

Multi-Functional E-Commerce Platform: Buy, Sell, Exchange

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FINAL YEAR DESIGN PROJECT REPORT

This Report Presented in Partial Fulfillment of the
Requirements for the **Degree of Bachelor of Science in
Computer Science and Engineering**

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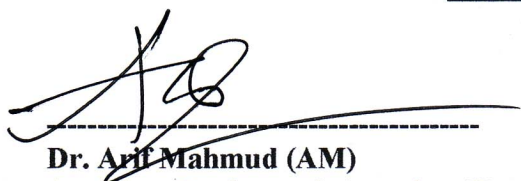
**DAFFODIL INTERNATIONAL
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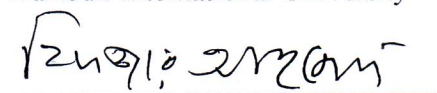
This Project titled “**Multi-Functional E-Commerce Platform :Buy ,sell, exchange**”, submitted by **MD. Golam Rabbani** , ID No: **212-15-4184** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **17 September, 2025**.

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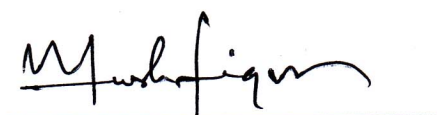
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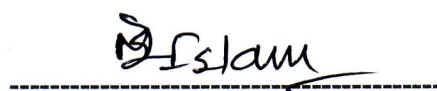
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We hereby declare that this project has been done by us under the supervision of **Mr. Raja Tariqul Hasan Tusher Assistant Professor**, Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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ABSTRACT

As the digital world is fast evolving, e-commerce websites are now the most vital tools for businesses and individuals to facilitate efficient purchasing, selling, and exchanging goods. Exchange Bazar is presented in this paper as a flexible e-commerce web application to facilitate easy and handy online trade. The site offers customers one site where they can purchase new or used goods, offer items for sale, or trade products, and thus is an inexpensive accessible site for modern consumers. Through the application of the Exchange Bazar facility, customers are able to trigger and negotiate good exchange, minimize wastage, and attain sustainability as well as offer opportunity for discount shopping. Product pictures can be loaded without any inconvenience, prices can be set, sellers can manage listings, and buyers are reassured with an ensured payment system that provides multiple modes of payments and a smooth and effortless interface.

The site is developed using Vue.js for dynamic front-end, Node.js using Express for back-end APIs, and MySQL database for properly managed data, thereby providing good performance, scalability, and reliability. The Bootstrap visually appealing, responsive layout suitable for both desktop as well as mobile users. Exchange Bazar differs from traditional marketplaces in that it focuses on ease of use through the emphasis on core functionalities with advanced analytics. By making it possible for individuals and small businesses to sell and showcase products at zero operation costs, the system creates an affordable, inclusive virtual marketplace. Through simplicity, security, and sustainability-based features, Exchange Bazar provides support to developing interest in flexible, low-cost, and efficient e-commerce solutions.

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Chapter 1

Introduction

The orientation of the project's motivation, goals, approach and expected results are laid out in this chapter. It gives a detailed outline of the report and provides a basis upon which to understand the project.

1.1 Introduction

In today's fast-paced digital world, the internet's widespread availability and the quick development of technology have fundamentally altered how people purchase and sell goods. E-commerce platforms are one of the most popular ways for consumers to shop because they offer convenience and a large range of products and services without requiring them to leave their homes. Modern life has become significantly impacted by online shopping, which has changed conventional business models and opened up new markets for both buyers and sellers.

Despite this growth, many e-commerce websites continue to focus only on the essential aspects of buying and selling, neglecting other helpful services that clients may need. One of the most obvious shortcomings in the current systems is the lack of a systematic and secure way to exchange goods. Users commonly use unofficial channels, such as unregulated marketplaces or social media groups, to exchange their goods. Numerous issues, including a lack of verification, problems with trust, security, and inefficient communication between parties, may arise from this. A specialized platform that enables the safe and efficient administration of product purchases, sales, and exchanges is therefore desperately needed.

The Exchange Bazar project seeks to solve these problems by creating a multifunctional e-commerce platform that integrates the three primary tasks of purchasing, selling, and exchanging into a single, intuitive system. Role-based dashboards on the platform are accessible to both administrators and users, ensuring effective management and suitable system control. Administrators have the ability to approve product listings, keep an eye on sales and exchanges, and send notifications to the entire system in addition to managing users. Customers, on the other hand, can post their own products for sale or exchange, make purchases, respond to requests, and receive notifications—all in a secure and organized environment—and have an excellent experience.

One of the key characteristics of this system is its robust security architecture, which includes session-based authentication to ensure safe user access and prevent illicit activity. The platform also supports a cart system for easy order management and integrates SSLCOMMERZ, a well-known online payment gateway in Bangladesh that enables users to make secure online payments. Cash on Delivery (COD) is an additional payment option available to users who prefer offline transactions.

By combining these traits, Exchange Bazar sets itself apart as a centralized, transparent, and reliable trading platform that streamlines the buying and selling

process while providing a much-needed, secure exchange functionality. This project demonstrates how technology can create a more dependable and inclusive e-commerce ecosystem by providing customers with multiple options for exchanging goods, ensuring security, and addressing the shortcomings of the market's current solutions.

1.2 Motivation

Exchange Bazar was founded in response to the increasing demand for a reliable, secure, and feature-rich online trading platform that facilitates both product exchange and buying and selling. Despite the abundance of e-commerce platforms available today, most of them primarily focus on traditional features for sales and purchases. Because so few platforms provide a structured and secure mechanism for users to exchange products with confidence, they are often forced to rely on unofficial or unreliable channels. Given this gap, there is an urgent need for a comprehensive platform that can support all aspects of online trading while ensuring security, transparency, and user satisfaction. The team gets hands-on experience with real-world technologies while building Exchange Bazar, including MySQL for database administration, Bootstrap for responsive design, Node.js for backend development, Vue.js for the frontend, and session-based authentication for secure login and user monitoring. These technologies not only enable the development of a dependable system but also provide the team with invaluable experience in the development of modern web applications.

Integrating payment systems such as Cash on Delivery (COD) for conventional payments and SSLCOMMERZ for online transactions can also teach the developers about safe transaction handling and financial workflows in an e-commerce environment.

In addition to its technical expertise, Exchange Bazar promotes social and environmental sustainability by reducing waste, promoting product reuse and exchange, and providing users with additional trading options. It encourages a culture of responsible consumption and extends the lifecycle of products, both of which benefit the community and the environment.

Finally, this project enhances the team's problem-solving, system design, and project management abilities because it necessitates careful planning, modular development, and rigorous testing to meet real market requirements. Apart from equipping the development team for forthcoming industry-level obstacles, the project provides a noteworthy resolution for users seeking a dependable and flexible e-commerce system by tackling practical problems and creating a practical, multifunctional platform.

1.3 Objectives

Closing existing gaps in online trading systems and offering a comprehensive, secure, and user-friendly platform are the primary objectives of the Exchange Bazar project. The particular objectives are as follows:

Building a Multifunctional E-Commerce Platform:

- To create a system that makes it easier to buy, sell, and trade goods.
- To provide a seamless experience that allows users to manage their transactions successfully and efficiently, thereby eliminating the need for multiple platforms or unofficial channels.

Implementing Secure Session-Based Authentication:

- To ensure that user accounts are protected and unauthorized access is prevented by using session-based login processes.
- To grant role-based access to administrators and users while maintaining data security and privacy.

Building Role-Based Dashboards:

- To design unique dashboards for administrators and users that have the right controls and tools.
- Administrators are in charge of user accounts, product listings, and system notifications, while customers are in charge of their sales, purchases, exchange requests, and profile data.

Control and Monitor Features for Administration:

- To enable the ability to authorize exchange requests, authorize products, and observe all sales and exchange activity.
- To ensure the integrity of the marketplace by guaranteeing that everything on the platform is transparent and validated.

Consumer Products Management:

- To enable consumers to list items for sale/exchange along with all relevant information related to the product like the product name, description, category, price, condition, and pictures.
- To facilitate communication between buyers and sellers or exchangers to create a smooth transaction.

Integration of Payment Gateway with Cart System:

- To have a cart system that seamlessly allows customers to add additional items and check out.
- To include Cash on Delivery (COD) options and the SSLCOMMERZ online payment gateway to provide customers secure and flexible payment options.

Establishing a Framework for Notification:

- To provide a reliable way to notify customers and administrators of important alerts, exchange requests, updates, and approvals.
- To ensure users receive timely updates on all platform activity and to enhance communication.

Creating an Interface That Is User-Friendly and Responsive:

- To use Vue.js and Bootstrap to develop an interface that is responsive, visually appealing, and easy to use.
- To provide a smooth and engaging user experience that encourages consistent platform use.

Providing Security, Transparency, and Scalability:

- To maintain stringent security standards for all user data and transactions.
- To build a transparent, scalable, and reliable system that can be enhanced in the future with additional features, users, or system integration.

1.4 Methodology

Exchange Bazar was created through a systematic, modular, and iterative process that ensures all functional and non-functional requirements are handled efficiently. The project's selected methodology consists of the following essential phases:

1. Requirements analysis

- By carefully examining the existing e-commerce platforms, it was possible to pinpoint the flaws in conventional buying and selling platforms as well as the gaps in product exchange mechanisms.
- described the functional requirements, which include user registration, login, notifications, exchange requests, payment processing, role-based dashboards, cart management, and product listings.
- Requirements were collected for both administrator and consumer roles to ensure that the system satisfies the needs of all user types.
- outlined the non-functional requirements of the platform, including responsiveness, scalability, security, and usability.

2. System Design

- To efficiently manage users, products, orders, cart contents, exchange requests, and notifications, a relational database schema was constructed using MySQL.
- ER and data flow diagrams were developed to ensure data integrity and show the relationships between different entities.
- used Vue.js and Bootstrap to create UI/UX prototypes that prioritized an intuitive, responsive, and user-friendly interface.
- The navigation flow and role-based access control were designed to differentiate between admin and consumer functionalities in order to guarantee security and proper workflow.

3. Implementation

- **Development of Frontends:** The user interface was made with Vue.js, Bootstrap was used for responsive design, and Pinia was used for State management. made reusable components for dashboards, modals, forms, and product cards.

- **Development of the Backend:** The server-side application was made with Node.js and Express.js. A MySQL database was set up to handle data storage and retrieval. Session-based authentication and role-based access control were implemented for secure login. Cash on Delivery (COD) was set up as a fallback payment method, and the SSLCOMMERZ payment gateway was integrated for online payments.
- **Implementation of Modules:** Modules for user management, cart management, exchange requests, product management, and notification management were made. ensured that each module dealt securely with business logic of validation, error handling, and secure processing.

4. Testing

- To ensure that each module performs as intended, functional testing was conducted.
- Carried out UI testing to confirm the user interface's responsiveness, usability, and device accessibility.
- Integration testing was done to make sure the frontend, backend, database, and payment systems interacted properly.
- Verified security features that prevent unauthorized access and data breaches include input validation, access control, and session management.

5. Implementation

- Created the system with cloud deployment in mind, allowing the frontend and backend components to be hosted independently.
- Performance optimization, environment setup, and database connectivity were ensured for a smooth deployment.
- Produced documentation for planned maintenance, scalability enhancements, and upgrades.

1.5 Project Outcome

The successful completion of the Exchange Bazar project will result in a comprehensive, multifunctional e-commerce platform that seamlessly integrates buying, selling, and exchange features in a single system. The platform ensures a secure, transparent, and reliable trading environment for both administrators and users.

The project's primary outcomes are as follows:

- This fully operational e-commerce system facilitates product sales and purchases as well as exchange requests, cart management, secure online payment integration through SSLCOMMERZ, and Cash on Delivery (COD) as a fallback payment option.
- The platform functions efficiently because of a dedicated admin dashboard that lets administrators approve product listings, manage user accounts, send notifications, and monitor sales and exchange activity.
- A customer dashboard that allows users to post items for sale or exchange, make purchases, keep track of exchange requests, manage the contents of their carts, and

receive timely notifications, all while providing a seamless and engaging user experience.

- A secure, scalable, and reliable system that can accommodate future growth and feature additions while ensuring user privacy, data integrity, and buyer-seller confidence.
- The development team gained invaluable knowledge of real-world technologies such as Vue.js, Bootstrap, Node.js, MySQL, session-based authentication, and payment gateway integration, alongside practical hands-on experience that improved their problem-solving, system design, and project management skills.

1.6 Organization of the Report

This report contains six main chapters that will organize the research into different focuses of the Exchange Bazar project. This will provide a distinct and organized report regarding the completed work. The report will be organized as follows:

- Chapter 1: Introduction - Discusses the background to the project, the motivations for the project, the objectives, the research methodology, the expected outcomes and the structure of the report. It establishes the foundation upon which the Exchange Bazar platform's intent and significance can be understood.
- Chapter 2: Background - Provides an overview of the current e-commerce systems and similar web and mobile applications. It includes a literature review and identifies gaps in the current approaches and subsequently identifies the need for an overarching platform for buying, selling and exchanging in one place.
- Chapter 3: Research Methodology - Provides the research methodology for the project, this consisted of requirements analysis, system design (specifying both functional and non-functional requirements), data flow diagrams, UI design and project plan. It will shows the timeline from conceptualization through design and implementation of the system.
- Chapter 4: Implementation and Results - Provides the details of how the platform was created in technical terms such as environment setup, module creation, an online payment system, testing, evaluation of issues, and the terms of results and discussion on performance and effectiveness.
- Chapter 5: Engineering codes and design issues - Covers compliance with software, hardware, and communication codes, plus the consequences of the development of the project has had on society, environment and sustainability, project management, financial considerations, and engineering issues that had to be solved as the project was developed and implemented.

- Chapter 6; Conclusion - Outlines the overall success of the project and achievements made, the limitations encountered, and potential future work and improvements to the system.

This chapter way information structure provides outlines the report as a whole and a general understanding of the Exchange Bazar platform, conceptual design, implementation and evaluation, as well as, future work and improvements in regard to the project and Exchange Bazar platform.

Chapter 2

Background

The chapter provides the background information and context required to understand how Exchange Bazar: A Multi-Functional E-Commerce Platform for Buying, Selling, and Exchanging Goods, the proposed project, has developed. It explains the rationale behind this project, highlights the technologies and tools that make up the system, and highlights the importance of e-commerce platforms in the current digital marketplace. In order to illustrate the breadth, intent, and distinctiveness of the suggested system, it offers a history of online marketplaces and existing same-function platforms.

2.1 Introduction

The explosion of technology and internet access has changed the way people participate in trade, communicate, and accomplish daily activity. In an increasingly busy world, e-commerce platforms are a staple of modern society and provide the ability to more easily buy, sell, and trade products and services quickly and seamlessly. The appearance of online platforms, such as Daraz, Bikroy, and Amazon, facilitates the ability to conduct business by allowing products to be made available to users regardless of distance, offering convenience and easy accessibility, as well as a secure financial space for transactions. These platforms not only support e-commerce, but they are also reshaping traditional retail service delivery methods that reduce the need for physical space, which benefits existing retailers and allows small businesses to grow their market size without the need for expensive retail space.

Yet, despite the growth and success of many e-commerce platforms, many of the popular ones are essentially platforms for buying and selling products, and the companies do not have dedicated platforms for users who want to, for example, conduct an exchange and cannot include this option, provide a full integration of multiple features/functions cohesively in a single ecosystem. This is problematic for user groups that prefer exchanging items rather than outright purchasing or selling, especially for populations in regions where affordability and maximizing available resources is an important aspect of their livelihood. Moreover, several e-commerce platforms struggle to provide a valuable and complete solution that manages the user experience with an easy to use front-end and an advanced software application at the backend, as well as using distinct features to appeal to differing consumer needs.

The Exchange Bazar project has been formulated to alleviate the issues of lack of multi-functionality and lack of a reliable way for product exchanges by creating a platform that encompasses not only an avenue for buying and selling, but also an effective and relatively safe means to exchange products. This new model aims to enhance the user-experience and peer-to-peer interaction while creating an easier pathway for criticism, navigation and visibility for product exchange. The addition of features such as notifications, features under management by admin roles, and a responsive as well as an effective technology included into Exchange Bazar, will provide a more complete and inclusive e-commerce space.

This section is providing the background knowledge needed to understand the project's aims, objectives, importance, and relevance to future chapters. This section essentially sets the stage for the sections to follow and provides context to explain why this platform was developed and its impact on the experience and the benefits to e-commerce. You are developing an easy-to-use, trustworthy, and effective platform that will help fulfil current and future demands within the digital marketplace.

2.2 Literature Review

The literature review examines existing ecommerce and online marketplace applications to identify critical aspects of features, capabilities, benefits/or constraints that would assist in the design of Exchange Bazar. This was accomplished through exploration of a number of platforms including Daraz, Bikroy.com, Amazon, OLX and Facebook Marketplace to have a deep understanding of the functionalities, manner of user interactivity, and general performance of the system.

The author noted a number of things based on the literature review:

Daraz and Amazon had complete buy/sell functionalities, but did not include an integrated exchange system for used or second hand products. Comprehensive features and functionalities from wish lists, payment options and product recommendations are a few of the added benefits they provide users.

Bikroy.com and OLX, allow users to post second hand products while also providing exchanges, but they are often more challenging to use with unclear interfaces which often make communication difficult between buyer and seller.

Facebook marketplace, serves as a simple, buy/sell platform, but it does not have an exchange mechanism, or support of payment options with negotiations.

Local platforms generally do not include notification-based seller-communication, filtering of products based on multi-criteria search and an organized exchange based workflow.

The research comes to light and depicts the challenges of integrating both buy/sell, and exchange capabilities into one community applications, and as such helps to inform the final design of Exchange Bazar for ease of use as intellectually dependent multi-function capabilities for all users.

Table 2.1: Summary of Literature Reviewed (Project-specific)

Platform	Year	Key Features	Observed Limitations / Gaps
Daraz	2023	Buy/Sell, Wishlist, Multiple Payment Options, Product Recommendations	No integrated exchange system; lacks simplified seller-buyer notification for exchanges

Amazon	2023	Buy/Sell, Wishlist, Multiple Payment Options, Recommendations	No structured exchange system; complex interface for second-hand products
Bikroy.com	2023	Buy/Sell, Second-hand Product Posting	Limited interface; communication between buyers and sellers can be cumbersome; no payment integration
OLX	2023	Buy/Sell, Second-hand Product Posting	No structured exchange system; lacks notifications and organized transaction flow
Facebook Marketplace	2023	Buy/Sell	No structured exchange system; lacks payment integration; no product filtering or notification system
Exchange Bazar (Proposed System)	2025	Buy, Sell, Exchange; Notifications with Seller Info; Search & Filter; Multiple Payment Options; Product Details; Add to Cart	Some advanced features like Reviews, Wishlist, Chat, Recommendations not yet implemented

2.2.1 Similar Applications

The design of the Exchange Bazar platform has been based and informed by various similar platforms that have successfully shown e-commerce, user interaction, and product management. For instance, Daraz [1], one of the largest e-commerce platforms in South Asia, allows its users to shop for an extensive range of products, offers safe payment gateways, and runs promotional campaigns that set the standard for usability, scalability, and accessibility in digital markets. Bikroy.com [2] is a larger classified based platform headquartered in Dhaka, Bangladesh, specializing in second hand items; it's incredibly easy and user-friendly interface allows users to submit advertisements and find them to local buyers. It is an excellent example of accessibility in second-hand commerce in Bangladesh. Amazon [3], perhaps the largest e-commerce platform in the world, with advanced features such as artificially intelligent (AI) product recommendations, a multitude of customer reviews, and remarkable efficiency in logistics, creates the reliability and trust expect in online shopping . And lastly is OLX [4]; a well known peer-to-peer platform, while OLX is fully based local exchange, allowing users to communicate with buyers and sellers directly, without third-party without passing the same amount of value. Lastly, eBay [5], one of the original global online platforms, also combines auction and buy-it-now selling, which offers buyers and sellers more flexibility in how the exchange takes place.

In all, these platforms, each are showing both the strengths and limitations of online marketplaces. The offerings perform well in selection, payment security, and design, but most do not fully add a dedicated product exchange and entirely multi-functional features (including buy-sell-exchange) into a platform. This naturally places Exchange Bazar in a position to differentiate itself by filling in a substantial gap, offering users a unique and efficient space to buy, sell, and exchange products in a unified platform, especially addressing the demand for second-hand and sustainable product exchange.

2.3 Gap Analysis

In the investigation of typical online marketplaces such as Daraz, Bikroy.com, Amazon, OLX, and Facebook Marketplace, a number of gaps were identified, providing spaces for improvements and innovation. The majority of existing platforms simply offer buying and selling products, providing little to no mechanisms to carry out product exchange actions, where users want to swap items instead appealing to a purchase new one .

Another gap observed to be most common in existing online marketplaces is the interaction between buyers and sellers. Although it is good that platforms like OLX or Facebook Marketplace provide messaging options, those interactions often result in actions overwhelmed with cluttered submissions or continuous back and forth with regard to communication. Exchange Bazar tries to mitigate this by providing notifications offering a seller with buyer detail, and eliminating the need for a chat system altogether. Ideally, people can provides exchanges without the hassle of messaging features.

A few other features present in large marketplaces include wishlist creation, like/dislike buttons, customer reviews and recommendations, and quick view

options. However, features mentioned similarly feature on local market platforms like Bikroy.com are left to be desired in terms of competence or inefficient in usage. Gaps such as these present the need for a platform that utilizes buy, sell, and exchange functionality for people but with simple user features as needed by users.

Features	Dara z	Bikroy.co m	Amazo n	OL X	Facebook Marketplac e	Exchange Bazar (Proposed System)
Search option for products	Yes	Yes	Yes	Yes	Yes	✓ (Implemente d)
Detailed product descriptions	Yes	Yes	Yes	Yes	Yes	✓ (Implemente d)
Add to cart	Yes	No	Yes	No	No	✓ (Implemente d)
Multiple payment options	Yes	No	Yes	No	No	✓ (Implemente d)
Exchange system (Buy/Sell/Exchange)	No	Yes	No	Yes	Yes	✓ (Implemente d)
Notification with seller info (instead of chat)	No	No	No	No	No	✓ (Implemente d)
User registration & login	Yes	Yes	Yes	Yes	Yes	✓ (Implemente d)
Product posting for exchange	No	Yes	No	Yes	No	✓ (Implemente d)
Order confirmation & tracking (basic)	Yes	No	Yes	No	No	✓ (Implemente d)

Table 2.2: Gap analysis

2.4 Summary

This section evaluated current online marketplaces Daraz, Bikroy.com, Amazon, OLX, and Facebook Marketplace to understand their features and limitations. A comparative study evaluated the advantages and disadvantages of current marketplaces in relation to the means of exchanging products, the means of sending and receiving messages between sellers and buyers, and the means of utilizing the features offered by each platform will a more robust success.

The gap analysis indicated that most of the platforms are missing an exchange system or make communication between buyers and sellers excessively complicated. Other features like wishlist, likes/dislikes, customer reviews, and product recommendations are absent or completely or partially non-functioning on the local marketplace sites as well.

Given these observations Exchange Bazar as a solution will fill the gaps described above through a multifunctional system that allows users to buy, sell and exchange products, provides notification-based communication, and sophisticated layers of usability for functioning on the platform. Thus, users interact with the platform easily, conduct transactions easily, and maintain a more structured and simplified experience as compared to any of the other systems.

In summary, this section identified the need and reason for the development of Exchange Bazar as a solution to the current online marketplaces.

Chapter 3

Research Methodology

Chapter 3 outlines the research methodology used to create the Exchange Bazar platform, with a focus on requirement analysis, system design, specifications, and interface planning to ensure a methodical and efficient project execution.

3.1 Requirement Analysis & Design Specification

The first step in developing the Exchange Bazar platform is the Requirement Analysis & Design Specification stage. This stage is a necessary process for collecting, evaluating, and documenting user requirements from both end-user stakeholders to identify user requirements and ensure that the system meets its expected goals. The requirement analysis and design specification stage outlines what the system needs to do, how it needs to do it, and how the system will be structured (i.e., a roadmap for the entire development process).

In the requirement analysis portion, we can identify the high-level features that will be included in the Exchange Bazar platform such as; listing products, buying, selling, exchanging functionality, and managing user accounts. In addition, requirements also recognize expected performance levels, security, and usability characteristics. A careful analysis of existing e-commerce systems, research, and simple observations of other e-commerce requirements has helped us to define the Exchange Bazar platform requirements to meet the user requirements efficiently.

The design specification builds upon the requirements as outlined previously, and maps these out in a specific manner that shows the technical design with; system architecture, database design, data flowcharts, and what interfaces may look like. Design specification describes the workflow between the different modules, how the users will interact with the Exchange Bazar platform, and how and where the data will be processed and stored. This approach helps minimize errors, supports more effective coding, and more importantly makes it easier and much more efficient to make changes in the future for growth or/or enhancements.

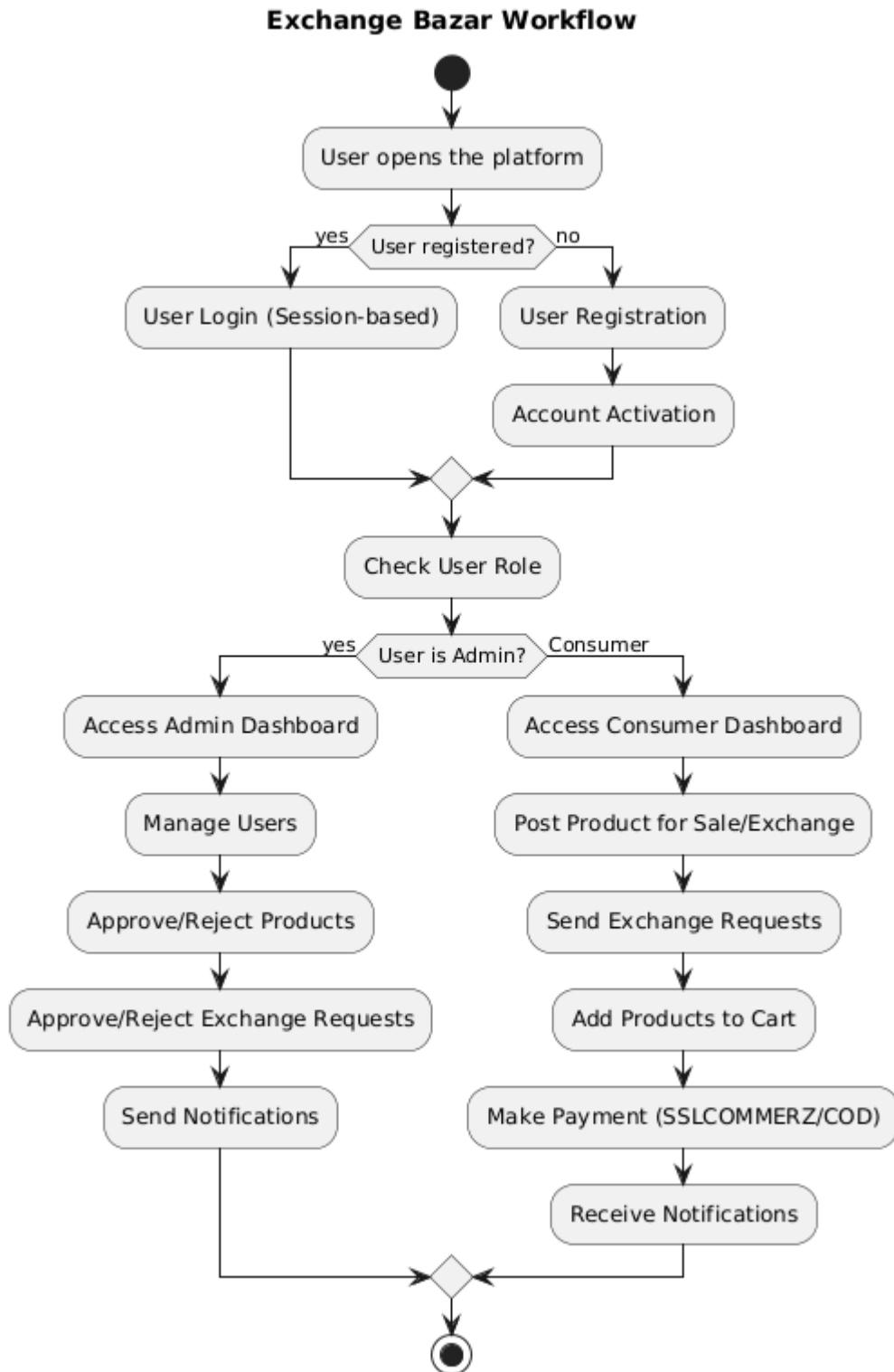


Figure 3.1 Workflow of Exchange Bazar

3.1.1 Overview

The Requirement Analysis & Design Specification phase is essential to successfully develop the Exchange Bazar platform. It forms the basis for determining users' true needs, the system requirements, and a definitive structure for knowing how the platform

will function. It addresses the gap between user needs and the technical implementation, ensuring that the final mode of implementation of the system is completed as planned from the beginning of the project as project goals.

In this phase the requirements were gathered by conducting research, observing existing e-commerce platforms, and examining user interactions. Both the functional requirements (shared site functionality such as posting products, buying, selling, and exchange) and the non-functional requirements (performance, security, scalability, etc.) of the context were included.

Next, the design specification was developed. It included architectural decisions, database schema design, layouts of user interface screens, user workflow, and system workflows. Furthermore, this stage also defines how various platform components interact with each other to provide the user with a holistic experience of the platform that is functional and intuitive.

This phase is critical, and a thorough review of analysis and design specifications lays appropriate groundwork and creates opportunities for successful implementation that reduces development risk, and allows a structured and best effort manner to build the system.

3.1.2 System Design

The System Design phase concentrates upon taking the collected requirements and creating a comprehensive and detailed plan of the entire application. This will give detail to the system architecture at a high level, along with the modules, user interface specification, data structure, and the connection of the system components. This process properly maps out each requirement along with its appropriate development, testing, and deployment.

Our suggested system is a Multi-Functional E-Commerce Platform that allows products to be bought, sold, and exchanged, with different modules based on who the user is, whether it is a user, seller, or administrator. The design should provide for modularity, scalability, and usability, so the platform can effectively handle a growing data set and increased user traffic over time.

A sequence diagram is a means to visually exhibit the order of operations between various components or actors throughout a system, over a period of time. For example, in an e-commerce marketplace like Exchange Bazar, you would utilize a sequence diagram to illustrate how the User, Frontend, Backend and Database work together throughout the order process for a product.

When the user clicks the Buy button, the frontend collects the order details (product, quantity, delivery address, etc.) and sends it to the backend. The backend gets the request, and first checks to see if the user is authenticated. Next it checks the amount of product in stock in the database. The database returns the in-stock details to the backend; the backend then creates the order and saves it to the database as an order. Once the information is saved, and successful, the backend sends a successful response back to the frontend. Finally, the frontend would display an Order Successful message to the user with the order details.

This sequence diagram is not only helpful to the developer, but it helps to show the logical or sequential order of events to any stakeholders or non-technical contributors involved

in the ecommerce project. It is a great means to see the system as a whole, show potential issues, and improve the overall design and communication between all the components of your application.

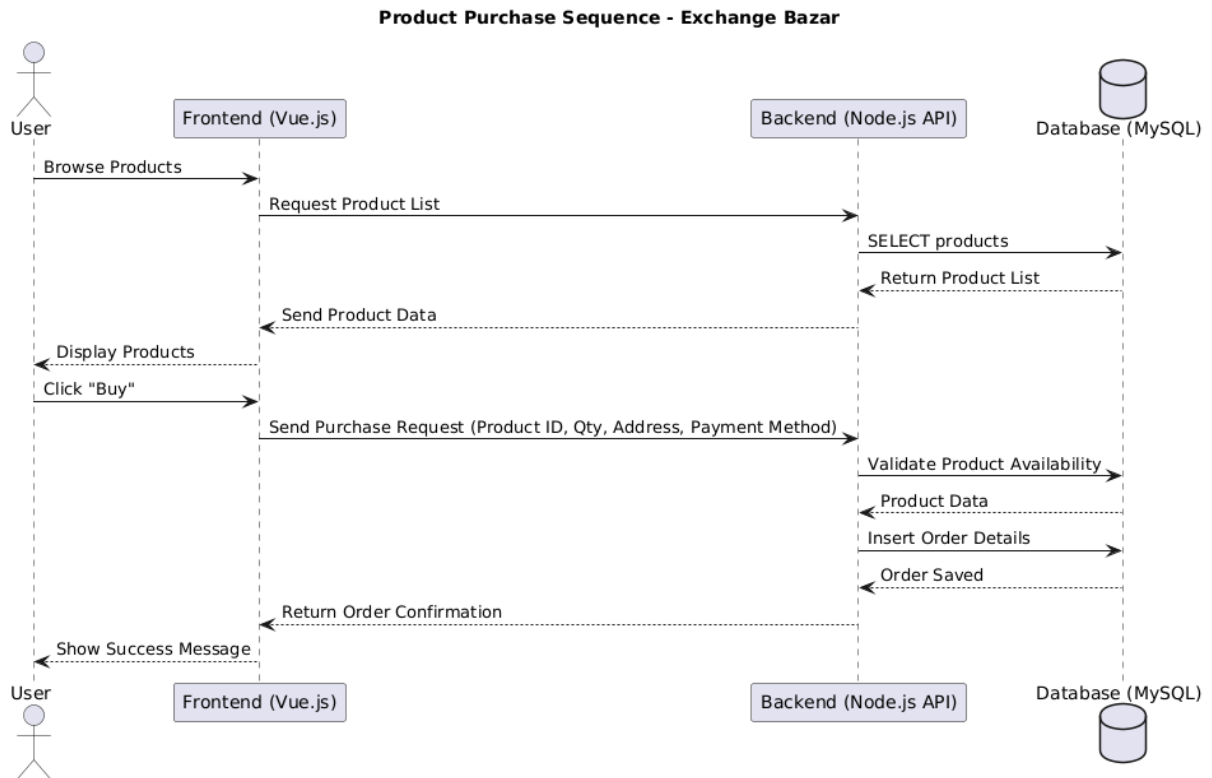


Figure 3.2: sequence diagram of exchange Bazar

3.1.3 Functional and Nonfunctional Requirements

Functional Requirements:

- Users can register and log in securely, so their personal information and contact information and account credentials are not accessible to anyone else.
- Users can search for and filter through a large selection of new products and second-hand treasures. Users should be able to filter, search, and sort the products by category, price, or popularity.
- Users can view detailed product information including but not limited to, images of the product, descriptions, price, availability, and seller's information.
- Users can purchase the product through a user-friendly modal which allows users to specify quantity, the delivery address, and select from payment options (such as cash on delivery or online payment).
- Users can post products to exchange by uploading images of the product, inputting details about the product, and setting any conditions for exchange.
- Users can send exchange requests to other users and can track exchange requests.
- Users will receive notifications of exchange requests being accepted or declined in an appropriate time period, users will also receive contact information and directions for successful exchanges.
- Admin can monitor overall exchanges, delete users, approve or deny exchanges, and monitor the overall usability of the system.
- System creates the order, checks stock, and notifies product availability in real-time.
- After a successful transaction, the platform gives users clear confirmation messages and order receipts, guaranteeing openness and record-keeping.

Non-functional Requirements:

- The system should function fast and responsive so that even with many users at once loading times are minimized.
- User credentials, payment information, and private information should be stored and transported securely to not be compromised by implementing encryption techniques as well as good authentication techniques to verify the user.
- The interface should be visually pleasing, intuitive, and responsive to the user due to the variety of applications available per device with desktops, tablets, and mobile phones.
- The system should be "easily maintained", it should be easy for the developers to update to add functional capabilities or bug fixes that do not interfere with anything that already exists.

- Reliability and availability are especially critical because we want this platform to have minimal downtime and be able to recover systems fast when one has failed.
- Notifications, alerts, and error messages should be accurate, clear, and meaningful to improve the user experience and not confuse the users by providing notifications that are unclear.
- The design should take scalability into consideration so adding users, products, and transactions does not degrade the organizations performance.
- The system should provide data consistency across all modules of data pertaining to orders, exchanges, and user information so that the data remains valid and uncorrupted.
- The system should conform to accessibility standards so that users with disabilities can effectively use the platform.

3.1.4 Data Flow Diagram

The Data Flow Diagram (DFD) shows, in a graphical manner, how data flows through the Exchange Bazar system, including Exchange Bazar Users, Administrators, and System components. It illustrates how data is entered into the system, updated and reviewed within the system, and stored after receiving the data. The DFD clarifies the major system modules, which include (but certainly not limited to), users registering and logging into the application, browsing new and second-hand products, posting items for exchange, sending and accepting exchange requests, purchasing products advertised on the system, and administrative management. The previous section outlined how users can search for products and categories, initiate the purchase or exchange of an item, receive notifications of product updates, while sellers manage their products and exchange offers within their account. The DFD illustrates how administrators oversee all users, their activities, products, exchanges, and the operation of the system as a whole. The DFD uses data flows to provide a complete picture of how information flows through the system to help guide the development of an effective system design and system implementation.

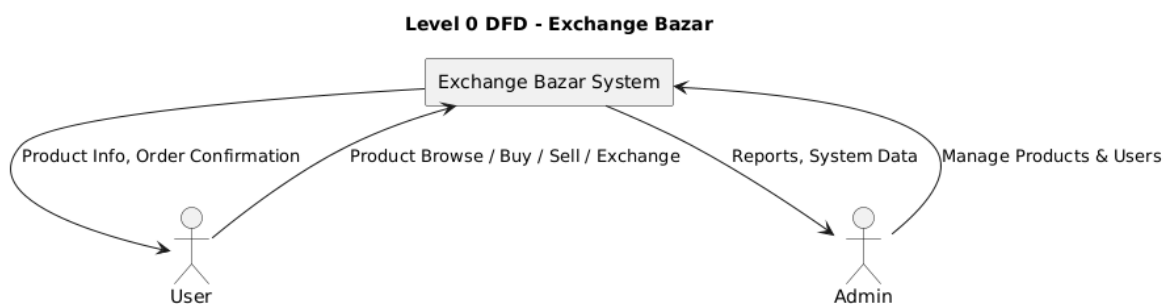


Figure 3.3: Level 0 DFD of exchange Bazar

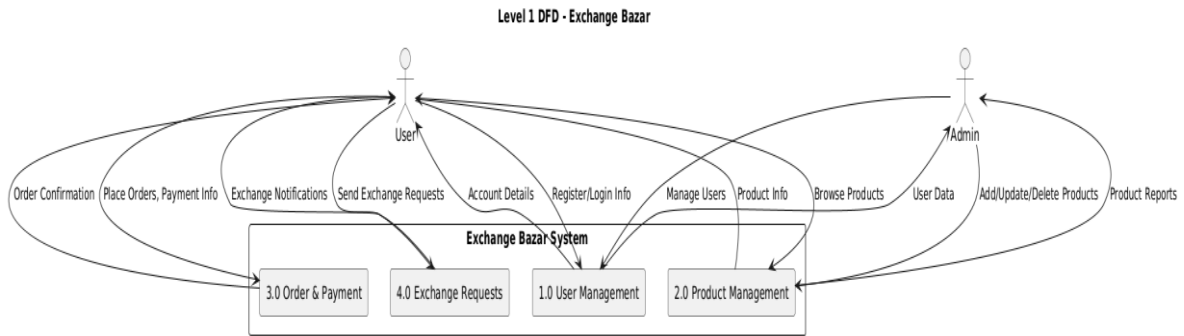


Figure 3.4: Level 1 DFD of exchange Bazar

The class diagram of Exchange Bazar describes the important classes, their attributes, and how they relate to each other in the system. Key classes include User, Product, ExchangeProduct, Order, Cart, ExchangeRequest, and Admin. The User class has attributes such as the name, email, password, address, and profile photo and is related to orders, exchange requests, and products that are posted. The Product class has attributes that contain names, descriptions, price, stock, and images, as well as user responsibility for posting or buying the products. The ExchangeProduct class has attributes that include the condition, description, images, and attached images, and is tied to exchange requests and users who exchange products. The Order class has a responsibility for details about purchase (quantity, total price, payment, and status). The Cart class, similar to the user class holding products that have been selected, is a temporary holding container for users. The ExchangeRequest class is a class to handle the request processing, with attributes for request status and information about the requester and responder. The Admin class is designated for oversight of users, products, exchanged items, and transaction aspects. This class diagram conceptually helps the developer understand the overall structure of the system, how they relate to the system as a whole, and how data traverses through multiple components of the platform.

Exchange Bazar - Class Diagram

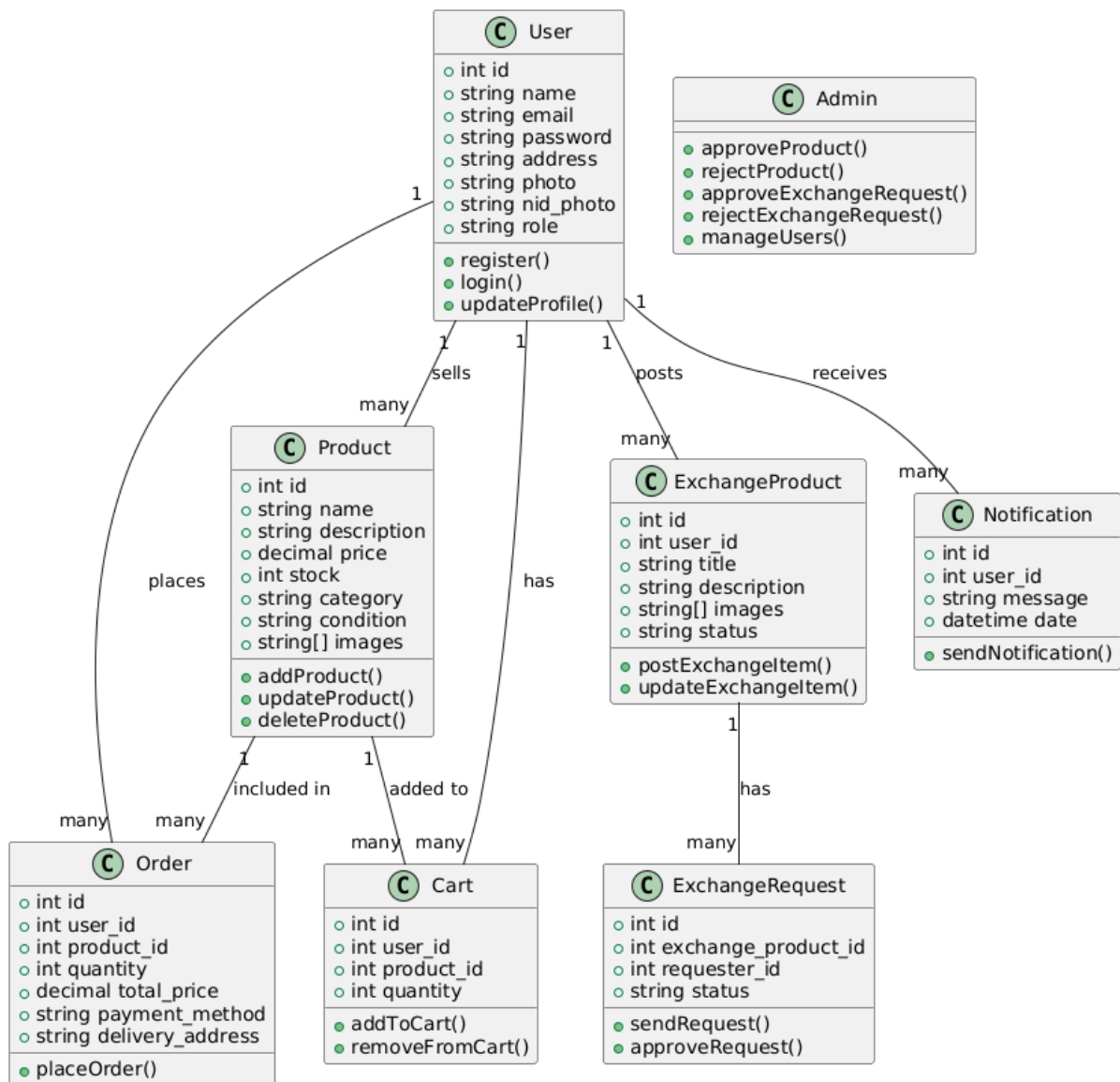


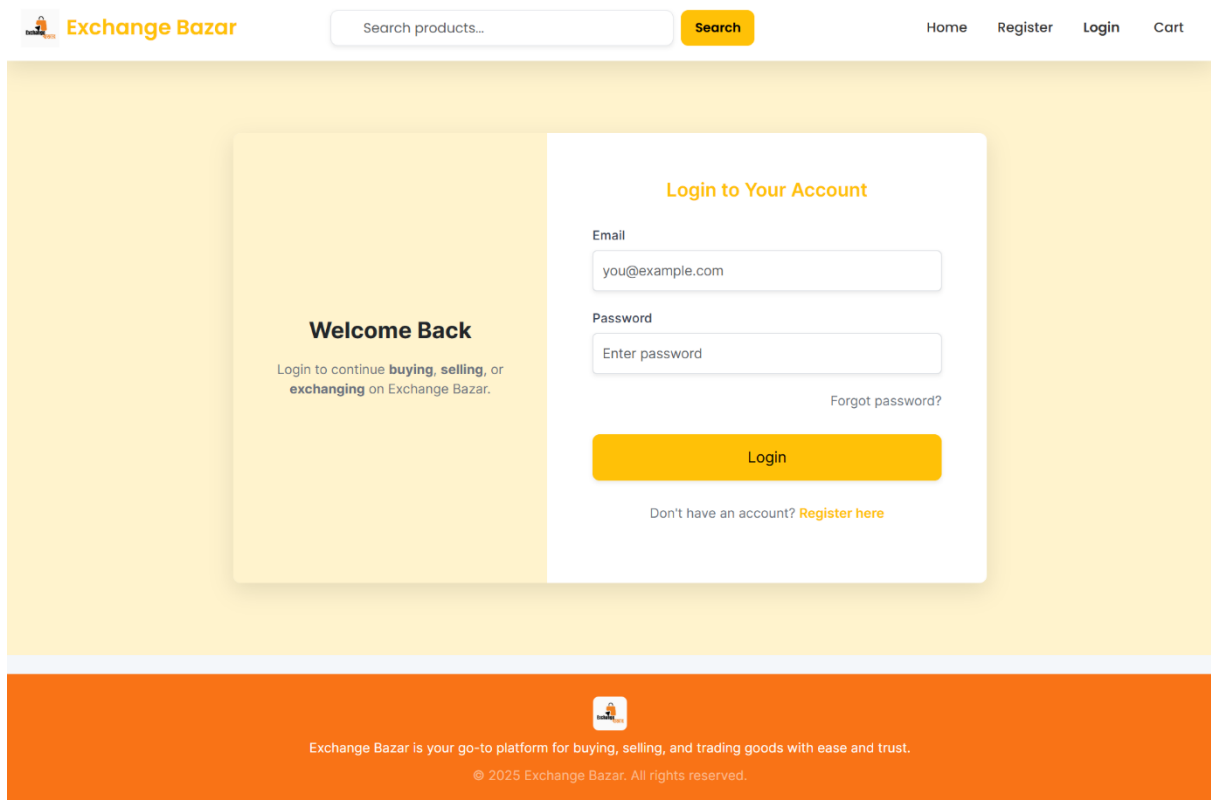
Figure 3.5: class diagram of exchange Bazar

3.1.5 UI Design

Buyers, sellers, and administrators can all navigate the Exchange Bazar platform with ease thanks to its user interface (UI), which is made to be clear, responsive, and easy to use. Using Tailwind CSS and Bootstrap 5, the design takes a contemporary and minimalist approach to ensure uniform styling throughout the platform. Now I showing all UI below :

Log in page :

That page there consumer and admin can also log in on one interface.



The image shows the login page of the Exchange Bazar website. At the top, there is a navigation bar with the Exchange Bazar logo on the left, a search bar with the placeholder text "Search products..." and a yellow "Search" button, and navigation links for "Home", "Register", "Login", and "Cart" on the right. The main content area has a light yellow background. On the left, a white box contains the text "Welcome Back" and "Login to continue buying, selling, or exchanging on Exchange Bazar." On the right, another white box titled "Login to Your Account" contains a form with fields for "Email" (with the placeholder "you@example.com") and "Password" (with the placeholder "Enter password"). Below the password field is a link for "Forgot password?". A yellow "Login" button is positioned below the form. At the bottom of the login box, there is a link: "Don't have an account? [Register here](#)". The footer is an orange bar with the Exchange Bazar logo, the text "Exchange Bazar is your go-to platform for buying, selling, and trading goods with ease and trust.", and the copyright notice "© 2025 Exchange Bazar. All rights reserved."

Figure 3.6 : log in page

Registration page : There all consumer can create there new account here. There consumer must be giver there all information them without given information

their account not active.

Figure 3.7 : registration page

Homepage : There 4 part first part to given button they can create an account after that there 2nd part is new item can purchases 3rd part is there can exchange product showing 4th part is there second hand product show there.

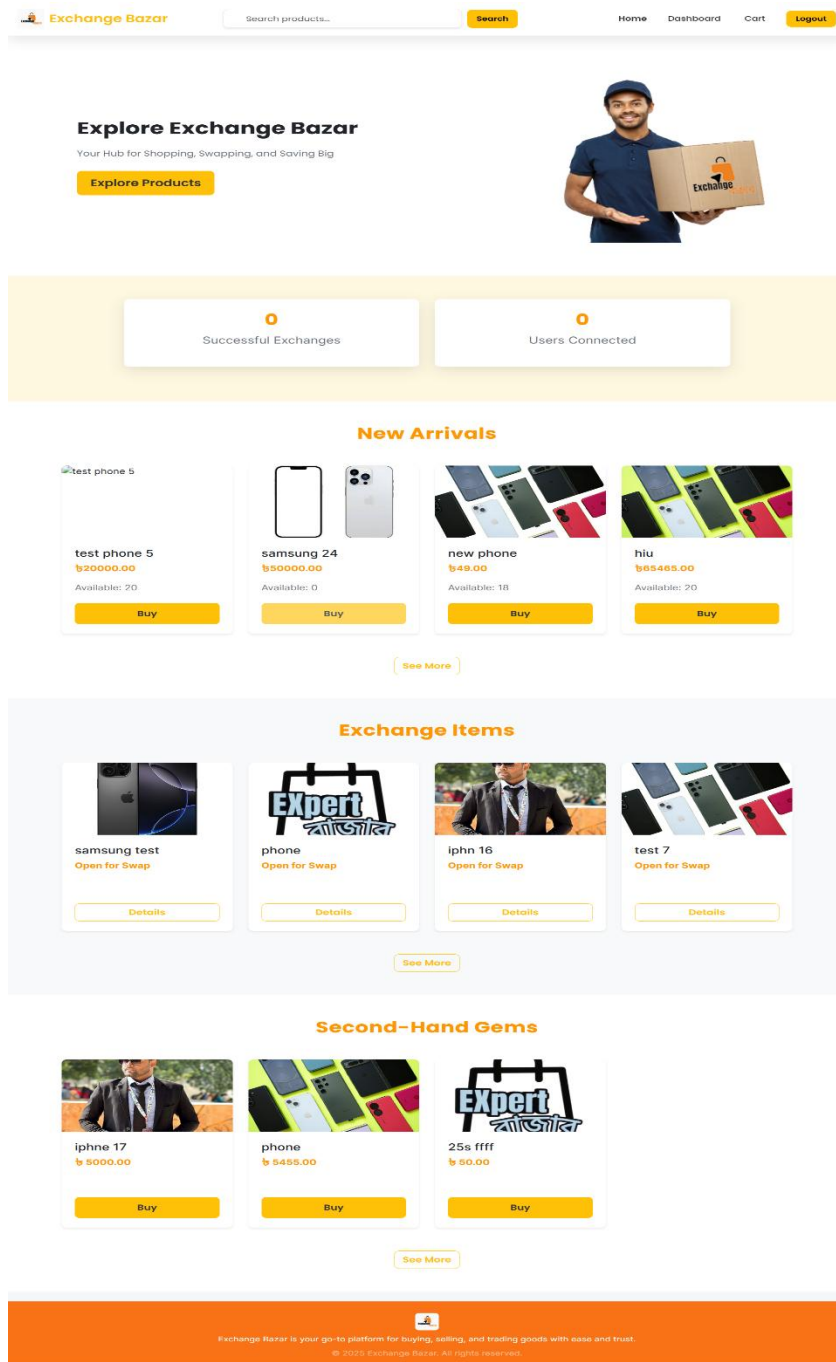


Figure 3.8 : homepage

Consumer Dashboard:

profile : There consumer information given there and also can they edit there profile.

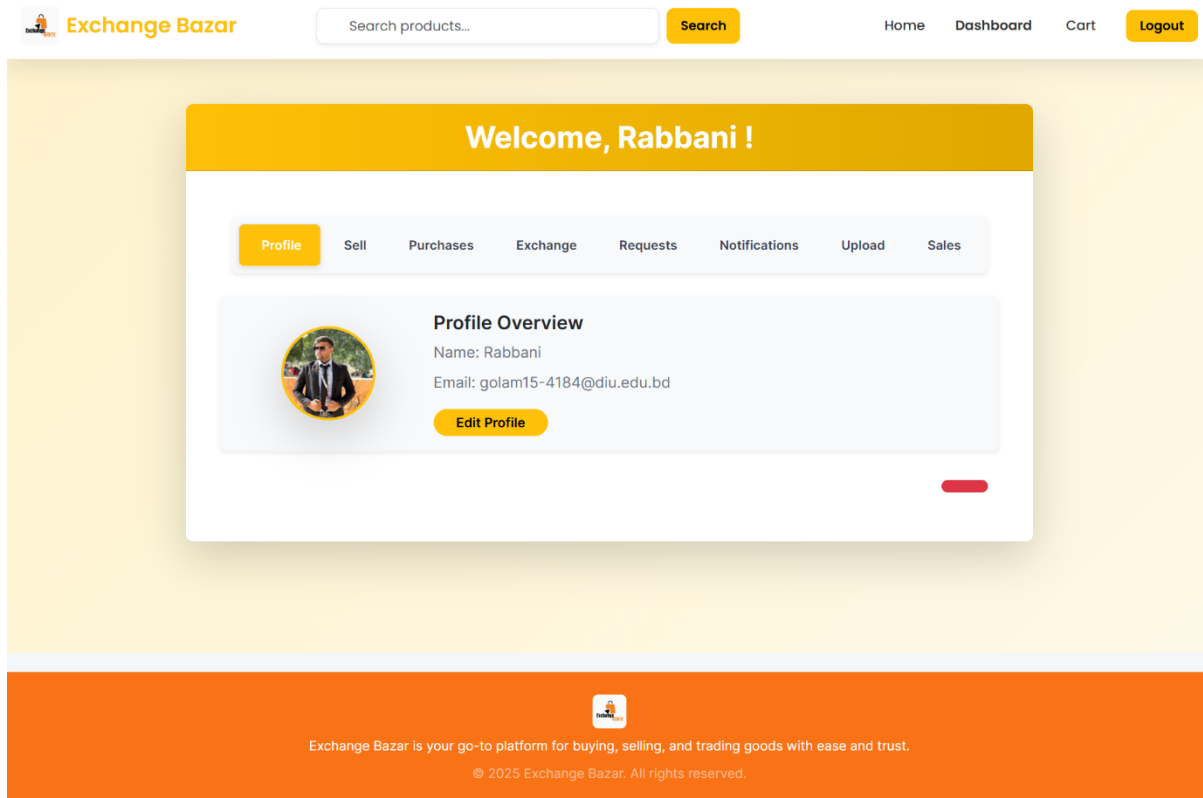


Figure 3.9 : Profile

Sell: There consumer can post there selling product request and wait for accept the post request.


Exchange Bazar

[Home](#)
[Dashboard](#)
[Cart](#)

Welcome, Rabbani !

[Profile](#)

[Purchases](#)
[Exchange](#)
[Requests](#)
[Notifications](#)
[Upload](#)
[Sales](#)

Post a Product for Sale

Product Name

Description

Price

Quantity

Category

Condition

Product Images (Max: 5)

You can upload up to 5 images.

My Sale Posts

Product	Price	Quantity	Category	Condition	Status	Approval	Actions
phone	₹5455.00	20	home	used	available	approved	Edit Delete
new phone	₹49.00	18	electronics	new	available	approved	Edit Delete
test phone 5	₹20000.00	20	electronics	new	available	approved	Edit Delete



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Figure 3.10 : sell post page

Purchases: There consumer see there what they order on this site and see and they also can cancel there order.

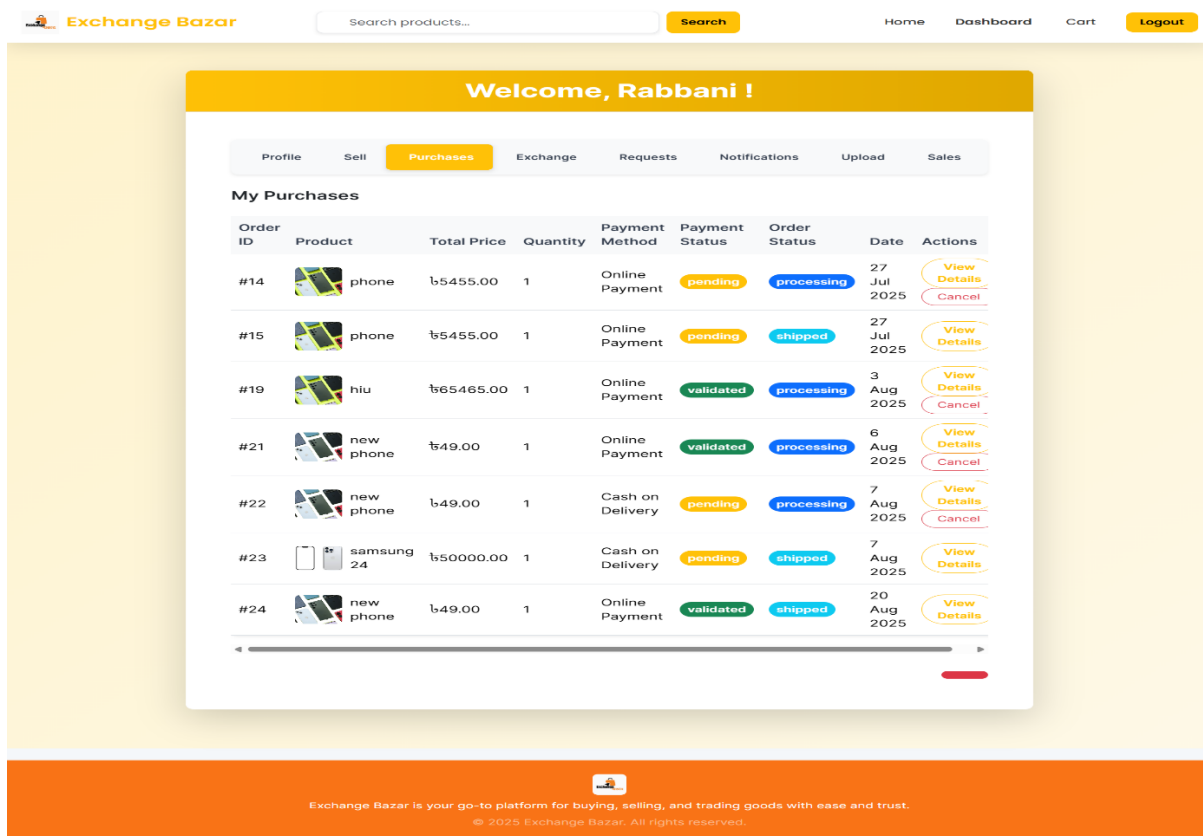


Figure 3.11 : purchases page

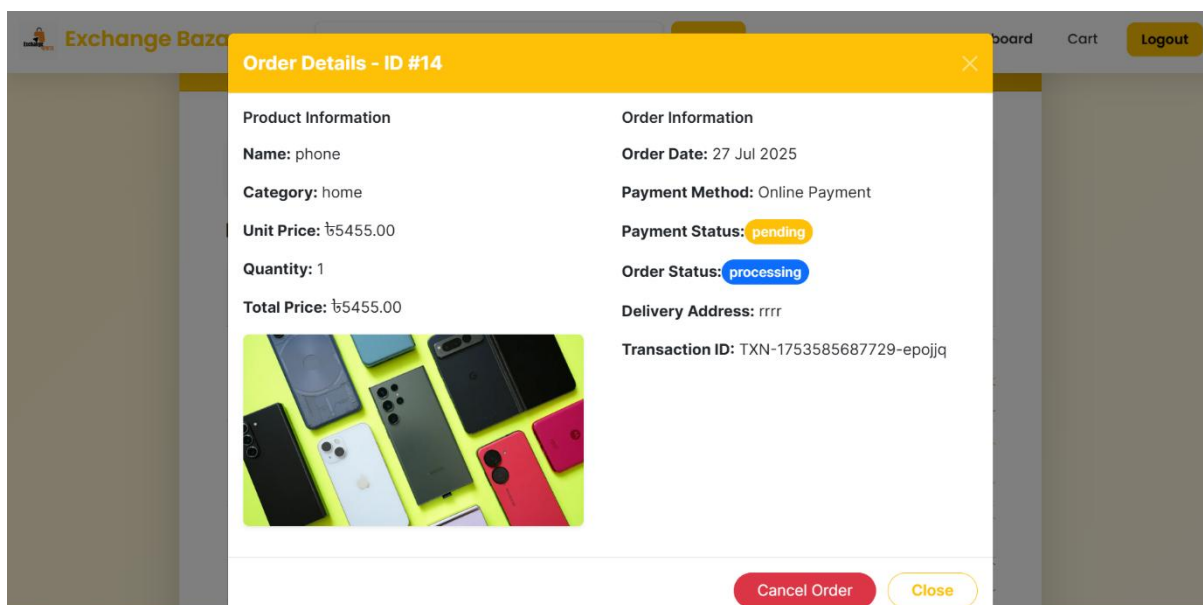


Figure 3.12: cancel order

Exchange : There showing what I post on for exchange and there to get show there to consumer can accept given request.

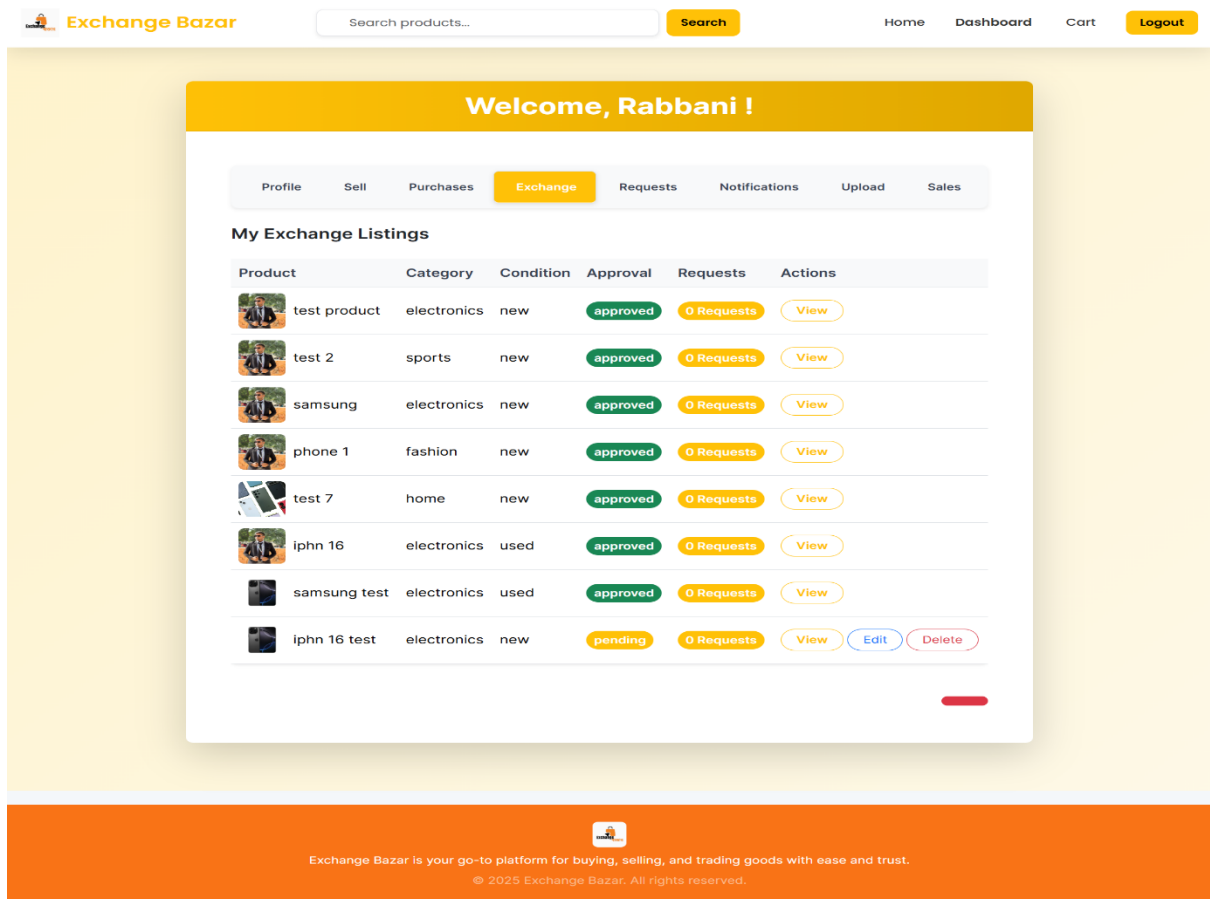


Figure 3.13 : Exchange tab

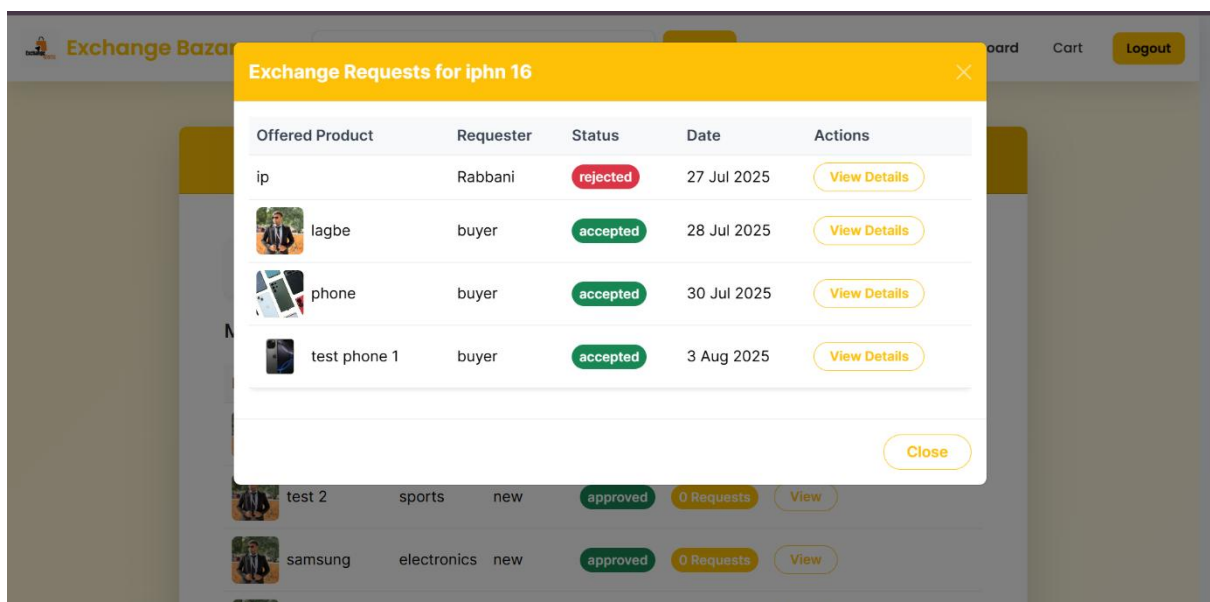


Figure 3.14 : exchange request

Requests : There showing my exchange requests sent and showing which processes on those time. There also consumer can see details.

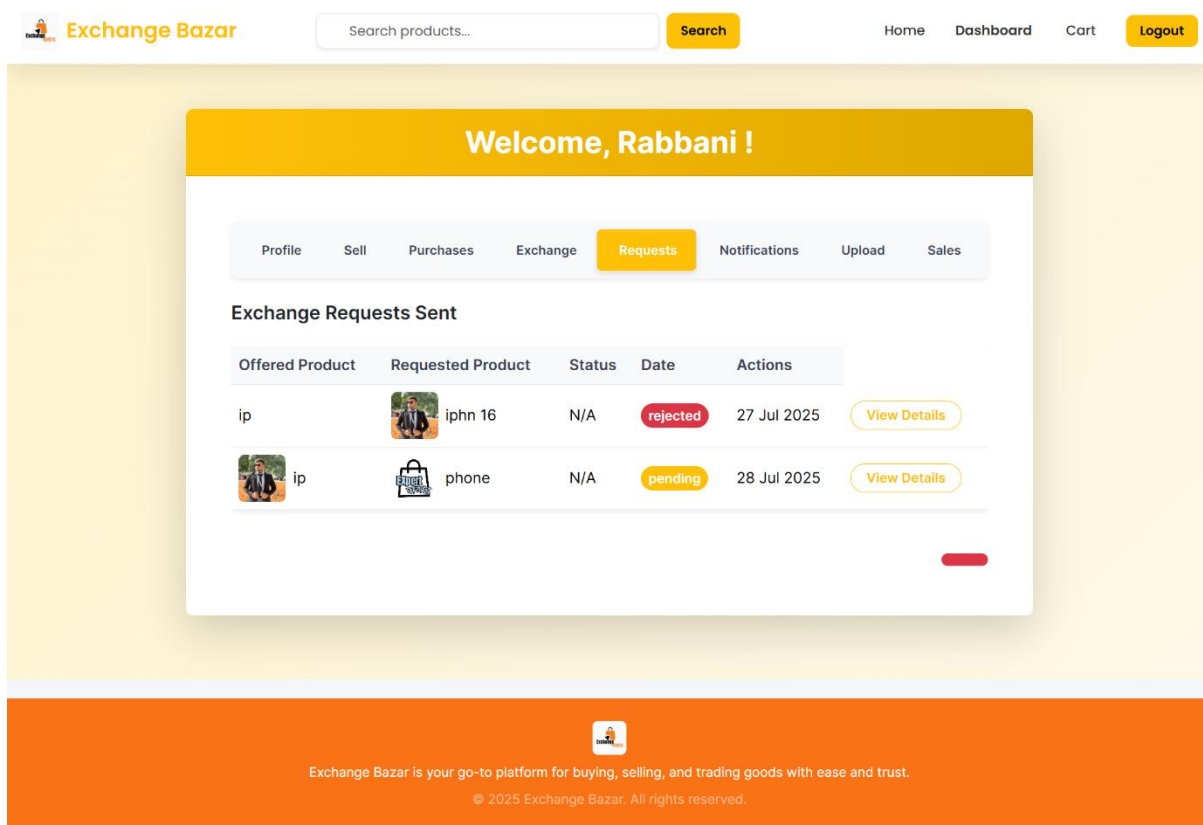


Figure 3.15: Requests tab

Notifications : There admin notification can show and after accept exchange request there showing there details also.

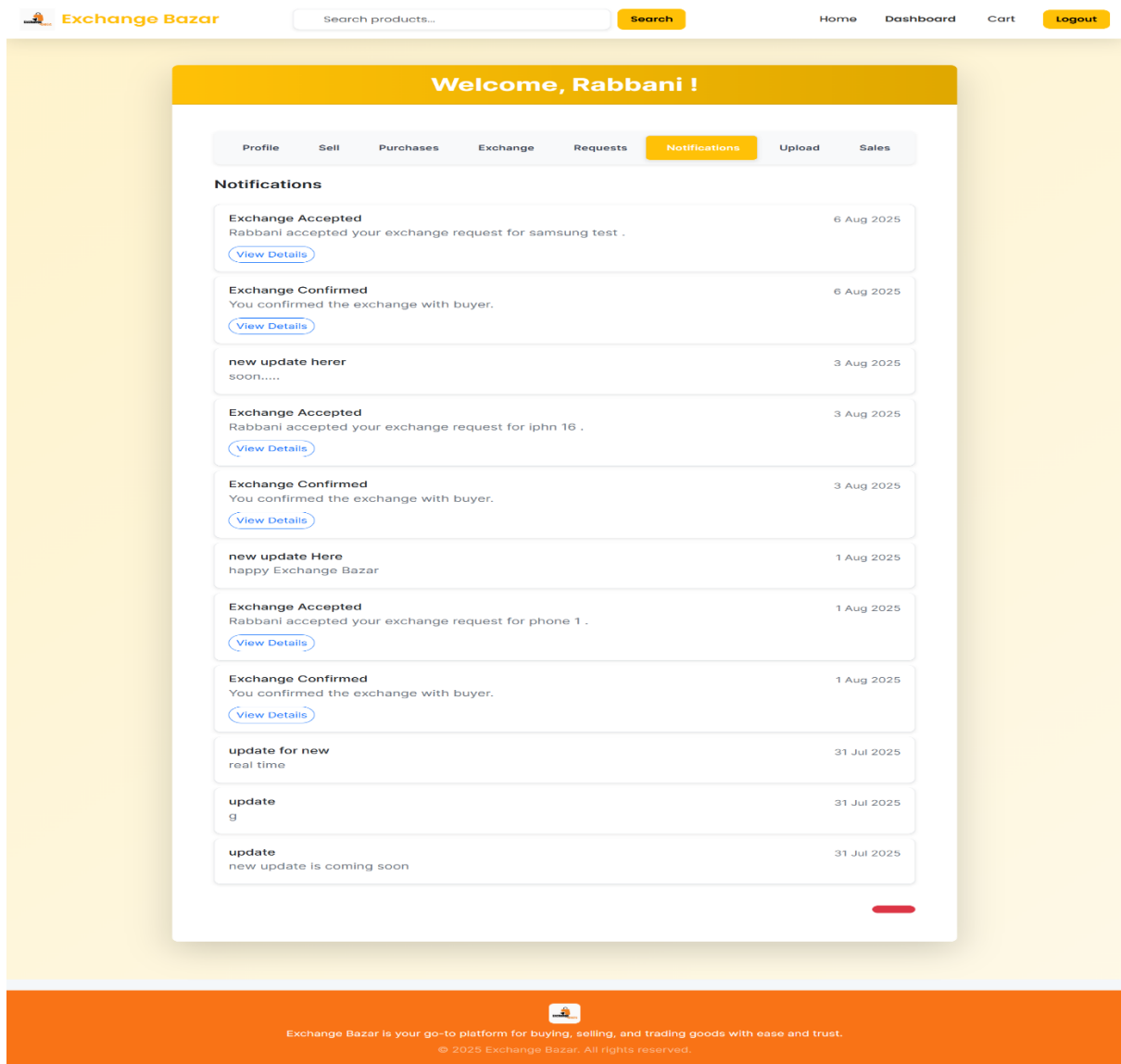


Figure 3.16: Notification

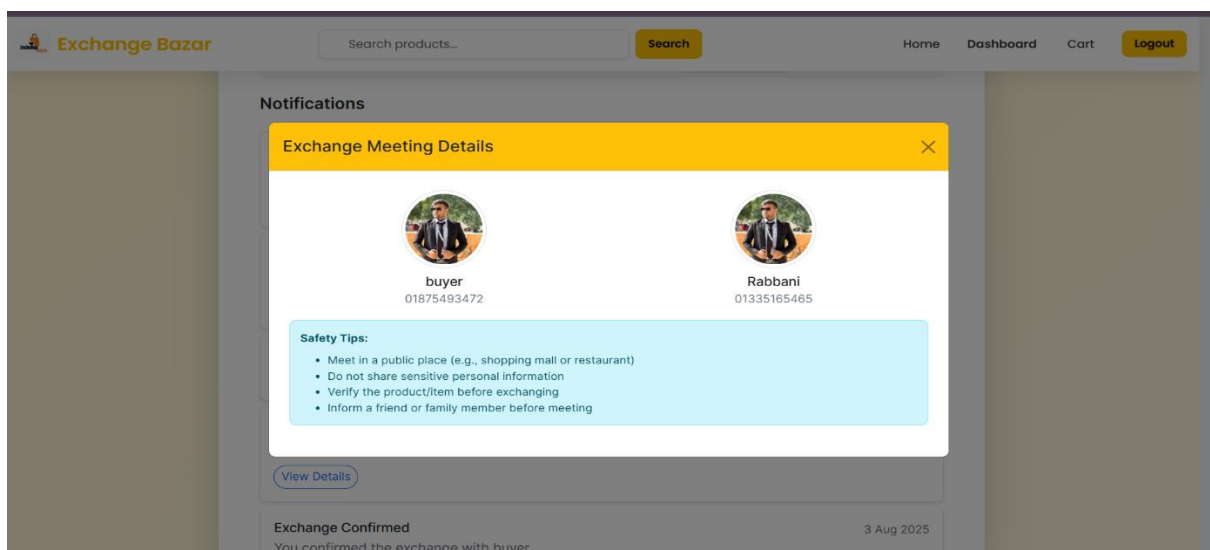


Figure 3.17 : sharing Information and guidelines

Upload : There upload there for exchange post and there can detected or edit when not the admin cant accept the exchange post.


Exchange Bazar

Search

[Home](#)
[Dashboard](#)
[Cart](#)
Logout

Welcome, Rabbani !

[Profile](#)
[Sell](#)
[Purchases](#)
[Exchange](#)
[Requests](#)
[Notifications](#)
Upload
[Sales](#)

Upload Product for Exchange

Product Name

Description

Category

Condition

Product Images

Choose Files
No file chosen

Post for Exchange

My Exchange Posts

Product Name	Category	Condition	Approval	Actions
test product	electronics	new	approved	View Edit Delete
test 2	sports	new	approved	View Edit Delete
samsung	electronics	new	approved	View Edit Delete
phone 1	fashion	new	approved	View Edit Delete
test 7	home	new	approved	View Edit Delete
iphn 16	electronics	used	approved	View Edit Delete
samsung test	electronics	used	approved	View Edit Delete
iphn 16 test	electronics	new	pending	View Edit Delete



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Figure 3.18 : upload tab

Edit Exchange Product - ID 19

Product Name
iphn 16 test

Description
i exchange with samsung phone

Category
Electronics

Condition
New

Product Images
Choose Files No file chosen

Current Photos:
[Phone 1] [Phone 2] [Phone 3] [Phone 4]

[Save Changes](#) [Cancel](#)

Figure 3.19 : Edit exchange post

Sales : There showing the consumer post product selling information and there given full information of buyer and there can consumer can update the product status.

Welcome, Rabbani !

Profile Sell Purchases Exchange Requests Notifications Upload **Sales**

My Sales

Order ID	Product	Buyer	Total Price	Quantity	Payment Method	Payment Status	Order Status	Date
#14	phone	Rabbani golam15-4184@diu.edu.bd babar raod , Dhaka-1207	৳5455.00	1	Online Payment	pending	processing	27 Jul 2020
#15	phone	Rabbani golam15-4184@diu.edu.bd babar raod , Dhaka-1207	৳5455.00	1	Online Payment	pending	shipped	27 Jul 2020
#20	new phone	buyer buy@gmail.com babar road	৳49.00	1	Cash on Delivery	pending	delivered	3 Aug 2020
#21	new phone	Rabbani golam15-4184@diu.edu.bd babar raod , Dhaka-1207	৳49.00	1	Online Payment	validated	processing	6 Aug 2020
#22	new phone	Rabbani golam15-4184@diu.edu.bd babar raod , Dhaka-1207	৳49.00	1	Cash on Delivery	pending	processing	7 Aug 2020
#24	new phone	Rabbani golam15-4184@diu.edu.bd babar raod , Dhaka-1207	৳49.00	1	Online Payment	validated	shipped	20 Aug 2020

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Figure 3.20 : Sales tab

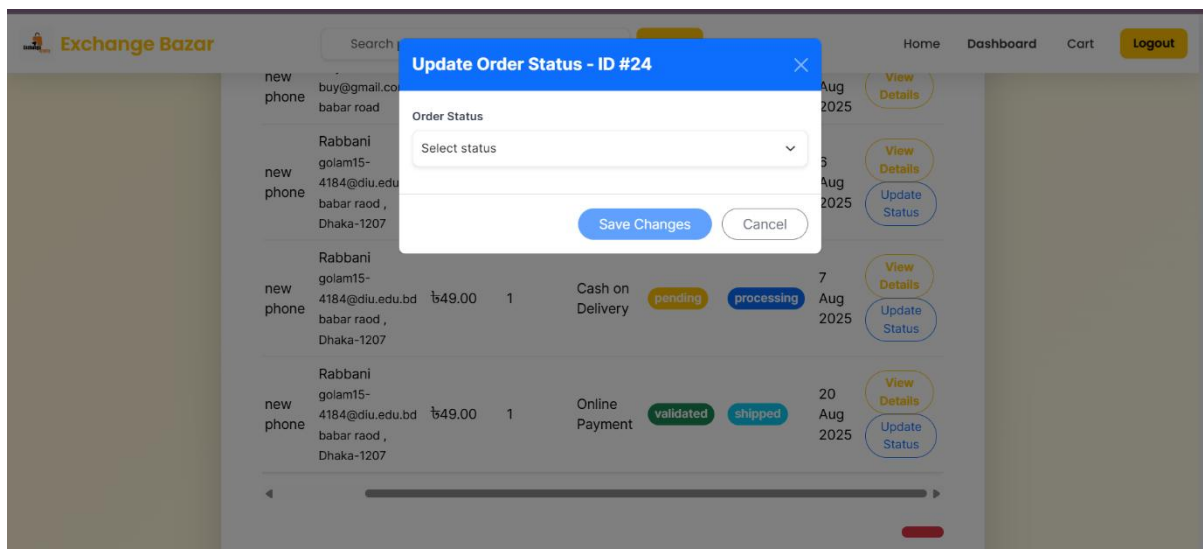


Figure 3.21 :Update order status

Buying Page : There product buying there open the modal and that modal can given information and there two method to payment first cash on delivery and other online payment there online payment have sslcommerz there can internationally card to payment other mobile banking to can payment.

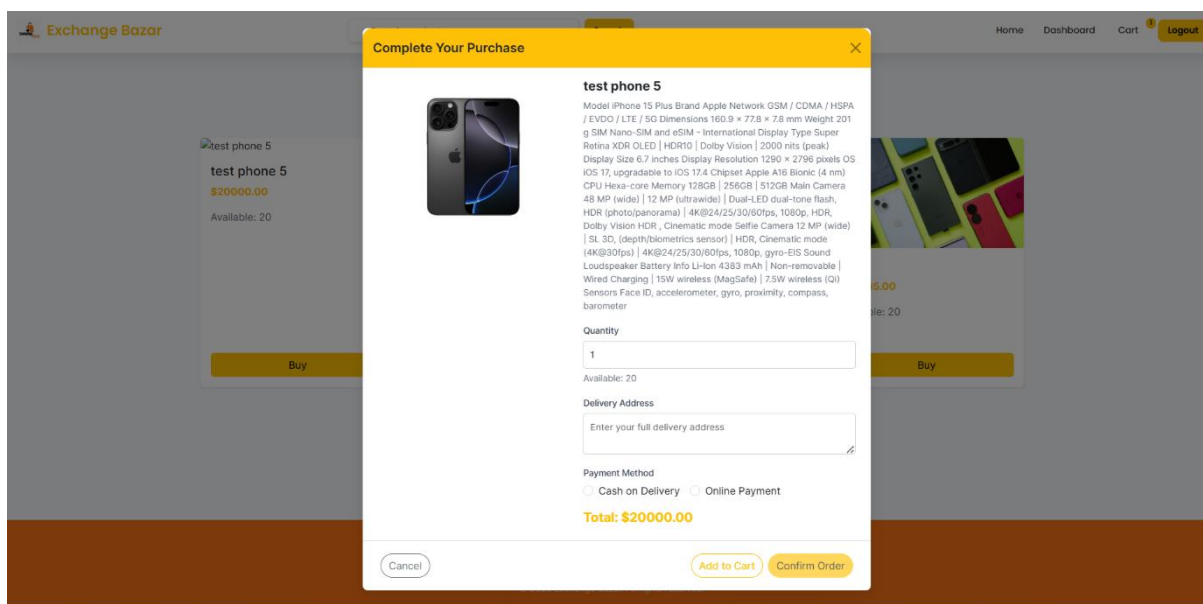


Figure 3.22 : Buying page

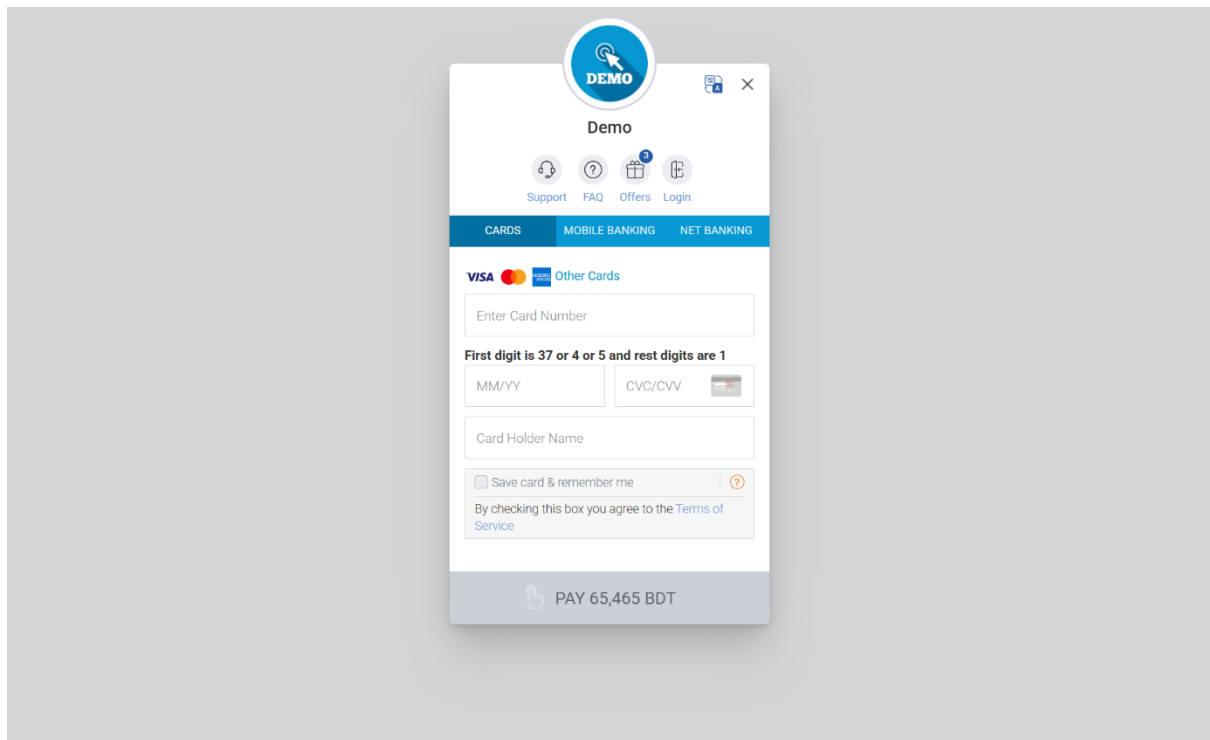


Figure 3.23 : sslcommerz page

OTP Page

Do not press browser back or forward button while you are in payment page

Payment Summary	
Please review the following detail for this transaction:	
Amount:	65465.00
Invoice number:	250904333230qOTLHgXVz0F1I
Description:	Products

Enter Card Information	
OTP: Success Failed	Your entered card information could not be corrupted or become known to the third party, as all transmitted data is encrypted by the SSL protocol. Note 1. For VISA and MC, look at the back side of your Card to find 3-digit CVV2/ CVC2. For AMEX, look at the upper right corner of the front side of your Card to find 4-digit CSC. 2. The cardholder's name should be entered just as it's written on the card.

SSLCOMMERZ TESTBOX GATEWAY (NO CARD INFORMATION WILL BE SAVED AND DUMMY)

Figure 3.24 : sslcommerz otp page

Exchange Request page : There to page to can upload there product photo and there disceptation to sharing there information.

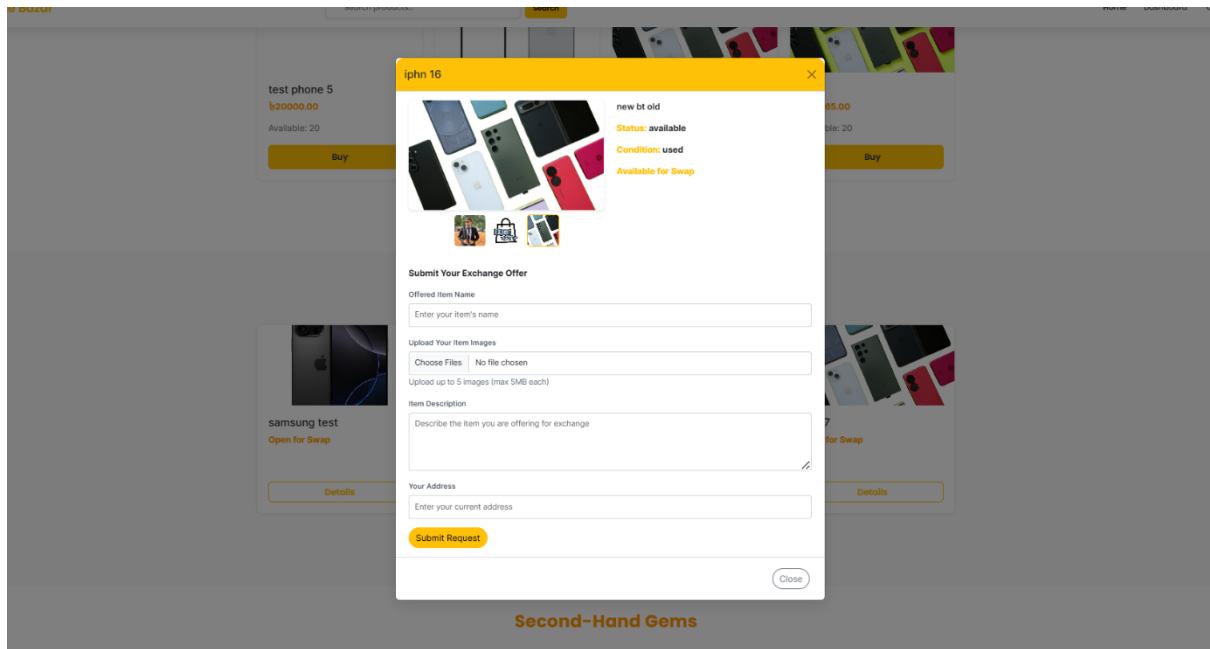


Figure 3.25 : submit exchange offer

Cart : There to add to product on cart there remember to knowing product they want to buy to add to cart.

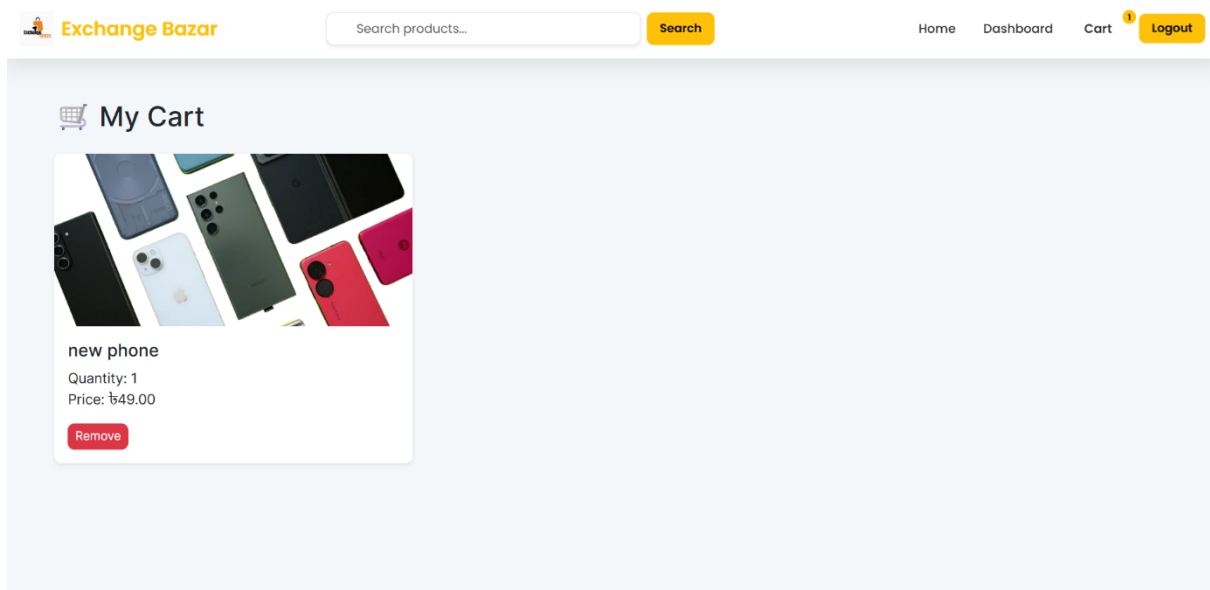
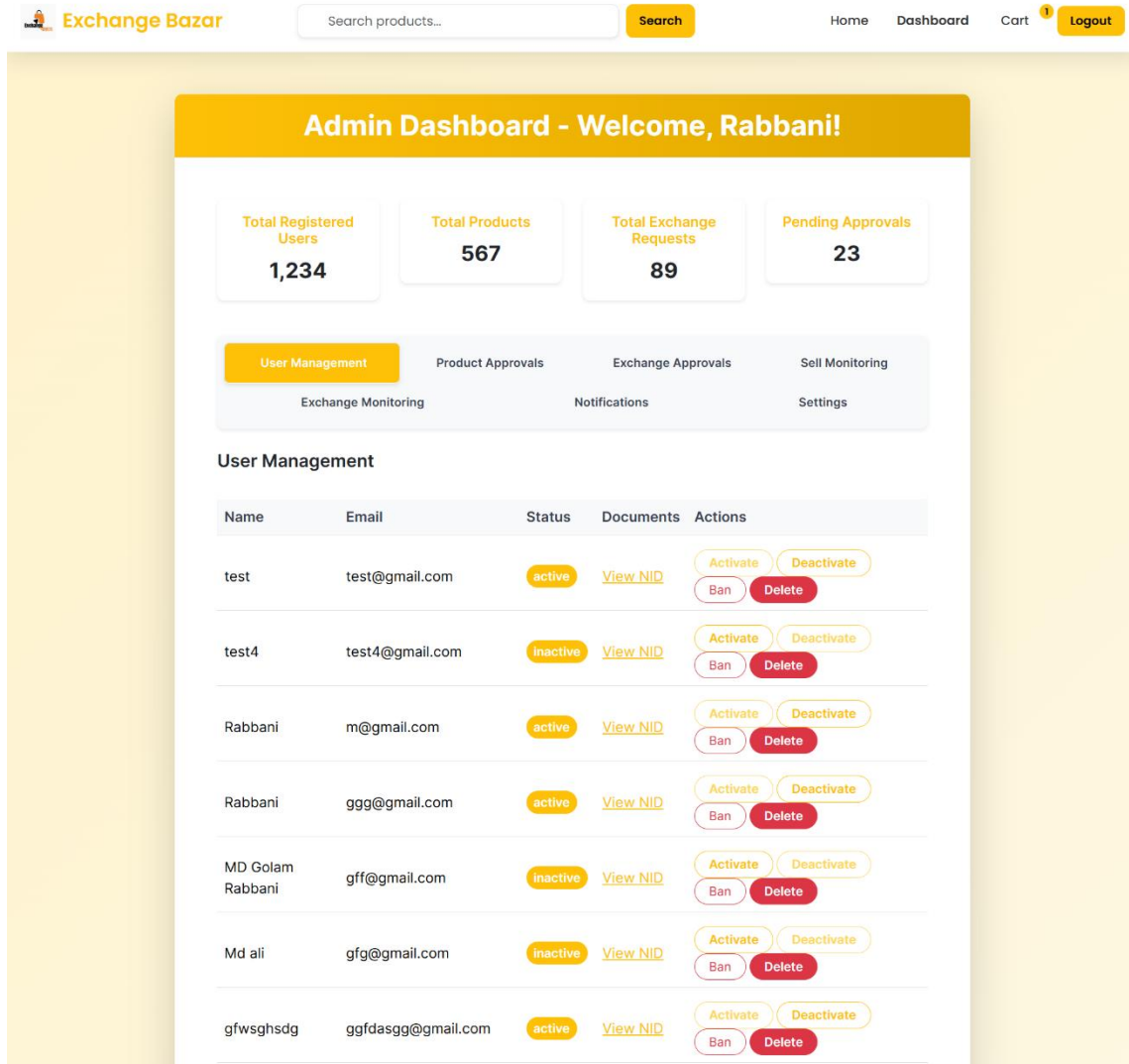


Figure 3.26 : Cart

Admin dashboard :

User management : There admin check this user is real or fake then they active or deactivate the account. If fine any type of problem from any account then admin can ban the account and also deleted the account.



Exchange Bazar Search products... Search Home Dashboard Cart Logout

Admin Dashboard - Welcome, Rabbani!

Total Registered Users
1,234

Total Products
567

Total Exchange Requests
89

Pending Approvals
23

User Management

Product Approvals

Exchange Approvals

Sell Monitoring

Exchange Monitoring

Notifications

Settings

User Management

Name	Email	Status	Documents	Actions
test	test@gmail.com	active	View NID	Activate Deactivate Ban Delete
test4	test4@gmail.com	inactive	View NID	Activate Deactivate Ban Delete
Rabbani	m@gmail.com	active	View NID	Activate Deactivate Ban Delete
Rabbani	ggg@gmail.com	active	View NID	Activate Deactivate Ban Delete
MD Golam Rabbani	gff@gmail.com	inactive	View NID	Activate Deactivate Ban Delete
Md ali	gfg@gmail.com	inactive	View NID	Activate Deactivate Ban Delete
gfwsghsdg	ggfdasgg@gmail.com	active	View NID	Activate Deactivate Ban Delete

Figure 3.27 : User management tab

Product approvals : There admin check the product and admin can approved or reject the product for post.

Admin Dashboard - Welcome, Rabbani!

Total Registered Users: 1,234

Total Products: 567

Total Exchange Requests: 89

Pending Approvals: 23

User Management | **Product Approvals** | Exchange Approvals | Sell Monitoring

Exchange Monitoring | Notifications | Settings

Product Post Approvals

Filter by Approval Status: All

Product	Type	Posted By	Status	Actions
nokia	Sell	Rabbani	approved	Approved Delete
25s ffff	Sell	Md ali	approved	Approved Delete

Figure 3.28 : product approvals tab

Exchange Approvals: There admin can check the consumer want to post the for exchange that post admin can accept or reject.

Admin Dashboard - Welcome, Rabbani!

Total Registered Users: 1,234

Total Products: 567

Total Exchange Requests: 89

Pending Approvals: 23

User Management | Product Approvals | **Exchange Approvals** | Sell Monitoring

Exchange Monitoring | Notifications | Settings

Exchange Approvals

Filter by Approval Status: All

Exchange ID	Product Name	Details	Posted By	Category	Condition	Status	Actions
3	test product	test description	Rabbani	electronics	new	approved	View Approved Delete
4	test 2	ggfgs	Rabbani	sports	new	approved	View Approved Delete

Figure 3.29 : Exchange approvals tab

Sell monitoring : There admin can see daily how many product selling or people purchase there no other work admin just admin can watch only.

Exchange Bazar Search products... Search Home Dashboard Cart Logout

Admin Dashboard - Welcome, Rabbani!

Total Registered Users: 1,234 Total Products: 567 Total Exchange Requests: 89 Pending Approvals: 23

User Management Product Approvals Exchange Approvals **Sell Monitoring**

Exchange Monitoring Notifications Settings

Sell Monitoring

All Status

Product	Image	Buyer	Seller	Price	Status
new phone		Rabbani	Rabbani	₹49.00	Shipped
samsung 24		Rabbani	buyer	₹50000.00	Shipped
new phone		Rabbani	Rabbani	₹49.00	Processing
new phone		Rabbani	Rabbani	₹49.00	Processing
new phone		buyer	Rabbani	₹49.00	Delivered
hiu		Rabbani	Rabbani	₹65465.00	Processing
phone		Rabbani	Rabbani	₹5455.00	Processing
phone		Rabbani	Rabbani	₹5455.00	Shipped

Logout

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Figure 3.30: Sell monitoring

Exchange monitoring : There same admin can watch only the daily exchange product how many exchange request accept.


Exchange Bazar

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[Cart](#)
Logout

Admin Dashboard - Welcome, Rabbani!

Total Registered Users
1,234

Total Products
567

Total Exchange Requests
89

Pending Approvals
23

User Management

Product Approvals

Exchange Approvals

Sell Monitoring

Exchange Monitoring
Notifications
Settings

Exchange Monitoring

Filter by Request Status
All

Requester	Requested Product	Category	Condition	Status
buyer	 samsung test	electronics	used	accepted
buyer	 iphn 16	electronics	used	accepted
buyer	 phone 1	fashion	new	accepted
buyer	 test 7	home	new	accepted
buyer	 test product	electronics	new	pending
buyer	 iphn 16	electronics	used	accepted
buyer	 iphn 16	electronics	used	accepted
Rabbani	 phone	sports	used	pending
Rabbani	 iphn 16	electronics	used	rejected

Logout


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Figure 3.30 : Exchange monitoring

Notification: There admin can give any type of notice for everyone can get the notice.

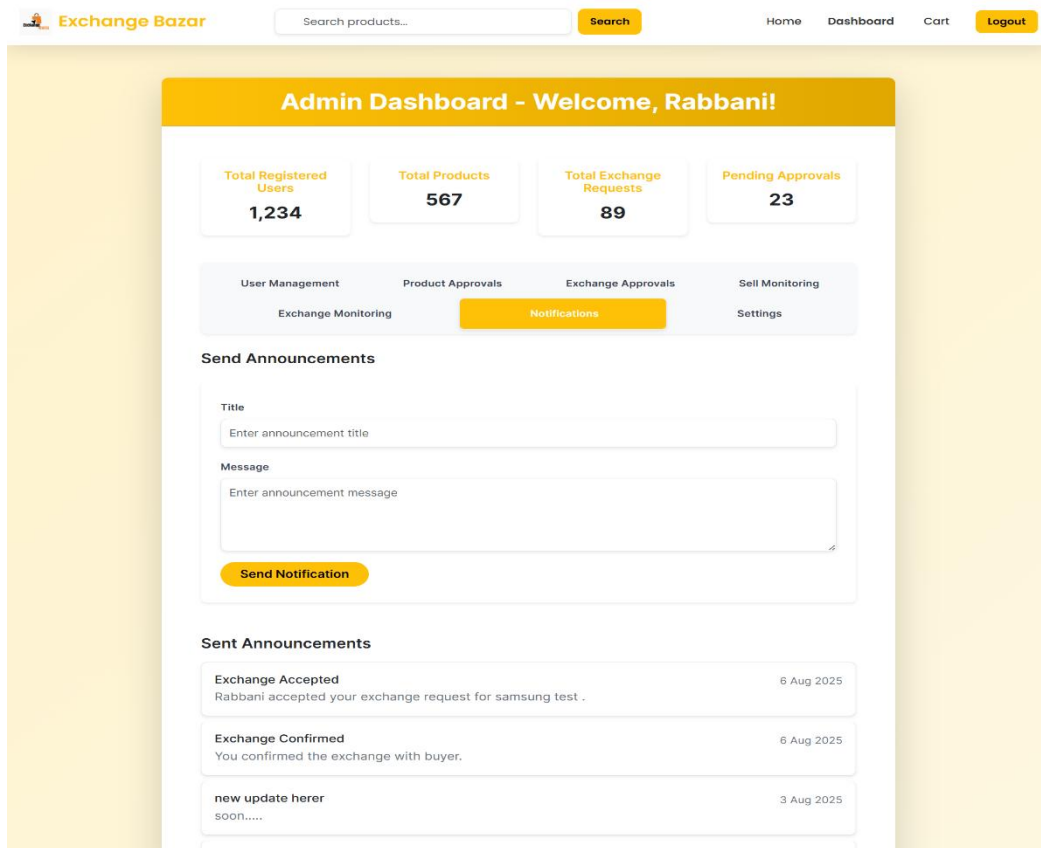


Figure 3.32 : Admin notification section

Setting : There admin can change there password and email.

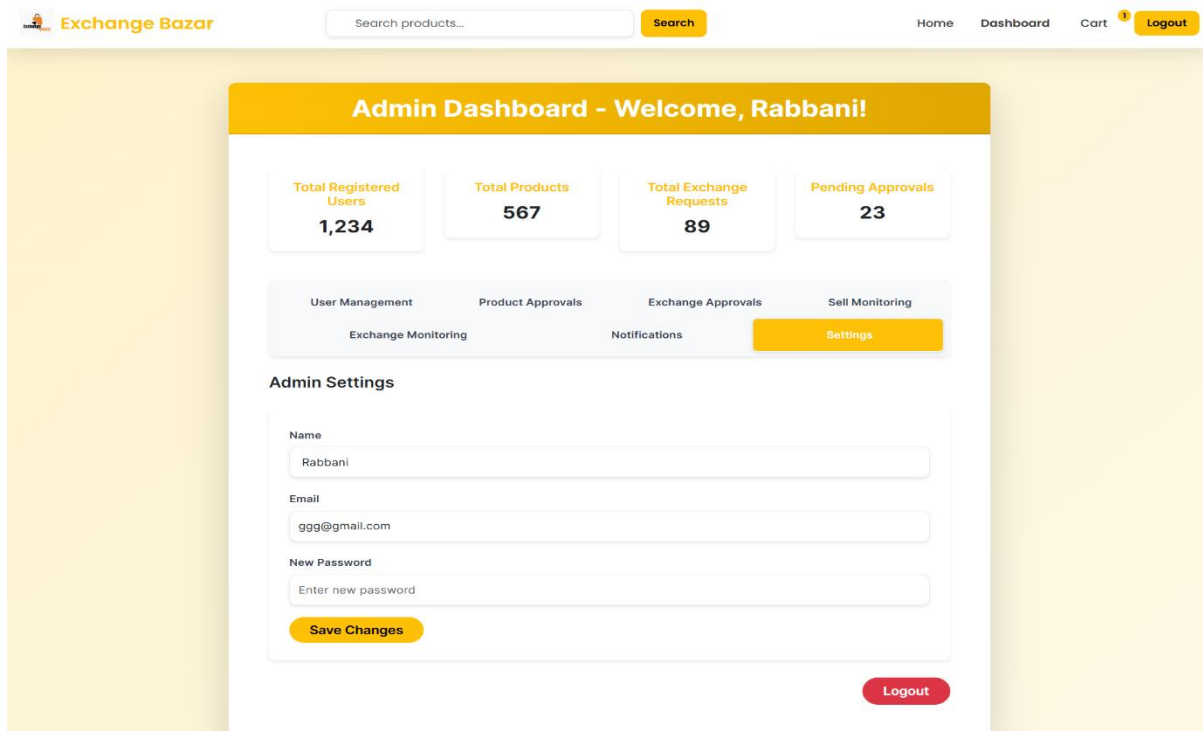


Figure 3.3 : setting

3.2 Detailed Methodology and Design

Exchange Bazar was designed intentionally with a consistent layout and user-friendly platform. As they developed the design analogue choices were assessed. The front-end built using simple HTML, CSS and JavaScript were compared with frameworks like React and Vue.js. We chose Vue.js, because it provides easier use of a component-based system, reactivity, and is easier to use with Bootstrap or Tailwind CSS for a faster UI approach. The back-end options were Node.js with Express, PHP and the Django framework in Python. We decided to go with Node.js because of the non-blocking, event-driven architecture to process multiple concurrent requests such as multiple users searching for products, placing orders, or looking for exchanges. We decided to go with MySQL as a DBMS over NoSQL because MySQL with a structured schema can define field types which keeps important data related to orders, products, exchanges requests and user information.

The design philosophy was centered on modular and component-based design. The frontend made good use of reusable components such as Header, Footer, Product Cards, and Modals, leading to more maintainable and scalable code. The backend followed the controller, model, route structure to separate business logic, data layer, and API endpoints. The design included security aspects to enhance user safety through JWT based authentication, input validation, and handling of uploads.

In conclusion, the methodology focused on technologies that prioritized reliability, speed of access, supportability, scalability, and user experience. The design of the system heavily emphasized the communication between the front end, back end, and database components through the use of sequence diagrams, class diagrams, and data flow diagrams.

3.3 Project Plan

The project schedule for Exchange Bazar was prepared so as to ensure completion in a timely manner, and systematic development. The project plan encompassed a number of phases:

- **Requirement Analysis:** Function and non-function requirements were gathered, users' needs were identified, and system features such as buying, selling, and exchanging of products were defined.
- **System Design:** Design documents were created and included Data Flow Diagrams (DFD), Class Diagrams, Sequence Diagrams, and UI mockups. Decision regarding the technology stack (Vue.js, Node.js, MySQL, Bootstrap) was completed.
- **Frontend Development:** Planned to develop reusable Vue.js components, design/design responsive pages, added Bootstrap (CSS) and Tailwind CSS to style, modify product display and modals, and navigation was included.
- **Backend Development:** Planned to implement Express.js APIs for authentication, product management, orders, exchange requests, and notifications. Integrated MySQL database and uploaded image files.

- **Integration:** Frontend components were connected to backend APIs, data flow was tested, and we ensured user actions, notifications, and orders were handled properly.
- **Testing:** We tested the main user functions to ensure that they worked correctly. Functions included user registration, login, product purchase, and exchange request. Nonfunctional performance tests focused on performance, security, and responsiveness of the platform.
- **Deployment:** The platform was ready for deployment. Server configurations were completed, database was set up with tables, and hosted securely to allow access to the public.
- **Maintenance:** Outlined updates, bug-fixes, and possible feature enhancements of the system after deployment.

The project plan adheres to an incremental development method, which enables the team to implement, test, and finalize one module before moving on to another. This method allows for user satisfaction, confirming that all functional requirements are met while ascertaining reliability and performance.

3.4 Task Allocation

This table depicts the timeline of principal activities for the Exchange Bazar project, from week 12 to week 48.

Tasks	Weeks																		
	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
Requirement Analysis & System Design																			
Frontend Development																			
Backend Development & Integration																			
Testing, Deployment & Documentation																			

Table 3.1:task allocation

Description of 4 Tasks:

Requirement Analysis & System Design: This is the requirement process, feature definition, data flow diagrams, class diagrams, sequence diagrams, UI mockups.

Frontend Development: Creating Vue.js components, pages, models, development and styles with Bootstrap/Tailwind.

Backend Development & Integration: Creating REST APIs, database integration, authentication, taking care of file uploads, and connecting the form data, and uploading to the frontend TODO app to the backend.

Testing, Deployment & Documentation: Conducting functional and non-functional testing, debugging, deployment of the system, and preparing documentation and a final project report.

3.5 Summary

The Exchange Bazar project's goal is to deliver an integrated online marketplace for the buying, selling, and swapping of new and used products. In the development of the platform, we took into account all the functional and non-functional requirements to provide users with a reliable, usable, and maintainable system. The architecture design of the system was created using contemporary web technologies, specifically Vue.js for front end, Node.js and Express for back end services, and MySQL for a structured database.

The Exchange Bazar platform allows users to register and log into the system securely. Users can browse for products, post items to swap, initiate a purchase and receive notifications about user's purchase or swap requests. The Administrator has the ability to oversee all the activity in the system, manage users and manage all products in the system.

The project had a strong basis of methodologies such as; modular component-based development, API backend resources and ecosystems, user authentication and usability and security improvements to aid develop a scalable, secure and data management capability.

We developed Data Flow Diagrams, Class Diagrams and Sequence Diagrams to plot the interactions within the system, movements of data and relationships between components. The project plan concentrated on using an incremental project management approach to develop the Exchange Bazar in modules; requirements analysis, design, front end and back end development, integrated, tested, deployed and documented to inform users engaged with the site. There was a well-defined scope of tasks between project team members for the development of the Exchange Bazar, to symbolize stage progress and completion through the project timelines and respective target finishes.

In summary, Exchange Bazar provides a robust and user-friendly platform that bridges buyers, sellers, and exchange participants efficiently. The project emphasizes secure transactions, responsive design, and maintainable architecture, making it a practical and scalable solution for online product trading and exchange.

Chapter 4

Implementation and Results

The purpose of this chapter is to describe the practical implementation of the project described in Chapter 1, and the results. The chapter contains information on the environmental setup, test and evaluation method, performance metrics, and the overall results from the system. The chapter will explain how the platform works, and analyze its performance based on the test scenarios.

4.1 Environment Setup

The development environment for this project was built in a way that would create a beneficial and effective implementation and testing process. The following details provide a description of the different elements and tools used:

Frontend Framework:

- The frontend of the platform was designed and developed using Vue.js (Vue 3).
- Vue provides a component based structure, meaning the application design is modular and significantly easier to maintain.
- The routing and state management involved the use of Vue Router and Pinia.

Backend Environment:

- Node.js is the runtime environment where JavaScript code can be executed.
- The express.js framework would provide backend logic, REST API creation with routing, and manage the exchange of data between client and hosting server.
- MySQL was selected as the Database Management System.
- The database was managed using phpMyAdmin, through XAMPP when working locally.
- Tables were designed to hold the following user information; products, exchange requests and any additional information that needed to be accessed or develop further processes on.

Server Set up:

- Using Node.js locally as a development server with XAMPP.
- The server would be able to deliver API endpoints to handle requests that could include registration, login, product posting, and aspects of the exchange.

Code Editor:

- Visual Studio Code (VS Code) was used as the symbolic Integrated Development Environment (IDE).

- The features of VS Code gave the ability to write code easier, through syntax highlighting, functionality with Git, and debugging tools etc.

Package Management:

- In addition to managing dependencies, npm (Node Package Manager) was employed to install dependencies on both frontend and backend side.
- The packages included in the project was Vue CLI, Express, MySQL driver, Axios, Bootstrap.

Version Control:

- Git was faster for version control to handle any changes with updates changes to the project source code.
- With the project files being stored in GitHub, GitHub was also used as the online repository to hold the project files along with collaborating and managing changes.

Testing Tools:

- Postman was used to test the API endpoints for the backend functionality.
- Browser DevTools and Vue DevTools were used for frontend testing and debugging.

Operating System:

- The whole system has been developed and tested using Windows 11, on a machine with a Core i5 or equivalent machine with 16GB RAM, running to SSD storage for performance efficiency.

Browser Compatibility:

- The project was tested using Google Chrome as the main browser to check responsiveness and performance.

4.2 Testing and Evaluation

The developed platform was rigorously tested and evaluated to ensure every aspect of its functionality was functioning effectively, and efficiently. The testing and validation involved a combination of manual testing and functional testing methods to verify every core feature of the platform. Each main module, including user registration, product uploads, buying, and selling, the exchange system, and the admin panel features, was validated to ensure they were accurate, usable, and stable.

The testing was conducted to simulate users interacting with the platform in different contexts which allowed us to measure the performance of the platform and reliability, both under normal and heavy loading circumstances. The testing involved simulating numerous users taking the same actions, like

browsing products, purchasing items, and exchanging products, simultaneously. The findings indicated that the developed platform and application could successfully handle regular loading without any major performance issues for the most part.

Further, the developed platform's features were compared using review and analysis of similar and established platforms such as Daraz and Bikroy. The feature comparisons helped assure that the developed platform provided comparable functionalities, positive user experience through ease of use while improving usability for buyers and sellers. The comparative analysis also aided in developing their design, the responsiveness of the users and navigation to ensure the usefulness and usability of the technology in the real world context.

Finally, there was produced the exhaustive test cases documentation to properly structure the testing process for each feature, including the results of the tests and anticipated results as a structured documentation form. The test cases could test all major components of the platform while dealing with any possible edge cases. Below is an example of the test cases:

Test Case ID	Test Scenario	Test Steps	Expected Result	Actual Result	Status
TC-01	User Registration with Valid Data	1. Go to Registration Page 2. Fill valid user details 3. Upload Photo & NID 4. Click Register	User is successfully registered and redirected to login page.	User registered successfully and redirected to login page.	✓ Pass
TC-02	User Registration with Missing Fields	1. Go to Registration Page 2. Leave required fields empty 3. Click Register	Error message displayed: "Please fill all required fields."	Error displayed correctly: "Please fill all required fields."	✓ Pass

TC-03	Login with Correct Credentials	1. Enter valid email & password 2. Click Login	User is successfully logged in and redirected to homepage/dashboard.	Login successful, redirected to dashboard.	✓ Pass
TC-04	Login with Incorrect Password	1. Enter valid email, wrong password 2. Click Login	Error message displayed: "Invalid email or password."	Correct error message shown.	✓ Pass
TC-05	View Homepage	1. Login 2. Navigate to homepage	Homepage loads with sections: New Arrivals, Second-Hand Gems, Exchange Items.	Homepage loaded correctly with all sections.	✓ Pass
TC-06	Product Upload (New Product)	1. Go to "Add Product" page 2. Enter valid details 3. Upload product images 4. Submit	Product is successfully uploaded and visible in admin panel.	Product uploaded and visible in admin panel.	✓ Pass
TC-07	Product Upload (Invalid File Type)	1. Try uploading a non-image file (e.g., .exe)	Error message displayed: "Invalid file format."	Error message displayed: "Invalid file format."	✓ Pass
TC-08	Search for a Product	1. Enter product name in search bar 2. Click Search	Matching products displayed.	Correct product search results displayed.	✓ Pass
TC-09	Filter Products by Category	1. Select category filter	Only products under that category are displayed.	Products filtered correctly by category.	✓ Pass

TC-10	Buy Product with Valid Data	1. Select product 2. Click “Buy” 3. Enter quantity, address, payment method 4. Confirm	Order placed successfully and confirmation message shown.	Order placed and confirmation displayed.	✓ Pass
TC-11	Add Product to Cart	1. Select product 2. Click “Add to Cart”	Product is successfully added to user’s cart.	Product added to cart successfully.	✓ Pass
TC-12	View Cart	1. Login 2. Go to cart page	Cart items displayed correctly.	Cart page displayed with correct items.	✓ Pass
TC-13	Remove Item from Cart	1. Go to cart 2. Remove an item	Item is removed successfully.	Item removed successfully.	✓ Pass
TC-14	Request Exchange	1. Select an exchange product 2. Send request	Request sent successfully and seller notified.	Exchange request sent and notification received.	✓ Pass
TC-15	Logout Functionality	1. Click Logout	User is logged out and redirected to login page.	User logged out and redirected correctly.	✓ Pass

Table 4.1:Test case

4.3 Results and Discussion

The results of the Exchange Bazar project were completed to meet all the development project goals and it met the requirements. The platform offers potential users and users with a fully functioning e-commerce site that allows them to buy, sell, and exchange products. Because of a clean user interface, the platform makes it easy for customers to browse products, look at details, and buy a product with a few simple clicks. Sellers also allow themselves to manage and upload their products seamlessly.

The system sends updates to users by way of real-time notifications when their exchange requests are accepted, when their product is out-of-stock, and when their offer was

accepted. An easy-to-understand admin panel was created to ensure the platform was managed well; providing opportunities to administrators so that they can see and manage activities occurring on the platform, as well as upload and manage their products.

The system went through rigorous testing to ensure the functionality, performance, responsiveness, and reliability of the system on different devices and screen sizes to ensure users can navigate and use the site properly. Furthermore, functional testing ensured that the basic modules, such as user auth, uploading of products, placing orders, and exchange requests, also functioned appropriately when there were varying usages.

A comparative study of leading e-commerce sites including Daraz and Bikroy was done on the basis of their features, usability and system design. This study showed that Exchange Bazar has a far simplified and more concise buyer and seller experience due to its easy navigation and condition for use compared to much larger platforms, yet still maintained exactly the same functionality.

In summary, the discussion of findings shows that the project achieved all three objectives and had provided a viable, sustainable, and competitive platform for consumers to engage in online product exchange and trade seeking a sustainable, low cost and easy to use option.

4.4 Summary

This chapter offered a comprehensive overview of the process of developing and testing the Exchange Bazar platform and highlighted the tools and environment in which the platform was built. The platform was designed with a good balance between functionality, user experience, and scalability focused on building a system flexible enough to meet the needs of buyers, sellers, and administrators.

Some of the successes achieved during this project include a precisely structured frontend developed in Vue.js, a backend supporting API requests through the Node.js and Express, and a MySQL database to store and handle users and product information. The synergistic effects of the technologies selected make the system robust but allow it to be dynamic as well.

Testing was a critical component for ensuring that the platform was reliable. Manual testing and functional and non-functional testing approaches confirmed all features from product uploads to user registration and the exchange system all functioned correctly with no significant bugs and performance concerns. The success of testing means the platform can be deployed in the real world and deliver a safe, intuitive platform for all users.

In conclusion, the Exchange Bazar project achieved its intended outcomes, delivering a complete multipurpose e-commerce platform and focusing on simplicity, accessibility, and usability. Using a combination of modern web technologies and good design principles, the system works well as a practical solution to online buying, selling and exchanging and offers an excellent starting point for future upgrades and extensibility.

Chapter 5

Engineering Standards and Design Challenges

The engineering standards used in the Exchange Bazar platform's development, the rationale behind design choices, and the challenges faced are all thoroughly explained in this chapter. In addition, it evaluates ethical concerns, sustainability projects, financial planning, and the system's impact on the environment and society. The dependability, security, scalability, and user-friendliness of the platform are ensured by these rules and standards.

5.1 Compliance with the Standards

Adhering to engineering standards is critical to developing any professional-quality software project because it ensures the quality of the system, security, maintainability, and scalability of the system. In the case of this multi-function e-commerce site displaying buying, selling, and trading of products, it is even more important to adhere to the engineering standards since they will be capturing

sensitive user data, conducting accounting, and managing a sizeable and fast-evolving database of products.

Using standards will help create a better quality and easier to use system while reducing errors, vulnerabilities, and inconsistencies. The aim of adhering to the internationally accepted standards for software, hardware, and communication is to provide both users and systems a good experience, allow the systems to interoperate with different devices and networks and allow the developer to follow best practices of software engineering. Further, with standards that are carefully chosen, the development team will be able to ensure that it is developing a system that is not only cost-effective, but makes a future-proofing system that supports any scaling that may be required as the platform develops.

The selected criteria were carefully considered and compared to alternative solutions. Each standard was chosen based on its degree of security, suitability for the e-commerce sector, and support for maintainability and integration. By employing this technique, the system ensures compliance with industry norms and generates a product that meets technical and business objectives.

5.1.1 Software Standards

The multi-functional e-commerce site we built originally sought to abide by rigorous coding and development standards in order to begin long-term maintainability, scalability and readability of the system. The application was coded with the user interface done in Vue.js, and the backend done in Node.js with Express which aided in the integration of the two sides of the system. During the development phase coders adhered to JavaScript

coding standards. These standards involved naming conventions, modular design of code, and sufficient commenting in code. In the end, I want to say differently, all of these standards and practices made user code more readable, maintainable, and scalable as the project evolves. While there were other alternatives that were possible--Python with Django or PHP with Laravel--Node.js was, in fact, still the right choice. Most primarily because it has slightly more event based, asynchronous operation which is what we're looking for, particularly if we want real-time updates and notifications that an e-commerce site requires. Additionally for the more seamless integration with Vue.js, via API, Node.js made for a much more easily consistent selection versus the other alternatives.

Modern web standards were used in addition to coding techniques to produce a polished and intuitive platform. In order to ensure responsive design and make the platform fully functional across a variety of devices, including desktops, tablets, and smartphones, the project made use of HTML5, CSS3, and Bootstrap 5. Since a significant percentage of users access e-commerce platforms via mobile devices these days, responsiveness was a primary focus. Although other options like Tailwind CSS and Material UI were investigated because of their adaptability and contemporary design ideas, Bootstrap was finally chosen because of its large library of pre-built components, robust community, and quick prototyping capabilities. By making this choice, the development team was able to concentrate more on functionality without sacrificing performance or design quality.

To ensure platform users' safety and trust, security was also given top priority throughout the development process. The application was created in accordance with OWASP security guidelines, and session-based authentication was utilized to protect user data and transactions. Protections against common vulnerabilities such as SQL injection, Cross-Site Scripting (XSS), and Cross-Site Request Forgery (CSRF) attacks were also included. Although JWT-based authentication was considered due to its stateless nature and suitability for distributed systems, session-based authentication was chosen because it simplifies session management and is better suited for integrating payment gateways. This approach ensures a smooth and secure checkout process, which is crucial for any e-commerce system.

5.1.2 Hardware Standards

Standard, modern PC configurations were used to develop and test this multi-purpose e-commerce platform to provide solid performance, smooth functionality, and reliable environments for testing. Each development machine had at least 8GB of RAM, an SSD (Solid-State Drive) to allow for faster read/write capability, and a processor that was akin to or more powerful than an Intel Core i5 processor. These specification choices provided the developers with the tools necessary to manage heavy codebases, maintain virtual environments, run back-end servers, and test front-end responsiveness efficiently.

For deployment, the system is designed to run in cloud (cloud-based) platforms such as Amazon Web Services (AWS), Google Cloud Platform (GCP), requires a minimum of 8GB of RAM, and Heroku. Cloud-hosted applications allow for substantial scalability, global availability, and come with security pre-built, allowing for ease of management. An e-commerce platform is anticipated to grow and service a large number of users, and it is essential to keep that in mind during deployment. When leveraging cloud environments, the cloud infrastructure ensures services offered by applications are highly available

without degrading performance when traffic increases in various locations around the world.

5.1.3 Communication Standards

A set of secure and efficient communication standards is implemented to ensure that data flow between the client-side application and backend server can be done securely, reliably and efficiently. The communication standards outlined within this proposal implemented using HTTPS protocol as a primary mechanism for all client-server communication to assure that important user sensitive information such as credentials, payment information, and any personal information do not get compromised. HTTPS encrypts all data shared/transmitted via the network and prevent unauthorized access to confidential data or data breaches via man in the middle attacks. The importance of encryption and data protection is not to be underestimated in an e-commerce platform where user trust, and data integrity are paramount.

For data shared between the front-end (client) and back-end (server) the system uses the principles of RESTful APIs (Representational State Transfer). RESTAPI is a common communication standard used in most modern day web applications due to its simplicity, scalability, and ability to run over HTTP. The design of REST APIs naturally allows one to carry out CRUD (Create, Read, Update, Delete) operations commonly required to support user account management, manage products, orders, or exchange requests necessary to support the multi-functional platform required. REST endpoints are required to be stateless and therefore easy to maintain, easy to debug and easy to scale with growth of the application and its number of users.

Although GraphQL was thought to be a viable alternative due to its ability to provide highly flexible and efficient data queries, it was ultimately turned down for this project. GraphQL requires more setup work, more complex server-side configurations, and a steeper learning curve for developers. Since the project prioritizes simplicity, maintainability, and rapid development without sacrificing reliability, RESTful APIs were determined to be a more sensible choice.

By combining RESTful APIs with HTTPS, this platform's communication framework strikes a balance between security, speed, and usability. This ensures a high degree of security and reliability while making sure that the special exchange feature and the buying and selling processes go without a hitch.

5.2 Impact on Society, Environment and Sustainability

The implementation of this platform has a major positive influence on society, the environment, and sustainability. By creating a multipurpose e-commerce platform both individuals and businesses will have an easier, more direct access to marketplace platforms where they can buy and sell, or share and exchange products and services easily, stimulating entrepreneurship and especially empowering small and medium-sized businesses by removing the barriers to market entry, and finding a bigger audience without having to invest in expensive fixed infrastructure. A platform including an exchange feature, promotes a culture of reuse where people will exchange items instead of simply throwing them away, contributing to a reduction in unnecessary consumption and waste.

From an environmental point of view, this system fosters sustainability by facilitating the resale and exchange of second-hand products, that helps to reduce both electronic and material waste. Instead of throwing items away that may still have a functional potential value, they are compelled to reuse and repurpose them. This reduces demand for mass production/demand for goods and will indirectly decrease the carbon footprint associated with manufacture and distribution. Of course, the platform supports digital transactions, and paper-less records and receipts to mitigate physical receipts and paper consumption and waste in support of environmental protection.

The system as a whole offers a lot to society because it saves time and resources for buyers and sellers in e-commerce transactions. Users can easily view and purchase online products in the comfort of their own home, while limiting unnecessary travel, further reinforcing sustainable consumption habits. The format of communication and transactions on the platform builds producer/consumer trust, which creates a secure and dependable exchange.

This e-commerce platform is ultimately in line with the three pillars of sustainable and environmentally aware marketplace for things like products services, and experiences. In terms of responsible consumption practices, it provides e-commerce tools to small business people while maintaining a circular economy and waste reduction routine. Also, it is easily accessible and scalable with a variety of users and stakeholders in the digital marketplace. Ultimately, it creates exponentially improved e-commerce efficiency, environmentally sustainable practices, and socially responsible marketplace.

5.2.1 Impact on Life

This platform's introduction has greatly improved users' everyday lives by streamlining and modernizing the way people conduct business. Users can peruse, buy, or trade goods from the comfort of their homes rather than investing time and effort in traveling to actual marketplaces. This offers accessibility and convenience while saving time and effort, especially for people with hectic schedules or limited mobility.

The platform also encourages responsible consumption practices. Users are encouraged to reuse and recycle items instead of throwing them away by allowing product exchanges and making it easier to buy used goods. In addition to cutting down on wasteful spending, this practice fosters a culture of thoughtful consumption, which eventually results in cost savings and more environmentally friendly consumer behavior.

5.2.2 Impact on Society & Environment

The platform also provides a meaningful benefit to society as well as environmental sustainability. By allowing the resale and trade of used items, it helps to reduce e-waste and other material waste which would otherwise end up in the landfill. The design of the platform promotes an e-commerce process influenced by the circular economy which helps mitigate the environmental costs of purchasing new products and disposing of used products.

Socially, the platform helps to rectify an imbalance that exists by helping small businesses, entrepreneurs, and individual sellers find a larger potential consumer base without the not only fixed costs of a physical store, but also the costs of advertising through traditional media. It provides a common space where sellers can be given more opportunity to be recognized to specification sell items where they otherwise would have difficulties making an impression enough to have consumers feel inclined to make a purchase.

Additionally, the platform is a valuable resource for reducing the accessibility gap by providing an e-commerce and reduced cost services to users who are rural and/or underserved. And as broadband continues to be accessible, the potential for platform such as these to help reach more people who need access to affordable goods and services.

5.2.3 Ethical Aspects

To protect users and maintain trust, platform development adheres to strict ethical and security standards. By restricting access to sensitive information to those who are authorized, the implementation of secure login processes, role-based access control, and encrypted storage of sensitive data puts user privacy first.

The platform also increases the transparency of transactions. Buyers and sellers can interact in a fair, regulated setting that lowers fraudulent activity by using secure communication protocols and verification processes. These steps not only increase user confidence but also create a safer environment where moral behavior is respected on the internet.

5.2.4 Sustainability Plan

The design emphasizes sustainability, flexibility, and growth. Developers can always build on additional functionality at some point, thanks to the modular design and scalable hosting technologies. For example, they will be able to add features like AI driven product recommendations, real-time chatting systems, upgraded analytics dashboards, and other future advances that improve users' experience.

The platform also runs on cloud connected hosting, which places almost no dependency on traditional hardware based servers. The design has established some limitations on the amount of energy that will be consumed due to hardware, thus minimizing the platform's environmental impact and limiting the platform's constraints of efficient growth as it expands.

The code base will provide future developers a way to upgrade and further development to newer technologies. In combination with sufficient code commenting, the developers will be able to comprehend ways to enhance the platform so that it is always current, while also allowing it to remain relevant with as little redevelopment as possible, thus saving time and money.

5.3 Project Management and Financial Analysis

Effective project management and financial planning are essential elements to the ongoing effective project execution and continuity of the Exchange Bazar project. This project was developed in accordance with a structured mandated development process which includes such phases as requirement analysis, design, prototype development, iterative product development, and testing to build a functioning and usable site.

In relation to financial costs, this site is developed with open source tools and frameworks (Vue.js, Node.js, MySQL) and is unlikely to accumulate any software licensing fees. The site has the potential to be hosted from a local server to minimize expenses; however, as user demand grows, it is expected to transition from a local server to cloud services (i.e., AWS, Google Cloud). There is risk control in being able

to keep costs low and utilize the existing local server to start, but there is also opportunity to scale, when necessary.

As for future cost commitments, the next phase is to establish a budget for marketing, potential server integration, and if more funding opportunities are realized, development costs associated with new features for enhanced user experience and performance of the Exchange Bazar platform.

Expenses Category	Cost (BDT)
Hosting and Domain	10,000
API Services & Payment	20,000
Marketing & Promotion	20,000
Total	50,000

Table 5.1 : cost

5.4 Complex Engineering Problem

The Exchange Bazar project presents several engineering challenges in multiple areas of web application programming. Some of the areas include secure user authentication and role-specific access to system levels for unique user types - Admin, Buyer, Seller. It manages listings of products, arrival of exchange requests, and real-time updates to change product availability for any potential transaction.

To create an overall richer experience, it ties all of the functionality to third-party services like SSLCommerz for secure online payments, and Cloudinary for storage and management of images, adding another layer of complexity to the design problem. Also, it has to navigate the complexity of achieving the right balance of ease of use and security for users, and access controls for administrative users. Providing security and developing access controls is one more layer of complexity. In addition to implementing standard best practices in web application development, it has to provide performance, data integrity, and scalability as the expected user base, and number of products available for exchange transactions also continues to grow. All these related pieces need to work together to develop a secure, scalable and seamless user experience.

5.4.1 Complex Problem Solving

The Exchange Bazar application presents complicated challenges in full-stack web development particularly relating to user secure authentication, real-time products and exchanges tracking, and incorporation of payment gateways. In addition, providing an easy-to-use interface for buyers and sellers with a complicated admin capability, maintaining data integrity, avoiding duplicate transactions, and managing the system in a reliable way as a whole means that these interconnected challenges need to be carefully planned, logically analyzed, and integrated thoughtfully and coordinated across many different modules.

Table 5.2: Mapping with Complex Engineering Problem.

EP1 Dept of Knowledge	EP2 Range Of Conflicting Requirements	EP3 Depth of Analysis	EP4 Familiarity of Issues	EP5 Extent of Applicable Codes	EP6 Extent Of Stakeholder Involvement	EP7 Interdependence
✓	✓	✓			✓	✓

EP1 - Knowledge Depth:

The project requires covering the technical stack, which is more than the average tech stack. The depth of knowledge that is required is in full stack development with Vue.js, Node.js and Express, and MySQL. Furthermore, the project will need secure authentication with JWT, a data structure for the database that can deliver large numbers of product delivery listings, and structure for exchange data and cultivate it with payment gateways.

EP2 - Conflicting Requirements:

The platform needs to be affordable (cheap), accessible for users, and fair so sellers can earn a fair profit as well. The interface needs to be simple for buyers and exchange users while remaining in control of a secure back office, and have severe security and administrative controls, and potential moderation capabilities. The operations need to be risk based and transactional safety likely comes first followed by reasonable access by reasonable users.

EP3 - Depth of Analysis:

In order to ensure product availability, manage exchange request and respond to user notifications in real time - the need for a transactional database that is able to not only keep track of all exchanges of product and products with orders, it needs to track down duplicate moves of all products, duplicates and invalid transactions, secure login, a secured database with data integrity related to the user's full transactions of products and exchanges.

EP6 - Stakeholders:

There will be three user roles, administrator, seller (also buyers who participate in the exchange) - each having distinct features based on their anticipated roles. Stakeholders for the platform would have to have workflows that reasonably maintained the security of the data, evoked trust, assured consistency throughout the process.

EP7 - Interdependence:

The project incorporates many interrelated components such as user authentication, product and exchange management system, notifications, an admin-monitoring system, payment processing, and UI speed and smoothness. A malfunction in any of the modules may impact the functionality of the entire platform, which will require integrational constraints and coordination.

Mapping with Knowledge Profile

K3 – Engineering fundamentals:

To support clients product listings, user account management, orders, and exchange requests requires knowledge of client-server architecture, a rudimentary understanding of relational database design (MySQL), and a basic understanding of RESTful API logic.

K4 – Special knowledge:

Part of the project requires implementing third-party libraries, such as You will implement SSLCOMMERZ's payment gateway for online payments securely, and you will need to implement Cloudinary for storage and management of images. The implementation of SSLCOMMERZ exposes you to specialized technical knowledge due to their use of a third-party library and SSL. This implementation is also the use of specialized technical knowledge.

K5 - Engineering design:

Some human factors will be in the design of a new system architecture to accommodate the different user roles as well as complexities with permissions and permissions to specific routes. The modular designed of the project is required for integrating future features, such as personalized AI-based product recommendations or separating dashboard analytic features from seller feature.

K6 - Engineering Practice:

The practice adhered to general engineering practices in the project, beginning with the MVC structure but including practices that pertain to ethical practices - session management, proper use of middleware, comprehensive testing, version controlled Git repository and deployment with cloud-based services with only prospective archival not storage, that maintains the scale and code of the project.

Table 5.3: Mapping with knowledge Profile.

K1 Natu ral Scien ce	K2 Mathem atics	K3 Engineeri ng Fundame ntals	K4 Special ist Knowle dge	K5 Enginee ring Design	K6 Enginee ring Practice	K7 Comprehe nsion	K8 Resear ch Literat ure
		✓	✓	✓	✓		

5.4.2 Engineering Activities

In this section, provide a mapping with engineering activities. For each mapping add subsections to put rationale (Use Table 5.3).

Mapping with Complex Engineering Activities

EA1 – Range of Resources:

The application has several technologies, such as Vue.js, Node.js, Express, Mysql, for payment SSLCOMMERZ, Cloudinary for images, Bootstrap for responsive webpage UI, and Pinia for state management, this platform shows variety in full-stack application development.

EA2 – Level of Interaction:

There is plenty of high-level interaction between the frontend and backend modules, between payment gateways, notification issuer functions, ecommerce role-based dashboards for admins, sellers, and buyers - these interactions ensure smooth running and communication of secure transaction and work throughout the platform.

EA3 – Innovation:

Exchange Bazar is innovative, it combines traditional aspects of e-commerce (buy and sell) with a new peer-to-peer product exchange system. Exchange Bazar has introduced structured exchange requests feature with approval from admin and buyer/seller to complete an exchange process, along with the set cart system that exchanges products into as 'cart' feature.

EA4 – Consequences for Society and Environment

The Exchange Bazar platform is sustainable because it promotes reusing products and product exchange instead of disposing of them. This application reduces the materials needed to make new products, while also providing small seller access to an e-commerce marketplace. Buyers acknowledge this and find savings in buying used product instead, highlighting positive effects on society while minimizing negative impacts with environmental sustainability visible.

EA5 - Familiarity:

The system employs well-known web technologies in a new practice — multi-merchant ecommerce with exchange capabilities — addressing region- and context-specific issues, such as their local payment solution through (SSLCOMMERZ and COD) and users' concerns with trust in exchanges online.

Table 5.4: Mapping with Complex Engineering Activities.

EA1 Range of re- sources	EA2 Level of Interaction	EA3 Innovation	EA4 Consequences for society and environment	EA5 Familiarity
✓	✓	✓	✓	✓

5.5 Summary

This chapter provided a thorough explanation of the standards, design constraints, and development considerations employed to create the Exchange Bazar Platform. The discussions highlighted the necessity of following appropriate software, hardware, and communication standards to establish a secure, efficient, and maintainable platform. The discussions deliberated how the quality of the code, good front-end coding practices,

responsive web design, session-based authentication, secure payments and a range of other aspects are central to code quality.

The chapter also considered how the platform relates to society, the environment, and sustainability to argue that the platform - through the possibility of facilitating the exchange of products - can help reduce material waste, promote responsible consumption, and be a low-cost means for small sellers to get products into buyers' hands. Lastly, the chapter addressed ethical considerations such as data privacy, transaction transparency, and fair access to users of the platform.

Project management and financial analysis were reviewed to illustrate the implications that every resource planning, cost management, and budget decision can have on their systems, however deployment and scalability have significant considerations. The previous chapter has also described technical depth, competing requirements, stakeholders, and interdependencies between systems and components, to illustrate the relational nature these all have system to system and, how product management, real-time exchange requests, notifications and payment processing relate specifically.

Overall, therefore, this chapter has articulated the substantial consideration, planning, scheduling and engineering management principles, for designing and implementing a secure, scalable, insightful, and inspirational e-commerce platform, that merges buying, selling and exchanging systems, whilst addressing various social and technology necessities.

Chapter 6

Conclusion

This chapter provides an overview of the project, highlighting its key concepts, highlighting its flaws, and suggesting potential avenues for further research and development.

6.1 Summary

The aim of the project "Multi-Functional E-commerce Platform: Buy, Sell, and Exchange" was to develop an integrated and unified solution that delivers three important services—exchange of products, selling used products, and buying new products—all on a single platform. The platform provides a single marketplace experience, thereby eliminating the need for end-users to navigate through a variety of platforms or applications.

The platform's clean and user-friendly interface allows end-users to quickly search for products, post items to sell or exchange across all categories, or let other users know their interests. One major point of differentiation is the exchange functionality that allows end-users to systematically propose exchanges, receive notifications, and execute trades according to specific rules. The order processing, exchange requests, and product management is all integrated to allow seamless operation for buyers and sellers.

The platform is, in terms of the technical architecture, a sustainable and scalable system for at least three reasons: the front-end portion is built using Vue.js, the back-end APIs are built with Node.js and Express, and the database is built with MySQL. Usability and reliability are further enhanced with components implemented such as responsive design, secure file uploads, and user authentication. This system fills a major gap within the marketplace industry, which offers ways to cover e-commerce workflow with exchange-based transactions that serves a much broader target audience with priority emphasis on affordability and convenience of reusing goods, and support sustainable consumption of goods.

Ultimately, the platform facilitates commerce and establishes trust within the marketplace ecosystem while helping users to save money by reusing or repurposing unused goods and supporting community-driven trade and sustainable consumption practices.

6.2 Limitation

Though the platform serves its main functions - to help users purchase new products, sell used products and exchange products - it has some limitations that will need to be developed in the future:

- **No built-in messaging system:**

There is currently no messaging system for the buyer and seller to communicate live. They have to use their external options (call, messenger, etc.) when negotiating prices, asking about product details or arranging exchanges. This

prevents the platform from having a complete communication system that is user friendly.

- **More advanced admin tools / and analytics:**

The admin tools only have simple management features - accept products for sale, track sales, accept exchange requests. The admin dashboard is missing advanced analytics features (insights, user engagement, sales trends, inventory forecasting, and performance reports) so this prevents the Admin from making the best possible use of the information at hand to make movements on the platform.

- **Lack of an Order Tracking System:**

Users are able to successfully finalize their orders, yet there is currently no order tracking system that will allow users to verify the state of their orders in terms of shipment, delivery updates, or an estimated arrival date. Without this feature, customers may become concerned or dissatisfied regarding their orders.

- **No AI-Based Product Recommendations, Personalized Recommendations, or Sorting for Trending Items:**

At this time the platform does not offer any AI-based product recommendations, personalized recommendations based on past purchases or items viewed by user, or any form of sorting of items as trending items. Without a means to customize and recommend products, the level of connection to customers from being on this platform, not mention the overall potential for enhanced user experience made possible by intelligent recommendation will considerably less.

- **Absence of Reviews, Ratings and Invoices:**

This platform lacks the ability for users to leave reviews or ratings on products for sellers, this absence lacks transparency, trust and feedback. Also, the platform does not generate invoices or payment receipts as proof of transaction at the time of purchase which could be an important tool for referencing record and dispute.

- **Design and Scaling Limitations:**

While version 1 is functional for the intended operation, it does not experience the entire scale when used by many users, and multiple transactions. There are still a few advanced UI/UX capabilities planned to be developed with the current functionality, such as dashboards that are interactive, advanced security groups / modules, adapting the design to mobile to allow users to experience a responsive UI on their smart device, and intricate product filters.

- **Onboarding a Single Payment Gateway:**

Currently, the only payment gateway the platform is connected to is SSLCOMMERZ payment system along with cash on delivery (COD), so users cannot use other online payment options, and others that might be interested in buying from the platform may not use it if they are seeking these payment gateways to be available.

- **Limited Multi-Language and Accessibility Functionality:**

The platform is currently functional to cater for primarily a single language and has limited accessibility capabilities for users who have disabilities, therefore reducing accessibility and inclusivity.

6.3 Future Work

To increase the Exchange Bazar offering's depth, adaptability, and usability, additional developments and functionalities can be built into future platforms, including:

- **a secure chat or messaging system:**
A secure chat or messaging format will bring the buyer and seller into direct contact with each other. A secure chat system will improve negotiations, facilitate quicker buying and selling decisions, and increase user engagement.
- **enhanced analytics and reports:**
If we build in some data analytics solutions into the admin dashboard, it can monitor sales patterns, user engagement, inventory levels, and exchange usage. The reports/visual dashboards will allow admins to make more informed decisions to enhance performance on the platform.
- **Tracking orders and notification system:**
A full tracking system for orders will enable buyers to track their orders from initial receipt of order to delivery. Automatic notification capabilities with status updates will provide further transparency and trust, also increasing user satisfaction.
- **A product review, ratings and feedback system:**
Letting users leave reviews/rate a product or seller will help build trust, increase transparency, and provide valuable knowledge that can be used to verify the quality of the platform.
- **Engage multiple payment gateways:**
Adding to the payment options to clients, both in addition to SSLCOMMERZ & COD, by considering options such as mobile banking, digital wallets, or alternate international payment gateways may provide more flexibility for buyers; therefore, allowing a broader base of users to consider using the platform.
- **AI-Driven Product Recommendations:**
Using machine learning algorithms and machine learning models to recommend products based on user's area of interest, past browsing history, past purchasing behavior to facilitate and optimize overall UX, brand loyalty, sales, and keep users more engaged.
- **Mobile Application and Progressive Web Application (PWA) Deployment:**
By simply creating a mobile application of the platform or converting it into a PWA, the accessibility of the platform would drastically improve and reach more users that only use their smartphones when shopping online and their devices to facilitate exchanges.
- **Improved UI/UX and Accessibility Features:**
Future improvements could include having a responsive mobile-first interface, advanced product filters, interactive dashboards, options for differently-abled users, an aesthetic interface that attracts users and keeps them.

- **Invoice Generation and Record-keeping:**
The capability of automated invoice generation of completed transactions would allow buyers and sellers to track their individual finances to support accounting practices and dispute resolution.
- **Scalability of the Platform and Optimized Performance:**
Optimizing any database queries, caching often requested data, and designing the platform for cloud scalability would provide an efficient way to scale its users and transactions well into the future.
- **Multi-language Options:**
Multi-language capabilities would increase user-base inclusion and allow non-native language speakers to navigate throughout the platform.

By implementing these changes, Exchange Bazar will become a more dependable, secure, and feature-rich platform. In addition to resolving current problems, this will give Exchange Bazar a competitive edge in the online marketplace sector. Giving buyers and sellers a complete, sustainable, and user-friendly e-commerce ecosystem is the aim of these improvements.

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