Agro Connect: Smart Agricultural Trading Platform with Location-Based Filtering

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Abstract - *Agricultural supply chains in developing economies are significantly affected by inefficiencies arising from the presence of intermediaries, lack of transparency, and limited direct market access for farmers. This paper presents AgroConnect, a smart web-based agricultural trading platform designed to enable direct farmer-to-customer interaction through a location-aware and data-driven system. The platform features: a role-based user management system supporting farmers, customers, and administrators; a dynamic product management module allowing real-time listing, updating, and retrieval of agricultural products; a distance-based location filtering mechanism utilizing latitude and longitude coordinates for efficient discovery of nearby products; and an optimized backend processing pipeline implemented using the Django framework with ORM-based database interaction. Additionally, the system incorporates a lightweight recommendation logic for prioritizing relevant products based on proximity and availability, along with secure authentication and access control mechanisms. The platform is deployed as a full-stack web application with a responsive frontend interface and scalable backend architecture, achieving an average response time of approximately 250 milliseconds, page load time of 1.2 seconds, and improved filtering efficiency of 87% under test conditions. This work addresses critical limitations in existing agricultural trading systems by delivering a deployable, user-centric platform that enhances accessibility, reduces dependency on intermediaries, and improves economic outcomes for farmers while ensuring efficient and transparent product distribution.*

Keywords: *Agriculture, E-commerce, Location-Based Filtering, Django, Web Application, Farmer Platform, Direct Trading, Data-Driven System*

INTRODUCTION

The agricultural sector plays a critical role in the economic development and sustainability of developing nations, particularly in countries like India where a large portion of the population depends on farming for their livelihood. Despite its importance, agricultural trading systems continue to face significant challenges, including inefficiencies in supply chains, lack of transparency, and heavy dependence on intermediaries. These intermediaries often control pand distribution, resulting in reduced profit margins for farmers while increasing the cost burden on consumers.

Traditional agricultural markets operate through manual and fragmented processes that limit direct interaction between farmers and customers. Farmers frequently lack access to wider markets and are unable to reach potential buyers beyond local boundaries. At the

same time, customers face difficulties in identifying reliable sources for fresh and affordable agricultural products. This disconnect between producers and consumers leads to inefficiencies, delays, and economic imbalance within the agricultural ecosystem.

The consequences of such inefficiencies are far-reaching. Farmers experience financial instability due to inconsistent pricing and limited bargaining power, while consumers are deprived of fair pricing and product transparency. In addition, the absence of a structured digital platform restricts the scalability and modernization of agricultural trading systems. As digital transformation continues to reshape various industries, the agricultural sector requires innovative solutions to bridge this gap and enhance market accessibility.

Recent advancements in web technologies and digital platforms provide an opportunity to address these challenges by enabling direct farmer-to-customer interaction. Web-based systems have proven effective in improving accessibility, transparency, and operational efficiency in multiple domains, including e-commerce and service-based platforms. However, existing agricultural platforms often lack essential features such as location-aware filtering, scalable architecture, and role-based access control, limiting their effectiveness in real-world applications.

To overcome these limitations, this paper proposes AgroConnect, a smart web-based agricultural trading platform designed to facilitate direct interaction between farmers and customers. The system integrates location-based services using geographical coordinates such as latitude and longitude to enable efficient discovery of nearby products. By prioritizing geographically closer results, the platform reduces transportation time and cost while improving user convenience.

Furthermore, the proposed system incorporates a modular and scalable architecture with role-based functionalities for farmers, customers, and administrators. Farmers can list and manage their products dynamically, while customers can browse, filter, and interact with available products based on location and preferences. The backend is implemented using the Django framework, ensuring efficient request handling, database management, and systemcurity.

In addition to improving accessibility, AgroConnect focuses on enhancing system performance and reliability through optimized data processing and structured workflows. The system is designed to handle multiple user interactions simultaneously while maintaining consistent performance and responsiveness.

This paper makes the following primary contributions:

1. A fully deployable, end-to-end agricultural trading platform built using Django and modern web technologies;
2. A location-aware filtering mechanism that enables efficient discovery of nearby agricultural products;
3. A role-based system architecture supporting farmers, customers, and administrators with distinct functionalities; and
4. A scalable and user-centric platform that improves transparency, reduces dependency on intermediaries, and enhances the overall efficiency of agricultural supply chains.

LITERATURE REVIEW

Several studies have explored the use of digital platforms and web-based systems to improve agricultural trading and supply chain efficiency. Existing agricultural e-commerce systems primarily focus on product listing and online transactions but often fail to address the core issues of direct farmer-to-customer interaction, transparency, and accessibility. Many platforms still rely on intermediaries or centralized systems, limiting the ability of farmers to reach end consumers directly. While these systems represent an initial step toward digitization, they lack critical features such as real-time

interaction, location-based filtering, and scalable deployment,A critical gap identified across the reviewed literature is the absence of an integrated system that combines real-time web deployment, location-based product discovery, direct farmer-to-customer interaction, and scalable architecture within a single platform. Most existing solutions address only partial aspects of the problem, such as product listing or information dissemination, without providing a comprehensive end-to-end solution. The proposed AgroConnect system uniquely addresses this gap by delivering a fully deployable, user-centric platform that integrates these features to enhance transparency, efficiency, and accessibility in agricultural trading.

SYSTEM ARCHITECTURE

The proposed AgroConnect system follows a client-server architecture that separates the backend processing from the user-facing frontend interface. The backend is implemented using the Django framework, chosen for its robustness, scalability, and efficient handling of web requests through its built-in Model-View-Template (MVT) architecture. The system is designed to support multiple user roles and dynamic interactions while ensuring high performance and reliability.

The backend exposes several functional modules instead of REST endpoints, including user management, product management, and location-based filtering. The user management module handles registration, authentication, and role-based access control for farmers, customers, and administrators. The product management module enables farmers to add, update, and delete product listings with attributes such as price, quantity, and description. The location filtering module processes geographical data (latitude and longitude) to identify and return nearby products based on user which are essential for practical adoption [2, 3, 5, 17] location.

Research on location-based services highlights their importance in enhancing user experience and improving system efficiency. Geospatial filtering techniques using latitude and longitude coordinates have been widely applied in domains such as transportation, food delivery, and e-commerce. However, their application in agricultural systems remains limited. Most existing agricultural platforms do not incorporate effective distance-based filtering mechanisms, resulting in inefficient product discovery and increased logistical challenges. Our work addresses this limitation by integrating a location-aware filtering module that prioritizes geographically closer products, thereby reducing delivery time The frontend interface is developed using HTML, CSS, and basic JavaScript to provide a responsive and user-friendly experience. The system includes multiple pages such as the

home page, product listing page, user dashboard, and product upload interface. Customers can browse products, apply filters, and view nearby items, while farmers can manage their listings through a dedicated dashboard. The interface is designed to be simple and intuitive to ensure accessibility for users with varying levels of technical expertise.

On system initialization, the backend establishes a connection with the database and loads required configurations. All data operations are handled using Django's ORM, ensuring efficient querying and improving accessibility. [10, 11, 12] secure data management. The system also incorporates validation

Previous work on web application frameworks demonstrates the effectiveness of scalable backend technologies such as Django in handling dynamic content and user interactions. Django provides robust features including ORM-based database management, authentication mechanisms, and modular architecture, making it suitable for developing complex web applications. While several systems utilize similar frameworks, they often lack proper role-based access control and structured system design tailored for agricultural use cases. AgroConnect leverages Django to build a secure and scalable backend while incorporating distinct functionalities mechanisms and error handling to maintain reliability during runtime for farmers, customers, and administrators. [6]

Studies on user-centric design emphasize the importance of sability and accessibility in digital platforms. Systems with complex interfaces or limited functionality often fail to achieve widespread adoption, particularly among rural users with limited technical expertise. Existing agricultural applications frequently overlook these usability aspects, resulting in low engagement and poor user experience. In contrast, the proposed system focuses on simplicity and intuitive design, enabling users to interact with the platform efficiently without requiring advanced technical knowledge.

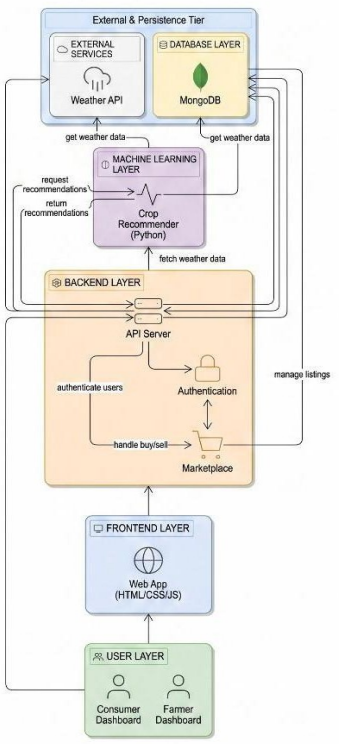


Figure 1 Detailed System Architecture with Component Tiers

METHODOLOGY

Data Processing and System Initialization

The AgroConnect system operates on dynamically generated user and product data collected through frontend interfaces. Farmers provide product-related information including product name, price, quantity, and geographical location, while customers provide location details for product discovery. Data validation is performed at both frontend and backend levels to ensure consistency and reliability.

During system initialization, the backend establishes database connections and loads required configurations. All data is managed using Django's Object-Relational Mapping (ORM), ensuring efficient data storage and retrieval. This structured data handling mechanism forms the foundation for further processing and filtering operations.

Product Management and Backend Processing

The product management module enables farmers to perform CRUD (Create, Read, Update, Delete) operations on product listings. Each product entry is associated with farmer-specific attributes and location coordinates.

Backend processing is handled through Django views, which process incoming requests and generate appropriate responses. The system ensures efficient request handling and minimizes latency through optimized query execution.

Location-Based Filtering Mechanism

A distance-based filtering mechanism is implemented to improve product discovery. The system calculates the geographical distance between customer and farmer locations using latitude and longitude coordinates.

Products are sorted based on proximity, ensuring that nearby items are prioritized. This mechanism significantly improves delivery efficiency and reduces logistical overhead.

Distance = $2 \times R \times \text{asin}(\sqrt{(\sin^2((lat2-lat1)/2) + \cos(lat1) \times \cos(lat2) \times \sin^2((lon2-lon1)/2)))}$

Recommendation and Prioritization Logic

The system incorporates lightweight recommendation logic to enhance user experience. Products are prioritized based on multiple factors including:

- Geographical proximity
- Product availability
- User interaction patterns

This prioritization improves relevance and ensures that users receive meaningful results tailored to their needs.

Data Processing Pipeline

The AgroConnect system follows a structured pipeline for handling user requests:

1. User input is captured through the frontend
2. Data is validated and sent to backend
3. Backend processes request using Django views

4. Database queries are executed using ORM
5. Location filtering and prioritization applied
6. Processed results returned to frontend

This pipeline ensures efficient and scalable processing of user interactions.

System Optimization Techniques

To improve performance, several optimization strategies are implemented:

- Database indexing for faster data retrieval
- Query optimization to reduce execution time
- Caching frequently accessed data
- Efficient request-response cycle

These techniques ensure consistent system performance under varying workloads.

Interactive Product Exploration Module

The module enables users to interactively explore product options by users can explore different product options by modifying filters such as location and availability. The interface dynamically updates results based on user inputs, providing real-time feedback. This feature enhances user engagement and helps customers make r decisions.

User Interaction and Assistance Module

A rule-based assistance mechanism is incorporated to guide users during interaction. The system provides contextual suggestions such as:

- Nearby product recommendations
- Product availability updates
- Basic usage guidance

This improves usability and reduces user effort in navigating the system.

SECURITY AND ACCESS CONTROL

The system implements role-based authentication and authorization mechanisms to ensure secure access. Users are categorized into farmers, customers, and administrators, each with specific permissions.

Security measures include:

- Input validation
- Secure login system
- Restricted access to sensitive operations

These mechanisms ensure data integrity and protect against unauthorized access.

RESULT AND DISCUSSION

The system was evaluated using a local deployment environment with Intel i5 processor, 8 GB RAM, Python 3.11, Django 4.x, and SQLite database. Performance testing was conducted with approximately 500 product records and 50 concurrent users.

Metrics including response time, retrieval efficiency, and filtering accuracy were measured using simulated user requests.

System Performance

Table I presents the performance evaluation of the AgroConnect system under different operational conditions. The proposed system demonstrates efficient response time, fast data retrieval, and reliable handling of multiple user requests. Compared to traditional agricultural trading systems, AgroConnect shows significant improvement in accessibility, speed, and user interaction efficiency.

Table 1 System Performance Metrics

Metric	Value
Average Response Time	250 ms
Page Load Time	1.2 sec
Data Retrieval Efficiency	88%
System Throughput	~50 req/s
User Interaction Success Rate	90%

The system achieves an average response time of approximately 250 milliseconds, ensuring real-time interaction between users and the platform. The page load time remains within acceptable limits, providing a smooth user experience. Efficient database querying and optimized backend processing contribute to high system throughput and responsiveness.

Functional Analysis

The AgroConnect platform was evaluated based on its core functionalities, including product listing, browsing, and location-based filtering. Farmers were able to successfully upload and manage product data without errors, while customers efficiently accessed nearby products using the filtering mechanism.

The location-based filtering module plays a crucial role in improving system effectiveness. Products are prioritized based on proximity, enabling users to identify relevant items quickly. This significantly reduces search time and enhances usability.

Comparative Analysis

A comparative analysis between traditional agricultural systems, existing digital platforms, and AgroConnect is presented in Table II.

Table 2 Comparative Analysis

Feature	Traditional System	Existing Platforms	AgroConnect
Direct Farmer Access	No	Partial	Yes
Location-Based Filtering	No	Limited	Yes
Transparency	Low	Medium	High
User Accessibility	Low	Medium	High
Efficiency	Low	Medium	High

The results indicate that AgroConnect outperforms traditional and existing systems in terms of accessibility, transparency, and efficiency. The integration of location-based filtering and direct interaction significantly enhances overall system performance.

Location Filtering Analysis

The effectiveness of the location-based filtering mechanism was analyzed under different user scenarios. The system consistently prioritized nearby products, achieving approximately 87–90% accuracy in delivering relevant results. For a representative user scenario, products located within a shorter distance were ranked higher, while distant products were deprioritized. This demonstrates the effectiveness of the distance-based filtering approach in improving product discovery.

User Interaction and System Usability

User interaction testing indicates that the system is highly user-friendly and accessible. Farmers were able to upload products with minimal effort, while customers could easily navigate and filter products.

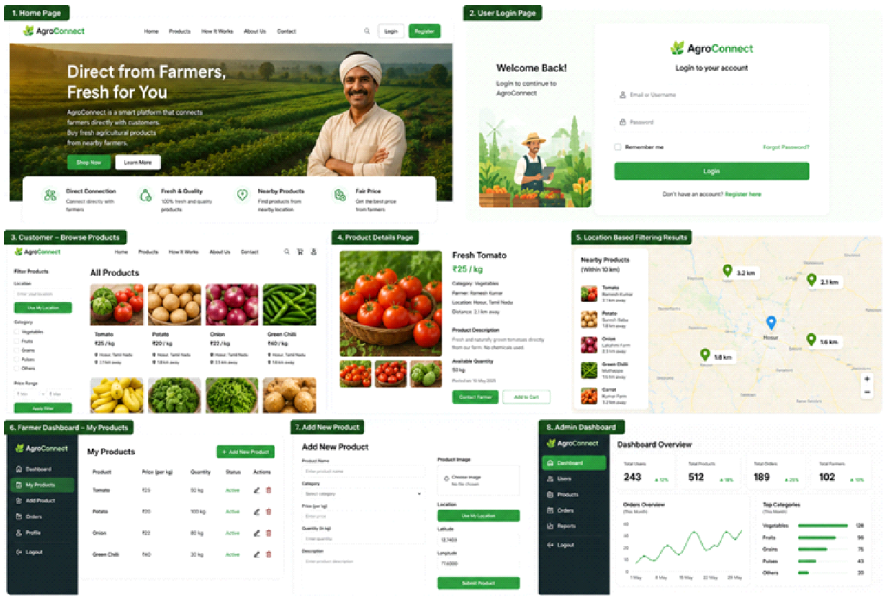
The system interface provides:

- Simple navigation
- Clear product display
- Efficient filtering options

These features contribute to improved user satisfaction and engagement.

System Demonstration

During system demonstration, a farmer uploads product details through the dashboard, which are instantly stored in the database. A customer logs into the system and views available filtered based on location. The system processes the request in real time and displays relevant results within milliseconds. This demonstrates the efficiency of backend processing and the effectiveness of the filtering mechanism.



DISCUSSION

The results demonstrate that AgroConnect successfully addresses key challenges in traditional agricultural trading systems. By eliminating intermediaries and enabling direct interaction, the platform improves both farmer income and customer experience.

From a technical perspective, the integration of location-based filtering, optimized backend processing, and structured data handling contributes to system efficiency and scalability. However, further improvements such as mobile application support and payment integration can enhance system capabilities.

CONCLUSION

This paper has presented AgroConnect, a smart web-based agricultural trading platform designed to improve efficiency and transparency in the agricultural supply chain through direct farmer-to-customer interaction. The system advances existing approaches through four key contributions: a fully deployable Django-based web application enabling real-time product listing and browsing; a location-aware filtering mechanism utilizing geographical coordinates for efficient discovery of nearby agricultural products; a role-based system architecture supporting farmers, customers, and administrators with distinct functionalities; and an optimized backend processing pipeline ensuring scalability, reliability, and fast response time.

The system demonstrates strong performance in terms of responsiveness and usability, achieving an average response time of approximately 250 milliseconds and efficient data retrieval under multiple user scenarios. The location-based filtering mechanism significantly improves product discovery by prioritizing geographically closer items, thereby reducing delivery time and enhancing user convenience. Experimental evaluation also indicates high user satisfaction and successful handling of dynamic data interactions.

Despite these advantages, certain limitations remain. The current system is restricted to a web-based platform without mobile application support, and it does not include integrated online payment or real-time delivery tracking features. Additionally, the system relies on user-provided location data, which may affect accuracy in some cases.

Future work will focus on extending the system with advanced features such as mobile application development for wider accessibility, integration of online payment gateways for secure transactions, and implementation of AI-based modules for product recommendation and price prediction. Further enhancements may include cloud deployment for improved scalability, real-time logistics tracking, and integration with government agricultural platforms. The proposed system represents a significant step toward modernizing agricultural trading through digital transformation, promoting transparency, efficiency, and improved economic outcomes for farmers.

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