Kisan Buddy: An Empowering Digital Platform Uniting Farmers and Consumers.

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***Abstract*—Farmers have various problems in establishing equal market access, fair pricing, and maximum profitability in a competitive agricultural business. This study describes a new digital platform that uses advanced capabilities to efficiently handle these difficulties. The platform's main feature is a bidding mechanism that enables farmers to market their produce and receive offers from many purchasers, allowing for more competitive pricing. A top bidder listing feature provides real-time transparency, allowing farmers to make more educated decisions based on the highest offers. In addition to pricing optimization, the platform has a location-based advising tool that helps farmers choose the most profitable marketplaces by analyzing demand patterns, pricing trends, and logistical feasibility. This functionality facilitates smooth navigation, route optimization for deliveries, and improved logistics management, leading to better decision-making and increased profitability. This comprehensive approach ensures that farmers can successfully bridge the gap between production and sales.**

The suggested system is intended to be both user-friendly and scalable, with applications ranging from small to large-scale agriculture. By increasing transparency, decreasing logistical inefficiencies, and assuring fair pricing systems, the platform hopes to build a more equitable and efficient agricultural economy. Preliminary evaluations show that the platform boosts farmers' profitability, decision-making abilities, and market reach. Future work will concentrate on integrating predictive analytics, broadening market insights, and introducing sustainability-driven features to boost agricultural innovation.

***Index Terms*—cultivators, fair-trade, bidding, price prediction, profitability, mandi locator.**

I. INTRODUCTION

The agricultural sector remains vital worldwide, providing livelihoods for countless individuals and contributing significantly to economic stability. Nevertheless, farmers encounter ongoing obstacles, including unpredictable pricing, inefficient resource use, restricted market access, and unreliable information, which impede productivity and profitability [1][2]. Addressing these challenges is crucial for ensuring sustainable agriculture and food security. Current studies emphasize the transformative impact of technological progress in tackling these issues. Mobile apps like SMART KISAN and Farm Connect have shown the benefits of linking farmers to essential information and resources. Additionally, research on AI-driven solutions such as Kisan Se Kisan Tak underscores the importance of incorporating user-friendly technology to boost farmer engagement [3]. Building on these advancements, Kisan Buddy offers a comprehensive platform that integrates real-time data analysis with predictive tools to assist farmers. By offering transportation information, bidding capabilities, and market insights, Kisan Buddy enables farmers to make informed decisions. The platform's architecture includes features that encourage sustainable farming practices, such as improved irrigation management, pest control, and efficient resource allocation [5][7]. This study investigates Kisan Buddy's role in revolutionizing agriculture through technological innovation. By combining insights from recent developments and exploring the platform's design and applications, the research aims to demonstrate how Kisan Buddy bridges the gap between conventional farming knowledge and modern agricultural technologies.

II. LITERATURE REVIEW

A. The Role of Digital Technology in Agriculture

In recent years, the agricultural sector has seen a significant increase in the use of digital technology, with mobile apps becoming a crucial tool for farmer support. These applications contribute to improved agricultural productivity, and operational efficiency, and provide farmers with access to vital resources like weather predictions, market rates, and farming guidance. Numerous research studies have highlighted the transformative potential of mobile applications in farming practices, especially in developing nations.

B. Present Agricultural Mobile Applications

Various mobile applications have been created to support farmers' daily agricultural tasks. For instance, the SMART KISAN app offers features such as weather forecasts, market price updates, and crop management, with a user-friendly interface designed for farmers with limited tech proficiency. However, the app's widespread adoption and functionality are hindered by challenges such as inadequate infrastructure and internet access in rural areas [1]. Similarly, Farm Connect enables direct farmer-consumer interactions, allowing farmers to circumvent traditional middlemen and obtain better prices for their produce, which has proven advantageous in reducing the gap between producers and consumers [2].

C. Peer-to-peer Platforms and AI

The Kisan Se Kisan Tak (KSKT) app employs artificial intelligence (AI) to create a peer-to-peer network for farmers to exchange knowledge, experiences, and solutions. While this promotes collaboration, the app's restricted ability to offer localized, region-specific advice remains a significant challenge [3]. Additionally, immersive technologies like virtual reality (VR) and augmented reality (AR) are being explored for agricultural training, offering interactive learning experiences that could enhance farmers' skills and knowledge. However, the high costs and infrastructure requirements associated with VR and AR technologies limit their widespread implementation in rural areas [4].

D. Farmers' Views on Adoption of Digital Technology

Multiple studies have focused on understanding farmers' views regarding the adoption of digital technologies in agriculture. These studies emphasize the diverse needs of farmers, particularly those in underserved and remote regions, where digital literacy and infrastructure continue to be significant obstacles to technology adoption. Research indicates that agricultural apps need to be flexible and user-friendly to accommodate farmers with varying levels of digital literacy and access to technology [5][6].

E. Research Deficits

While tremendous progress has been achieved in the creation of agricultural mobile applications, some gaps remain in current solutions. Most applications focus on giving basic information such as weather updates or market pricing, but they frequently lack advanced capabilities that might have a direct influence on farmers' productivity and earnings. Many existing platforms lack key capabilities such as quality inspections, price comparisons, and transportation specifics. Furthermore, while some apps provide direct market access, a strong bidding component that assures competitive pricing is frequently absent. This research tries to fill these gaps by including numerous critical elements that are currently missing from most agricultural apps.

The proposed platform would include a check for quality feature to assist farmers in determining the quality on their produce and ensuring that they get fair rates. A bidding option will be added to enable farmers to compete in a highly competitive market, ensuring they obtain the greatest price for their produce. Furthermore, the transportation information feature will help farmers discover the best transportation choices, improve logistics, and reduce expenses. Finally, farmers will be able to compare pricing across multiple markets, allowing them to make more educated judgments about where they should market their produce. These features are intended to give an expanded solution, meeting many demands that are frequently missed by present apps.

III. METHODOLOGY

A. Software and Hardware Requirements

To create and implement the Kisan Buddy app, certain software and hardware components are necessary:

Software Requirements:

- Android Studio (4.2 or newer): This serves as the primary development platform for coding, troubleshooting, and constructing the application.
- Firebase SDK: This is incorporated into Android Studio to facilitate smooth user verification, instantaneous data updates, and database administration.
- Google Maps API Key: This is employed to incorporate location-based functionalities, such as address conversion, cartography, and distance computation.

Hardware Requirements:

- Mobile Device: An Android smartphone or tablet running version 7.0 or later is needed to operate and evaluate the application.
- Computer: A desktop or laptop with at least 8GB of memory and 10GB of available storage is required for development work using Android Studio.
- Internet Access: A connection is essential for utilizing Firebase services, and APIs, and enabling real-time data synchronization throughout the development and deployment process.

B. Architecture of Kisan Buddy

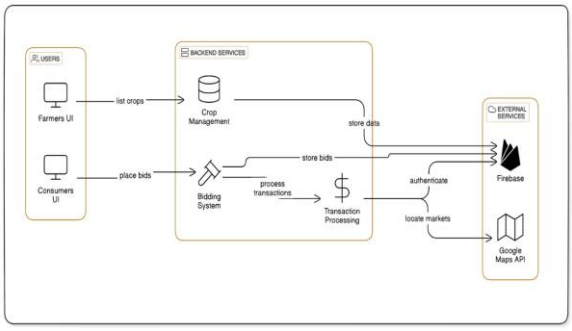

Figure 3.1: Architecture model

The model showcases the primary functions of the Kisan Buddy application, demonstrating how farmers and consumers engage with the system. It emphasizes crucial activities such as crop management and bidding services. This visual representation aids in outlining the app's operations and provides a basis for future enhancements.

C. Module-wise Implementation

This segment outlines the methodology employed in creating the Kisan Buddy app. The project utilizes Firebase for backend operations, Google Maps API for location-specific functions, and Android frameworks to ensure a user-friendly interface. Essential features include user verification, profile administration, crop cataloging, auction processes, and location-based offerings. Each component is engineered to cater to the requirements of agriculturists and buyers, guaranteeing effectiveness, dependability, and simplicity of use. The subsequent subsections elaborate on the development and functional mechanisms of individual modules:

The Authentication Module guarantees secure user verification through Firebase Authentication. It permits users to access the app using their email and password, confirming their status as either Producer or Consumer. Following successful login, the application retrieves and saves the user's location with proper authorization and directs them to their respective control panels.

The User Profile Module allows individuals to examine and modify personal data such as name, age, gender, and Aadhaar number. This module employs Firestore to safely retrieve and store user information, presenting editable and fixed fields in an easily understandable manner.

The Crop Listing Module enables Producers to advertise crops for purchase. Producers can input details like crop name, quantity, weight, and price. This information is stored in Firestore, linked to the logged-in producer, ensuring precise and systematic data handling.

The Producer Control Panel equips Producers with instruments to oversee and manage listed crops. It showcases a crop inventory using a RecyclerView and enables Producers to access individual crop entries to view bidding specifics. Firebase Firestore is utilized to retrieve crop data, and intuitive navigation aids in efficient management.

The Consumer Control Panel is customized to address Consumer needs, offering a user-friendly interface to explore available crops listed by Producers. This panel fetches and displays a

comprehensive crop inventory from Firebase Firestore, including details such as crop name, quantity, weight, and price. Consumers can select crops of interest to view additional information, including bidding history and producer details.

The Bidding Feature facilitates interaction between Producers and Consumers by allowing Consumers to place bids on listed crops. Bid information, such as bid amounts, is stored in Firestore under specific crop documents. This feature also retrieves and displays the top bidders for each crop.

The Google Maps Integration Component enhances the application with visual representations of customer, producer, and market locations. Utilizing APIs such as Geocoding, Places, and Distance Matrix, it identifies the nearest market, calculates distances, and provides route information. Markers are employed to distinguish Producers, Consumers, and markets on the map for easy visualization.

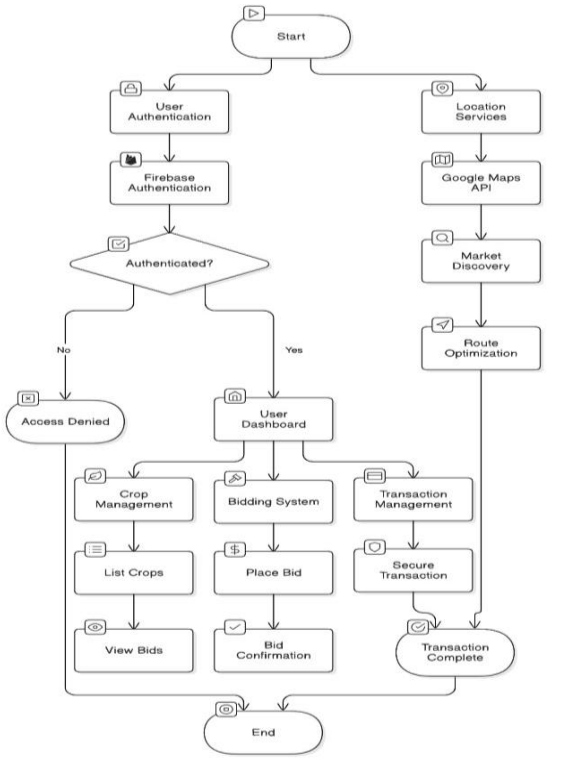

Figure 3.2: Work flow diagram

IV. RESULTS AND DISCUSSIONS

The Kisan Buddy application effectively combines various features to support farmers and consumers in the agricultural marketplace. Users can safely access role-specific dashboards (Producer or Consumer) through Firebase Authentication. Farmers can post crops for sale, while consumers can make bids, promoting fair pricing and competitive offers. The incorporation of Google Maps API enables efficient tracking of farmers, consumers, and nearby markets, improving connectivity and ease of use. Firebase Firestore powers the application's smooth user experience by storing and updating all user, crop, and bidding information in real time. The consumer and producer dashboards offer user-friendly interfaces for managing profiles, crops, and bids, simplifying navigation and interaction within the app. The application achieves its goals of streamlining agricultural transactions, expanding market access, and boosting efficiency for both farmers and consumers. It ensures that producers can easily connect with potential buyers, while consumers benefit from a simplified bidding process. This blend of features and technologies illustrates Kisan Buddy's potential to revolutionize the agricultural marketplace.

This paper includes screenshots of the app's interface and functionalities, providing a visual representation of the system's operations and highlighting key features and user-friendly design.

A. Splash Screen and Registration Page

The app's initial screen acts as a welcoming interface, showcasing the logo and name while loading core features, creating a powerful first impression. New users can easily set up an account on the registration page by inputting essential information like name, contact details, and a secure password, ensuring a smooth onboarding process for full app access.

B. Login Page and Profile page

Existing users can safely enter their accounts through the login page by providing their registered email and password, guaranteeing effortless app entry. Users can view and modify their personal information, including name, contact details, and preferences, on the profile page, allowing for a tailored app experience.

C. Crop entry and Producer Dashboard

Producers can effortlessly input crop information in the crop entry section, such as name, quantity, weight, and price per kilogram, facilitating a

straightforward listing process for potential buyers. The producer dashboard offers a thorough overview of active crop listings, showing crop names, seller information, prices, and bids, enabling producers to effectively manage their offerings and track market demand.

D. Consumer Dashboard and Customer List

The consumer dashboard presents an organized display of available crops, including crop names, sellers, prices, and current bids, allowing consumers to easily browse and participate in bidding. The customer list page provides a detailed view of registered customers, displaying their names, bid amounts, and email addresses, facilitating efficient management and communication between producers and consumers.

E. Bid Settlement and Location Access

On the bid settlement page, farmers can evaluate and choose the most lucrative bid from consumers. They can finalize the transaction by selecting "Yes" or decline and wait for a better offer by choosing "No." The location access page displays a visual representation of producer, consumer, and mandi locations, enabling efficient navigation and optimized delivery routes for improved decision-making and profitability.

The adoption of this system has resulted in significant improvements in operational effectiveness, market functioning, and economic outcomes for both growers and buyers. The buyer interface boosts participation and promotes competitive offerings, leading to improved price determination and more detailed insights into expenses and profits. The proposed system significantly reduces the effort, time, and unnecessary financial burden on agricultural producers by optimizing their interactions with market spaces. Traditionally, producers face the challenge of traveling to marketplaces (*mandis*) with their crops, incurring transportation costs, time delays, and laborious efforts. Often, these trips result in suboptimal sales or unsold produce, leading to economic losses and a waste of resources. This issue is particularly pronounced when the market dynamics, such as demand and price fluctuations, are unpredictable.

By integrating a bidding mechanism within the system, producers can make informed decisions about when and where to transport their produce. The system ensures that a bid is only finalized when there is a confirmed buyer willing to purchase the crop at an agreed-upon price. This eliminates the need for speculative or unnecessary travel to mandis, which might otherwise result in unsuccessful sales.

Furthermore, the system incorporates detailed expense and travel estimations tailored to each producer's situation. These estimations consider key factors such as the crop's weight and the producer’s distance from the mandi.

V. CONCLUSION

The Kisan Buddy project effectively addresses the needs of farmers and consumers by offering a user-friendly platform for crop management, bidding, and transactions. Producers can list their crops and interact with buyers through a bidding system, while consumers can easily view available produce and place bids. The integration of location services facilitates efficient market discovery and route optimization to reduce travel costs, enabling smooth transactions between parties. The use of Firebase for authentication and real-time data storage ensures secure and seamless user experiences. By incorporating Google Maps API, the app enhances usability by allowing users to locate nearby markets and producers. These combined features result in a comprehensive tool that connects farmers and consumers, improving accessibility and efficiency in the agricultural sector. In summary, the Kisan Buddy app represents a significant advancement in utilizing technology for agricultural growth. The project not only simplifies transactions but also promotes fair trade and transparent communication between producers and consumers. Looking ahead, further improvements can be made to expand the app's reach and capabilities, ultimately contributing to the modernization of farming practices.

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