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FarmKart – A Cloud-Based Agricultural E-Commerce Platform:A survey

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Abstract— Agriculture trade in developing countries has suffered from multiple levels of intermediation, diminishing returns for farmers and distortions in price discovery, and poor digital infrastructure. Current agricultural e-commerce solutions are often either regionally specific, have limited technical scalability, or lack the underlying cloud infrastructure to support high-throughput transactions and maintain reliability. This paper proposes FarmKart, a cloud-based agricultural e-commerce marketplace designed to connect farmers and buyers directly and eliminate the need for traditional intermediaries in agricultural trade. The system is implemented using a full-stack approach, utilizing React.js as a frontend javascript framework, Java (Spring Boot) as a backend APIframework, and MySQL as a relational database management system, all hosted on an AWS cloud platform using EC2 instances, S3 storage, RDS, and CloudWatch monitoring for scalability and reliability. RESTful API's power communication between the application's frontend and backend components, enablingmodularity and flexibility in development. The proposed solution enables farmers to post their produce listings directly, negotiate prices, and transact with buyers outside the traditional supply chainwhile providing buyers with a discoverable, reliable source for agricultural commodities. FarmKart addresses the key challenges of reliability, availability, and technical scalability in current agricultural e-commerce solutions through its underlying cloud-native infrastructure while also enabling future enhancements suchas AI-based price recommendation engines, logistics support, and multilingual accessibility for farmers and buyers. Thus, the paper demonstrates the potential for improved digital trade solutions for farmers and presents a technically viable solution for agricultural e-commerce marketplace development.

Keywords— Agricultural E-Commerce, Cloud Computing, AWS, Spring Boot, React.js, MySQL, REST API, Farmer-Buyer Marketplace, Scalable Web Architecture.

I.INTRODUCTION

Agriculture is the primary source of employment and livelihood for a huge proportion of the population in developing countries. However, farmers face problems in finding appropriate markets for their produce. The traditional agricultural marketplace comprises local traders, middlemen, commission agents, and other entities that result in lower yields for farmers and higher prices for consumers. Marginal farmers and small-scale farmers often lack the required resources and means to sell their products online and do not have the know-how to navigate the existing online marketplaces.

With the rising internet penetration and smartphone adoption in rural areas, it is now possible to disrupt the traditional supply chain by creating an end-to-end digital marketplace for agricultural produce. E-commerce has been instrumental in removing the middlemen in almost all industries and has proven to be extremely effective. However, agricultural products present a unique set of challenges such as perishable nature, price discovery across regions, and trust between two unconnected entities. In addition, such a marketplace needs to function effectively without a stable and fast internet connection for both buyers and sellers.

Cloud computing is the most appropriate technology to host and manage such a large-scale e-commerce marketplace. It provides the infrastructure neededto run theapplicationwhile being economical for both smaller and larger scales of operation. Cloud hosting enables elastic scaling according to traffic needs which is vital in the case of agriculture because of fluctuating supply and demand throughout the year and between regions. Moreover, cloud computing also offers monitoring services to keep track of the performance of the application at all times.

FarmKart is a cloud-based agri-e-commerce marketplace that connects buyers and sellers directly without any intermediaries. The web application has been built using React.js as the frontend framework while Java (Spring Boot) is used for backend services and MySQL as the primary database. It has been hosted on AWS (Amazon Web Services) cloud which provides virtual servers (EC2), storage (S3), database (RDS), and monitoring (CloudWatch) services. The application uses RESTful APIs to facilitate communication between the frontend and backend. This paper will also look at the working principle and system flow of this application as well as its benefits, challenges and limitations and future scope.

This document outlines various sections of a paper focused on agricultural e-commerce and cloud applications: Section II reviews related works; Section III details system architecture and design; Section IV elaborates on the working principle and system flow; Section V presents results with screenshots and performance evaluation; Section VI discusses benefits, challenges, and limitations; Section VII examines future research scope; and Section VIII concludes the paper.

II. RELATED WORK

A. Digital Platforms for Agricultural Trade

There has been a number of researches exploring the concept of digital platforms connecting farmers directly to buyers. The first simple applications only offered SMS and basic mobile phone technology for sharing mandi (market) prices – though it allowed farmers to get timely information on the market, it did not facilitate the exchange itself [1]. Later works focused on developing end-to-end e-commerce features, enabling farmers to list their products and buyers to place the order via mobile devices and websites [2]. While this body of work showed tangible benefits for the farmers' income, these applications mostly used a monolithic design making it hard to scale outside a limited adoption scope [3].

B. Cloud-Based Web Applications

The concept of cloud infrastructures has been explored by a number of researchers aiming to provide a scalable e-commerce platform. AWS-specific research works showcased how EC2 hosting combined with database-as-a-service (RDS) could reduce infrastructure management overheads and improve reliability [4]. Comparative studies within this field produced evidence on the relative benefits of different cloud hosting mechanisms, with auto-scaling being particularly advantageous for applications witnessing sporadic traffic patterns – which is common for agricultural marketplaces due to seasonality [5]. There has also been a body of research focused on exploring the practical application of content/object storage services (AWS S3) and their use cases [6].

C. Web Development: Full-Stack Architecture

Research works exploring modern web development practices and full-stack architecture mostly focus on the benefits of decoupled front- and backend development. The benefits of such an approach were showcased in a paper evaluating the practical application of React.js framework (front-end) and Spring Boot framework (Java-based back-end), with coupled development enabling each facet of the applicationto scale independently[7]. Development practices for RESTful APIs were also reviewed as the standard method of communication between the application front- and backend [8].

D. Database Management: Designing Transactional Tables

The topic of database management mostly focuses on the aspects of relational tables and their' application in e-commerce settings. Articles on the topic often refer to the need for normalized schemas for transactional tables (within a database management system) as a way to ensure data integrity, particularly in contexts involving multiple constituents (buyers, sellers, orders, payments, etc.) [9]. Comparative research on database management systems highlights the advantages of managed systems (AWS RDS) over self-hosted MySQL databases, particularly in terms of reliability and data redundancy [10].

E. Trust, Transparency, and Integrity

The theme of trust and transparency in facilitating economic transactions is prevalent in a number of research works on digital marketplaces. Studies in this area explored the ways in which trust could be established between transacting parties, with recommendationsrangingfrom verification mechanisms to rating systems and open pricing [11]. Works focusing on security aspects of digital marketplaces highlight the need for integrity checks, particularly when it comes to sensitive information [12].

F. Operations and Platform Reliability

Research works focused on the operations of cloud-based applications mainly discuss the need for monitoring tools (AWS CloudWatch) and their role in ensuring continuous uptime and reliability [13].

G. Comparative Summary

TABLE I. COMPARISON OF EXISTING AGRI-COMMERCE SYSTEMS

System/Study	Direct Trade	Cloud Scalability	Price Transparency	Real-Time Monitoring
SMS Price Discovery [1]	NO	NO	YES	NO
Regional Agri App [2]	YES	NO	PARTIAL	NO
Monolithic Marketplace [3]	YES	NO	PARTIAL	NO
FarmKart (Proposed)	YES	YES	YES	YES

III. RESEARCH GAPS IDENTIFIED

The survey of existingagricultural trade platforms and cloud-based e-commerce architectures highlights five research gaps that motivate the development of FarmKart:

Limited integration of direct trade with scalable cloud infrastructure: While several platforms have implemented farmer-buyer direct trade functionality, most rely on monolithic or on-premises architectures that do not scale effectively with seasonal demand fluctuations or regional expansion. Conversely, platforms built on robust cloud infrastructure often lack agriculture-specific trade features, resulting in a persistent disconnect between functional completeness and technical scalability.

Insufficient price transparency mechanisms: Although some existing systems provide market price information, few offer real-time, verifiable pricing transparency at the point of transaction. Farmers frequently remain dependent on informal price discovery even within digital platforms, undermining the core objective of eliminating information asymmetry in agricultural trade.

Absence of real-time system reliability monitoring: Existing agri-commerce research rarely addresses production-grade reliability engineering. Few documented systems incorporate continuous monitoring or alerting mechanisms, leaving platforms vulnerable to undetected downtime—a significant

concern given the time-sensitive nature of agricultural transactions involving perishable goods.

Underdeveloped trust and verification frameworks: Digital marketplaces connectingpreviously unconnectedfarmersand buyers require robust trust-building mechanisms. Current literature offers limited exploration of verification, rating, or dispute-resolutionsystemstailoredspecificallyto agricultural trade, where product quality assessment and delivery reliability are difficult to standardize.

Fragmented data management practices: Many existing platforms rely on self-hosted or loosely managed database systems, lacking the structured, replicated, and fault-tolerant data architecture necessary to support growing transaction volumes. This limits both platform reliability and the ability to derive meaningful analytics from trading data over time.

IV. PROPOSED SYSTEM

A. Concept Overview

FarmKart is a cloud-based agricultural e-commerce platform connecting farmers and buyers. The system is designed to enable transparent, efficient, and scalable agricultural trade without the need for traditional intermediary structures. The target audience includes smallholder and marginal farmers looking to directly access markets and provide individual or institutional buyers with reliable sourcing options for agricultural produce. The system is designed as a three-tier architecture consisting of presentation, application, and data layers and will be deployed on AWS cloud infrastructure to achieve scalability and reliability under variable and seasonally fluctuating trading volumes.

B. System Architecture

The platform's frontendwill be builtusing React.jsto provide a responsive single page application interface that supports both desktop and mobile users. The backend will be developed in Java using the Spring Boot framework and will be based on RESTful API endpoints to handle business logic such as user authentication, product listing management, order processing, and transaction handling. The MySQL relational database will be used to manage structured data such as user profiles, product catalogs, orders, and transaction records. The cloud infrastructure will be provided by AWS, which will host the application on scalable EC2 instances and provide managed backup and replication services for the database. The static assets and product images will be hosted on the AWS S3 platform while the CloudWatch service will be used to monitor the infrastructure and application performance.

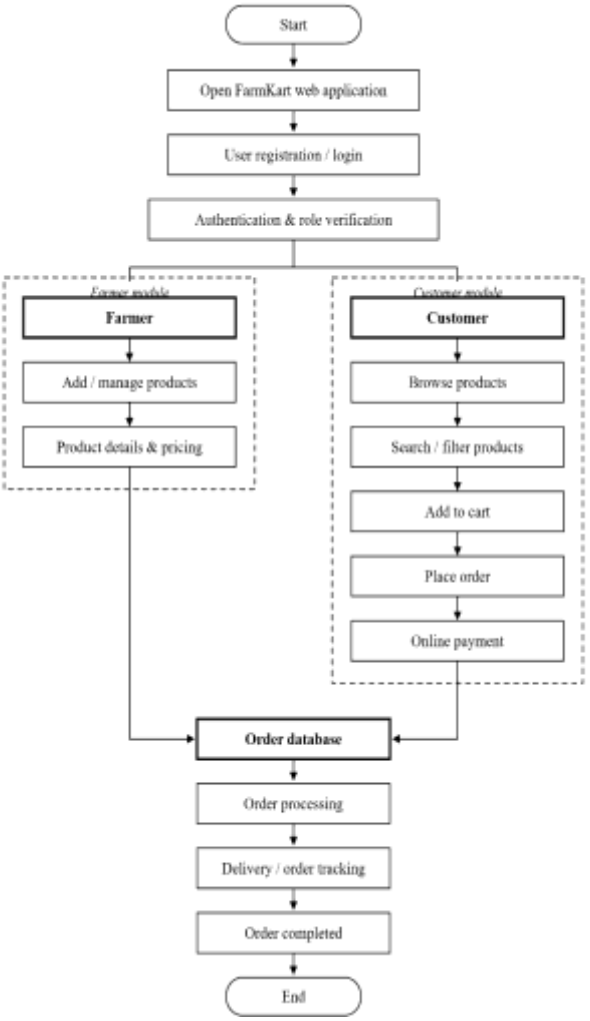
C. Working Principle

The farmers will be able to register on the platform and create verified seller profiles that include location, produce type, quantity, and asking price. The listings will be published in a centralized product catalog that will be searchable by registered buyers. The buyers will be able to browseor search the catalog and select the desired produce using filters such as crop type, location, andprice range. The selecteditemswill be added to an order management system where the final purchase details will be determined. The platform will facilitate transparent pricing as the final sale price will be published at the point of listing and will eliminate the information asymmetry associated with traditional intermediary-based trade. The order confirmation and communication will take place through the platform's interface with appropriate transaction records being generated.

D. System Flow

The complete system flow will entail the following steps: (1) Farmer will register and create a verified seller profile or log in if they already have one; (2) The farmer will list the produce with details such as quantity, price, and location; (3) The buyer will search or browse the catalog and select the produce of interest; (4) The buyer will place an order; (5) The order management module will process the order and update the inventory in real-time; (6) The buyer and farmer will receive order notifications and updates through the platform; (7) The CloudWatch service will monitor the system and infrastructure performance; (8) The system will store the transaction and listing data in the RDS-hosted MySQL database.

E. Flowchart of FarmKart – Cloud-Based Agricultural E-Commerce Platform



V: RESULTS AND DISCUSSION

The E-KrushiMart platform was assessedfor its user interface and features tailored for farmers. Its homepage includes categories for agricultural products such as grains, vegetables, and fertilizers. There is also a section for blogs and guides to aid farming practices. The farmer portal allows users to manage crop listings, track orders, and access sales

information, supplemented by screenshots showcasing the system's functionalities.



Figure 1: E-KrushiMart Home Page and Agricultural Product Categories



Figure 2: E-KrushiMart Blogs and Agricultural Information Portal

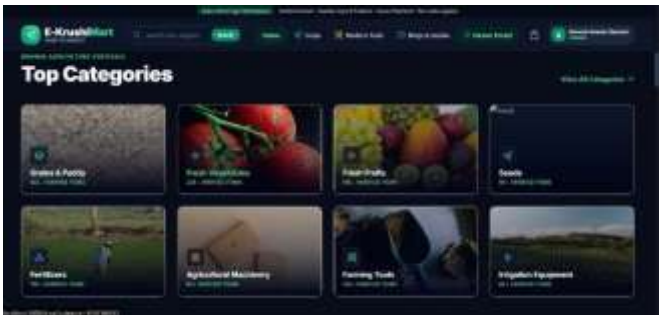


Figure 3: E-KrushiMart Farmer Portal Dashboard

VI. BENEFITS, CHALLENGES, AND LIMITATIONS

The proposed cloud-based system provides several advantages over existing systems in the domain of agricultural trade. Firstly, the integration of direct trade eliminates the price distortion caused by intermediaries. This means that farmers will be able to sell their produce at a higher price than would be the case with third-party involvement. Similarly, buyers will benefit from more competitive prices.

The proposed solution's cloud-based design offers significant advantages over existing solutions in terms of scalability and reliability. The system will be hosted on AWS's EC2 service, which provides elastic compute capacity that can scale up or down depending on the traffic needs. This means that there will be no downtime that could impact the business during peak seasons when more buyers are searchingfor agricultural produce. Additionally, the RDS-managed database will offer enhanced data reliability since it will have built-in replication and backup features that will reduce the risk of data loss during peak times.

The system's real-time monitoringcapabilities, which will be enabled by the CloudWatch service, provide another significant advantage over existing systems in the domain. While most existing systems fail to address production-grade reliability engineering, the proposed solution will be able to detect potential downtime with enough time to mitigate the issue. This is critically important for agricultural trade due to the time-sensitive nature of transactions, especially wherethe involved products are highly perishable.

Finally, the proposed solution's use of modular, API-driven architecture offers significant advantages in terms of extensibility and adaptability. It will be possible to enhance the system's capabilities, for instance, by integrating a payments system or enabling logistics tracking without impacting the existing system components. This design approachwill enablethe system to evolve over time andserve additional purposes beyond basic agricultural trade.

CHALLENGES AND LIMITATIONS

A. Digital Literacy and Accessibility

The success of FarmKart depends upon the users' ability to navigate the interface, list products, and pay digitally. Many small and marginal farmers may not have the digital literacy or devices needed to quickly adopt such a system.

B. Trust and verification gaps

A direct exchange marketplace between previously unconnected farmers and buyers carries risks about the quality of goods and services as well as the assurance of money delivery. The current system design does not ensure buyer and seller trust and verification, which may discourage high-value trades and slow down initial adoption.

C. Logistics and delivery limitations

While FarmKart allows direct exchange listing and processing, it is still the responsibility of both parties to deliver the goods to each other. The proposed system would only be useful to farmers in nearby locations who can transport their goods to the buyers.

D. Database reliability

Most features depend on farmers listing the produce details correctly. Inaccuracies and inconsistencies may arise if farmers regularly fail to update the database. Maintaining an updated andreliabledatabase becomes a challenge, especially with a broad user base from different geographical areas.

E. Cost-efficiency

The cloud-based nature of the system allows it to scale up to any numberof simultaneous users. However, at a certain level of adoption, maintaining the system becomes unviable due to AWS charges and potential losses.

F. Dependency

FarmKart is a centralized digital system that is a significant point of failure for the majority of the users who depend on the software to perform crucial economic activities. Any technical problems that may occur in the system or network downtime, which are bound to occur, couldnegatively impact those who adopt the system. This is particularly importantfor the reliability of the system, which is discussed in Section IV.

VII. FUTURE SCOPE

The currently proposed system allows for a significant number of improvements to both the core system and future developments. Some of the most significant changes can be split into short-term, medium-term, and long-term additions. In the short term, the software can be translated into multiple languages to allow a larger number of users to access and use the program. It would mitigate the issue raised in Section VI about user literacy and expand the potential impact of the system. Adding voice recognition or other methods of input would allow illiterate farmers to use the application by speaking instead of typing.

In the medium term, the company can consider adding artificial intelligence features to the system to recommend prices based on existing knowledge of deals and seasonal availability. This would provide additional assistance to farmers, who may find it challenging to sell their goods at reasonable prices. An additional feature could be to add a verified rating and review system for both buyers and sellers, which would help establish better trust between users, particularly in higher-value scenarios, which are discussed in Section VI.

It would be helpful to establish partnerships with third-party logistics companies to help facilitate the movement of goods or build a system within FarmKart to allow shipping coordination. This would alleviate the burden of delivery on both parties, particularly for buyers that are not local to the farmers.

In the long term, transforming the system into a mobile app would enhance its utility for farmers. Incorporating features related to government agricultural schemes and the e-NAM system could expand FarmKart's functionality beyond trading, offeringusers additional resources. Utilizingexisting data to make statistical predictions and recommendations would further develop the application as more than just a trading platform.

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VIII. CONCLUSION

This paper aims to design a cloud-based agricultural e-commerce system to facilitate direct exchange of farmers' goods betweenfarmers andbuyers. By reviewingthe existing online trade shows and agricultural e-commerce platforms, as well as the cloud-based e-commerce system, this study identified five research gaps that the proposed system hopes to resolve. First, an existing system that utilizes both the direct exchange mechanism and cloud-based nature to scale to a large number of simultaneous users had not been considered. Second, existing agricultural trade systems lack a reliable price discovery mechanism, particularly to help farmers sell their goods. Third, system reliability and monitoring do not appear to be common practices for agricultural exchange systems, which can cause significant issues for buyers and sellers, particularly in large-scale transactions. Fourth, the majority of e-commerce systems ignore the potential trust and verification gap between unknown buyers and sellers. Fifth, most systems do not attempt to bridge the gap between agricultural trade and regular e-commerce, utilizing the existing infrastructure of the latter while helping scale the former to use beyond local markets.

The designed system utilizes React.js, the Spring Boot framework, and MySQL database to implement a three-tier software system that is hosted on AWS through EC2 instances. The system is designed around the principles of reliability, availability, and observability to ensure smooth operations for the majority of its users. FarmKart aims to bridge research gaps byenablingusers to exchange goods and facilitate direct money transfers, overcominglocal limitations of traditional markets and supporting price discovery. Although it does not address issues like digital illiteracy or logistics, it represents progress toward a more reliable agricultural trade system. Future enhancements could include multilingual support, AI recommendations, logistics coordination, and statistical prediction tools to create additional user opportunities.

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