceptance testing showed positive feedback from stakeholders, highlighting the platform's ease of use, informative dashboard, and effective communication features. Buyers appreciated the direct access to farm products and transparent pricing, while administrators found the dashboard useful for monitoring trends and managing users. The system performed stably during testing, with smooth interaction between frontend, backend, and database layers.

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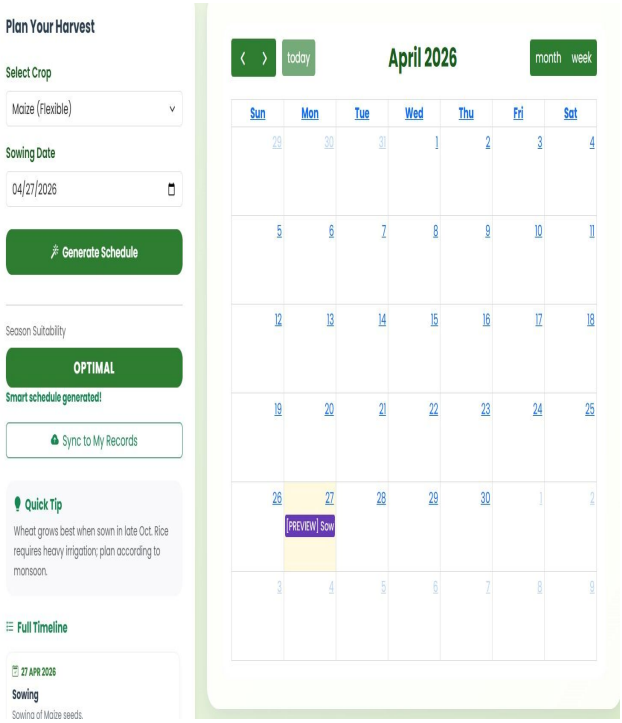
Overall, experimental results indicate that AgroSetu effectively bridges the gap between manual agricultural practices and digital farming solutions. The platform provides a scalable and user-friendly environment for farmers and buyers, promoting informed decision-making and improving market access through a centralized digital ecosystem.

V. RESULT AND DISCUSSION

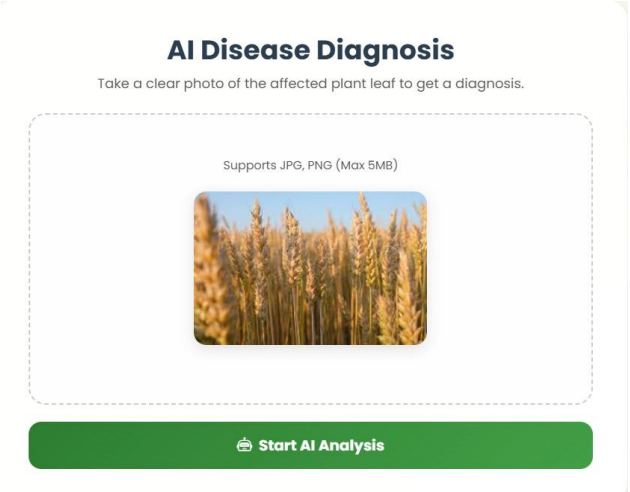
A. Farmer Calendar (Suggestion)

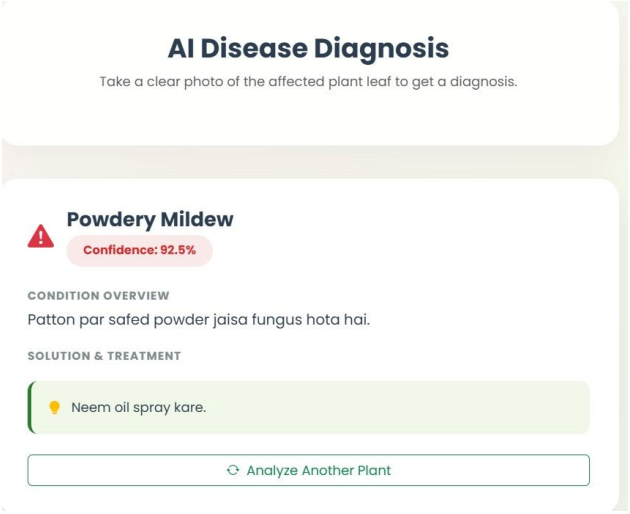
The Farmer Calendar module of AgroSetu provides farmers with a structured schedule of farming activities and timely suggestions based on crop type, season, and soil conditions. It offers reminders for irrigation, fertilization, pest control, and harvesting to help farmers plan their work efficiently and improve crop yield.



B. Crop Disease Prediction:

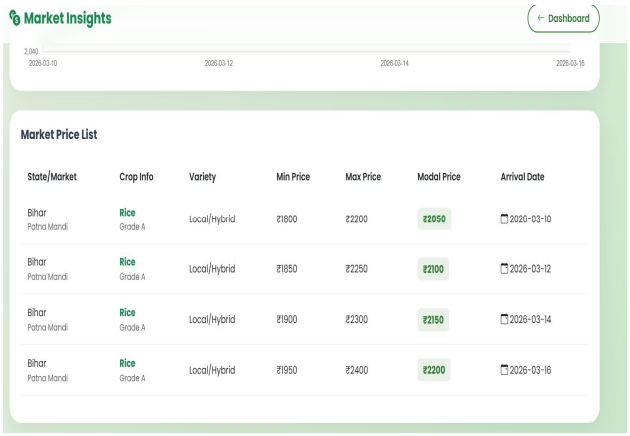
The Crop Disease Prediction module of AgroSetu helps farmers detect crop diseases at an early stage. It analyzes crop type, visible symptoms, and uploaded leaf images to predict diseases. The system can identify common diseases such as leaf blight, rust, powdery mildew, and pest-related infections with satisfactory accuracy.





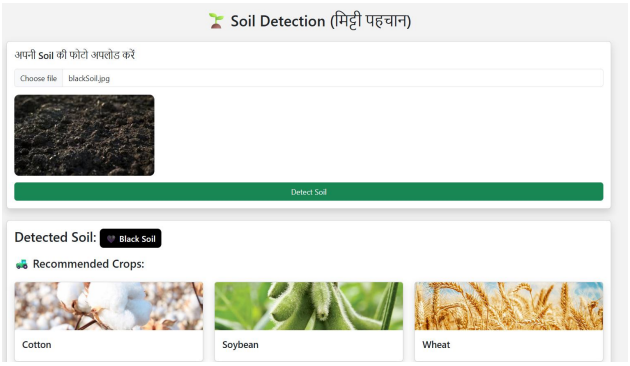
C. Current Market Price

The Crop Price Prediction module of AgroSetu provides farmers with updated and estimated market prices of crops. It analyzes historical price data, market trends, and location-based information to help farmers make informed decisions about selling their produce**.**



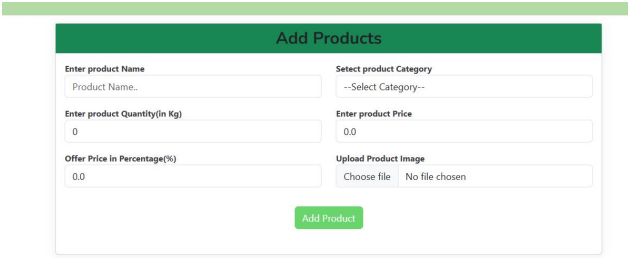
D. Soil-based Crop Prediction

The Soil-based Crop Prediction module of AgroSetu recommends suitable crops based on soil parameters such as soil type, moisture, pH level, and nutrient content. This helps farmers select the most appropriate crops to improve yield and reduce cultivation risk.



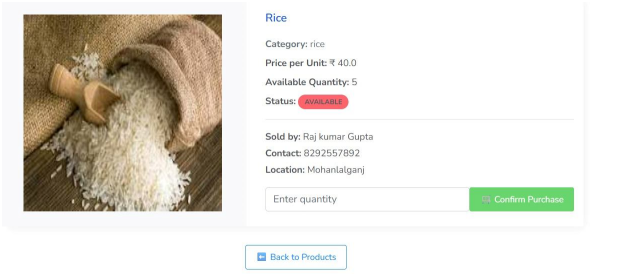
E. Add Product

The Add Product module of AgroSetu allows farmers to easily list their agricultural products by providing details such as crop name, quantity, price, and images. This helps farmers showcase their produce and reach potential buyers directly.



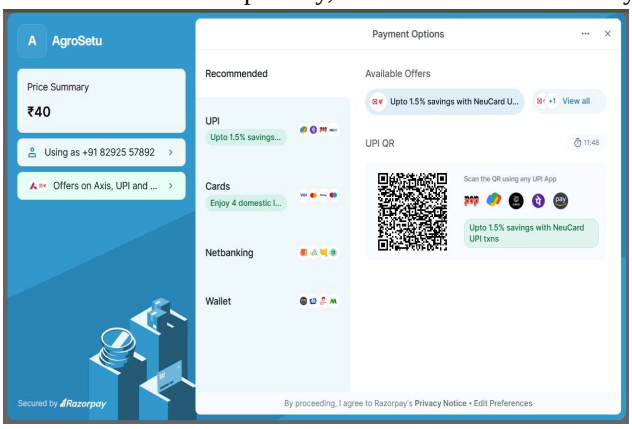
F. Ordering

The Ordering module of AgroSetu enables buyers to place orders directly from farmers through a simple and secure process. It ensures transparent transactions, order tracking, and smooth communication between farmers and buyers.



G. Payment Module

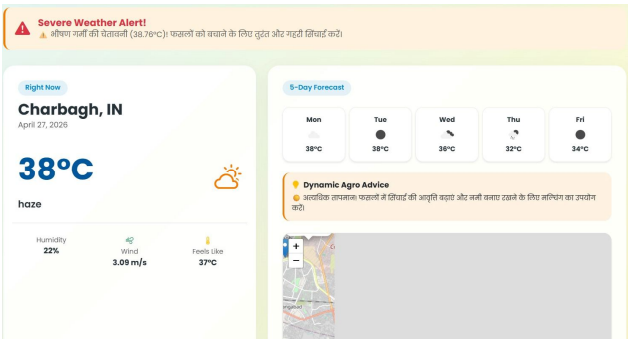
The Payment module of AgroSetu provides a secure and reliable platform for online transactions between farmers and buyers. It supports digital payment methods, ensures transaction transparency, and enables safe and timely payments.



H. Weather Alert Module

The Weather Alert Module in AgroSetu provides real-time weather updates and early warnings to farmers, helping them take preventive actions to protect their crops and improve productivity.

The Weather Alert Module analyzes real-time weather data to provide farmers with alerts about severe conditions such as heavy rainfall and heatwaves. It also includes a 5-day forecast and agro-advisory features, which help farmers make informed decisions regarding irrigation and fertilization.



VI. FUTURE SCOPE

1) Development of a Mobile Application (Android & iOS): A dedicated mobile app can be developed to provide farmers with easy and quick access to AgroSetu services anytime, anywhere. It can include offline features, push notifications, and a more user-friendly interface for better engagement.
2) Expansion to Support Multi-language Interfaces: The platform can be extended to support multiple regional languages, making it more accessible to farmers from different regions and improving usability in rural areas.
3) Multi-language Support: Voice-based and text-based language options can be integrated to help users interact with the system in their preferred language, reducing the learning curve.
4) IoT Integration: Integration of IoT devices such as soil moisture sensors, temperature sensors, and humidity sensors can enable real-time field monitoring and automated decision-making for irrigation and crop management.
5) Government Scheme Integration: The system can provide real-time updates on government schemes, subsidies, and policies, helping farmers easily access benefits and apply directly through the platform.

VII. LIMITATION

1) Dependence on Internet Connectivity: AgroSetu requires a stable internet connection to access real-time data such as weather updates and market prices, which may be challenging in rural or remote areas.
2) Accuracy of External Data: The system relies on third-party APIs for weather and market information, which may sometimes provide delayed or inaccurate data, affecting decision-making.
3) Limited Initial Features: The current version of the system may not include advanced features such as full AI automation, IoT integration, or mobile application support.
4) User Awareness and Training: Farmers with limited technical knowledge may face difficulty in using the platform effectively without proper guidance or training.
5) Data Dependency: The accuracy of recommendations depends on the correctness of user input data; incorrect or incomplete data may lead to inaccurate results.

VIII. CONCLUSION

This paper presented an AI-enabled stock market simulation platform aimed at enhancing financial learning for beginners and students. By integrating real-time market data, virtual trading, and AI-based analysis, the system provides a safe and interactive learning environment. The platform helps users understand stock market operations, portfolio management, and trading strategies without financial risk. The platform helps users understand trading strategies, portfolio management, and market behavior more effectively than traditional learning methods. Future work may include advanced AI models, mobile application support, and integration of news-based stock analysis.The simulation-based approach allows learners to gain hands-on experience that is often missing in traditional finance education.

Through virtual trading and performance monitoring, users can understand the practical impact of their decisions, improving their confidence and decision-making skills. The inclusion of visual dashboards and analytical tools further enhances comprehension by presenting complex financial data in an accessible manner. The AI-based components support learners by offering basic insights into portfolio diversification and risk exposure. Rather than focusing on profit generation, the system emphasizes conceptual clarity and responsible trading behaviour. This makes the platform particularly suitable for educational institutions and beginner investors seeking foundational financial knowledge.

Overall, the results demonstrate that the proposed system effectively bridges the gap between theoretical learning and real-world stock market practices. The platform promotes experiential learning and encourages users to actively engage with financial concepts in a controlled environment. Future work may focus on enhancing the intelligence of the recommendation module by incorporating advanced machine learning models and predictive analytics. Additional improvements may include mobile application support, personalization of learning paths, and integration of news-based sentiment analysis using financial and social media data. These enhancements can further improve the educational value and scalability of the platform.

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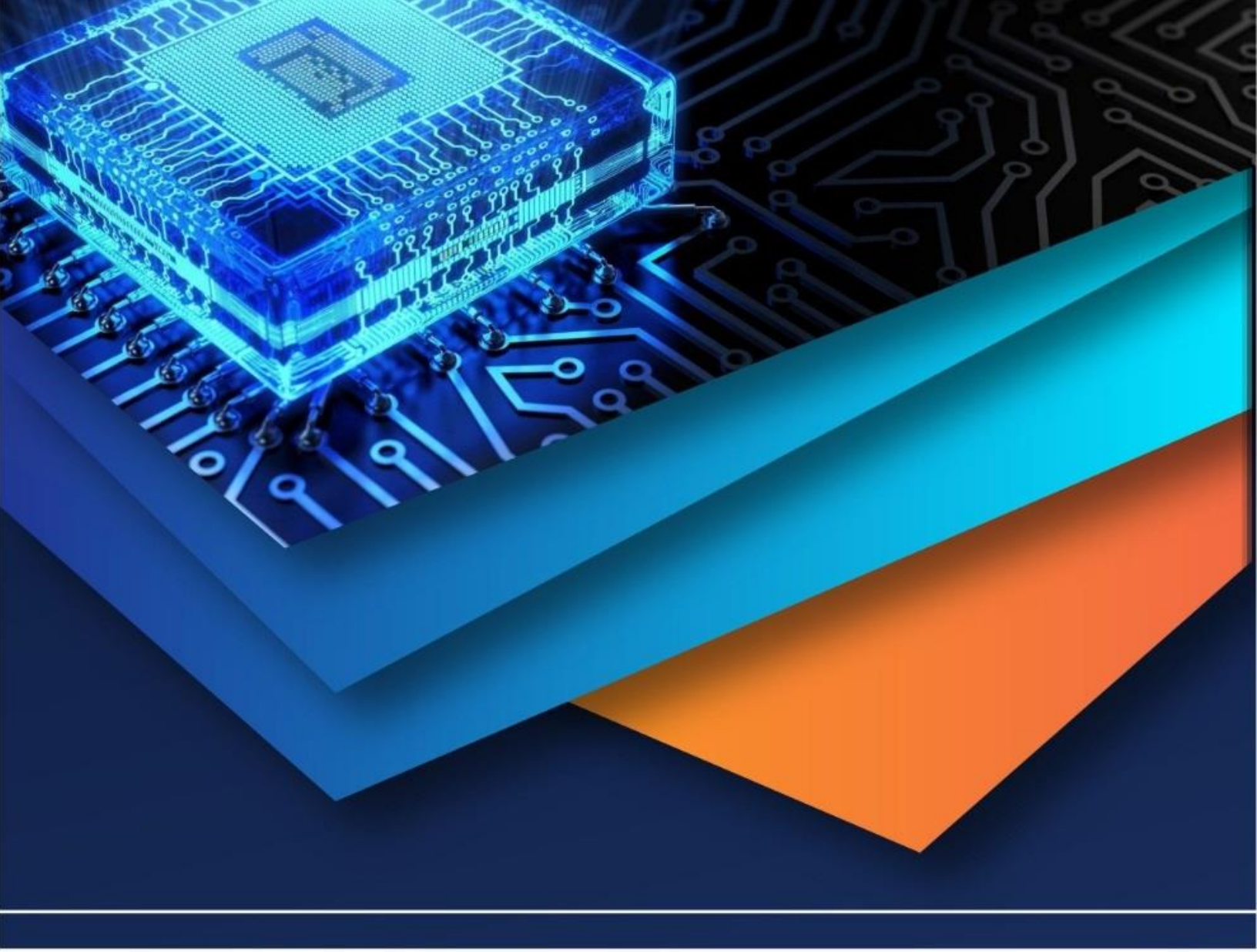

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