

# SmartBazaar: Digital Agri-Marketplace for Empowering Small Farmers

## Introduction & Motivation

In Pakistan, small-scale farmers often face unfair pricing and middlemen exploitation, earning significantly less than the market value of their produce. Limited access to real-time market data, language barriers, and lack of digital literacy worsen the situation.

SmartBazaar aims to solve these challenges by providing a localized, intelligent, and transparent digital marketplace that connects farmers directly with buyers such as wholesalers and local retailers.

Through transparent pricing, multilingual accessibility, and smart automation, SmartBazaar empowers farmers to make informed decisions, maximize their income, and strengthen their financial stability. The platform generates revenue through a 2% commission on every successful sale.

## Logical Workflow

### Farmer Onboarding

- Farmers register using **Firebase Auth**, selecting their role (“Farmer” or “Buyer”).
- Profile data (CNIC, phone number, email, and location) is stored in **Firestore**.

### Product Listing

- Farmers list produce (name, quantity, price, unit, photo).
- Data stored in **Firestore** under: /listings/{listingId}

### Fair Price Suggestion

- The system fetches real-time regional price averages from an online source.
- Suggests recommended prices to guide farmers based on past market prices, number of active listings (supply), number of orders (demand) and location.

### Buyer-Seller Matching

- A **text embedding-based search** identifies relevant farmers that buyers can buy from based on location, price, and crop name.
- **GitHub Actions** fetch data hourly and store embeddings in Firestore for efficient retrieval.

### AI Chatbot (AgroGuru Assistant)

- An intelligent chatbot that provides personalized farming advice in Urdu or English
- Built using **Firestore**, and **Gemini API** for natural language processing.
- Offers advice on crop selection and seasonal planning, fertilizer and irrigation schedules, pest and disease management and weather forecasts and risk alerts
- Conversation history stored in **Firestore** for personalization and model improvement.

## Daily AI Farming Report

- A personalized report automatically generated for each farmer every morning, providing localized and data-driven insights.
- Includes daily weather and soil conditions, irrigation and fertilizer recommendations, pest alerts and crop-specific tips, market trend summaries
- Gemini API used for report generation and translation into the farmer's preferred language.

## Seamless Farmer-Buyer Chat

- Real-time text based communication system between farmers and buyers.
- Implemented using **Firebase Cloud Messaging (FCM)**.
- Firebase Auth ensures only verified users can communicate, maintaining trust and safety.
- Notifications alert users instantly about new messages.

## Order Management System

- **Farmers:** Manage received orders, update delivery statuses, and track sales history.
- **Buyers:** Save listings, place orders, view purchase history, and reorder easily.
- All order data stored in **Firestore** for transparency and tracking.
- Notifications (via FCM) provide real-time updates on order status.

## Localization & Accessibility

- Integrated **Google Gemini API** dynamically translates the interface into Urdu, Punjabi, Sindhi, and Pashto.
- Ensures inclusivity for rural and semi-literate users.

## Firebase Studio & Google Services Integration

Service	Usage in SmartBazaar
<b>Firebase Studio</b>	Used as the central development environment to build, integrate, and debug all Firebase components. Streamlined cloud configuration and real-time testing improved development efficiency.
<b>Firestore</b>	Primary NoSQL database for storing product listings, user profiles, price histories, and transaction metadata. Chosen for scalability and offline sync capabilities.
<b>Firebase Auth</b>	Implements secure, role-based access (Farmer/Buyer) using phone/email authentication. Supports multi-language onboarding.
<b>Firebase Cloud Messaging (FCM)</b>	Sends instant notifications when new produce is listed, a buyer matches, or an order update occurs. Improves engagement and transaction speed.
<b>Firebase Analytics</b>	Tracking user behavior—like page views, user engagement, and retention

<b>Firebase App Hosting</b>	For hosting the platform.
<b>Genkit</b>	For implementing AI functionalities with Gemini api
<b>Google Gemini API</b>	Provides real-time translation of app content into Urdu, Punjabi, Sindhi, and Pashto. Enhances inclusivity, classifies crop images, and generates reports and provides advice

## Impact & Feasibility

SmartBazaar directly addresses agricultural inefficiencies in Pakistan, where more than 60% of farmers lack access to transparent digital markets. By leveraging AI and Firebase technologies, it connects farmers directly with buyers, improves efficiency, and provides localized digital assistance to enhance agricultural productivity.

## Accessibility for Rural Environments

- Multilingual support (Urdu, Punjabi, Sindhi, Pashto).
- Simple, intuitive interface suitable for new smartphone users.

## Deployment Feasibility

- Built on Firebase's **serverless architecture**, minimizing infrastructure costs.
- Hosted entirely on **Firebase Hosting** for global scalability and real-time synchronization.

## Scalability Across Regions

- The same architecture can be adapted for neighboring agricultural economies such as India and Bangladesh.

## Innovation & Uniqueness

- **AI-Powered AgroGuru Assistant** for personalized farming support.
- **Daily AI Farming Report** with weather, soil, and crop insights.
- **Real-Time Chat System** powered by FCM.
- **Comprehensive Order Management** for both farmers and buyers.
- **Fully Firebase-Based Architecture** ensures scalability and seamless integration.
- **Localized and Inclusive Design** tailored for Pakistan's rural communities.