KISAN BUDDY

Dr. Vairavel Chenniyappan
School of Computer Science and Engineering
Presidency University
Bengaluru, India
vairavel.c@presidencyuniversity.in

Mohammed Ismail
School of Computer Science and Engineering
Presidency University
Bengaluru, India
mohammed.20211cse0784@presidencyuniversity.in

Shaik Akram
School of Computer Science and Engineering
Presidency University
Bengaluru, India
shaik.20211cse0783@presidencyuniversity.in

Bandi Raghavendra
School of Computer Science and Engineering
Presidency University
Bengaluru, India
bandi.20211cse0762@presidencyuniversity.in

Abstract

The *Kisan Buddy* project is a mobile application designed to empower Indian farmers by addressing critical challenges such as limited market access, outdated market prices, and inefficient trade systems. With agriculture being the backbone of India's economy, improving farmers' accessibility to real-time data and optimized trade mechanisms is essential for sustainable growth. Despite existing applications, research highlights significant gaps, including a lack of real-time market updates, user-friendly interfaces, and robust decision-making support. *Kisan Buddy* bridges these gaps by leveraging Firebase Authentication for secure login and registration, Firebase Realtime Database for seamless data management, and Firestore for structured, scalable data storage. The app offers features like real-time mandi price updates, personalized cost estimation, and intuitive navigation to nearby mandis through Google Maps integration. Methodologically, the application integrates advanced mobile technologies, ensuring offline functionality to cater to the diverse needs of Indian farmers. Early testing has demonstrated improved decision-making, market transparency, and accessibility, fostering better economic outcomes. By addressing issues such as market inefficiencies and digital literacy barriers, the app aligns with the United Nations' Sustainable Development Goals, particularly those related to economic growth and reduced inequalities. *Kisan Buddy* represents a transformative solution, combining innovative technology with user-centric design to enhance agricultural productivity and profitability. This research underscores the potential of digital tools in revolutionizing rural livelihoods, offering a scalable and adaptable framework for improving the socio-economic conditions of farmers in India. The findings highlight its ability to bridge existing gaps and its role in advancing sustainable agricultural practices.

Keywords— Android Application Development, Firebase Authentication, Firebase Realtime Database, Firestore Integration, Mandi Recommendations, Google Maps Navigation

I. INTRODUCTION

The agricultural sector in India forms the backbone of its economy, yet farmers face persistent challenges such as limited market access, lack of real-time information, and inefficient trade practices. The *Kisan Buddy* project aims to address

these issues by leveraging modern technologies to empower farmers with digital solutions. This mobile application integrates Firebase Authentication, Firebase Realtime Database, and Firestore to provide a secure, scalable, and efficient backend. It offers features such as real-time access to mandi-related data, geolocation-based navigation for nearby market identification, and financial recommendations to optimize transactions. Designed with a user-friendly interface in Android Studio, *Kisan Buddy* ensures accessibility for farmers, particularly those with minimal technological literacy. By addressing critical gaps such as the absence of real-time market data and the lack of personalized cost estimations, this project bridges the divide between farmers and digital agriculture. Ultimately, *Kisan Buddy* contributes to the economic empowerment of farmers, enhances decision-making, and promotes sustainable agricultural practices, aligning with global efforts to achieve food security and economic growth.

II. LITERATURE REVIEW

The Kisan Buddy project addresses the pressing challenges faced by farmers, including limited market access, lack of real-time information, and inefficient trade systems, by leveraging advancements in mobile technology. Studies have highlighted the transformative potential of digital platforms in empowering farmers. Agarwalla (2015) explored the Kisan Network, which connects farmers directly to buyers, eliminating intermediaries, fostering trust, and improving market efficiency. Similarly, Mohan et al. (2024) demonstrated the impact of features like buyer-seller communication, real-time pricing updates, and transportation sharing on enhancing profitability and optimizing market access. These findings emphasize the importance of integrating transparency and efficiency into platforms like Kisan Buddy to address these challenges effectively.

Mobile technology has emerged as a cornerstone in modern agriculture, enabling features such as real-time price tracking, weather forecasting, and crop advisory services, as noted by Kambale et al. (2024). Their research highlights the necessity of designing user-centric applications for rural populations with limited technological exposure. Complementing this, Nimje and Wankhede (2019) analysed the Farmer Buddy app, which bridges the gap between farmers and markets, offering timely pricing updates and facilitating financial inclusion through digital payment systems. These insights underscore the relevance of incorporating similar features into Kisan Buddy to improve decision-making, enhance productivity, and promote economic resilience.

Emerging technologies like Artificial Intelligence (AI), the Internet of Things (IoT), and machine learning have revolutionized smart agriculture by enabling predictive analytics and precision farming. Oteyo et al. (2021) demonstrated how IoT sensors and AI-driven models optimize resource use and improve productivity through real-time monitoring of soil conditions and weather patterns. Integrating such advanced technologies into Kisan Buddy can significantly enhance its functionality, providing predictive analytics and AI-driven crop advisories to empower farmers in making proactive decisions.

Firebase has proven to be an indispensable tool for mobile application development, offering real-time database management, user authentication, and cloud storage capabilities, as noted by Khawas and Shah (2018) and Saraf et al. (2022). Its offline capabilities and cross-platform compatibility are particularly suited for rural areas with inconsistent internet connectivity. These features make Firebase an ideal choice for Kisan Buddy, ensuring scalability, security, and efficiency in managing critical data like mandi prices, user profiles, and transaction records.

Mobile applications have had a profound impact on farming systems by improving decision-making,

market access, and financial inclusion. Kumari (2022) and Gorde et al. (2024) emphasized the importance of value-added services, such as insurance and subsidies, as well as multilingual support and intuitive interfaces, in addressing the diverse needs of farmers. These findings reinforce the need for our project Kisan Buddy to serve as a comprehensive platform, incorporating features that extend beyond basic functionalities to support inclusivity and accessibility, ultimately promoting the economic empowerment of farmers.

III. OBJECTIVES

A. *Enhanced Access to Real-Time Mandi Prices*

Farmers can now access real-time mandi price information for various crops through an intuitive interface. This empowers them to make informed decisions based on up-to-date market data sourced from reliable government platforms and dynamically updated in Firebase databases.

B. *Profitabilty Computation and Recommendations*

The project provides a unique feature that calculates mandi profitability based on user inputs like crop cost and quantity. The app generates a ranked list of mandis, prioritizing those offering maximum profit. The app's core functionality lies in its ability to recommend the most profitable mandis based on real-time price analysis and user inputs. This functionality equips farmers with actionable insights to maximize their earnings.

C. *Seamless Integration of Navigation Services*

By incorporating Google Maps for navigation, the app simplifies the process of locating and traveling to recommended mandis. Farmers can seamlessly switch from evaluating mandi options to receiving precise directions, reducing logistical barriers.

D. *Maintain Historical Data for User Reference*

Kisan Buddy includes functionality to maintain and display a history of mandis visited by the user. This historical data provides valuable insights, enabling farmers to track price trends, compare past profits, and make better-informed decisions.

E. *Farmer-Centric User Interface*

The app's user interface is specifically designed with farmers in mind. Recognizing that many users may have minimal technical expertise, the app incorporates a simple and intuitive layout. Features such as clear instructions, responsive design, and intuitive navigation ensure accessibility for users of all backgrounds.

F. *Ensure Data Security and User Privacy*

Data security and privacy are paramount in Kisan Buddy. Firebase Authentication ensures that only authorized users can access their profiles, while Firebase Firestore encrypts all stored data. The app complies with industry standards for data protection, safeguarding sensitive user information such as personal details and crop data.

IV. METHODOLOGY

The methodology for the Kisan Buddy project is designed to address the challenges faced by Indian farmers in accessing real-time mandi information and making informed decisions. The approach includes systematic planning, implementation of modern technologies, and user-centric design to deliver an efficient, scalable, and user-friendly solution. Below are the key components of the methodology:

A. Research Design

The research methodology follows an applied research approach aimed at solving practical problems faced by farmers. The study involves qualitative insights gathered through farmer interviews and quantitative analysis of mandi data to develop a comprehensive mobile application. A user-centered design process ensures that the app aligns with the specific needs of farmers.

B. Data Collection

The mandi price data was sourced from the Open Government Data (OGD) Platform India, which provides accurate and verified information on daily crop prices across multiple markets in India. The dataset contains fields such as state, district, market, crop name, and price. This data was cleaned, validated, and uploaded to Firebase Realtime Database and Firestore for seamless integration with the application.

C. Data Analysis and Processing

The raw dataset underwent preprocessing, including the removal of duplicates and validation of key fields like price and market name. This ensures that the data presented to users is reliable and actionable. Filtering and sorting algorithms allow users to view mandis based on location, crop, and profitability.

D. System Architecture

The application employs a **Model-View-Controller (MVC)** architecture for modular development.

- **Model:** Manages data from Firebase, including mandi information, user profiles, and historical search data.
- **View:** Implements XML layouts for an intuitive user interface, focusing on accessibility for non-technical users.
- **Controller:** Facilitates interaction between the user and data, including data fetching, recommendations, and navigation.

E. Core Functionalities

- **Mandi Recommendations:**
  Profitability computation is a core feature, leveraging the formula:
  Profit = (Mandi Price - User Crop Cost) × Quantity.
  The app ranks mandis based on profitability and proximity, providing farmers with actionable recommendations.

- **Navigation:**
  Integration with Google Maps for Navigation enables farmers to access turn-by-turn directions to nearby mandis, simplifying logistics.

- **Recent Recommendations:**
  Recent mandi searches are saved using Shared Preferences, enabling users to review past decisions.

F. Firebase Integration

Firebase serves as the backbone for managing data in the Kisan Buddy project, ensuring seamless real-time synchronization and secure storage of critical information. The application leverages multiple Firebase services, including Firebase Authentication, Firebase Realtime Database, and Firebase Firestore. Each database is utilized for specific functionalities, enabling scalability, reliability, and secure data management.

1. **Firebase Authentication:**
   Firebase Authentication is employed to manage user login and registration securely. It allows farmers to create accounts using email and password, ensuring that only authorized users can access their profiles and personalized recommendations. This service also

simplifies user management and ensures compliance with data security standards.

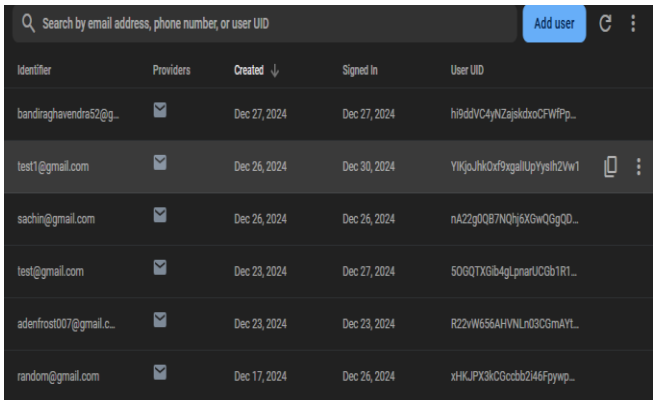

Figure 1: Firebase Authentication (E-mail/password)

2. **Firebase Realtime Database:**
In the Kisan Buddy app, user registration details entered via Register (such as name, email, password, address, city, and phone number) are securely managed using Firebase. Upon successful registration, Firebase Authentication handles email/password verification, while additional user details are stored in the Firebase Realtime Database under a unique user ID. During login, credentials are authenticated through Firebase, and user-specific information is fetched from the database for personalized interactions. This integration ensures secure user authentication and dynamic data management, enhancing the app's functionality and user experience.

Figure 2: Firebase Realtime database

3. **Firebase Firestore:**
Firestore is employed as the primary cloud database to store mandi and crop data.
- **Mandis Data:** Stores comprehensive details about mandis, such as state, district, market name, crop name, and price. This data is dynamically retrieved and displayed to users in the application.
- **Crops Collection**: Farmers' entered crop details, such as crop name, quantity, and cost, are stored in this collection. This data is later used to compute profitability and generate personalized recommendations.

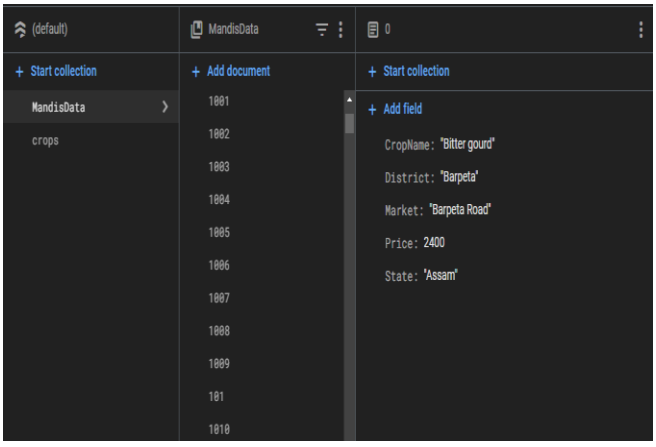

Figure 3: Firestore database

users can access various app features seamlessly. This process ensures secure and efficient user management.

G. Workflow

1. User Authentication

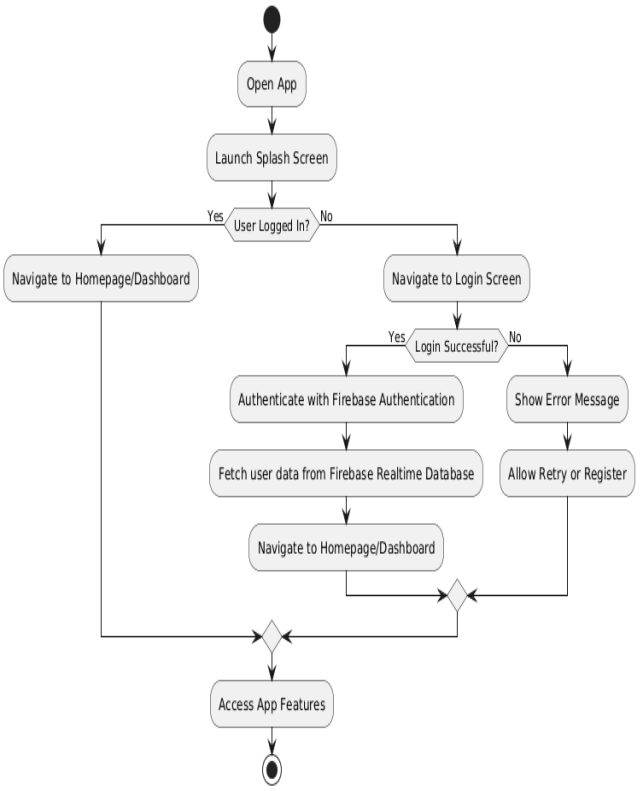

Figure 4

This flowchart (fig.4) outlines the user authentication and navigation process in the Kisan Buddy app. When the app is launched, it displays a splash screen and checks if the user is already logged in. If logged in, the user is directed to the homepage/dashboard; otherwise, they are redirected to the login screen. Upon entering credentials, Firebase Authentication verifies them, and user data is retrieved from the Firebase Realtime Database. Successful login navigates the user to the homepage/dashboard, while failed login prompts an error message with options to retry or register. Once logged in,

2. Crop Information and Mandi Recommendation

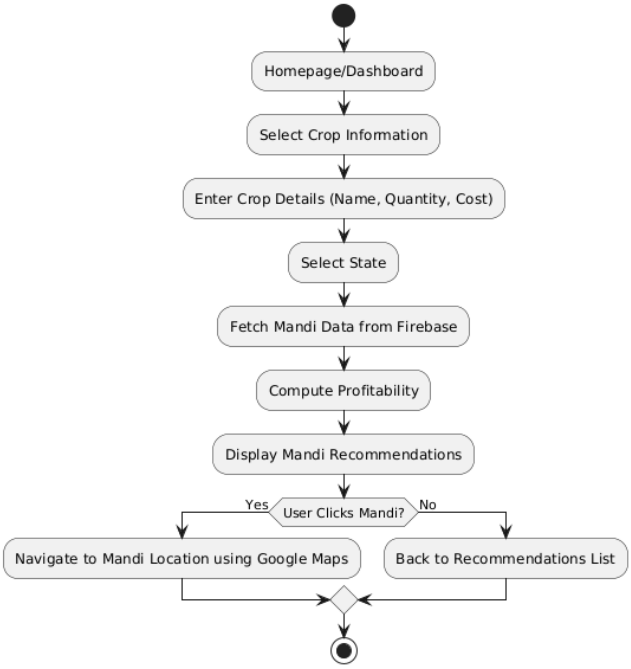

Figure 5

This flowchart (fig.5) illustrates the process of managing crop information in the Kisan Buddy app. Starting from the homepage/dashboard, the user selects the crop information feature and enters crop details, including name, quantity, and cost. The user then selects the state, after which mandi data is fetched from Firebase. Profitability is computed, and a list of recommended mandis is displayed. If the user clicks on a mandi, they are navigated to its location via Google Maps; otherwise, they are directed back to the recommendations list. This streamlined workflow enables efficient decision-making for farmers.

H. Testing and Optimization

The application was tested for usability, functionality, and performance. A focus group of farmers provided feedback, leading to iterative improvements. Optimization techniques such as efficient data queries and caching mechanisms were implemented to enhance responsiveness.

V. RESULTS

The Kisan Buddy project effectively addresses critical agricultural challenges through a mobile application that provides real-time mandi information, cost estimation, and transaction tracking. Firebase Authentication ensures secure user login and registration, while Firebase Realtime Database and Firestore enable seamless retrieval of mandi data, including recommended mandis highlighted in green on the user interface for improved decision-making.

Figure 6: Mandi Recommendation

The app's features were tested for functionality, confirming the accuracy of mandi recommendations and the efficiency of real-time data updates. Performance tests demonstrated scalability and reliable backend operations with Firebase, handling concurrent user requests effectively. The user interface proved intuitive and user-friendly during testing, enhancing usability among farmers.

Preliminary evaluations indicate that Kisan Buddy supports better financial planning and market decision-making, empowering users with actionable insights. The app highlights its potential to transform agricultural practices, laying a foundation for future enhancements, including multilingual support and advanced analytics.

CONCLUSION

The Kisan Buddy project represents a significant advancement in empowering Indian farmers by addressing critical challenges in accessing mandi information, calculating profitability, and navigating logistical barriers. By leveraging modern technologies such as Firebase Firestore, Firebase Realtime Database, Google Maps for navigation, and secure Firebase Authentication, the application provides a comprehensive and user-centric platform that ensures real-time access to mandi prices, accurate profitability calculations, and efficient data-driven recommendations. The farmer-centric design, coupled with seamless integration of features like dynamic filtering, sorting, and historical data maintenance, enhances user experience and fosters informed decision-making. Through its scalable architecture and robust backend, Kisan Buddy simplifies complex market dynamics, making agricultural trade more efficient and transparent. The application contributes to improving the financial stability of farmers, enhancing productivity, and fostering

sustainable agricultural practices, aligning with broader developmental goals in India.

FUTURE SCOPE

While Kisan Buddy has achieved its foundational goals, there is significant potential for further development. Future iterations could introduce multilingual support to cater to the diverse linguistic needs of Indian farmers, thereby expanding accessibility. The integration of advanced data analytics and predictive modeling could provide insights into future mandi price trends, helping farmers plan their produce and sales strategies effectively. Furthermore, incorporating weather forecasting and crop health monitoring features using IoT sensors and AI technology could elevate its utility. Finally, collaborations with government bodies and agricultural organizations could enhance the accuracy and reach of the platform, solidifying Kisan Buddy as a transformative tool in the agricultural domain.

REFERENCES

[1] Agarwalla, A. (2015). Independent work report: Kisan Network (Hindi for "Farmer Network"). Princeton University, Department of Computer Science. Retrieved from https://www.cs.princeton.edu/~rdondero/iw/15Agarwalla.pdf

[2] Haseemun, P., & Somasekhar, K. (2019). A study of Farmers Buddy app development. *International Journal of Computer Sciences and Engineering, 7*(Special Issue 6), 173–175. https://doi.org/10.26438/ijcse/v7si6.173175

[3] Kambale, P., Dharma Raj, B. M., Patil, D., & Ganavi, N. R. (2024). Mobile technology for farmers: An overview of agricultural apps. Asian Journal of Agricultural Extension, Economics & Sociology, 42(9), 75–81. https://doi.org/10.9734/ajaees/2024/v42i92543

[4] Khawas, C., & Shah, P. (2018). Application of Firebase in Android app development: A study. International Journal of Computer Applications. https://doi.org/10.5120/ijca2018917200

[5] Kumari, D. (2022). A study of agriculture-related mobile apps and its impact on farming system. DDU Gorakhpur University. IJCRT, 10(2). https://ijcrt.org/papers/IJCRT2202239.pdf

[6] Mohan, C. R., Kumar, C. S., Chowdary, K. L. N., Ganesh, K. V. S., & Narahari, C. V. (2024). Farmers Buddy: Farmers Online Selling Application. *International Journal of Research in Engineering, IT and Social Sciences, 14*(06), 29–37. Retrieved from https://www.indusedu.org/pdfs/IJREISS/IJREISS_4234_61801.pdf

[7] Nimje, M., & Wankhede, P. (2019). Farmer Buddy. In R. Babu (Ed.), National Conference on "Recent Advances in Engineering and Technology" (SAMMANTRANA 19) (Vol. 4, No. 8). International Journal of Innovations in Engineering and Science. Retrieved from https://www.ijies.net/finial-docs/finial-pdf/220519CS10.pdf

[8] Oteyo, I.N., Marra, M., Kimani, S. et al. A Survey on Mobile Applications for Smart Agriculture. SN COMPUT. SCI. 2, 293 (2021). https://doi.org/10.1007/s42979-021-00700-x

[9] Prof., Gorde, Vaishali, S.., Bidgar, Gaurav, D.., Pangavhane, Kalyani, K.., Shinde, Pranali, S.., Jeughale, Ashish, M.. (2024). Farmer Application. International Journal of Advanced Research in Science, Communication and Technology, doi: 10.48175/ijarsct-17280

Saraf, P. R., Jadhao, S. M., Wanjari, S. J., Kolwate, S. G., & Patil, A. D. (2022). A review on Firebase (Backend as a Service) for mobile application development. *International Journal for Research in Applied Science & Engineering Technology (IJRASET, 10*(1), 967–973. Retrieved from https://www.ijraset.com/best-journal/firebase-backend-as-a-service-for-mobile-application-development