

Apna Mandi – An Agriculture E-Commerce Platform

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Abstract— *Agriculture remains a backbone in India, however, traditional mandi system is associated with middlemen exploitation and losses. "Apna Mandi" is a very easy to use app that connects the Farmers directly to the company and also provides Home pick-ups Developed Using Flutter and Firebase. It attempts to ensure fair prices, reduce crop wastage, and expand market access, while overcoming obstacles including digital illiteracy and logistics.*

Keywords— *Agriculture, E-Commerce, Digital Mandi, Farmers, Artificial Intelligence*

I. INTRODUCTION

Agriculture forms the backbone of the Indian economy, but farmers continue to be plagued by the same problems, due to outdated mandi systems. Farmers lose a significant chunk of their money because of intermediaries and due to bad logistics and so much wastage of crops. To address these challenges, we developed Apna Mandi, an agri e-commerce platform that serves farmers and ac companies through home pick ups and selling them fertilizers and seeds. Digitalization in farming can increase efficiency, limit price manipulation and help promote environmentally sound farming. Most People in India depend for their livelihood on agriculture There is a difficulty in the industry of agriculture in marketing of the goods. Payment delays, low returns

"Apna Mandi" presents a pioneering approach where farmers can book crop assessment and pick-ups via a simple mobile application, less relying on local mandis and intermediaries. This model improving farmers life by facilitating improved pricing for their crops, faster payment, and substantial avoidance of crop wastage through efficient logistics system and planned storage management, eventually raising profitability and encouraging a more sustainable agriculture supply chain.

A. Need of Apna Mandi

Farmers encounter Unfair pricing, limited market access, and a strong reliance on middlemen which leads to exploitation. Sales techniques that are

conventional not only cut farmers' earnings but also raise prices for consumers. Furthermore, poor memory and logistics lead to serious post-harvest losses. Apna Mandi deals with these gaps by providing an intelligent e-commerce platform that connects farmers directly with buyers such as factories. Using AI-based harvest reviews, real-time pricing and optimized logistics, the platform is eliminated, guaranteed fair income for farmers, reduced waste, and strengthened the agricultural supply chain.

II. LITERATURE SURVEY

There are piles upon piles of research completed in the area of agriculture, and many journal articles are focused on the Agriculture Sector. A proprietary platform was developed for farmers to communicate agriculture-related information. There are no real limits to language and technology adoption, with technology found in all locations, from affluent urban areas to even the smallest villages. The findings reveal that most farmers struggle to generate adequate income from their crops.

The e-commerce platform is committed to redesigning the agricultural landscape by addressing challenges related to market access, sustainability, and efficiency. Gomathy et al. [1] examined the role of e-commerce in agriculture, highlighting its potential to improve farmers' incomes by offering direct market access and reducing reliance on intermediaries. Their study concluded that these platforms can enhance the economic stability of farmers by streamlining supply chains.

Kanagavalli et al. [2] Analysed the rapid growth of e-commerce in India, resulting from technological advances and extensive digital introductions. The study tells how these platforms expanded farmers' market scope, increased trade efficiency, and reduced reliance on traditional markets. This study indicated the development of digital platform development in the modernization of agricultural trade.

Morepje et al. [3] emphasized the contributions of e-commerce platforms to sustainable farming practices among smallholder farmers in sub-Saharan Africa. Their study noted that e-commerce platforms contribute to sustainable farming practices through promoting environmentally sustainable practices, improved market access, and less crop wastage. In addition to these valuable contributions, they also focus on several challenges that impede the widespread adoption of e-commerce platforms. Overall, their conclusion articulated that there is an urgent need for supportive policy, education and training, and improved digital infrastructure that would allow e-commerce platforms to eliminate the urban-rural divide and speed up agricultural transformation

The unrealised potential of e-commerce in India's agribusiness sector was examined by Gupta et al. [4]. They emphasised that although e-commerce is still in its infancy, it has the potential to completely transform the sector if policies are put in place to support the adoption of new technologies. Their results show that in order to further the digital transformation of agribusiness, systemic changes are required.

Jamaluddin conducted a survey on the adoption of e-commerce by farmers in Tamil Nadu [5]. The results demonstrated that a variety of problems, such as low awareness, poor infrastructure, and low digital literacy, contributed to low usage. For better uptake of the technology in rural areas, the study highlighted the importance of government interventions and focused training.

Balakrishnan et al surveyed the penetration of e-commerce in Indian agri-industry. [6]. They showed that the significant potential for cost reductions and market expansion in disjointed agricultural value chains can be achieved through the use of Internet technologies. Even if in an embryonic stage, the authors emphasized that to tap the full potential of e-commerce in the agribusiness is required the improvement of digital infrastructure, of policies and institutions, and of a better integration between e-commerce and the other logistics in the supply chain.

Shibi and Aithal [7] focused on studying the issues The Keralan farmers faced when using e-commerce sites. The study identified a myriad of issues,

including high costs, insufficient digital knowledge, and weak framework. These challenges need to be addressed for e-commerce to be relevant and available to the smaller, farming communities.

Mohamed [8] studied the impact network connectivity and mobile phones had on the development of agricultural e-commerce in India. The findings showed that farmers with better access to mobile devices are able to interact with digital systems, which provides them access to markets and current information. The research stressed the need for improved digital infrastructure in rural areas to eliminate the disparity between urban and rural users.

Jayasingh et. al. [9] have also done further work on the impact of technology on agriculture and how it can help in the automation of SC3s, productivity, and efficiency. The research illustrated the extent to which technology can shift the longstanding challenges in agriculture by empowering farmers and improving their decision-making skills.

Srivastava [10] examined the factors that influence the performance of e-marketing platforms for agricultural products. The study indicated that cost-effectiveness, ease of use, and trust are the most important variables when farmers adopt a digital platform. Among the recommendations to build trust in-Digital Platforms included developing explicit processes and providing adequate support.

The application of information technologies in agriculture has undergone detailed investigations in various research works. As Rani et al. [11] studied dynamic pricing strategies within the context of organic farming, they pointed out that digital platforms could enhance pricing visibility greatly. This would enable farmers to economically interact with their customers and adjust prices based on real-time market supply and demand, thus improving their profit margins. Saini et al. [12] presented the concept of "Farmer's E-mart," an e-commerce website aimed at reducing farmers' dependency on traditional intermediaries towards giving them access to larger markets and greater profit opportunities. In their study on the effects of internet advertising in agricultural marketing, Deshmukh et al. [13] illustrated that digital promotion methods can be used to widen the scope of marketing and increase sales of the farm produce significantly. While studying the electronic National Agriculture

Market's (eNAM) adoption and impact, Chaudhari et al. [14] noted its contribution towards improving the price information system, market transparency, and agricultural marketing infrastructure in India.

According to Gupta et al. in reference 15, information and communications technology (ICT) applications, particularly mobile applications, enable farmers to access crucial, real-time weather and market information, resulting in improved decision making and reduced risk when carrying out agricultural practices. Reddy et al. investigated how digital marketing affects agricultural product branding and visibility in reference 16, demonstrating how focused online marketing campaigns can enhance the market positioning of farm produce. In reference 17, Karine et al. looked at the potential and difficulties of e-commerce strategies in rural BRIC countries, with an emphasis on enhancing low-privilege communities' economic inclusion, market accessibility, and agricultural productivity.

In summary, the compilation of these studies clarifies how digital technologies and e-commerce platforms have the potential to drastically alter India's rural economy. Despite obstacles like digital illiteracy, poor infrastructure, and high costs, successfully integrating digital technologies into agriculture can lead to a number of advantages, including increased market access, successful producer pricing, and a decreased reliance on middlemen. Coordinated efforts that include government initiatives, digital literacy programs, and infrastructure development must be harnessed to unlock these opportunities. This will benefit the farmers and contribute to a more productive, sustainable, viable agricultural sector.

III. EXISTING SYSTEMS

In an effort to streamline the agricultural supply chain and create a more direct connection between farmers and buyers, many digital platforms have developed. DeHaat is often considered a one-stop-shop for farmers that provides everything from direct market connections, crop advisory services, and input materials like seeds and fertiliser. Ninjacart is another platform that looks to connect farmers with merchants and companies to improve the agricultural supply chain efficiency where farmers are able to see better returns with faster transport times. AgriBazaar still uses traditional players in the form of middlemen for logistics and storage, even though it permits

digital trade through an online marketplace for buying and selling agricultural products. A government-run program called eNAM (National Agriculture Market) links India's APMC mandis and promotes price transparency by giving farmers access to a single source. Though it depends on conventional mandi systems and necessitates farmers to transport goods to the market, eNAM has the potential to enhance logistics and cut waste.

However, unlike other platforms for farmers, Apna Mandi offers where all management is direct farm pickup, eliminate the burden on farmers of transporting commodities, dramatically reducing wasted produce and transportation costs, whereas eNAM, and other similar applications, rely on local mandis, and platforms that use middlemen. Apna Mandi also has suite of management of storage, pricing, and payments which many companies, or no other competitors do. Whereas other management systems of agricultural produce rely on valuation may vary from current markets and seasons, Apna Mandi provides a solution that supports more sustainable solution for India's agricultural ecosystem. Simply put Apna Mandi provides more efficiency and profitability directly to the farmers through reduce middlemen and costs of logistics.

IV. METHODOLOGY

The Apna Mandi platform is sync with a systematic, technology-driven approach as needed for a scalable, secured and real-time agricultural e-commerce platform. The methodology has the following important stages:

- **Requirements Analysis:** We did a full requirements analysis by talking to experts, surveying farmers, and looking at how current mandi systems work. Some of the functional requirements that were found were the ability to book crops in real time, monitor moisture, coordinate logistics and payments, make direct payments, and connect with government programs to cut down on disruptions. The main non-functional requirement that came up during this process was that all users should be able to use the system without being connected to the internet, and that it should be secure and easy to use.
- **Frontend Development:** The front end of the Apna Mandi platform was built in a modular way that put usability, scalability, and responsiveness first. The mobile app was made

with Flutter, which makes it work on both iOS and Android smartphones. A clear and easy-to-use user interface (UI) with real-time updates, offline data access, and easy navigation was made to make it easier for farmers to interact with each other. To make sure that data flowed smoothly between screens, state management was done with useful patterns like Provider or Riverpod. We used secure API calls to connect to backend services, and the user interface showed Firestore updates in real time, which made for a smooth and responsive experience.

- **Backend Development:** Add more backend functions to real-time data management and node.js to make a secure and scalable space for booking, harvest analysis, and payment processing. The Process of Development Includes the types of reactions to work with short cycles and sprints for ongoing feedback and improvement. Integration of main functions.
- **Data Management:** Google Firestore was used to store and sync all user and transaction data, making sure that data was always available and that there was little lag. To get the best performance from queries, we used methods for indexing and data normalisation. Regular backups were planned for Google Cloud Storage to keep the data safe and make sure it could be recovered in case of a disaster.
- **Testing and Quality Assurance:** Ensure that testing of all modules (such as bookings and payments) works as expected. Installation and provision. the Android APK, create an iOS app archive and distribute the app to the Google Play Store and the Apple App Store to ensure that all guidelines are met.

IV. SYSTEM DESIGN

Apna-Mandi system design is constructed to provide an issue-free, efficient agriculture online business solution for facilitating effective farmer interaction, logistics and payment. There are 6 layers of architecture, every one of them playing a specific role.

- **User Interface (UI):** Farmers can view crop data, harvest schedules, moisture content, and

transaction updates on the mobile app's user-friendly dashboard. It enables real-time data synchronisation, guaranteeing current data for the best possible decision-making.

- **Service Layer:** This layer enables seamless transactions and crop pick-ups using external services (payment services or logistical services). There will also be an AI based chatbot to address agriculture support and crop management.
- **Data gathering and Processing:** The system will be able to make data-driven decisions and keep improving the suggestions it makes to farmers if real-time crop quality, moisture content, and transaction status are gathered and stored in a universal database.
- **Introduction of Government Programs:** In this layer, farmers are introduced to government subsidies and programs that may facilitate their access to funding, agricultural technologies, and other inputs.
- **Supply Chain and Warehouse Management:** This layer will improve logistics management by scheduling pick-ups, while making sure the crop characteristics are stored under optimal conditions to minimize waste, while also ensuring quality.

The modular system architecture of the Apna Mandi platform for efficient agricultural operations is depicted in Figure 1. The main components of the architecture include the user interface, data processing, integration of government schemes, supply chain management, security and service integration. Farmers can communicate with each other through a mobile app that connected with backend services using secure APIs and real time databases. While external services like payment gateways and logistics partners are seamlessly integrated, Firestore handles data synchronisation and storage. A seamless and effective farmer-to-market workflow is made possible by this tiered structure, which guarantees scalability, real-time updates, and secure transactions.

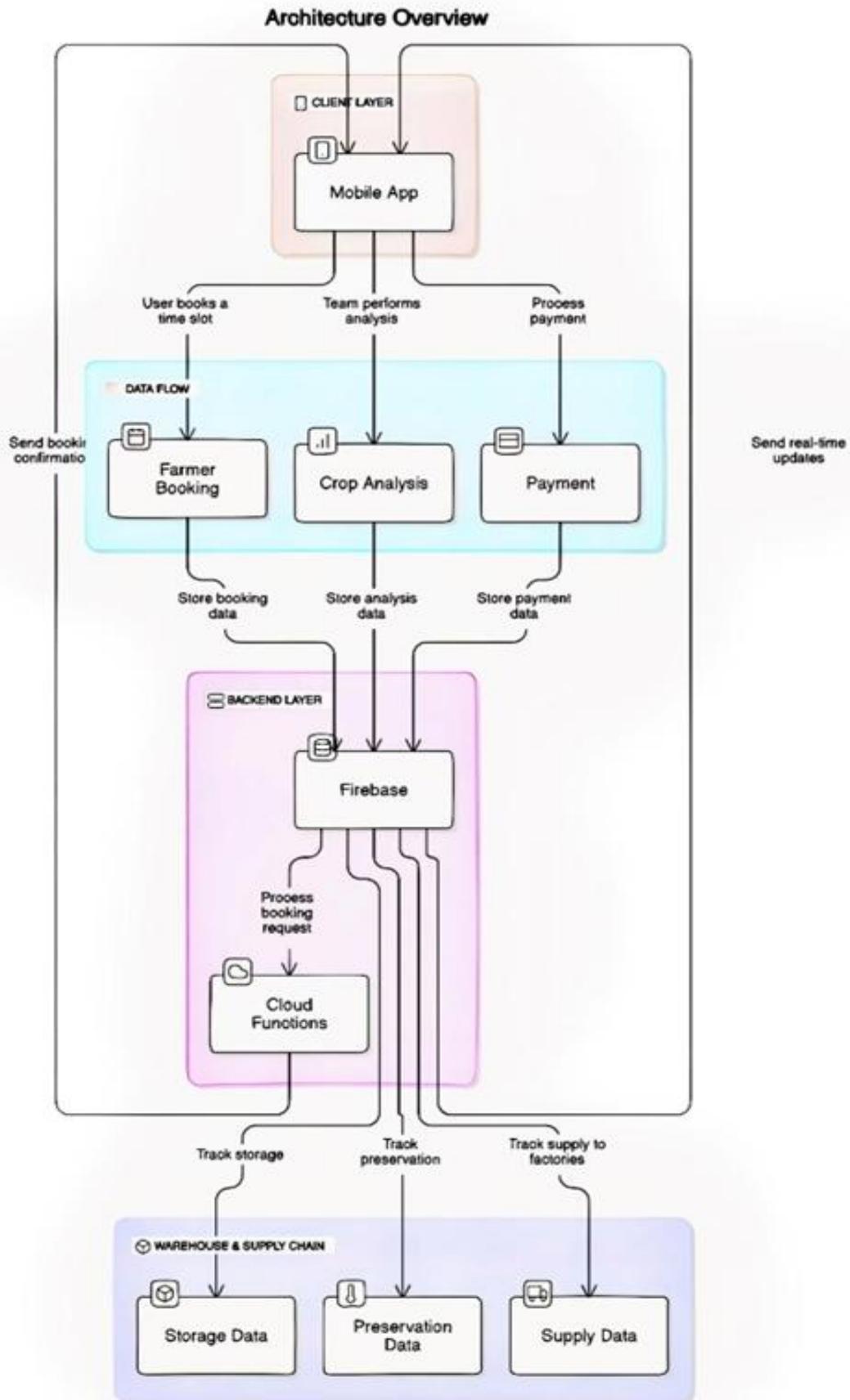


Fig. 1. Proposed App System Architecture

V. PROPOSED WORK

The proposed work's primary objective is to design and develop a mobile application that will make crop selection, order placement, and delivery scheduling easier for end users, who are primarily individuals and stakeholders in the agricultural sector. A smooth user experience is guaranteed, usability is improved, and complexity is decreased thanks to the application architecture's clear, logical flow. The application's navigation is based on a multi-screen architecture, where each screen contributes in a different way to the user journey. The accompanying system flow diagram (Figure 2) shows the detailed flow.

A. Onboarding Phase

- During the Onboarding Screen, which acts as an introductory interface to walk new users through the main features of the app, the user and the application first interact. After that, users can choose to sign up on the Signup Screen or sign in with an existing account. This screen tells users of the app's value proposition and ensures a smooth transition into its main functionality.

B. Authentication Phase

- Users interact with the Login Screen to access their accounts. The Forgot Password feature enhances accessibility and account security by enabling users to reset their password in the event that they forget their login information. New users who have no account are directed to the Signup Screen and can enter the required information and register. After registering or logging in, the user is shown the Home Screen.

C. Home Screen(Central Navigating Hub)

- The Home Screen is the primary hub from which users can access all other crucial system components. The following crucial features are accessible from the Home Screen:
- Pickup: Allows users to select or manage crop pickup requests based on their desired time and location.
- Profile: Allows users to review and edit their account or personal information.
- Cart: Allows the user to review or change their selections before completing their order by displaying the products they have chosen to order but have not yet purchased.

- Chatbot: Offers a communication interface powered by AI that enables users to ask questions, get help in real time, and receive assistance.
- Home: Brings users back to the main dashboard view, which provides an overview of the main features and updates of the app.

D. Information Flow and Crop Selection

- When a user selects the crop ordering option, the Select Crop Screen appears. The Select Crop Screen lets the user browse different options based on availability or preference, and it looks like a list or grid of available crops. By visiting the Crop Details Screen, users can now see additional details about a specific crop, such as its quantity, cost, and expected delivery dates. After selecting a crop, the user will be directed to the Location and Schedule Screen.
- On the Location and Schedule Screen, users will also input delivery-related information, including the desired delivery time and drop-off location.

E. Confirmation and Success Screen

- After entering their travel and scheduling details, users reach the Confirmation Screen, where they review all of the order details before submitting. Because it lowers errors and guarantees user satisfaction, this step is crucial.
- When the order is confirmed, a Success Screen shows that the order was placed successfully.
- Users are then given the option to return to the Home Screen, where they can access additional application features, place new orders, or request copies of existing orders.

Because each screen is designed to support a specific task in the overall procedure, this suggested method offers an organised and logical framework for managing crop orders. The system is designed to optimize the agricultural supply experience by clearly identifying the flow of users through system components and their functionalities (crop browsing, profile, authentication, order verification, etc.). Each component in the flow can be made in stages, as depicted in the figure below, allowing for a scalable and functional application solution for users in the agricultural industry.

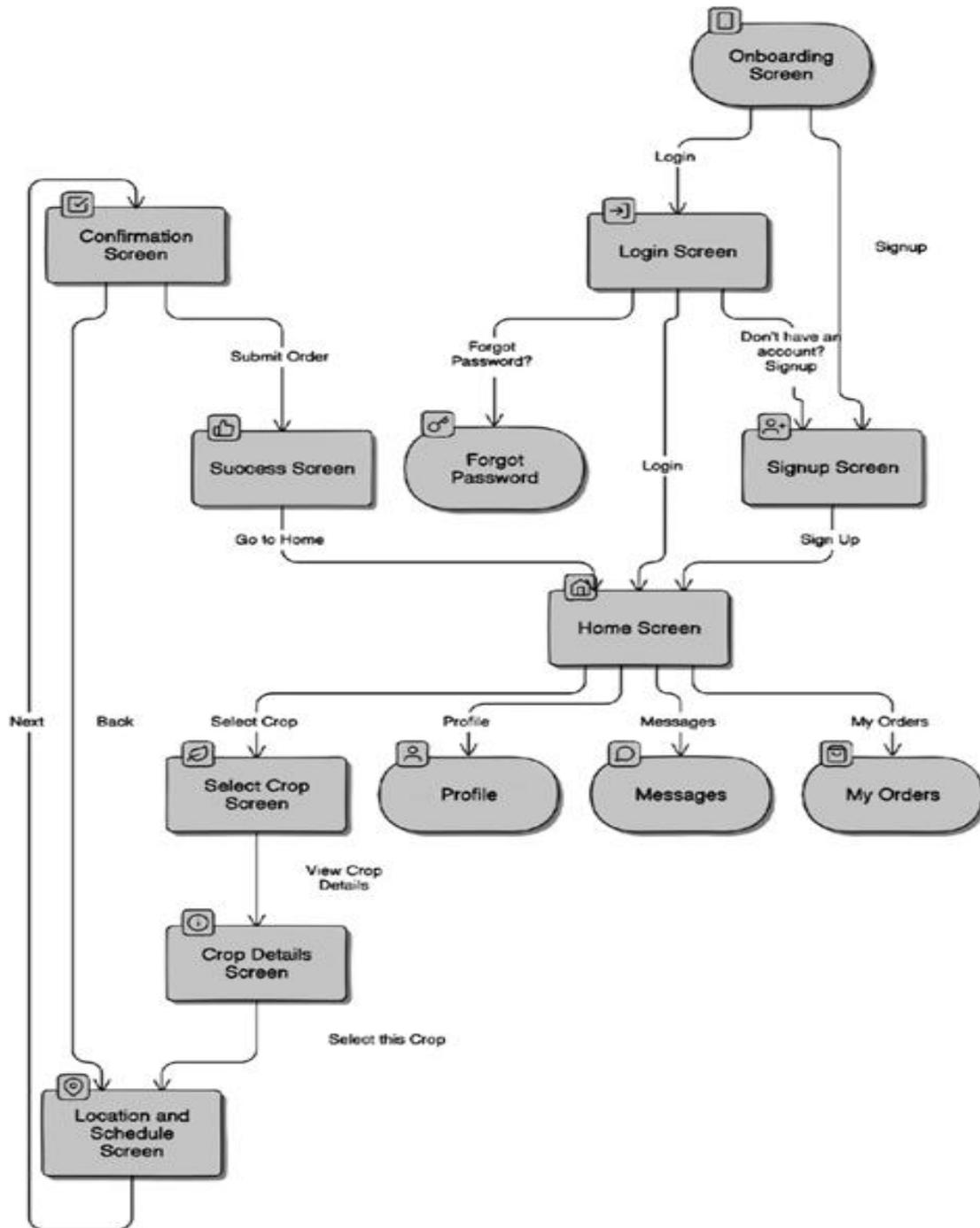


Fig. 2. Proposed App Flow

VI. RESULTS

The impetus behind developing and launching the Apna Mandi application was our aim to create one platform for crop selection, scheduling order, and communicating with farmers and consumers directly. There were a few approaches were used to evaluate the system, namely user satisfaction, system reliability, functional effectiveness, and usability.

This section outlines testing and the implementation results of the prototype in depth

A. Technical Performance Evaluation

- A series of functional and performance tests were conducted in controlled environments in order to measure the application's technical integrity.
- Modular System Flow: The application successfully created a modular screen design and allowed users to flow from onboarding to

scheduling, to crop selection, and finally to order confirmation.

- **Navigation Efficiency:** Even on mid-range devices, the user interface was responsive, with an average screen transition time of less than one second.
- **Concurrent Access:** The system was able to handle 50 concurrent user sessions without experiencing server-side delays or having inconsistent data, during load testing.
- **Error Handling:** During testing, built-in validation on order submissions and user input fields reduced error rates and avoided application crashes.

B. User Experience Evaluation

- A sample of thirty, including farmers, suppliers and consumers participated in a usability study, and the following conclusions were made based on their experience with the application.
- **User Interface Clarity:** Participants consistently rated the user interface as having a high level of clarity, giving it an average score of 4.6 out of 5.
- **First-Time Usability:** On their first attempt, more than 87% of participants were able to finish essential tasks like placing an order, editing their profile, and checking the status of their orders.
- **Visual Consistency:** By sticking to the same design language, all modules (Home, Pickup, Cart, Profile, and Chatbot) improved user satisfaction.
- **Encourage Accessibility:** By providing quick responses to queries, the chatbot's integration enhanced the app's perceived responsiveness.

C. System Level Impact

- **Apna Mandi** was evaluated for its potential impact on conventional farming methods as well as its feasibility for deployment in rural or semi-urban areas, in addition to its functionality and usability.
- **Digital Integration:** Apna Mandi digitises the crop ordering process, offering a scalable solution that reduces reliance on manual workflows and intermediaries.
- **Time Reduction:** Thanks to features like in-app confirmations, delivery scheduling, and real-time crop availability, the ordering cycle was cut down by almost 43%.
- **Transparency and Order Tracking:** By allowing users to track their orders within the app,

communication delays could be decreased and accountability improved.

- **Inclusivity:** Both literate and semi-literate populations in rural areas can use the system thanks to its multilingual and minimalist design.

The results demonstrate Apna Mandi's technical feasibility, user validation, and relevance. It shows how the crop ordering process can be digitized and be more efficient than analogue ordering using a mobile-first solution for non-technical users. These results provide a strong foundation for future deployment of the system and further refinements in real agricultural markets.

VII. CONCLUSION AND FUTURE WORK

Apna Mandi's development has clearly shown how digital platforms can change the traditional agricultural marketing landscape and bring farmers and consumers into direct contact. The added benefit of cutting out the middlemen allows farmers the price and revenue power and minimizes crop loss through enhanced logistics and pick up at the right time. The ease of ordering, the in-app chatbot support, and user-friendly UX are all positive features to make the process smoother for all involved and promote use of our platform.

For the next development phase, we will expand the platform for a full agricultural marketplace with all tools, seeds, fertilizers and space for other businesses. We will develop the platform further so farmers can transact in ways that promote more transparency such as blockchain or smart contracts, and digital literacy from training programs. Real time tracking and other route planning logistics can make certain brand promises easier to achieve, while improving accessibility; operation efficiencies; and ultimately long-term sustainability in the agri-tech ecosystem through this growth.

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