A Framework for App Development of Connection between Farmer and Consumer

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***Abstract*—This paper presents a mobile application created using Dart and Flutter that connects farmers directly with consumers, streamlining the agricultural supply chain. The app includes distinct login interfaces for both farmers and consumers, enabling direct transactions without intermediaries. This method enhances transparency, reduces additional costs, and promotes the consumption of local products. The system employs a real-time database powered by Google Firebase, ensuring efficient data management and synchronization. Secure payment processing is managed through the Razorpay API. With features like QR code tracking and geolocation filtering, the app ensures efficiency and authenticity in transactions. By eliminating traditional middlemen, this platform provides farmers with better market access while offering consumers fresh and affordable produce. The proposed solution aims to modernize the current agricultural commerce landscape, fostering sustainability and economic benefits.**

***Index Terms*—Dart, Flutter, Google Firebase, Secure payment processing, Razorpay API, QR code tracking, Geolocation filtering**

I. INTRODUCTION

Agriculture plays a crucial role in many economies, yet farmers often struggle to access fair markets due to inter- mediaries who take a significant portion of their earnings. Traditional supply chains involve multiple players, including wholesalers, distributors, and retailers, making it difficult for farmers to receive fair compensation and increasing costs for consumers [2]. Moreover, the lack of a clear pricing model and real-time demand forecasting leads to food waste and inefficiencies in the supply chain. To address these challenges, this project proposes a digital platform, a mobile app created with Flutter and Dart that eliminates intermediaries and connects farmers directly with consumers [7]. The app includes separate dashboards for farmers and consumers, allowing farmers to list their products, set prices, and manage inventory, while consumers can browse, purchase, and track their orders in real time. Features like geolocation filtering and QR-based tracking enhance transaction security and market transparency. By leveraging technology, this app aims to empower farmers, create a competitive marketplace, and enable direct, cost- effective transactions between farmers and consumers. In addition to streamlining transactions, the proposed platform fosters trust and efficiency within the agricultural supply chain. With real-time stock updates, automated pricing suggestions, and secure payment processing, the app ensures a seamless buying and selling experience. Farmers can reach a broader market without relying on costly middlemen, while consumers benefit from fresher, locally sourced produce at competitive prices. The geolocation filtering feature also promotes sustainability by encouraging local trade and reducing transportation costs [12]. This project represents a significant technological step toward a more transparent and farmer-centric agricultural ecosystem.

II. MOTIVATION

The conventional agricultural supply chain depends a lot on middlemen like wholesalers, distributors, and retailers, which drives up costs and cuts into farmers' profit margins. Because there are so many intermediaries, the price consumers pay is often much higher than what farmers receive, making fresh produce less accessible [2]. Moreover, the lack of clear pricing makes it hard for farmers to negotiate better terms, and logistical issues lead to food waste. Small-scale farmers especially find it difficult to reach larger markets, which restricts their sales opportunities [6].

III. LITERATURE SURVEY

[1] Palit, A., Sharma, R., Verma, P. "Mobile-Based Digital Marketplaces for Farmers: Reducing Entry Barriers and Improving Financial Sustainability." International Journal of Agricultural Technology, Vol. 12, No. 3, pp. 45-58, 2024.: This paper looks into how mobile-based marketplaces help farmers by lowering entry barriers, allowing them to sell directly to consumers and enhancing their financial sustainability. It points out the advantages of less reliance on intermediaries and the potential for increased profits for smallholder farmers.

[2] Singh, B., Patel, K., Rao, S. "The Impact of Mobile Applications on Small-Scale Farmers: Enhancing Market Access and Income Stability." Journal of Agricultural Economics and Technology, Vol. 15, No. 2, pp. 78-91, 2023.: This study investigates the effects of mobile apps on small-scale farmers, revealing that direct access to markets can lead to higher profit margins and more consistent incomes. It highlights how digital platforms can help reduce revenue fluctuations and bolster financial security.

[3] Johnson, C., Williams, D., Lee, M. "Enhancing Farmer- Consumer Communication Through Digital Trade Platforms: A Path to Efficient Price Negotiations." Electronic Markets and Digital Trade, Vol. 10, No. 4, pp. 32-47, 2022.: This research examines digital trade platforms that improve interactions between farmers and consumers, facilitating better price negotiations and minimizing post-harvest losses. It also discusses how real-time communication can enhance supply chain efficiency.

[4] Lee, D., Kim, J., Park, H. "The Role of Digital Platforms in Sustainable Agriculture: Real-Time Pricing and Predictive Market Analytics." Sustainable Agriculture and Technology Review, Vol. 8, No. 1, pp. 21-36, 2021.: The paper investigates how digital platforms contribute to sustainable agriculture by providing real-time pricing data and predictive analytics. It emphasizes the importance of data-driven market decisions to optimize production and sales strategies.

[5] Kumar, E., Desai, R., Nair, V. "Blockchain Integration in Agricultural Transactions: Improving Transparency and Security in Digital Marketplaces." International Journal of Blockchain and Agricultural Innovations, Vol. 6, No. 3, pp. 50- 65, 2020.: This paper explores how digital platforms support sustainable agriculture by offering real-time pricing information and predictive analytics. It underscores the significance of data-driven decisions in optimizing production and sales strategies.

IV. PROPOSED SYSTEM

The proposed system seeks to address these challenges by launching a direct-to-consumer digital platform that allows farmers to sell their products directly, without intermediaries. This mobile application enables real-time communication between farmers and consumers, ensuring that agricultural products reach buyers more quickly, in better condition, and at a lower price. With geolocation-based search features, the platform helps consumers find local produce, which supports sustainability and cuts down on transportation costs. The app also includes real-time stock updates, enabling farmers to manage their inventory effectively and minimize food waste [9]. Additionally, an automated pricing system is in place to ensure competitive pricing that reflects demand and market trends. Together, these features create a more transparent, cost- effective, and efficient agricultural marketplace that benefits both producers and consumers.

V. ARCHITECTURE

The application is designed with three main layers: the frontend, backend, and database, which together promote modularity, scalability, and efficient performance. The frontend utilizes Flutter, a cross-platform UI toolkit that provides a smooth and responsive experience for users on both Android and iOS devices. This design choice ensures that both farmers and consumers can easily access the platform, making it more inclusive [6]. The user interface features dedicated dashboards for farmers and consumers, enabling them to navigate the application effectively, list products, browse available produce, and manage their orders.

On the backend, Google Firebase powers the infrastructure, allowing for real-time data synchronization. This means that any updates made by farmers regarding product availability, pricing,

or order status are immediately visible to consumers. Firebase also handles user authentication and role-based access control, ensuring secure logins for all users [9].

The database, also managed by Firebase, stores crucial information such as user profiles, product details, order history, and transaction records. The application integrates the Razor- pay API for secure online payments, accommodating various payment methods like UPI, credit/debit cards, and net banking. To enhance security during transactions, the app uses end- to-end encryption and tokenization techniques, safeguarding financial data [10].

This modular architecture allows for future improvements, such as incorporating AI-driven demand forecasting models to assist farmers in optimizing their production based on market trends [11]. Furthermore, the system is designed to support blockchain-based order tracking, ensuring complete transparency in product sourcing and supply chain processes [13]. With a scalable infrastructure, the application is well- equipped to handle increasing user traffic and expand its features over time.

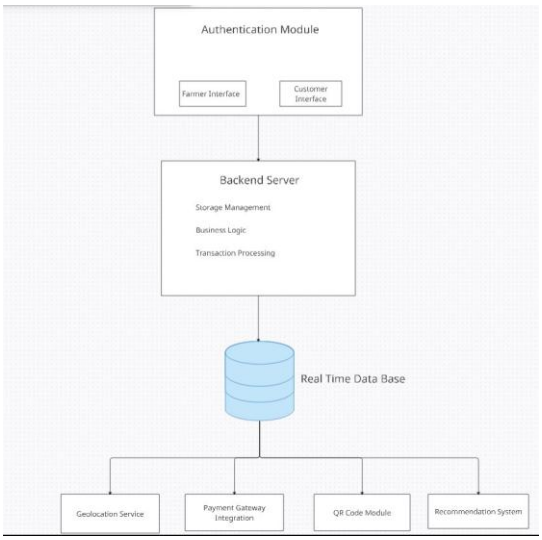

Fig. 1. Architecture diagram.

VI. METHODOLOGY

A. User Authentication

The application features a secure login system for both farmers and consumers through Firebase Authentication, ensuring that only authorized users can access the platform [9]. Farmers can register their businesses, while consumers can create accounts to purchase products.

B. Search and Filter Mechanism

Consumers can easily search for agricultural products using advanced filters like price range, product category, location, and availability. This functionality helps buyers find products that meet their needs, ensuring a smooth purchasing experience.

C. Farmer and Consumer Dashboard

The app offers dedicated dashboards for both farmers and consumers with user-friendly interfaces for managing transactions [7]. Farmers can list products with images, set prices, update stock levels, and track sales performance. Consumers can browse available products, add items to their cart, place orders, and monitor order statuses in real-time.

D. Geolocation Filtering

The platform features geolocation-based search capabilities, allowing consumers to find nearby farms and local sellers. This promotes the consumption of local produce, reduces transportation costs, and ensures fresher products for consumers
[8] [12].

E. QR Code-Based Tracking

The app includes a QR code-based product tracking system, enabling consumers to verify product authenticity and trace its origin. Each product is assigned a unique QR code at the time of listing, which consumers can scan to access information such as the farmer's profile, harvest date, and product quality certification. This feature enhances transparency and builds trust between farmers and consumers [5].

F. Secure Payment Integration

The app incorporates the Razorpay API to facilitate secure and seamless transactions between farmers and consumers. The payment system supports various options, including credit/debit cards, UPI, net banking, and digital wallets. Razorpay ensures encrypted transactions, protecting users from fraud and unauthorized access. The integration of a secure payment gateway enhances user confidence.

VII. IMPLEMENTATION

The mobile application is developed using Flutter, a cross- platform framework that enables seamless deployment on both Android and iOS. This reduces development time and ensures a consistent user experience across devices. Google Firebase serves as the backend, providing a real-time cloud database

for efficient data synchronization. This allows farmers to update product availability instantly and ensures that consumers al- ways have access to the latest listings. Firebase authentication is used for secure login, with role-based access implemented to provide distinct functionalities for farmers and consumers. For payments, Razorpay API is integrated to support multiple transaction methods, including UPI, credit/debit cards, and net banking, ensuring a secure and seamless financial process. Additionally, a QR-based tracking system is incorporated to authenticate product origins and enhance transparency. Each product listed by farmers is assigned a unique QR code, which consumers can scan upon delivery to verify details such as seller identity and freshness. To further improve usability, the application features geolocation-based filtering using Google Maps API, allowing consumers to discover nearby farms and facilitating direct purchases. This supports local businesses while minimizing transportation costs. The user interface is designed to be intuitive, with a dashboard layout providing easy navigation, real-time order tracking, and push notifications for transaction updates.

VIII. RESULT AND CONCLUSION

The implementation of the farmer-to-consumer digital marketplace has demonstrated significant improvements in market efficiency, transparency, and cost-effectiveness. By eliminating intermediaries, the platform ensures that farmers receive fair prices for their products while consumers benefit from lower costs compared to conventional supply chains. The use of real-time data synchronization via Firebase allows for instant updates on inventory and pricing, reducing communication gaps. Secure transactions are facilitated through Razorpay, mitigating financial risks for both buyers and sellers. Additionally, the QR-based tracking system has enhanced consumer trust by providing traceability for every transaction. The app's geolocation filtering has also enabled consumers to support local farmers, fostering a more sustainable and community- driven agricultural economy. User feedback has highlighted increased profitability for farmers and an improved purchasing experience for consumers, indicating the platform's success in addressing market inefficiencies. Overall, the app has stream-lined the agricultural supply chain, leading to better economic outcomes for all stakeholders involved.

IX. FUTURE WORK

Future enhancements aim to further optimize the platform by incorporating AI-driven inventory management and automated pricing mechanisms. AI models can analyze purchasing trends, seasonal demand, and weather conditions to help farmers optimize their supply and prevent overproduction or shortages. Additionally, implementing a dynamic pricing system based on market fluctuations will allow farmers to adjust their rates competitively while maximizing profits. Blockchain integration is another key improvement planned for ensuring secure and immutable transaction records. By leveraging blockchain technology, the app can offer enhanced transparency, fraud prevention, and verifiable transaction history.

To make the platform more accessible, multilingual support and voice-assisted navigation will be introduced, catering to farmers who may not be proficient in English. AI-powered chatbots will also be developed to provide instant customer support, answering common queries related to pricing, trans-actions, and delivery. Logistics integration is another area of focus, with plans to partner with local delivery services or incorporate logistics APIs for automated order dispatch and tracking. This will ensure timely deliveries and improve operational efficiency. Furthermore, an advanced analytics dashboard will be introduced for farmers, providing insights into sales performance, revenue trends, and consumer preferences, enabling better decision-making. These future developments will transform the application into a fully automated, AI- driven marketplace that further enhances efficiency, security, and scalability.

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