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Mobile App For Direct Market Access For Farmers

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Abstract—The Mobile Application for Direct Market Access is a technological solution designed to link farmers with buyers and to remove middlemen to provide fair and transparent transactions. The app was developed using Flutter with Firebase Integration and allows farmers to create, list, and manage their produce, sales, and real-time revenue across different channels. Buyers are enabled to access locally grown fresh produce through an intuitive and simple interface that can authentically support a multiple language and multi-user authentication platform. The role-based dashboard allows ease of use for rural and urban users alike. Real-time data synchronization provides accurate inventory of products available for order. This solution provides farmers with direct access to market demand and fair pricing, reduces exploitation, and strengthens local agricultural economies in rural areas. It leverages the latest mobile and cloud technology to bring efficiencies to agricultural marketing and digitalize rural economies.

Index Terms—Direct Market Access, Farmers, Mobile Application, Agricultural Supply Chain, Digital Marketplace, Multilingual Communication, Secure Payments, Price Transparency, Buyer/Seller Platform, Block-Chain, Predictive Analytics

I. INTRODUCTION

Agriculture is the main livelihood for countless people in developing countries including India. However, while agriculture is crucial, farmers face a multitude of challenges, including barriers to market access, lack of fair pricing, and reliance on intermediaries, all of which discourage profitability and motivation. In recent years, the development of digital technologies in agriculture has broadened the scope of potential direct connection to market, along with transparency to where their resources are ultimately sold. The KhetBazaar mobile application

seeks to address these challenges by creating a digital space for farmers and consumers to connect directly.

KhetBazaar allows farmers to post the agricultural goods they have available, manage produce, and track current sales performance. The buyer is free to explore locally grown organic produce, purchase items, and provide feedback through the application. The system is built using Flutter in order to ensure it is cross platform compatible and responsive, while Firebase manages the backend, including authentication, database, and real-time data delivery. With the addition of multiple regional languages to the application, farmers from all geographic locations and in varying dialects of the primary language, are able to navigate at ease.

KhetBazaar facilitates equitable pricing, transparency, and enhanced communication between producers and customers by eliminating intermediaries. Furthermore, it encourages sustainable farming practices and local sales and reduces post-harvest losses. KhetBazaar also represents a pathway toward digital empowerment in agriculture, increasing market efficiency and stimulating the rural economy with technology.

II. EASE OF USE

A. User-Friendly Interface for Farmers

The KhetBazaar application is created with a high priority on user-friendly and easy access for farmers, allowing even users with little to no technology to easily navigate the application. The design focuses on user-friendly, usability, and simplicity to facilitate the uncomplicated navigation of the application for farmers. The home screen has a language option for farmers to interact in whichever regional language they prefer, which helps with any barriers farmers may have with literacy or communication.

The dashboard for farmers displays pertinent areas of information such as total revenue, orders, and quantity of products sold through clear images and easy to read analytics. The application utilizes simple interactive cards and pictures rather than menus, which will help the user navigate easily. The “Create Listing” button allows farmers to quickly add or update its details including name, price, and quantity, meanwhile the system automatically updates if it is “Active” or “Sold Out”. The KhetBazaar application is created with a high priority on user-friendly and easy access for farmers, allowing even users with little to no technology to easily navigate the application. The design focuses on user-friendly, usability, and simplicity to facilitate the uncomplicated navigation of the application for farmers. The home screen has a language option for farmers to interact in whichever regional language they prefer, which helps with any barriers farmers may have with literacy or communication.

The app employs Firebase real-time syncing to provide updates on product stock and sales immediately, without the need for a manual refresh. Clear feedback messages, confirmations, and status messages help farmers stay informed about their activities. The design also minimizes text, uses large buttons, and flows logically to facilitate the user experience, reducing cognitive load.

Overall, KhetBazaar’s farmer interface is designed for accessibility, efficiency, and ease of use, providing a simple and enjoyable means for farmers to engage with agriculture’s digital counterpart. Combining an intuitive design with smart backend automation, KhetBazaar gives farmers the confidence to run their business with limited prior experience on digital platforms.

B. Seamless Buyer Experience

The KhetBazaar application offers an encouraging, fast, and simple experience for buyers so they can interact with farmers and buy fresh produce seamlessly. The buyer interface is simple, fast, and intuitive so the buyer can quickly insert themselves into the buying experience. Logging in presents buyers with product categories and the type of information associated with a listing as an example of total transparency. Information includes product name, costing price per kg, disposal status, and freshness. The search and filtering process allows for quick and easy access to products, elevating the browsing experience.

In addition, due to real-time synchronization using Firebase, buyers are always able to review updated real-time information without any lag. The cart and checkout

process is effortlessly streamlined allowing users to review their purchases in the cart, calculate totals, and order with a single tap of the order button. After the checkout process is complete, buyers have the chance to rate the product and process, promoting transparency and high-quality control.

Furthermore, KhetBazaar offers order tracking and confirmation updates, allowing purchasers to stay informed during the transaction journey. The overall design of the interface prioritizes speed, responsiveness, and reliability. By bringing together seamless navigation and real-time updates, KhetBazaar offers a trustworthy, transparent, and user-focused experience that increases consumer satisfaction and contributes to a fair digital marketplace environment.

III. SYSTEM ARCHITECTURE / METHODOLOGY

KhetBazaar’s system architecture has a multi-layered approach for scalability, flexibility, and data handling capabilities. The architecture is divided into three layers—Mobile Application Layer, Backend Layer, Database and Cloud Layer. Each layer has a specialized role in delivering a seamless user experience and optimal performance.

A. Mobile Application Layer

This layer serves as a user interface designed in Flutter which makes the application usable across both Android and iOS devices. It presents farmers and buyers with their dashboards which are designed using intuitive navigation, role-based functionality, and real-time updates. Farmers add or manage their products, track their revenue, and can access their orders while buyers can browse listings, add items to their carts, and place orders with ease. The mobile layer also supports many Indian languages improving accessibility and usability for rural users.

B. Backend Server Layer

The backend layer is responsible for the application logic, authentication, and communication between users and the database. Firebase Authentication is used to manage secure sign-in for users through either Google, mobile OTP, or email. Firebase Cloud Functions are included in the backend and handle updates, notifications, and analytics processing automatically, allowing for seamless real-time synchronization between users and data..

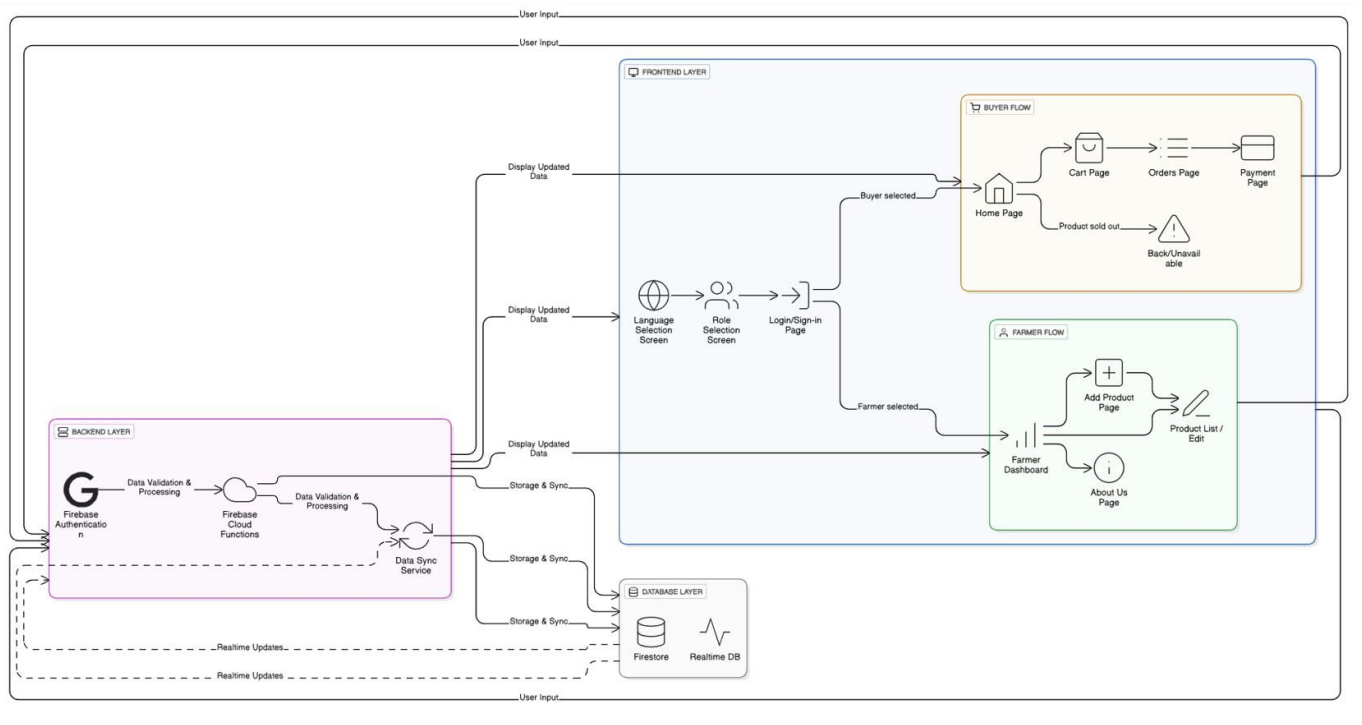


Fig. 1. Process Flowchart of the KhetBazaar Application

C. Database and Cloud Layer

KhetBazaar utilizes Firebase Cloud Firestore and Realtime Database to effectively store and manage all data pertaining to users, products, and orders. Firestore maintains structured data storage for scalability, while the Realtime Database manages the real-time updates to ensure that buyers see accurate information on inventory levels and prices.

For the cloud layer, KhetBazaar relies on Google Firebase Cloud Services, which provides high availability, auto-scaling, and data security through a resilient systems architecture. It provides hosting, cloud analytics, and storage services, creating a real-time flow of data between users. This infrastructure allows for overall reliability and performance efficiency, while also supporting a consistent user experience across devices and minimizing developer maintenance burden.

Workflow: Farmers register and upload produce → Backend validates and stores data in Firebase → Buyers browse and select products → Orders are placed and confirmed → Payment is processed securely → Farmers receive order notifications → Delivery status is updated and tracked in real time → Buyers provide feedback after completion.

IV. FEATURES & FUNCTIONALITY

The KhetBazaar application consists of three primary functional modules: the Farmer Module, the Buyer Module, and the Admin Module. Each of these modules offers unique functionality that ensures the seamless operation of the application, transparency in transactions, and real-time communication between user segments using the KhetBazaar application.

A. Farmer Module

- Enables farmers to create, edit, and delete product listings that include product name, pricing, and quantity.
- Features a dashboard for check out sales analytics, total revenue, and orders.
- Delivers real time notifications for new orders and stock balances.
- Offers support for multiple languages to allow for better access and ease of use.
- Facilitates access for farmers to monitor order status and inventories in real time.

B. Buyer Module

- Lets buyers search, filter, and browse agricultural products by category, price, or availability.

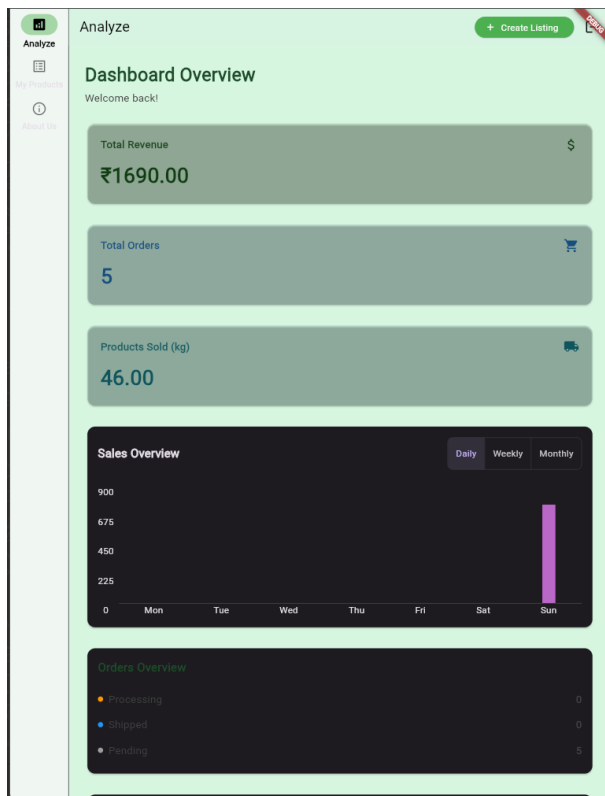


Fig. 2. Farmer module showing dashboard analytics and product management (Source: Developed by Authors).

- Enables real-time product updating so stock and prices are accurate.
- Provides a shopping cart and checkout system for easy ordering.
- Offers order confirmation and tracking through Firebase.
- Allows buyers to rate and review their purchases to build trust and transparency.

C. Admin Module

- Administers user accounts, product listings, and the history of transactions to maintain control over the overall system.
- Reviews application performance and analytics data to maintain seamless execution of the application.
- Manages any dispute resolution or content moderation between users.
- Monitors data security, backups, and updates to ensure reliability.
- Facilitates compliance and transparency across the KhetBazaar platform.

By putting these modules together, this creates an integrated collective, secure, and efficient digital market-

place where farmers can improve profits while delivering fresh products at fair prices. The marketplace eliminates unnecessary intermediaries and enhances transparency in the process of buying and selling. KhetBazaar can be utilized in the future with AI-based pricing prediction and recommendation systems and IoT-based quality control and reporting systems, further empowering farmers with smart, data-empowered solutions in agriculture as a business.

V. IMPLEMENTATION

The KhetBazaar app employs Flutter as front end and Firebase as the backend. This combination creates real-time synchronization, authentication security and smooth data flow. Each application module - Farmer, Buyer, Admin - communicates through Firebase services for an efficient, reliable, and responsive experience across all devices.

A. Front-End (Flutter)

KhetBazaar's front end was built in Flutter, which provides us with one code base for both Android and iOS. The design prioritizes ease of use with role-based dashboards for farmers and buyers. Flutter's widget-based architecture provides fluid navigation, fast load times, and dynamically render UI. Multilingual capabilities ensure that the application is accessible to users in rural areas. Additionally, we integrated Firebase listeners to provide instant updates on product availability and orders. Clean layouts, icons, and color themes deliver a professional and good user flow for users with little technical background.

B. Back-End

Firebase powers the backend, which manages authentication, logic without relying on a server, and cloud functions. Firebase Authentication also allows for secure log in for users using either Google, mobile OTP or email/password combination. Cloud functions perform automated tasks, including sending important notifications, updating stock levels, and calculating all trade analytics. Firebase handles real-time communications between the front end of the application and the database, without requiring any manual reloads. It also scales easily, supporting multiple users, with low latency. This serverless construction also leads to less ongoing maintenance, improving platform security, and facilitates the transition of all modules (Farmer, Buyer, and Admin) interacting within the application.

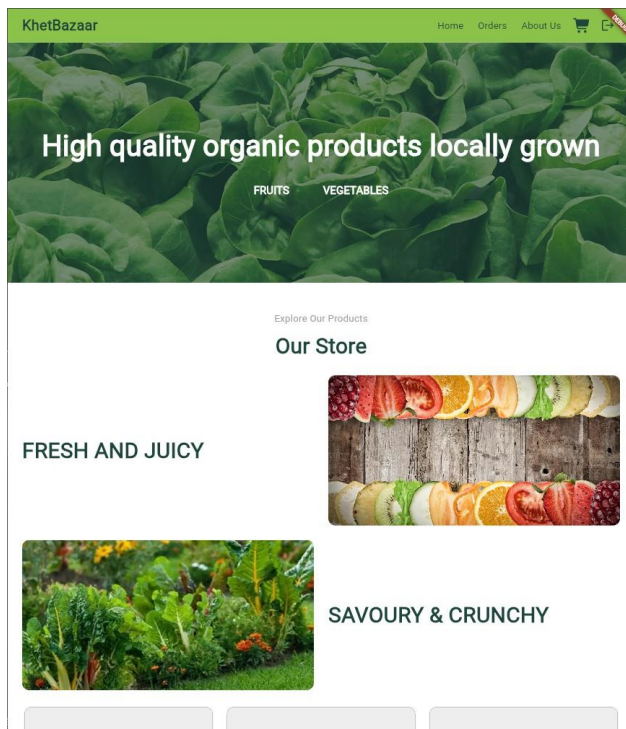


Fig. 3. *

(a) Buyer Home Page

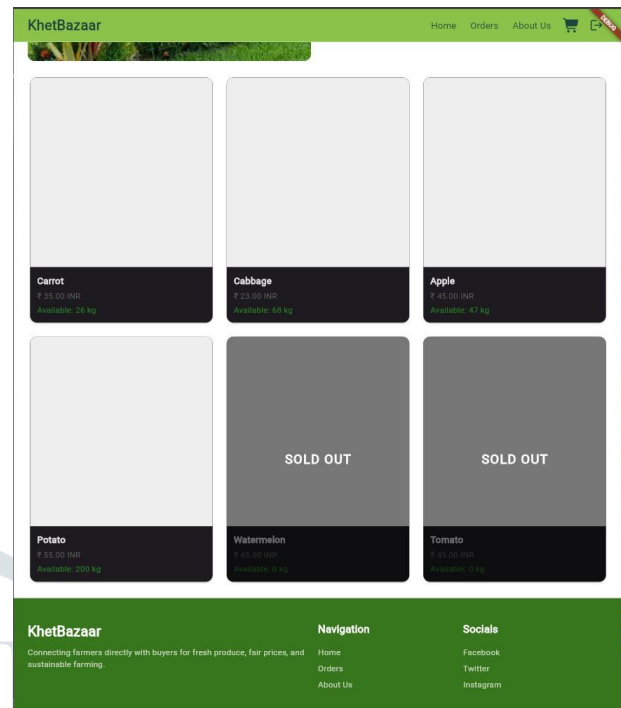


Fig. 4. *

(b) Buyer Product Listings

Fig. 5. KhetBazaar Buyer module interfaces showing (a) the homepage for browsing fresh produce and (b) the product listing section displaying available and sold-out items (Source: Developed by Authors).

C. Database (Firebase)

The database layer employs Firebase Cloud Firestore and Realtime Database for effective handling of application data. Firestore holds structured information about user profiles, product details, and transactions. The Realtime Database provides real-time updates regarding order status and product availability. Both databases synchronize automatically with the client-side, ensuring data consistency and correctness. The use of two databases promotes fast data access, scalability, and seamless end-user performance, creating a robust foundation for all marketplace functions in the KhetBazaar application.

D. Additional Functionalities

- **Secure Payments:** Embedded payment gateways (UPI, wallets and net banking) ensure safe encrypted financial transactions for both farmers and buyers.
- **Real Time Updates:** Firebase integration allows for instant updates for product such as product listings, order status and notifications for an uncomplicated user experience. .

- **Admin Panel:** Enables the full visibility of user, transaction and analytics management data, to provide clarity and transparency through the whole process, from product uploading, payment verification and order delivery tracking.

Process: Farmers upload produce → the backend validates and stores data → buyers see listings → orders completed → payment processed → delivery tracked.

The method by using Flutter and Firebase will deliver a safe, scalable, and user-friendly platform that allows farmers to connect with buyers while offering real-time synchronization of data, security of data, and optimal performance of the system in all modules and all devices.

VI. RESULTS AND DISCUSSION

KhetBazaar has shown effective real time connectivity between farmers and buyers. The functionality of the system was smooth, transactions were safe, and accessibility was safe, all resulting in more profits for farmers, better satisfaction for buyers and a higher degree of transparency in agricultural trading processes.

A. Farmer Benefits

KhetBazaar enables farmers to access market opportunities directly, without middlemen, ensuring fair prices and increased profitability. Real-time order tracking and revenue analytics allow farmers to better manage their sales. The multilingual interface makes it easier to use. Instant notifications and secure payment facilitate transactions, thereby improving productivity and economic security for small-scale and local farmers.

B. Buyer Benefits

KhetBazaar allows buyers to enjoy the benefits of shop-fresh produce sourced locally at a great price. The familiar interface, constant product availability, and user-friendly checkout process provide added convenience and confidence while shopping. With transparent pricing, order-in-transit information, and secure payment processing, the KhetBazaar experience fosters a sense of reliability, leading consumers to support local farmers while receiving top-notch agricultural products.

C. System Performance

KhetBazaar demonstrated outstanding performance and reliability when evaluated against similar technologies, successfully maintaining real-time data synchronization with more than 99% uptime using Firebase. The app was light, based on the Flutter framework, and allowed the app to load rapidly and navigate smoothly. The app was effective in managing multiple user actions at the same time without lag. The system's performance indicated its scalability and capacity to maintain data security in preparation for open public use in substantial, large-scale agricultural digital marketplaces.

D. Discussion

The assessment of KhetBazaar reveals that Flutter and Firebase provide a solid underpinning for agricultural digitization. KhetBazaar rather efficiently connects farmers and buyers in real time, allowing transparency, fair prices, and effective and efficient transaction management. User testing showed very positive feedback, particularly on its simple interface, multilingual capability, and easy-to-navigate structure. Farmers felt more in control of their sales, were able to earn more for their products, and had better access to market information, while buyers had easy access to fresh produce and transparent pricing.

Furthermore, Firebase's real-time update capability greatly improved communication among users, with less manual time spent waiting to communicate and

immediate updates of product listings and orders. The platform showed high levels of scalability, security, and responsiveness, with numerous simultaneous user interactions without lag. All in all, KhetBazaar is a reliable and effective digital marketplace that has the potential to transform agriculture, creating a more connected, equitable, and data-driven ecosystem.

VII. CHALLENGES AND FUTURE SCOPE

A. Challenges

While KhetBazaar has experienced success, the design and implementation had a number of challenges. One of the main challenges was that it was difficult to achieve reliable internet access wherever farmers are situated, as many farmers in rural settings have unreliable network connectivity. This affected the real-time update and synchronization process during the field test, among the other different things that could be impacted. Another challenge arose around language localization, whereby, we had to translate agricultural and technical terms correctly in multiple regional languages so that the terminology was consistent, clear and usable for farmers. A third challenge was in connection with training farmers to use digital technology; this included coming up with awareness programs and designing the features to ensure the ease of use for farmers that had low digital literacy.

From a technical perspective, the secure payment integration and data privacy aspects of application development required the careful implementation of Firebase's authentication and encryption aspects. Building for scaling and real-time performance whilst managing multiple simultaneous users working on the same issues required finding a way to optimize the read and write conditions in the database. Despite these challenges, ongoing testing and optimization enabled KhetBazaar to provide ongoing stability and performance. KhetBazaar was able to demonstrate that it has potential to operate in real agricultural environments.

B. Future Scope

KhetBazaar's future direction is to advance its technology and functionality to build a more intelligent and connected agriculture ecosystem. One important improvement could be addibility of Artificial Intelligence (AI) and Machine Learning (ML) to establish predictive pricing models that would support farmers in choosing the best selling period based on market trends. Further, the addition of AI-based crop recommendations and weather forecasting systems would support farmers to raise yields and reduce losses.

KhetBazaar would also be enhanced with IoT-based sensors that would monitor crop quality, soil conditions, and storage conditions to manage product more effectively. The addition of a digital payment wallet and logistics tracking system would also streamline transactions and deliveries. Additionally, a connection of KhetBazaar to a government agricultural database and to Farmer Producer Organizations (FPO's) would extend the reach and credence of KhetBazaar. Each of these elements would turn KhetBazaar into a wholly smart agriculture platform that encourages sustainability and economic empowerment for rural communities.

VIII. CONCLUSION

The creation of KhetBazaar marks a significant step forward in closing the technological divide in agriculture. By developing a digital marketplace for farmers and buyers, KhetBazaar improves the transparency of the trading process by eliminating middlemen. The application has easy-to-use features and supports diverse languages, which makes it user-friendly even for people with limited digital experience. Each farmer has the ability to upload their produce, monitor their sales, and receive real-time updates, while buyers can enjoy browsing fresh, local products for a fair price.

Flutter and Firebase are used to ensure all marketplace features offer real-time data synchronization, secure authentication, and efficient data management. As a result, the KhetBazaar platform can work seamlessly from multiple devices, and can scale as KhetBazaar meets user requests. Order tracking, feedback, and notifications are useful additions that help increase trust and engagement in the marketplace, operating efficiently and transparently for the user experience. Firebase's cloud system ensures data protection along with uninterrupted service capabilities.

Ultimately, KhetBazaar shows the effect technology can have in improving sustainability in agriculture by lifting rural farmers. The digital marketplace enables a fair, equitable and scalable system to connect agricultural producers with their consumers. Future upgrades, including AI price prediction, IoT crop monitoring, and smart logistics, may enhance even further and transform KhetBazaar into a legitimate smart farming ecosystem to sustain innovation and long-term sustainable agricultural practices.

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