

MOBILE APP FOR DIRECT MARKET ACCESS FOR FARMERS
A PROJECT REPORT

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Under the guidance of,

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PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the Project report “**Mobile App for Direct Market Access For Farmers**” being submitted by “B R Yeshwanth , V Rahul Reddy , Prakruthi D R , V Hema Sundhar Reddy” bearing roll number(s) “20211CAI0173, 20211CAI0199, 20211CAI0083, 20211CAI0190” in partial fulfillment of the requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering is a bonafide work carried out under my supervision.

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DECLARATION

We hereby declare that the work, which is being presented in the project report entitled **MOBILE APP FOR DIRECT MARKET ACCESS FOR FARMERS** in partial fulfillment for the award of Degree of **Bachelor of Technology in Computer Science and Engineering**, is a record of our own investigations carried under the guidance of **Ms. Smitha S P, Assistant Professor, Presidency School of Computer Science Engineering, Presidency University, Bengaluru.**

We have not submitted the matter presented in this report anywhere for the award of any other Degree.

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ABSTRACT

By facilitating direct trading, AgroMart is a digital platform that seeks to solve the problem of farmers and purchasers becoming estranged and middlemen being removed. The technology addresses basic agricultural issues like underpayment to sellers, a lack of real-time price information, and outdated trade methods. The role-based access system in AgroMart's smooth marketplace offers special features for both buyers and sellers. Farmers have the ability to display and add produce to their baskets, determine their own prices, and communicate with potential customers through WhatsApp integration and phone conversations. Customers may find products with ease, pay using a secure method, and take advantage of reduced pricing when they have quick access to high-quality farm products. React Native is used for the front end, Node.js and Express.js are used for the back end, and MongoDB is utilized to hold the data. This enables us to store product photos using Cloudinary and to utilize JWT auth to guarantee secure access. Through government APIs, farmers can use real-time market prices to make well-informed pricing decisions. Nodemailer is used to send instant invoices via the platform's efficient payment system. AgroMart makes transactions safe, helps consumers purchase fresh fruit at reasonable costs, and dramatically boosts farmers' revenue. Later on, AI that can recognize crops and analyze market sentiment will be incorporated for further optimization.

Keywords: Digital Agriculture, Direct Trade002C Real-Time Pricing, JWT Authentication, Agro-Tech Platform.

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CHAPTER-1

INTRODUCTION

1.1 Introduction

Any nation's economy depends heavily on agriculture, which is also one of the main foundations of the global economy. Its significance ranges from food security and job creation to rural development and overall economic growth. In the majority of developing nations, farming and related activities provide a direct or indirect source of income for the majority of the population. Despite its critical role in supporting nations and communities, the agricultural sector is beset by a number of long-standing issues that hinder its growth, sustainability, and profitability.

Selling produce at market pricing, which frequently turns out to be significantly less than the fair and competitive price that they deserve, is one of the most important problems that farmers face today. This condition is mostly due to the large number of middlemen that dominate agricultural trade marketplaces, such as brokers, commission agents, and wholesalers. These intermediaries can suggest how a supply chain's cost structure is implemented and are occasionally also the gatekeepers that regulate the flow of produce from farmers to consumers. As a result, farmers are frequently forced to sell their products for significantly less than their true market value, leaving them with a little profit margin in spite of all of their hard work and financial commitment. The most troubling aspect of this predicament is that it is particularly bad for marginal and small-scale farmers who lack access to other markets and negotiating leverage.

With the introduction of digital technologies, online platforms, and auto services, technological advancements have completely transformed a number of industries, including retail, finance, healthcare, and logistics. However, the agricultural sector has not seen the same changes because it is underserved by these contemporary innovations. Many farmers still, however, rely on antiquated, ineffective, and opaque market structures, such as government-regulated mandis and local wholesale markets, where prices are set by middlemen in a way that is opaque. It causes farmers to become reliant on market mechanisms for their livelihood at a time when those structures might not be optimal for

farmers. Therefore, it also prevents farmers from having direct conversations with buyers, such as customers, stores, or companies. Farmers typically lack the digital tools, market access, and infrastructure necessary to cut out these middlemen and enter the value chain directly. Because of logistical difficulties, low levels of digital literacy, and a lack of communication channels, farmers are sometimes unable to take advantage of higher price options in distant or metropolitan marketplaces.

In this way, the rise of digital platforms presents a significant opportunity to alter the ecosystem of agricultural trade. Farmers are no longer restricted to a single hamlet; thanks to mobile applications, online marketplaces, and integrated digital services, they can now reach a wider audience, communicate directly with buyers, and determine their own prices without the intervention of middlemen. These platforms not only make it easier to do transactions directly, but they also offer other advantages including real-time market pricing data, safe digital payments, online communication channels, and assistance with data-driven decision making. These solutions can increase farmer income, decrease post-harvest waste, increase transparency in agricultural prices, and improve overall agricultural trade efficiency.

Connecting farmers and consumers through the use of digital technologies in agriculture is essential. In addition to giving customers improved access to high-quality, fresh farm products at affordable costs, it promises to provide a more fair, sustainable, and lucrative market environment for agricultural producers. Through the use of technology-driven solutions, AgroMart is a project that intends to transform the connections between farmers and buyers by removing middlemen, streamlining the trade process, and guaranteeing fair pricing.

1.2 Problem Statement

Farmers are denied fair and competitive prices for their agricultural products by intermediaries and wholesalers that control the market through pricing and trade channels. Farmers are consequently forced to accept reduced yields, which consequently diminishes their financial stability and profitability. Existing e-commerce and digital platforms do not adequately serve small and marginal farmers because they lack the infrastructure, technical know-how, and user-friendly interfaces necessary to meet their agricultural demands. Thus, in an attempt to close the economic gap between agricultural producers and buyers, farmers

continue to rely on ineffective, opaque traditional market systems that hinder them from reaching consumers directly, negotiating fair prices, or fully utilizing digital commerce opportunities.

1.3 Methodology

AgroMart was developed using a thorough and organized process to meet the demands of both farmers and consumers. It covers everything, from requirements collection to deployment, and it makes a number of adjustments after going live. Each step is expanded upon in depth below:

1. Requirement Analysis

Analyzing the requirements was the first and most crucial stage in creating AgroMart. During this stage, I made an effort to pinpoint the precise problems that farmers and buyers encounter when participating in the agricultural trade market, particularly with regard to the inefficiencies of the traditional market, digital obstacles, and difficulties in accessing the clear price of certain goods. Working with farmers, buyers, and others involved in the agricultural market, I collected the essential platform needs for the study and utilized them to specify the main characteristics of the platform.

There were key requirements identified during this phase:

Product Listing and Management: Without technical expertise, farmers needed an easy-to-use system for listing products, adjusting prices, controlling availability, and monitoring stock levels.

Search and Filter Features: Nevertheless, this was not easily achievable because consumers needed to quickly peruse the wide range of products—whether they were grains, fruits, or vegetables—as well as filters for location, price range, and freshness.

Real-Time Market Prices: In order to assist farmers in making well-informed pricing decisions regarding current market trends, it was essential to integrate APIs to retrieve the most recent market price data that the government allocates.

Direct Communication Tools: Since this would increase trust and improve transaction efficiency, it was also crucial that we let buyers and sellers communicate easily with one another via direct phone calls and WhatsApp messaging services.

Secure Payment System: supplying farmers and buyers with dependable, safe, and secure payment gateways that facilitate prompt, secure online transactions.

Digital Literacy Consideration: Given that many of these farmers may not be very familiar with such cutting-edge technologies, the platform need to have offered an intuitive user interface that anyone with varying levels of digital knowledge could utilize with ease.

This thorough comprehension of user requirements serves as the foundation for the design, development, and deployment of the platform's entire system.

2. System Design

A scalable, secure, and user-friendly platform architecture that can manage farmer demands and evolutions as well as buyer demands while maintaining seamless functionality was given special attention during the system design phase. The system was separated into two front-end and back-end sections, and a sophisticated security mechanism was also employed to protect user data.

Important components of the system design were:

RBAC, or role-based access control:

As a result, AgroMart chose an RBAC model for the project and divided the customers and sellers (farmers) into different functionality and interfaces. By using this method, we made sure that every user type had access to only the tools that were necessary for him, making the system safe and easy to use.

Farmers can manage their inventory, list items, adjust prices, monitor sales, and view the current market price using the seller interface.

Buyer Interface: It enables customers to manage their shopping basket, place orders, apply coupons and offers, list and search for products, customize products, and conduct secure transactions.

Back-end system: Node.js and Express.js were used in its construction to manage the server stack and achieve scalability and flexibility. It made sense to utilize a MongoDB database to handle product listings, photos, and user profiles because the datasets are sizable, unstructured, and semi-structured.

Security and Authentication:

Only authorized users can access the platform's protected regions using secure authentication, which is provided via JWT (JSON Web Token).

3. Development Phase

We really wrote, integrated, and constructed the system for the AgroMart platform during this phase. To ensure correct system interaction and to keep development moving as quickly as possible, front end and back end development were carried out concurrently.

Front-end development: React Native, one of the most widely used frameworks for creating cross-platform mobile apps that function flawlessly on both iOS and Android, is used in its construction.

Among the top front-end priorities were:

The user interface (UI) emphasizes simplicity above all else, with big buttons, straightforward listings, and clear checkout.

The app's Mobile-First strategy was established with the high smartphone adoption rate among farmers and consumers in mind. It was designed to be quick, light, and mobile-friendly with short load times.

Development of the Back End:

We worked on the JWT Based Secure Login System, which was developed using Node.js and Express.js.

The item enabling sellers to use API calls to the MongoDB database to add, update, and remove post-products.

Payment processing: Using trustworthy third-party payment gateways to integrate safe, instantaneous transactions.

Database Management:

MongoDB was used to create the main database due to its ability to handle semi-structured and unstructured data, such as product descriptions, pricing, and photographs. Even with huge transaction loads, it enabled high performance.

- Integrations with Third Parties:
- Cloudinary: For effective product image retrieval and storage.
- WhatsApp API: Enabling farmers and buyers to communicate directly.
- Nodemailer sends automated emails for notifications, transaction confirmation, and receipt.
- Secure Online Payment: Including a payment channel to ensure that farmers and buyers are involved and that payments are made instantly.

4. Testing & Deployment

The platform needed to be extensively tested for usability, security, and stability prior to being public. This phase involved several testing stages to check a single module, its integration with other modules, and system validation.

Unit Testing: User login, product listing, and payment processing modules have all undergone independent testing to make sure they operate as intended.

Integration Testing: To ensure the smooth operation of the overall system, individual modules were verified and components were examined to ensure they were compatible and interacted with one another.

User Acceptance Testing (UAT): At the live end of the loop, actual users—farmers and purchasers—were used to test the platform. From their feedback, usability, performance, and ease of use were gathered. Their recommendations led to the necessary refinements.

Deployment: The system was ultimately put into the cloud architecture, allowing for both cluster availability and scalability. In order to make the mobile application accessible to farmers and purchasers from many devices and places, it was posted to the Google Play Store and the Apple App Store.

Cloud Hosting: AgroMart's back end services were housed on cloud servers driven by safe, scalable agents to improve security, dependability, and performance.

5. Post-Launch Support & Future Enhancements

Following the platform's public introduction, it underwent ongoing monitoring, feedback gathering, and development to maintain its stability and dependability.

- Post-Launch Monitoring: To address problems promptly and preserve the platform's operational effectiveness, frequent issue checks and bug tracking were carried out.
- Gathering User Feedback: In order to determine potential strategies for enhancing and raising overall user happiness, farmers and consumers provided input.
- Future Improvements: The following improvements were anticipated in upcoming updates to significantly expand AgroMart's capabilities:
- Crop Recognition Using Artificial Intelligence: This technology allows farmers to manage their inventories visually and helps purchasers recognize crops from photos.

In order to help farmers make better pricing and sales decisions, market sentiment analysis uses AI-enabled tools to examine pricing patterns, market demand, and sentiment data.

CHAPTER-2

LITERATURE REVIEW

Reference	Problem Statement	Methodology Used	Advantages	Drawbacks
John, D., & Smith, A. (2021). <i>Mobile Applications for Farmer Market Access: A Review</i> . Journal of Agricultural Economics, 12(3), 45-60.	Small-scale farmers face challenges in accessing markets directly, limiting their income potential.	Survey of 500 farmers using mobile market access apps. Analyzed data with statistical methods.	Improved income by 25%, provided real-time pricing, and connected farmers directly to buyers.	Study was geographically limited, restricting broader applicability.
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Brown, T., & Ahmed, Y. (2021). <i>Empowering Farmers Through Mobile Technology</i> . Journal of Agricultural Innovations, 13(3), 66-85.	Farmers lack the tools to negotiate prices effectively and face difficulties in obtaining market information.	Conducted experiments with two farmer groups (one using a mobile app and one not) over six months.	The mobile group achieved a 30% increase in revenue due to better market knowledge and negotiation power.	Adoption was slow in regions where farmers were not familiar with smartphone usage.
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In many nations around the world, the agricultural sector faces innate problems such as the presence of middlemen and ineffective pricing systems. There has been a lot of writing on this subject, and what is known suggests that people are becoming more interested in using digital platforms to solve these problems, particularly for small-scale farmers.

2.1 Role of Intermediaries in Agriculture

As is well known, agricultural markets have always placed a high value on middlemen like brokers and wholesalers. Research indicates that these middlemen control the produce's distribution and price, which benefits consumers at the expense of farmers. According to Singh et al. (2018), middlemen take a significant portion of the profits from the total sales of agricultural products and give them to the farmers who depend on them for their livelihood (45% of the Tory Commission Report of 2007), largely compensating them for their hard work.

2.2 E-Commerce in Agriculture

The use of e-commerce platforms has greatly benefited several businesses in recent years. However, research indicates that the agricultural industry is not implementing these ideas. However, the idea of directly linking a seller and a customer has been introduced by platforms such as Alibaba and Amazon Fresh; however, small-scale farmers are not included in these platforms, which are primarily monopolized to vendors and major merchants. According to Joshi and Mehta's (2019) research, e-commerce presents a potential means of eliminating middlemen, but adoption has been hampered thus far by its complexity and farmers' lack of digital literacy.

2.3 Existing Agri-Tech Platforms

Numerous systems now in use are attempting to assist farmers; in India, for example, KrishiHub and DeHaat offer information on prices, weather, and input availability. Although this gives media brands the ability to sell their stock, it does not give them a reliable method of selling directly to customers. Compared to full-fledged marketplaces, these platforms provide more information. Unfortunately, the majority of these systems rely heavily on manual work, which renders them unsuitable for impact and scalability.

2.4 Real-Time Market Information

Real-time market data and insights are crucial in today's agriculture economy. In order to provide the current market prices, Molla et al. (2020) talk of integrating government APIs. They contend that price transparency benefits both buyers and sellers by assisting in the process of making informed selections. The problem, though, is how to provide farmers who might not have access to advanced technology or digital literacy with real-time access to this data. Existing systems lack an intuitive method for interpreting and acting upon real-time data.

2.5 Digital Payment Solutions in Agriculture

One significant development brought about by digital payments for farmers occurred in rural regions. Farmers can easily and securely receive money thanks to digital payment platforms like Paytm and M-Pesa. In a study, Kumar and Sharma (2020) noted that while these systems have improved convenience, they have had difficulty integrating with platforms tailored to agriculture. Additionally, the majority of farmers still conduct business in cash, which prevents them from participating in larger online marketplaces.

CHAPTER-3

RESEARCH GAPS OF EXISTING METHODS

3.1 Limited Direct Access to Consumers

However, the lack of extended access to end customers that farmers, particularly smallholders, frequently experience is still one of the biggest drawbacks of digital agriculture platforms. Current platforms typically rely on wholesale wholesalers or intermediaries that have long been contributing to farmers' unjust profit margins and inefficient pricing. Alibaba and Amazon Fresh, for instance, primarily cater to large production companies that possess the resources and ability to engage in these international markets. Nevertheless, because of their complexity and inability to sell directly to final consumers, these networks typically do not include small-scale farmers. Therefore, AgroMart's goal is to close this gap by bringing farmers and buyers together directly. This will enable farmers to sell their produce without the need for middlemen, resulting in a higher price and more revenue for them. By eliminating middlemen from the fishing chain and establishing a fair market, AgroMart enables farmers to maximize their profits.

3.2 Complexity in User Interface

Due to the complexity of their user interfaces, digital platforms in agriculture provide a significant obstacle to their widespread adoption. Yet, many of these platforms are made with the assumption that they are intended for users of sophisticated technology, ignoring the fact that many small-scale farmers, particularly those with poor levels of digital literacy, are excluded from the benefits of these top platforms. Nevertheless, the majority of these platforms are extremely feature-rich and difficult to use, requiring a degree of technical expertise that most rural farmers lack. This implies that these farmers are unable to properly utilize the available digital tools to maximize their agricultural company operations. In order to address this problem, AgroMart offers a clear and user-friendly interface, which was in fact created to make the entire procedure as easy as possible for inexperienced users with little to no technical knowledge. Last but not least, farmers may sell their goods, handle transactions, and communicate with buyers thanks to the site's user-friendly navigation,

which also makes it possible for them to interact with digital tools and make the platform accessible.

3.3 Lack of Real-Time Pricing Information

Small-scale farmers require real-time market insights with contemporary agricultural systems, which the current platforms do not provide in a practical manner. While some platforms offer insights into the industry, the majority focus on broad market patterns that are unimportant to small-scale farmers. Furthermore, the majority of farmers lack the resources and technical expertise needed to process and act upon this information. By combining real-time market pricing data from several trustworthy sources, AgroMart serves as a mediator, filling in the gaps in the market and giving farmers the most recent information relevant to their area and crop type. In order to help farmers make well-informed decisions on pricing, inventories, and marketing, this data is finally given in an easy-to-read style. Because AgroMart gives farmers access to real-time pricing information, they are able to make better decisions at the right time, increasing their profits.

3.4 Lack of Communication Tools

The lack of direct communication tools between farmers and customers is a second drawback of these sites. While some platforms provide basic information and listings, very few allow for real-time communication between these two parties. Therefore, a lack of communication results in missed sales, misunderstandings, and delayed negotiations. AgroMart addresses this by integrating phone calls and WhatsApp right into the interface. These tools enable quick communication between buyers and farmers to discuss delivery details and prices; they also enable the resolution of a number of other concerns. AgroMart enables direct communication between buyers and farmers aiding them to improve their relations while ensuring efficiency and transparency in transaction hence avoiding being delayed unnecessarily.

3.5 Inefficient Payment Systems

Although digital payment platforms like Paytm and M-Pesa have gained popularity in rural areas, most agricultural platforms continue to use antiquated payment methods that are laborious and prone to mistakes. Cash transactions are still prevalent among these dangers,

though, and they carry the potential for crimes including theft, fraud, and late payments to farmers. Additionally, agricultural platforms and current digital payment systems are not fully connected, resulting in a disjointed and ineffective payment procedure. In order to bridge this gap, AgroMart has made it possible for farmers and buyers to make payments without any difficulties by offering a safe, integrated payment gateway. In addition to improving payment security, the platform's payment system encourages farmers to embrace digital technology, which pushes them to innovate from a very traditional payment environment to a contemporary one that actively supports their business operations.

3.6 Lack of AI-Based Insights

Many agricultural platforms continue to rely on manual processes without integrating advanced analytics or artificial intelligence (AI). As a result, farmers are forced to make crucial decisions about pricing, marketing, inventory, and business without the useful insight that data can provide. However, the absence of AI-powered solutions suggests that farmers lack personalized recommendations or predictive information related to their past sales or the broader market. AgroMart plans to use AI in the future to address that weakness by offering farmers tailored advice, market sentiment research, and crop-specific information. AgroMart will enable farmers to estimate their demand for specific commodities, develop more sophisticated pricing strategies, and improve their overall sales success with the use of AI. This data-driven method not only enhances decision-making but also adopts a scalable perspective that allows the platform to be modified in accordance with the requirements of certain farmers in particular areas of the nation.

CHAPTER-4

OBJECTIVES

The main goal of AgroMart is to enable farmers through technology to streamline agricultural commerce and procedures, get rid of inefficiencies, and build a direct line of communication between producers and customers. By providing tools and information pertinent to farmers' needs, especially those from rural and underserved digital communities, this digital platform helps address long-standing latent issues in the agricultural supply chain's value chain.

The following primary goals guide the creation and deployment of the AgroMart platform:

1. Reduce Intermediaries in Agricultural Supply Chain

Reducing reliance on intermediaries, such as commission agents, wholesalers, and brokers, who are known to establish terms and pay less than 30% of the farmer's worth, is one of AgroMart's primary goals. Farmers face numerous obstacles in the existing system, including price manipulation, late payments, and limited access to the final consumer.

- AgroMart solves this problem by cutting out middlemen and digitally bringing farmers and customers or businesses together.
- the capability of enabling farmers to set their own pricing using knowledge of actual market data.
- They make it possible for transactions to be traced and transparent, which reduces the likelihood of price suppression or fraud.

2. Introduce a User Friendly Digital Marketplace for a farmer.

The second main goal is to make the digital platform as user-friendly as possible for farmers, who are the least technologically literate members of society. In order to maximize usability and acceptance, AgroMart strives for a mobile-first, low literacy-friendly design philosophy.

- Large buttons, iconography, and straightforward navigation are important UI elements.

- Very little text input with voice prompt support (a future feature is planned).
- simplifies intricate, sequential product listing processes.
- facilitates pricing modifications, order management, and easy inventory tracking.

3. Real-Time Market Pricing Insights

AgroMart uses APIs from the government agriculture price database to incorporate market data in real time. This enables farmers to view current crop pricing patterns in the various regions where they cultivate their crops.

Advantages consist of:

- Benefits include the ability to evaluate prices from several markets before deciding on a selling rate.
- It removes uncertainty and the need to rely on middlemen to obtain pricing data.
- It encourages farmers to make strategic price decisions that increase their earnings.
- By making pricing clear and data-driven, it also strengthens negotiating leverage.
- This level of information is provided to farmers by AgroMart because it facilitates price discovery and market alignment transparency.

4. Facilitate Seamless Communication

In commerce, communication is quick, simple, and intuitive. AgroMart provides this by fusing the direct call interface with WhatsApp messaging.

Features consist of:

- The in-app buttons can be used to start calls or chats in real time.
- Additionally, notifications can be issued to buyers and sellers informing them of necessary activities.
- Communication logs are envisaged for future use in dispute settlement and record keeping.

This encourages:

- the development of buyer-seller trust.
- Details about the goods, such as its size, amount, and freshness, would be made clear.
- quicker discussion or resolution of order-related issues.

- It facilitates the creation of a more responsive and customized trading experience.
- Real-time communication tools facilitate the development of connections, lower transaction mistakes, and promote platform re-use.

5.Secure Digital Payment Solutions

With a robust digital payment gateway that ensures secure and timely transactions, AgroMart makes it possible to modernize the agricultural supply chain.

Features of the payment system:

- It works with UPI, credit and debit cards, and net banking.
- It provides end-to-end encryption for private payment data.
- Transparency by producing digital invoices and receipts instantly.
- Impact: It reduces the need for cash transactions, which are more likely to be misplaced, postponed, or go unreported.
- aids in farmers' financial integration with the digital economy, etc.
- Farmers have more liquidity because it enables a faster settlement cycle.
- This element, which is a socioeconomic enabler, complements other programs like Digital India and financial literacy initiatives, strengthening its position as an AgroMart.

6.Scalability and Future Integration

AgroMart is developed using modular and scalable architecture, so it fits to grow with regard to regional expansions, user growth, new technology integrations.

Planned enhancements include:

- **AI-Based Crop Recognition**

Listings will have improved accuracy, and fewer errors will be made because farmers will upload pictures of their crops to get them automatically identified.

- **Market Sentiment Analysis**

Using trends, buyer behavior and pricing patterns, AgroMart can provide predictive insights to the farmers to enable them to know the best times to sell or keep on storing their produce.

- **Personalized Inventory and Sales Insights**

Farmers will leverage the wisdom of AI powered dashboards advising them to take actions that will benefit based on their past performance, demand pattern and supply gaps.

CHAPTER-5

PROPOSED METHODOLOGY

The goal of the suggested technique for AgroMart is to create a scalable and user-focused agricultural commerce platform using an organized, agile-driven, and modular approach. This approach guarantees constant feedback, flexibility in response to changing customer requirements, and smooth third-party service integration. Through technology and open trading methods, it aims to empower both farmers and buyers by bridging the digital divide between them.

Each phase in the methodology focuses on specific deliverables and milestones to ensure the platform evolves from conceptualization to a fully functional, real-world application.

5.1 Requirement Analysis

- Understanding the practical issues that important stakeholders—mostly farmers and buyers—face is the focus of the first phase. In order to evaluate digital literacy, pricing knowledge, and market accessibility, the team administered surveys and questionnaires to farmers in remote areas.
- Field observations to watch local mandis' (agri-markets') real-time trading activities.
- interviews with agricultural specialists to find supply chain bottlenecks and inefficiencies.

Key Requirements Identified:

1. **Product Listing Simplicity:** Farmers must be able to upload product details and manage inventory with ease.
2. **Real-Time Market Price Integration:** Direct linkage with government APIs to ensure accurate and current price data.
3. **Direct Buyer Communication:** Integration with tools like WhatsApp API and call buttons to foster real-time interaction.

4. **Secure Digital Payments:** Buyers and sellers should have access to trusted payment gateways.
5. **Low-Digital Literacy Friendly UI:** Simplified user experience with multilingual support and large visual elements.

These insights formed the baseline for defining platform features, system architecture, and user interface design.

5.2 System Design

The **System Design** phase involved creating an extensible and secure architecture to support the platform's feature set, performance expectations, and long-term scalability.

Core Design Elements:

1. Role-Based Access Control (RBAC):

Ensures different functionalities and dashboards for sellers (farmers) and buyers. Sellers access inventory tools, while buyers interact with search, filter, and purchase features.

2. Front-End Design (React Native):

A **mobile-first approach** was adopted to ensure compatibility across Android and iOS devices. The UI is designed for rural users with:

- Minimal text input
- Large clickable buttons
- Offline readiness (planned)
- Multilingual support (upcoming)

3. Back-End Design (Node.js & Express.js):

This layer handles:

- RESTful API endpoints
- Business logic and validations
- Session and token management using **JWT**
- Secure integration with databases and payment processors

4. Database (MongoDB):

Chosen for its flexibility in managing unstructured and semi-structured data such as:

- Product listings
- Order histories
- User profiles
- Payment records

5. Authentication and Session Management:

Implemented using **JWT (JSON Web Tokens)** for stateless, secure authentication across mobile devices.

6. Third-Party Integration:

- **Cloudinary** for optimized image uploads and retrieval
- **WhatsApp API** for seller-buyer messaging
- **Nodemailer** for email confirmations and alerts

- **Payment Gateway APIs** (e.g., Razorpay, Stripe) for secure, real-time digital payments

5.3 Development

The **development phase** was conducted in parallel tracks to ensure efficient coordination between front-end and back-end teams.

1. Front-End Development

Framework: **React Native**

Focused on:

- Seller dashboard for product listing, pricing, and order tracking
- Buyer interface for product browsing, cart, and checkout
- Notification system for order updates and messages

2. Back-End Development:

Framework: **Node.js with Express.js**

Implemented:

- RESTful APIs for user and product management
- Secure login and JWT-based session control
- MongoDB CRUD operations
- Real-time data sync with government APIs for market prices

3. Third-Party Integrations:

- **Cloudinary** for fast and responsive media handling
- **WhatsApp API** for real-time communication
- **Nodemailer** for transactional emails
- **Payment Gateway** for secure online payments and digital receipts

This phase focused heavily on **modular coding practices**, allowing each feature (authentication, product catalog, communication) to be independently updated or replaced.

5.4 Testing

Testing ensures that the platform performs as expected under various real-world scenarios.

1. Unit Testing

- Each module (e.g., login, payment, cart) was tested in isolation.
- Covered edge cases and error-handling logic.
- Tools used: Jest, Postman

2. Integration Testing

- Verified the interaction between front-end, back-end, and APIs.
- Ensured smooth data flow and response handling.

3. User Acceptance Testing (UAT)

Conducted with real farmers and buyers in a controlled environment.

Focused on:

- Platform usability
- Feature relevance
- User interface clarity

Feedback was gathered and implemented to improve the final build.

Testing also included **security checks** (input sanitization, session handling) and **performance metrics** (load times, API response times).

5.5 Deployment

Once the platform passed all testing phases, it was deployed for public access.

Key Deployment Tasks:

Hosting the back-end on **cloud platforms** like AWS, Heroku, or Render.

Publishing the mobile application on:

- **Google Play Store**
- **Apple App Store** (future scope)

Ensuring **low latency** and **high availability**, particularly in rural areas with fluctuating internet connectivity.

Deployment involved using **Docker** containers (optional for future use), CDN optimization, and CI/CD pipelines for automatic updates.

5.6 Post-Deployment Monitoring and Enhancements

After deployment, continuous monitoring is essential to ensure performance, stability, and user satisfaction.

1. Monitoring Includes:

Server uptime and latency tracking

Error logging and automated alerts

Real-time user analytics to understand behavior patterns

Feedback collection via in-app surveys or contact forms

2. AI-Based Crop Recognition:

Allowing farmers to upload images for automated crop detection and classification.

3. Market Sentiment Analysis:

Using price history and trends to forecast demand and recommend pricing strategies.

4. Multilingual Support:

Expanding language options to include Kannada, Hindi, Tamil, Telugu, and more, to enhance accessibility.

All these improvements are a part of the long haul plan to move AgroMart to be a smart AI based agricultural platform.

CHAPTER-6

SYSTEM DESIGN & IMPLEMENTATION

This relates to the AgroMart platform's implementation and architectural design. The concept is that there is a platform that is simple, scalable, and uses contemporary technology to make it user-friendly and efficient for both buyers and farmers.

6.1 System Design

In addition to managing real-time data with high user numbers and smooth payments, the AgroMart system design will make this digital infrastructure reliable, safe, and scalable. It is modular and cloud-based, allowing us to grow it in the area or add intelligence later. The system's two primary components—the front-end interface and the back-end infrastructure—are connected to third parties and bond via a dynamic API layer.

6.1.1 Front End:

Using the same code base for both iOS and Android apps, React Native is used to create a cross-platform front end for mobile frameworks. This customized application is appropriate for farmers in rural regions as well as individuals with varying levels of digital literacy.

1. Seller Interface Features:

- **User Registration & Login:** Simple on boarding with OTP & local language support, User Registration & Login.
- **Product Listing:** You can upload product images; enter the quantity of product you want; set dynamic pricing and describe your produce details.
- **Government Price Updates (Real Time Market Prices):** The farmers can be registered to get the price updates from the government for farmers to be more competitive.

Image	Item	Price	Quantity
	Mangoes	₹12	1
	Potato	₹20	1
	Chilli	₹56	1
	Carrot	₹50	1
	Pine Apple	₹49	1
	Grapes	₹47	1
	Watermelon	₹40	1
	Strawberry	₹60	1
	Coconut	₹30	1
	Brinjal	₹35	1
	Banana80	₹88	1
	Banana	₹20	1
	Apple	₹200	1
	Green Apple	₹250	1
	Strawberry	₹100	1

Table 6.1

Sample for Real-Time Pricing Insight

- **Order & Inventory Management:** Visual tracking of product availability, pending orders and completed sales is provided for Order & Inventory Management.
- **Buyer Interface Features:**
- **Product Discovery:** Search, filter, and browse products based on location, category,

price range, and freshness.

- **Cart & Checkout:** Easy-to-use cart management with real-time updates and a secure checkout process.
- **Order Tracking & Communication:** View order status and communicate with sellers via integrated WhatsApp or in-app messaging.

2. User Experience (UX) Optimizations:

- Large touch-friendly buttons
- Minimal text input
- Icon-based navigation
- Multilingual support for inclusivity

6.1.2 Back-End Design:

The back-end is implemented using **Node.js** with **Express.js**, offering a lightweight, asynchronous, and high-performance server environment. The architecture supports RESTful APIs and microservices for scalable and maintainable development.

Key Components:

Role-Based Access Control (RBAC):

- Differentiates features for sellers and buyers.
- Ensures restricted access to sensitive actions based on user roles.

Authentication & Authorization:

- **JWT (JSON Web Tokens)** provide stateless, secure authentication.
- Supports persistent sessions and token refresh for better user experience.

Database Management:

MongoDB is used as the primary data store due to its schema-less and document-oriented model.

Collections include:

- users: Profiles, roles, and activity logs.
- products: Listings with media, metadata, and real-time price references.
- orders: Transactional data and order history.
- payments: Secure records of payment statuses and gateways.

API Layer:

- A set of well-documented **RESTful APIs** facilitates seamless communication between the client-side application and back-end services.
- Core APIs include:
 - User registration and login
 - Product management (CRUD operations)
 - Order placement and tracking
 - Payment processing and receipt generation

3. Third-Party Integrations

AgroMart uses several third-party tools in order to enhance the platform functionality and provide essential services.

- **Cloudinary:**

Used for uploading and managing high-quality product images.

- **WhatsApp API:**

Enables direct messaging between buyers and sellers, fostering real-time communication.

- **Payment Gateway Integration (e.g., Razorpay, Paytm):**

Facilitates secure, encrypted transactions for orders.

- **Nodemailer:**

Sends automated email confirmations for transactions, receipts, and account activities.

- **Market Price APIs:**

Integrates with government databases to fetch and display real-time crop price data.

6.2 Workflow

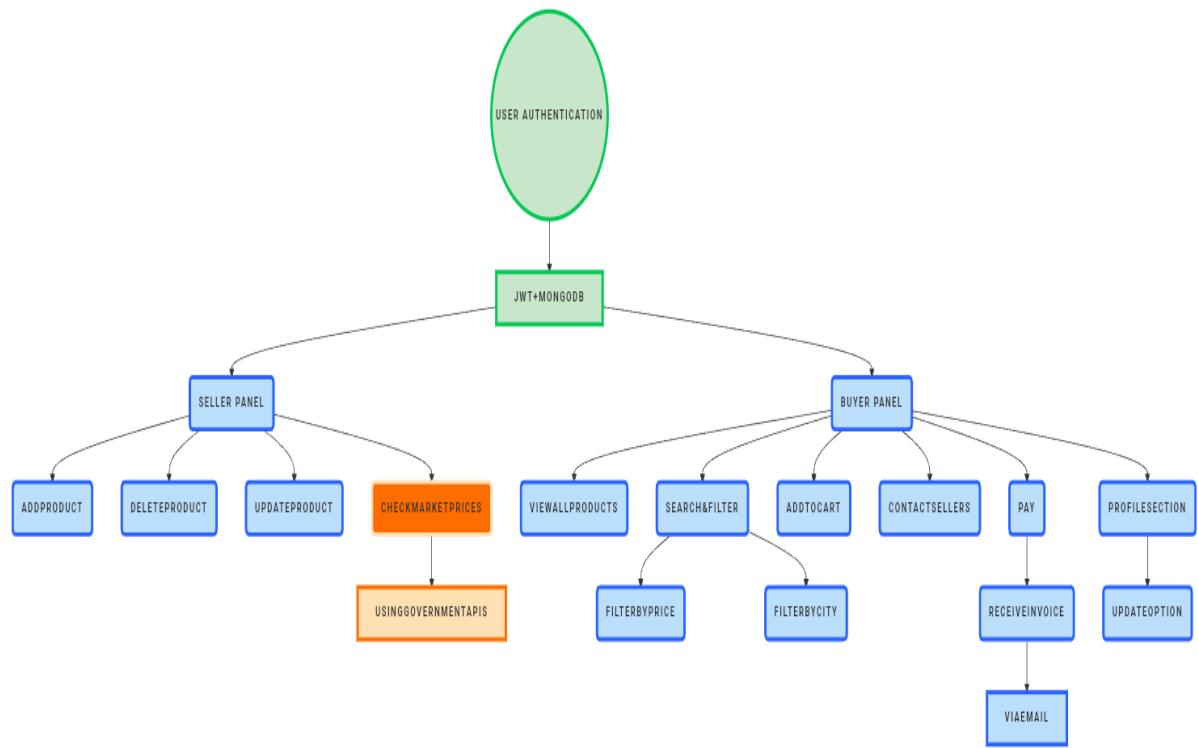


Figure 6.1: Workflow The platform was created to give both buyers and farmers (sellers) a simple and intuitive user experience. The platform's goal is to provide safe, effective transactions as well as open communication throughout the entire registration and payment processing processes. Workflows are tailored to make them sticky, eliminate friction, and encourage repeat use.

6.2.1 Seller Workflow:

Instead, the emphasis is on the seller workflow, which enables farmers to display their produce, monitor orders, and get payments with the least amount of technological hassle. The following are the steps:

1. Registration/Login

- The merchants use their mobile number to register on the portal.
- An OTP (One-Time Password) is sent through their database for verification.
- Following a successful login, a JWT (JSON Web Token) is generated to secure the session.

2. Product Listing

- Farmers can add new products –taking pictures, adding categories (vegetables, grains), adding descriptions, determining amount, and unit prices.
- Drafts of the Listings can be saved or published at the time.

3. Price Management

- Sellers can view real-time market pricing from official government APIs on a dedicated dashboard.
- With the aid of current trends, they may compete on price, and appropriate pricing will always be reached, giving farmers larger margins.

4. Order Management

- Vendors would receive real-time notifications whenever an order was placed.
- They have the authority to select or reject orders based on stock availability.
- Farmers can analyze buyer behavior by looking at a sales history log, which shows the past transactions and buyer country.

5. Communication

- WhatsApp API integration allows for instant messaging between buyers and sellers.
- Make direct phone calls to get information on delivery preferences, quality, or quantity.
- This encourages openness and expedites decision-making.

6. Payment Processing

- Once an order is fulfilled, payment is processed through an integrated **digital payment gateway**.
- Sellers receive payments directly into their registered bank or digital wallet.
- Automated invoices and receipts are generated and stored for future reference.

6.2.2 Buyer Workflow:

The buyer workflow focuses on a smooth purchasing experience, helping buyers find, evaluate, and order fresh produce from nearby sellers efficiently.

1. Registration/Login

- Buyers sign up using a mobile number.
- OTP-based verification and JWT authentication secure the login process.
- Returning users are auto-logged in for convenience, with session management via tokens.

2. Product Browsing

- Buyers land on a personalized home screen with trending or nearby products.
- Advanced search and filter options are available, including:
- Product category

- Price range
- Distance/location
- Freshness (harvested date)
- Listings include high-resolution images, seller ratings, and price comparisons.

3. Cart Management

- Buyers can add items to a cart, update quantities, or remove items before checkout.
- Estimated totals and delivery information are updated in real-time.

4. Communication

Buyers can:

- Use in-app messaging or WhatsApp integration to clarify questions.
- Call sellers directly for urgent or bulk orders.
- These channels help ensure the buyer is well-informed before purchase.

5. Checkout & Payment

Once ready, the buyer proceeds to checkout.

A secure payment gateway (e.g., Razorpay, Stripe) processes transactions via:

- UPI
- Credit/Debit Cards
- Net Banking

Payment confirmation is sent instantly to both parties.

6. Order Confirmation

- The buyer receives:
 - A **digital receipt via email or SMS**
 - An **in-app order summary**, including delivery timeline, seller contact, and payment breakdown
- Buyers can track order status and rate sellers after fulfillment.

Workflow Benefits

- **Efficiency:** Automation of product listings, pricing, and payments reduces manual effort.
- **Transparency:** Real-time data and direct communication improve clarity and trust.
- **Security:** JWT authentication and encrypted payments ensure data and transaction safety.
- **User Empowerment:** Both buyers and sellers have control over their activities, fostering independence and confidence in using digital tools.

Key Features Illustrated in the Diagram

1. **Two-way communication** between buyers and sellers (real-time).
2. **Centralized API interaction layer** that connects:
 - Front-end app
 - MongoDB database
 - Government market data API
 - Payment processing systems

3. **Role-based access** ensures sellers and buyers see only relevant tools and data.
4. **Automated processes** like invoice generation, payment confirmation, and price updates enhance platform efficiency.

6.3 Implementation

The implementation of AgroMart involves setting up both the front-end and back-end systems, integrating third-party services, and ensuring seamless interaction between components.

6.3.1 Software and Hardware Requirements

Software:

1. Operating System: Windows/macOS/Linux (for development)
2. Front-End: React Native
3. Back-End: Node.js with Express.js
4. Database: MongoDB
5. APIs: Government market price API, WhatsApp API, Cloudinary, Payment Gateway
6. Version Control: Git

Hardware:

1. Processor: Intel Core i5 or equivalent
2. RAM: 8 GB minimum
3. Storage: 500 GB
4. Test Devices: Android & iOS smartphones

6.3.2 Assumptions and Dependencies

The following assumptions and dependencies were considered during the implementation of AgroMart:

- **Assumptions:**
 - Users have access to smartphones with internet connectivity to use the AgroMart mobile application.
 - Farmers are familiar with basic mobile applications and can operate features like adding products and viewing prices.
 - Government market price data is available and updated regularly via API access.
 - Buyers and sellers are comfortable with digital payment systems.
- **Dependencies:**
 - The system relies on third-party services like WhatsApp API, government market price APIs, Cloudinary for image storage, and secure payment gateways.
 - The performance and scalability of the system depend on MongoDB's ability to handle large datasets.
 - Proper functioning of JWT for secure login and authentication of users.

6.3.3 Implementation Details

The actual implementation process for AgroMart is divided into various stages to ensure efficient development and deployment.

1. Front-End Implementation:

- Developed using **React Native** to ensure that the mobile app runs smoothly across different devices and platforms.
- Key features include:

- **Login/Registration Page:** Simple forms for user authentication.
- **Product Listing:** Sellers can add products with images, descriptions, and prices.
- **Cart Functionality:** Buyers can add products to the cart and proceed with payments.
- **Notification System:** Buyers and sellers receive notifications about order status and communications.

2. Back-End Implementation:

- The back-end was built using **Node.js** and **Express.js** to handle RESTful API requests.
- **JWT-based authentication** ensures secure login and session management for both buyers and sellers.
- **MongoDB database:** This NoSQL database stores user profiles, product listings, and transaction details.
- **Real-Time Price Integration:** APIs fetch and display real-time market prices, helping sellers adjust prices dynamically.

3. API Integration:

- **Cloudinary Integration:** For image upload and management, allowing sellers to upload product images.
- **WhatsApp API Integration:** Allows buyers and sellers to communicate directly via messages.
- **Payment Gateway Integration:** Enables buyers to securely pay for products via credit/debit cards, UPI, or mobile wallets.
- **Nodemailer:** Sends email confirmations for orders and payment receipts.

4. Testing and Debugging:

- The app underwent **unit testing** for individual components (e.g., authentication, payment processing).

- **Integration testing** was done to ensure all components (front-end, back-end, third-party services) work seamlessly together.
- **User acceptance testing (UAT)**: Involving real users (farmers and buyers) to test the app for functionality, usability, and bug identification.

5. Deployment:

- The app is deployed on a cloud platform to ensure scalability and high availability.
- **Continuous Integration/Continuous Deployment (CI/CD)**: Automated pipelines were set up for testing and deploying updates without downtime.
- The mobile app was made available on the **Google Play Store** and **Apple App Store** for public access.

Conclusion:

AgroMart's system design and implementation prioritize the creation of a scalable, safe, and user-friendly digital platform for farmer-buyer interactions. AgroMart wants to transform agricultural trading by utilizing contemporary technologies to do away with middlemen, offer real-time pricing information, and enable safe transactions.

Use case diagram:

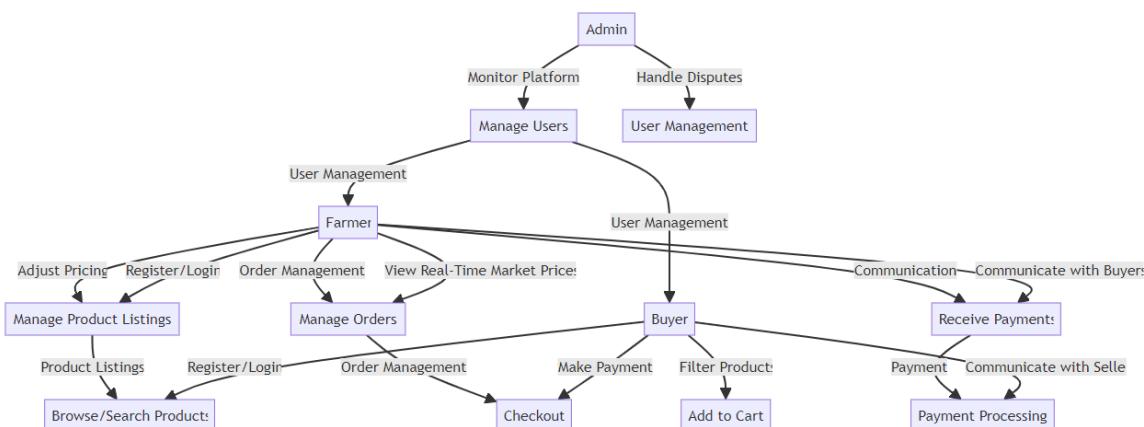


Figure 6.2: Use Case diagram

The primary interactions between users (actors) and the AgroMart system are depicted in the use case diagram. Farmers, buyers, and the administrator are the main players in the system. The main functions that each player in the system is capable of performing are shown in this diagram.

- Farmers can do things like sign up on the site, post their produce, update their prices, check market rates, and get in touch with customers.
- Customers can browse items, filter by area and category, place orders, pay, and get in touch with farmers directly for questions or to negotiate.
- The administrator is in charge of user management, account verification, platform activity monitoring, and system integrity.

The Sequence Diagram illustrates how the back-end system, application logic, and user interface interact over time. When a user completes a crucial task, such as a buyer placing an order or a farmer adjusting the price of a product, it describes the detailed communication that takes place.

- The user (such as the buyer) sends a request via the user interface at the start of the diagram.
- The Front-End Application processes the request before sending it via API to the Back-End Server.
- To retrieve or edit data (such as order details or product listings), the back-end interacts with the database.

Following request processing, the user interface receives a response that shows the revised outcome or confirmation.

From there, these real-time communication possibilities also flow: sending a triggering WhatsApp API, sending an email confirming payment.

This graphic emphasizes the significance of request/response synchronization and backend dependability by clearly illustrating how the system's components interact.

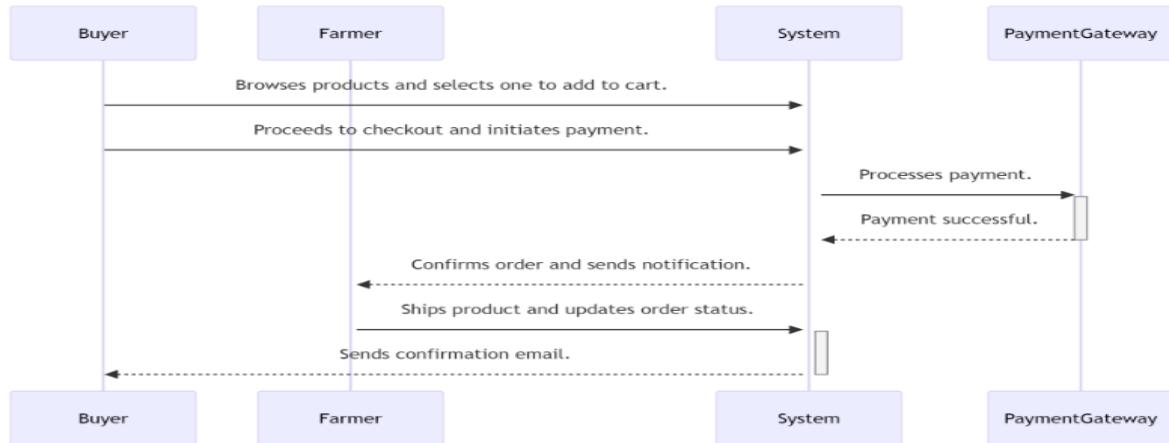


Figure 6.3: Sequence Diagram

Additionally, the System Workflow diagram provides a comprehensive overview of the data flow between processes in the AgroMart system. It consists of processes that satisfy user choices, conditionals, and automation requirements for every feature.

- User authentication is the first step in one of these processes, which involves users joining up or logging in, regardless of whether they are farmers or buyers.
- Depending on their role, users are led to their dashboards, if any.
- For farmers, the process goes like this: listing the product, determining the price, uploading an image using Cloudinary, and then publishing the product.
- Customers must browse products, filter or search, add them to their carts, place their orders, and then pay.
- Direct calling or the WhatsApp API are used to communicate with users who require assistance or clarification.
- The system logs the transaction into the MongoDB database and sends a confirmation email following payment.

This image makes it easier to see the logical flow of information and decision-making procedures and makes it clear how each component works together to get the best possible conclusion for a seamless farmer-to-buyer transaction.

CHAPTER-7

TIMELINE FOR EXECUTION OF PROJECT

(GANTT CHART)

The planning, development, testing, and deployment phases make up the AgroMart timeline's execution. Each phase is given a specific amount of time to ensure that the project is finished on schedule. It is anticipated that the project will be finished in six months.

7.1 Project Timeline Breakdown:

The AgroMart project timeline is divided into multiple development phases that are evaluated at checkpoints to assess progress toward quality targets and align with academic aims. A comprehensive evaluation of the creation of the AgriTech platform, the success and failure stories, and the team's comprehension of AgriTech, system design, and user-centered development comprise the final Viva-Voce.

1. Task 1: Requirement Analysis and Project Planning

Understanding the problem area and determining the actual demands of the parties involved were the main goals of this first phase. To collect system needs, the team had in-depth conversations with farmers, buyers, and agri-market specialists. This served as the basis for defining the AgroMart platform's scope, which included essential functions including product listings, real-time pricing, safe payment methods, and channels for communication.

Review-0: January 29, 2025 to January 31, 2025

- Finalization of project title and objectives
- Stakeholder interviews and requirement gathering
- High-level project scope definition
- Drafting a preliminary Gantt chart and planning deliverables

2. Task 2: System Design, Literature Review, and Methodology

We created a comprehensive system architectural diagram, MongoDB schema structure, and API design at this point. The inadequacies in AgriTech platforms were the focus of the literature review. Specific hardware and software requirements were provided in the documentation for the suggested techniques.

Review-1: February 17, 2025 to February 22, 2025

- Literature survey of 10+ research articles
- Finalization of system architecture (front-end + back-end)
- Module definition and flow diagrams
- Selection of tools: React Native, Node.js, Express.js, MongoDB, JWT
- Timeline preparation with Gantt chart
- Compilation of Review-1 report

3. Task 3: Front-End Development and Partial Implementation

I had to use React Native to create the platform's user interface during this phase. Software interfaces (product listings, inventory, pricing and product filtering, cart, checkout) were developed for both buyers and sellers. Market price APIs were connected with real-time pricing.

Review-2: March 17, 2025 to March 22, 2025

- Completion of front-end for sellers and buyers
- Integration of real-time pricing via government APIs
- Walkthrough of product management modules
- Presentation of 50% functional implementation with live demo

- Submission of interim project report

4. Task 4: Back-End Development and Full System Integration

Using third-party services like Cloudinary (product photos), WhatsApp Communication APIs (one-on-one), and payment gateways, I constructed the back-end at this point using Node.js and Express.js in addition to REST APIs for the transaction. Complete system integration was accomplished by the end of this phase.

Review-3: April 21, 2025 to April 26, 2025

- Integration of authentication, cart, and order management modules
- Secure transactions via integrated payment gateway
- Communication tools embedded (WhatsApp, phone)
- Demonstration of complete, working AgroMart platform
- Submission of final report in print and digital formats

5. Task 5: Final Project Viva-Voce

The viva-voce concluded with a comprehensive analysis of AgroMart's whole development process, methodology, implementation, and results. The team demonstrated that the technology also solved real-world agricultural issues including intermediary reduction and price transparency.

Final Viva-Voce: May 12, 2025 to May 24, 2025

- Presentation of the final live demo of AgroMart on mobile
- Discussion of design decisions, features, and architecture
- Evaluation of platform effectiveness based on user testing
- Suggestions for future work (AI-based crop recognition, market trend analysis)

Post-Viva: Project Maintenance and Enhancements

After the product is turned in, attention is kept on tracking performance, getting user input, and organizing next upgrades. Additionally, it has multilingual support, deeper analytics for farmers, and AI to enhance platform functionality.

Ongoing (Weeks 17+)

- Platform monitoring and bug fixing
- Collection of user feedback for improvements
- Roadmap planning for future releases (AI tools, predictive analytics)

It's structured timeline makes sure that project's each phase is finished in an effective manner so that proper time is left for the testing, debugging, and post-launch improvements.

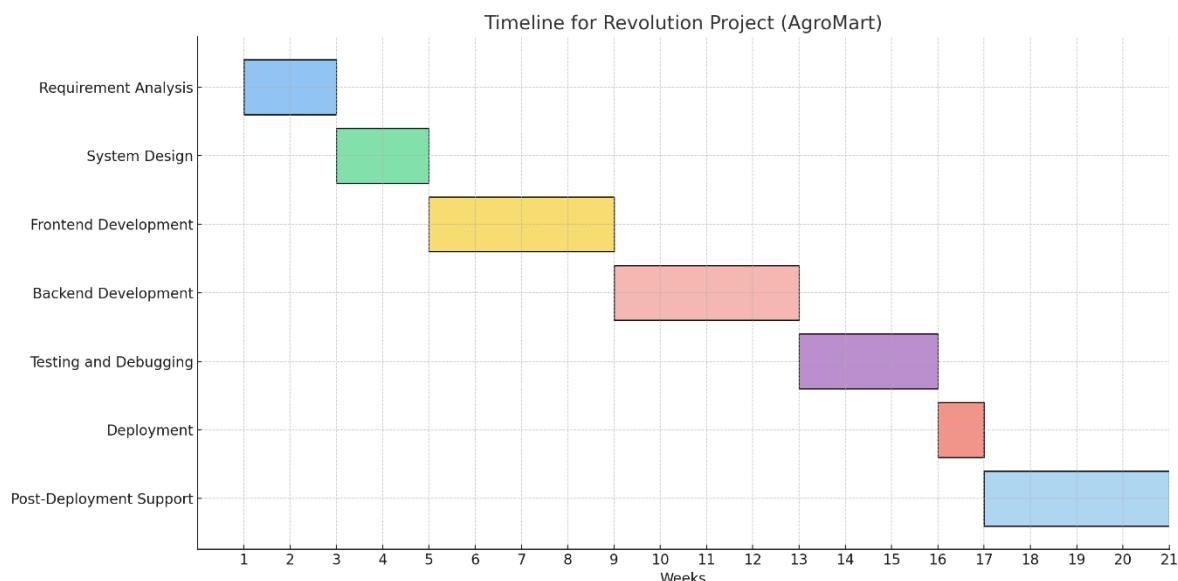


Figure 7.1: Timeline

CHAPTER-8

OUTCOMES

These are the outcomes AgroMart is expected to achieve.

8.1 Increased Farmer Profits

By selling directly to consumers—without the need of middlemen like brokers and wholesalers—AgroMart significantly boosts farmer revenue. Farmers can set prices based on the market, keep more of their earnings, and profit from middlemen underpricing their crops.

As a result, the platform gives farmers access to features like secure digital payments, real-time price data, and an intuitive user interface, enabling them to handle their sales independently. They will benefit from increased profit margins and a stronger financial position as a result.

For long-term agricultural growth and sustainability, the farmers' increased income also enables them to reinvest in improved equipment, seeds, and farming methods. For rural farmers, AgroMart generally creates a fair and open market.

8.2 Enhanced Buyer Experience

By making it possible to purchase fresh, premium, and reasonably priced farm products, AgroMart improves the shopping experience. Features like real-time product availability, search and filtering capabilities, and simple merchant communication through WhatsApp or phone calls are all enjoyed by the customers.

Recurring buyer-seller interactions and long-term partnerships are fostered by trust and accountability through open pricing and public seller details. By pleasing the consumer and boosting platform customer loyalty, it provides this user-centric strategy that streamlines the purchasing process.

8.3 Secure and Efficient Transactions

To ensure a quick and easy transaction, AgroMart offers both buyers and sellers a clear and safe digital payment method. Additionally, features like email confirmations and automatic

invoicing, as well as encrypted payment processing, reduce the likelihood of theft and incorrect invoicing.

Because of these simplified procedures, we have been able to gain the trust and faith of users, which enables us to pay farmers on time and guarantee a seamless checkout. For this reason, maintaining a safe transaction flow is essential to both user pleasure and platform dependability.

8.4 Digital Inclusion for Farmers

The AgroMart application's usability and accessibility are the primary development criteria; it is especially made for farmers who may not be familiar with digital technology. In order to make the platform easy to use for everyone, including non-technical users, it has a straightforward and intuitive design that mostly consists of big buttons, little text input, and visual signals.

By providing tools that make it simple for farmers to sell items, adjust prices, track inventory, and handle orders, the platform breaks down the obstacles that keep farms in rural areas from participating in digital markets. Additionally, multilingual support makes the system more usable by enabling farmers from different areas to communicate with it in their own tongue.

By exposing farmers to digital tools and workflows in an intuitive and user-friendly format, AgroMart plays a crucial role in fostering digital literacy. Enhancing their proficiency on the platform also equips them with the necessary abilities to explore other facets of the digital economy, leading to long-term socioeconomic inclusion and empowerment.

8.5 Data-Driven Decision-Making

The incorporation of real-time Government price of crops market APIs, which provides farmers with access to current agricultural prices, is another aspect of AgroMarts' innovation. This makes it easier for them to set pricing that reflect actual market conditions and remove guesswork from their decision-making process.

Farmers would be able to make well-informed decisions about when and how to sell their goods if they had access to accurate and up-to-date price trends. This would help them avoid being underpaid or taken advantage of by volatile or unclear market dynamics. Additionally,

it provides more strategic selling and helps farmers increase their profits, minimize losses, and compete in the market.

AgroMart helps farmers save money on the market by facilitating the shift from traditional methods to more analytical and knowledgeable channels. They also support a more analytical and knowledgeable approach to pricing tactics.

8.6 Data-Driven Decision Making

Additionally, by offering helpful insights through platform analytics, AgroMart—which is a transactional platform by itself—becomes a decision support tool for farmers. In order to help farmers understand exactly what sells, when it sells, and at what price, the platform lets them track and analyze data such as buyer preferences, order histories, and market pricing patterns.

These insights allow farmers to:

- **Change what kind of products are being offered based on what buyers are searching for.**
- **Can be used to optimize pricing strategies to remain competitive and to be in line with the consumer expectations.**
- **Choose the best crop planning and inventory management as it will help identify peak demand periods.**

Farmers that have access to this data are able to increase their productivity and profitability in addition to shifting the paradigm from meeting their numbers based on intuition to hitting their numbers based on facts.

Future iterations of AgroMart will incorporate AI-based technologies to help farmers improve their operations. These improvements will consist of:

Personal recommendation may be made for pricing by analyzing historical sales data and market sentiment.

- **The demand patterns are updated and predicted so that what to grow may be suggested through use of predictive analytics.**

- **And helping you know and take the most intelligent marketing insights to guide your promotional strategies and target buyers by direct targeting.**

By transforming raw data into actionable intelligence, both technologies help farmers make better decisions at every stage of production, from pricing to sales and marketing, and eventually build a more robust and prosperous farming ecosystem.

8.7 Scalability and Future Readiness

With a forward-thinking, future-focused strategy, AgroMart's modular design was created to enable the company to maintain its long-term viability and adaptability. The platform is naturally scalable and can accommodate more users, transactions, and features without compromising speed because to its cloud-based architecture and modern development frameworks like React Native, Node.js, and MongoDB.

This scalability enables:

- It ensured the road to smooth regional or national expansion for the platform, so that it can easily onboard thousands of farmers and buyers across various states or zones.
- It also has flexible module integration, i.e., new functionalities such as AI based crop recognition, demand forecasting, support for multiple languages etc can be easily integrated without affecting core functionality.

Because of its high availability and load balancing architecture, the platform can handle high traffic volumes during busy harvest seasons or during marketing campaigns without experiencing lags or outages. Maintaining user trust and motivation to interact on the platform depends on this kind of dependability.

AgroMart is also prepared for the future; the team has a development roadmap that includes the introduction of market sentiment research, predictive analytics, and intelligent recommendations to assist farmers in making the best choices. But with agro-tech on the rise with IoT, blockchain, and machine learning, AgroMart can use these tools to stay ahead of the curve in digital agriculture and continue to serve their customers long into the future.

CHAPTER-9

RESULTS AND DISCUSSIONS

For the goal of piloting the system, a group of farmers and buyers were used to examine the usability, effectiveness, and overall impact of agricultural trade in connection to the use of AgroMart.

9.1 Results

AgroMart's efficacy was assessed both in live user demos and during the User Acceptance Testing (UAT) phase. Based on the platform's functional performance, transaction efficiency, and user happiness, the results confirm that the platform can fulfill its primary goal of supporting farmers and improving buyer-seller relationships.

1. User Feedback

A specific set of farmers and buyers were chosen to participate in the UAT and provide input on the platform's feature set and usability. They frequently provided encouraging comments, particularly in the following areas:

Ease of Use:

The intuitive, minimalistic interface was praised by farmers, which enabled them to create products list, updated product prices as well as product orders. The platform's success in bridging the digital literacy gap can be seen through the fact that most users needed barely any technical assistance.

- Product Discovery:**

Buyers found the search and filter features of the app very easy to use, in particular the option to filter and sort products by category, price, location and freshness. It made purchasing easier and took the time on browsing for particular items.

- Communication tools:**

WhatsApp messaging and direct phone calling were what set them apart. By connecting instantly with the other party, users confirmed that transactions were more transparent, trusted, and time saved, making the buying and selling simpler and

safier.

On the overall, UAT showed that AgroMart does provide a user centric experience to its wide rural and urban user base.

2. Transaction Efficiency

- Because of AgroMart's distance, farmers were less likely to have to use cash for transactions, which increased their level of confidence and enabled them to fully benefit from real-time financial transactions between farmers and purchasers on the safe digital payment gateway. Almost all transactions are now handled instantly, and in many situations, within a few minutes, resulting in a considerable reduction in payment delays.
- In order to protect our clients from frequent issues like incorrect transfers or illegal access, we handle payments securely and error-free using encrypted channels in addition to conventional payment card channels.
- By guaranteeing that both parties have official records of their transactions, the digital invoices and receipts that are generated automatically strengthen financial transparency between them.

These made the transaction of these products a more efficient and professional one, which made AgroMart to be a reliable platform for transacting agricultural commodities.

3. Real-Time Market Price Usage

Two of the most important features of AgroMart, they were able to extract market price data from government sources and present it in real time, were able to prove useful to the farmers. This system enabled them to:

- They always keep themselves updated about the existing market rates for their produce.
- Adjust the selling prices dynamically in order to stay competitive and profitable.
- They avoid undervaluation of their crops from outdated or inaccurate market information.

Farmers became less reliant on the conventional middlemen who typically handle the discussions as their confidence and independence in determining prices grew, and the price also rose in tandem! In particular, Ethereum views this functionality as a significant step toward promoting financial empowerment and guaranteeing market openness.

9.2 Discussion

Strong potential for AgroMart to radically alter the agricultural trading model has been demonstrated via pilot testing of the platform and real-world user involvement. With few or no workable and scalable digital solutions for the modernization of farmer-buyer interactions, AgroMart tackles long-standing challenges like price manipulation, reliance on middlemen, and lack of market transparency.

Key Successes:

- **Intermediary Elimination:**

One of AgroMart's greatest accomplishments is its ability to free farmers from middlemen like wholesalers and dealers, enabling direct sales between customers and vendors. This change not only increased farmers' profit margins but also provided them greater negotiating and pricing power. The absence of middlemen reduced exploitation and allowed for speedier and more equitable commerce, according to feedback given in the following stage.

- **Increased Trust:**

Among its users, AgroMart did establish dependability and trust. The transactional environment was very transparent and seamless thanks to secure digital payments, real-time pricing via government APIs, and direct communication capabilities. Given that farmers and buyers expressed more confidence in every transaction, this is crucial for fostering long-term involvement on the platform.

- **High Adoption Readiness**

Not only did this result in successful adoption, but people with limited exposure to technology were also encouraged to learn and embrace due to the mobile-first design's strong emphasis on usability. Even digitally unskilled farmers were able to participate in e-selling with little assistance thanks to the app's clear layout, big buttons, and simple operations. This suggests that AgroMart can serve a range of customers, including both rural farmers and tech-savvy consumers.

Identified Challenges:

Digital Literacy Barriers

However, even though the interface was made simpler, some farmers had trouble using the platform at first, particularly those who had never used a smartphone or mobile app before. These usability flaws can be fixed in a subsequent version by:

- Voice instructions or visual onboarding tutorials
- Using onboard tutorials with speech or visual instructions
- Detailed in-app instructions for tasks such as product listing and pricing adjustments.
- The capability to offer multilingual support, allowing users to use the platform in their native tongue to enhance comfort and comprehension.
- Enhancing the platform with such features would make it inclusive and decrease the onboard friction for new users.

Dependence on Internet Connectivity:

The other challenge that was experienced during field test was service disruption at times due to bad internet connectivity, in particular in remote rural areas. This slowed down the list updates in speed, price fetching, and real time communication. To solve this problem, the following solutions come to mind:

- An offline functionality to enable farmers to create product listings offline and sync them once connectivity is restored again.
- Never-ending SMS-based notification and alerts functionality that makes sure people receive notifications even with inactive internet

Such features would be very useful to platform resilience and usability in underserved areas.

Pending Advanced Features

Although AgroMart's basic features were successful in achieving their objectives, the current release lacked some of the anticipated future enhancements, such as AI crop recognition, market sentiment analysis, or personalized sales recommendations. It's important to note that user response indicated a high level of interest in this type of service, indicating a need for sophisticated decision-making tools that go beyond simple listings and transactions.

In addition to improving AgroMart's value proposition, these improvements will be included in the upcoming upgrades, positioning the company as a technologically advanced solution within the expanding agri-tech ecosystem.

CHAPTER-10

CONCLUSION

The AgroMart initiative, for instance, has demonstrated how digital technology might change the long-term negative state of affairs in the agricultural industry. Farmers will be able to set fair pricing and maximize their profits by eliminating the need for middlemen by creating a single, user-friendly platform where they can communicate directly with purchasers. The platform eliminates the main issues that producers and customers have with its straightforward design, real-time market integration, safe digital payments, and direct communication features. Regardless of digital literacy, everyone is welcome to use AgroMart's app thanks to its user-friendly UI and mobile-first strategy. Responses from the pilot testing phase were also quite favorable, confirming the platform's capacity to improve transaction efficiency while preserving pricing transparency and fostering confidence among stakeholders. Although there have been significant difficulties, particularly with rural connection and user onboarding, they have paved the ground for future advancements. Lastly, AgroMart is ready for future development in areas like AI-based crop recognition, predictive analytics, logistics integration, multilingual support, and more. Its architecture is scalable and flexible. Additionally, the initiative can be utilized to advance more general objectives like financial empowerment, digital inclusion, and the sustainable development of rural communities; it goes beyond simple technology execution. In the end, AgroMart is a significant turning point in the evolution of India's agricultural trading scene by offering fair competition, openness, and effectiveness in a digital agricultural ecosystem that empowers farmers and benefits the agricultural value chain.

Additionally, this project is beneficial since it offers hands-on experience and educational opportunities in software development, system design, project management, and interdisciplinary teamwork. This made it possible for the team to apply fundamental academic ideas like role-based access control, cloud computing, RESTful API integration, and full stack development to a practical business situation with social implications. Through iterative testing, user feedback, and real-time deployment, we gained personal

experience designing scalable, user-centric digital solutions. The successful implementation of AgroMart has demonstrated the importance of empathy-driven technological innovation and sharpened the technical, analytical, and problem-solving abilities we will need to develop as engineers and future technology leaders.

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APPENDIX-A

PSUEDOCODE

// === IMPORTS ===

Import express, mongoose, bcryptjs, jwt, nodemailer, dotenv, cors

Load .env file

Initialize express app

Use middleware: express.json, express.urlencoded, cors

// === DATABASE CONNECTION ===

Connect to MongoDB using mongoose.connect(URL)

Log "Database Connected" or error

// === USER SCHEMA ===

Define User schema:

name, email, mobile, password, image, gender, profession, userType, whatsapp, city
products: [array of { image, name, price, quantity, unit, date }]

// === ROUTES ===

// --- ROOT ---

GET "/" → return "Hello, World!"

// --- REGISTER USER ---

POST "/register":

Extract user info from request body

If user with email exists → return "User already exists"

Hash password

Create new user document

Return: status "ok"

// --- LOGIN USER ---

POST "/login-user":

Extract email, password

Find user by email

If not found → return error

Compare password with hash

If match:

Sign JWT token

Return: token + user details

// --- GET USER DATA FROM TOKEN ---

POST "/userdata":

Extract token

Verify JWT

Find user by decoded email

Return user data

// --- UPDATE USER ---

POST "/update-user":

Extract email and updated fields

Update user document by email

Return: "Updated"

// --- DELETE USER ---

POST "/delete-user":

Extract user ID

Delete user by _id

Return: "User Deleted"

// --- GET ALL USERS ---

GET "/get-all-user":

Return all user documents

// === PRODUCT ROUTES ===

// --- ADD PRODUCT TO USER ---

POST "/add-product":

Extract token, product details

Verify token → get user email

Find user → push product into products array

Return: "Product added"

// --- GET USER PRODUCTS ---

POST "/products":

Extract token

Verify token → get user email

Find user → return products

// --- UPDATE SPECIFIC PRODUCT ---

PUT "/products/:productId":

Extract token, productId, new product data

Verify token → get user email

Find and update product in products array using \$set and positional operator

Return: updated products

// --- DELETE SPECIFIC PRODUCT ---

DELETE "/products-delete/:productId":

Extract token, productId

Verify token → get user email

Pull product by _id from products array

Return: updated products

// --- GET ALL PRODUCTS (ALL USERS) ---

GET "/all-products":

Find all users

Map each product with user details (name, mobile, image, city)

Return merged product list

// --- GET ONLY 'PINEAPPLE' PRODUCTS ---

GET "/apple-products":

Find users with products named 'Pineapple'

Filter only pineapple products

Return pineapple product list

// === AUTH MIDDLEWARE ===

Function middleware(req, res, next):

Read token from 'x-token'

If missing → return "Token not found"

Verify token using jwt.verify

On success: set req.user = decoded user

Call next()

// === SERVER START ===

Start app on PORT 5000

APPENDIX-B

SCREENSHOTS

Consumer Dashboard

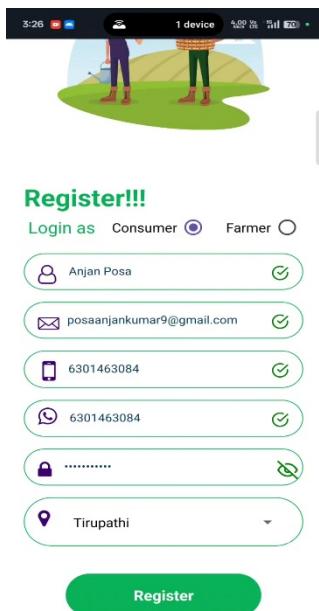


Figure 11.1
Sign Up for Consumer

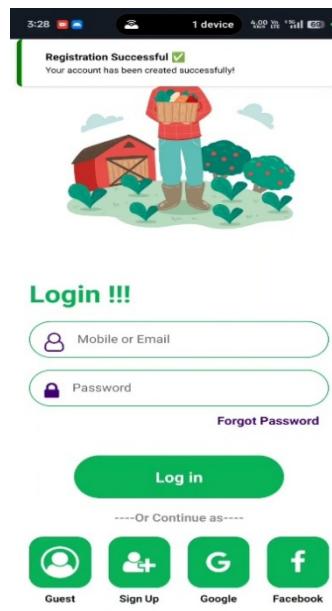


Figure 11.2
Login Page

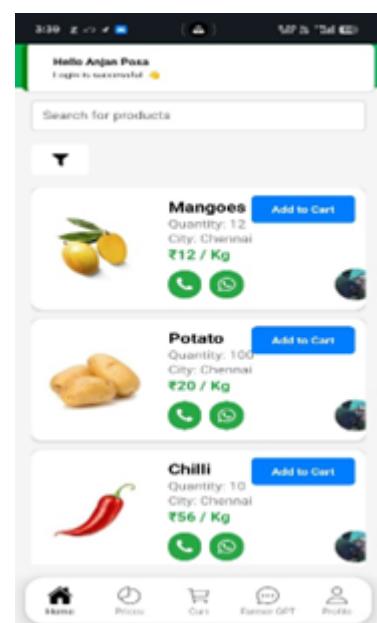


Figure 11.3
Home Page

Mobile App for Direct Market Access for Farmers

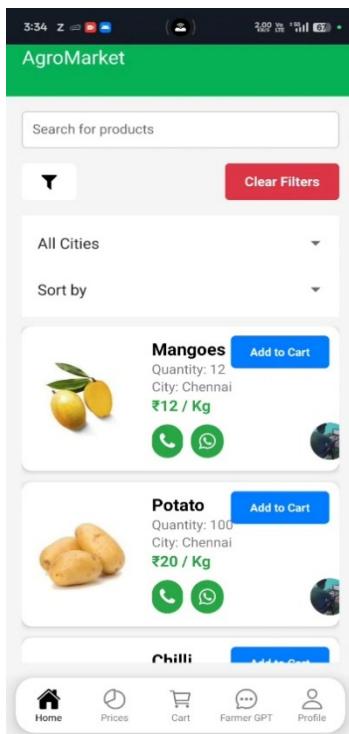


Figure 11.4
Filter

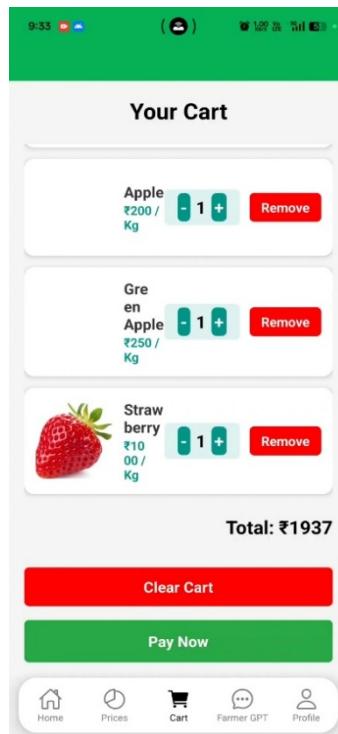


Figure 11.5
Cart

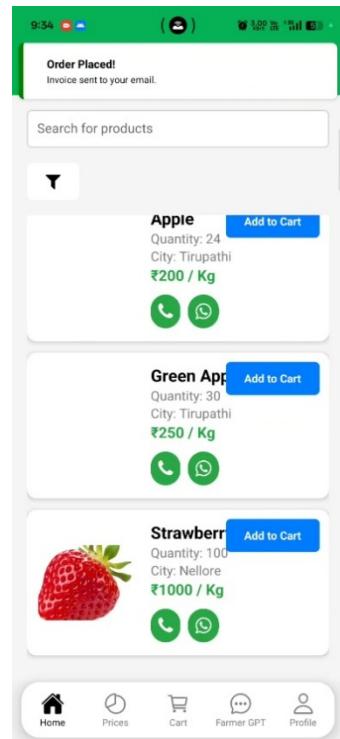


Figure 11.6
Order



Figure 11.7
Invoice

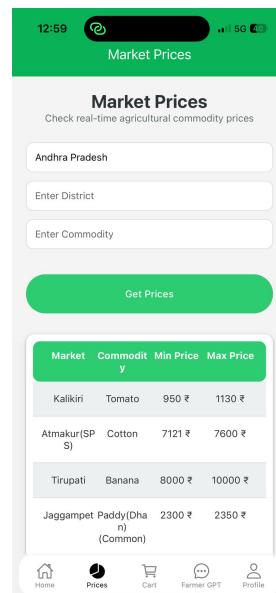


Figure 11.8
Mart Prices

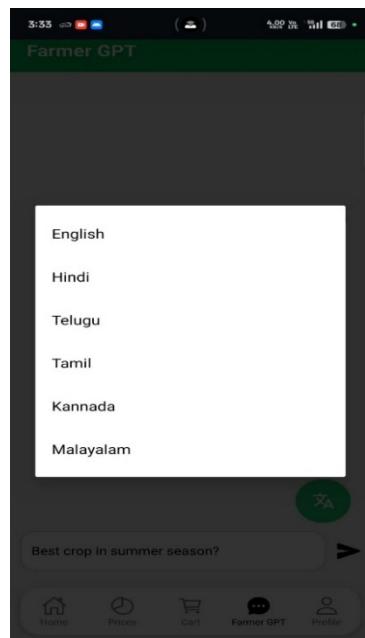


Figure 11.9
Multilangauge Support

Mobile App for Direct Market Access for Farmers

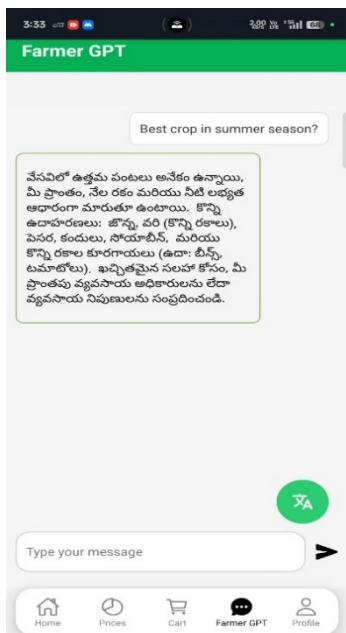


Figure 11.10
GPT

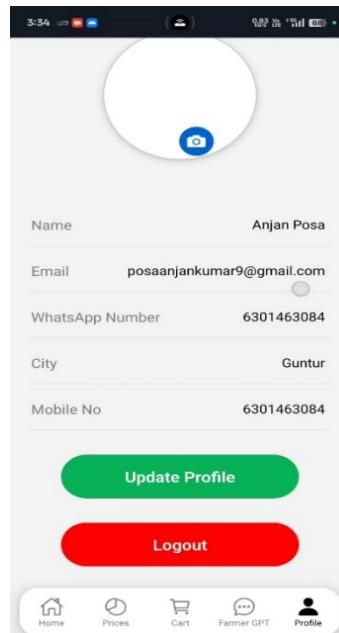
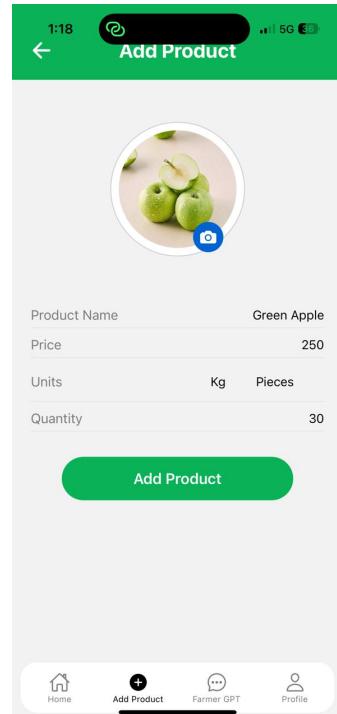
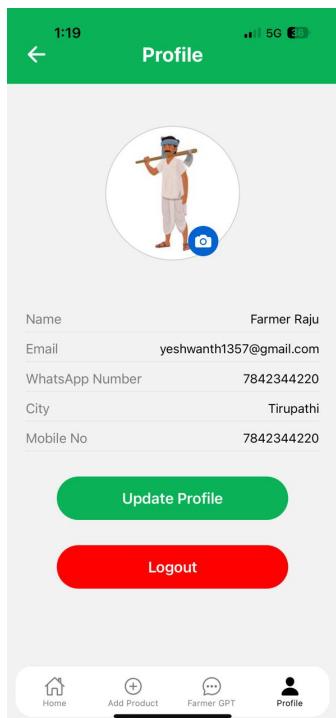


Figure 11.11
Consumer Profile

Farmer Dashboard



1:23



Login !!!

Mobile or Email

Password

[Forgot Password](#)

Log in

----Or Continue as----



Figure 11.12
Farmer SignUp

Figure 11.13
Adding Product

Figure 11.14
Home Page

Mobile App for Direct Market Access for Farmers

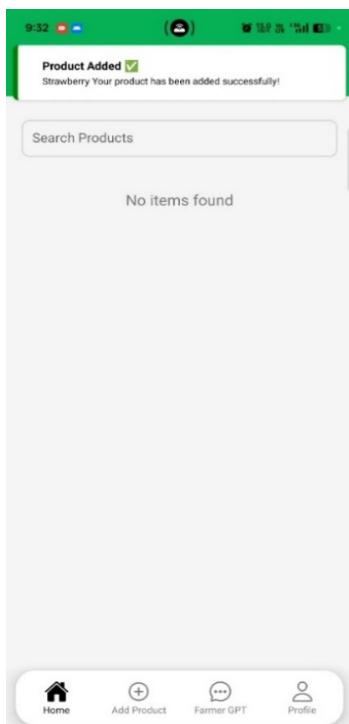


Figure 11.15

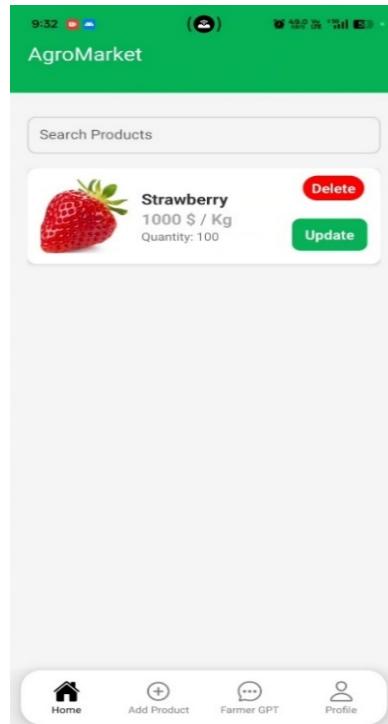


Figure 11.16

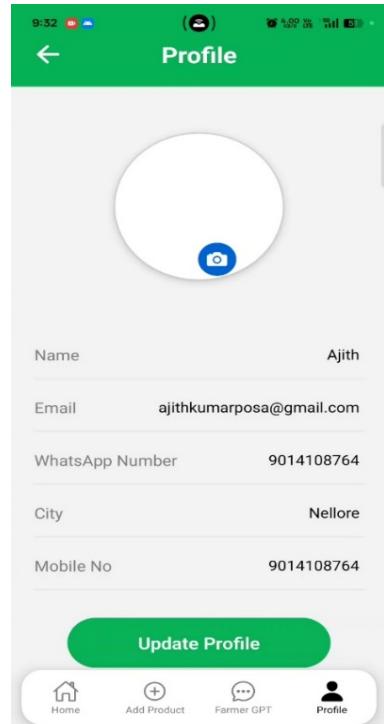


Figure 11.17

APPENDIX-C

ENCLOSURES

Acceptance Certificate



Plagiarism Report

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Smitha_S_PS_report_224

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-  Quick Submit
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Top Sources

- 5%  Internet sources
- 2%  Publications
- 5%  Submitted works (Student Papers)



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Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

Rank	Type	Source	Percentage
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Sustainable Development Goals (SDGs).



Goal 1 – No Poverty

Your innovative digital marketplace has substantially empowered smallholder farmers throughout the region by eliminating parasitic middlemen and enabling producers to set competitive prices directly with customers. This unprecedented autonomy has significantly boosted average incomes, especially for marginalized agricultural workers in impoverished rural communities. Their improved financial stability now substantially contributes to alleviating destitution.

Goal 2 – Zero Hunger

By streamlining an efficient supply chain, your application has reduced food waste and enhanced distribution. It helps farmers profitably market surplus harvests, ensuring fresher crops reach consumers. This bolsters food security and makes nutritious, affordable provisions more accessible to all residents.

Goal 8 – Decent Work and Economic Growth

AgroMart is catalyzing economic development by modernizing antiquated agricultural commerce. It furnishes cultivators with a fair, transparent, and efficient electronic exchange. By digitizing transactions and pricing dynamics, it promotes sustainable livelihoods and encourages digital entrepreneurialism in farming.

Goal 9 – Industry, Innovation, and Infrastructure

The platform embodies a major technological leap forward in agri-technical infrastructure. By integrating emerging technologies like mobile apps, APIs, secure online payments, and future artificial intelligence applications, your ambitious initiative is nurturing innovation and constructing scalable digital infrastructure for rural markets.