E-Mart : (Wholesale E-Commerce Platform)

Kale Sakshi, Adamane Rushikesh, Dhotre Sahil, Bhaskarwar Rounak, Prof. Mrs. Manjushri Raut

Department of Information Technology

Smt. Kashibai Navale College of Engineering, Pune, India

Savitribai Phule Pune University, Pune

Abstract: *The E-Mart project is a wholesale e-commerce platform designed to bridge the gap between manufacturers, distributors, and retailers by providing a seamless online marketplace. In an era where digital transformation is reshaping industries, wholesale commerce remains a critical area that demands modernization. E-Mart addresses the inefficiencies of traditional wholesale operations by offering a user-friendly, scalable, and secure platform where bulk buyers and sellers can interact and transact with ease. This platform not only simplifies the procurement process but also opens new business opportunities by leveraging technology to create a transparent, efficient, and cost-effective supply chain.*

The core objective of E-Mart is to streamline B2B (business-to-business) transactions, offering a robust platform for wholesale buyers to access a wide range of products directly from manufacturers and distributors. Key features of the platform include product listing, price comparison, bulk order management, secure payment gateways, and logistics integration for tracking shipments. Sellers can manage inventory, set pricing, and receive real-time analytics to optimize their business strategies, while buyers benefit from competitive pricing, bulk discounts, and an easy-to-navigate interface that reduces the complexity of large-scale procurement.

To develop this platform, we employed agile development methodologies and open-source technologies to ensure flexibility, scalability, and security. The system architecture is designed to handle large volumes of transactions and concurrent users while ensuring data integrity and protection through encryption protocols. The backend integrates with various APIs for payment processing, shipping, and inventory management, while the frontend focuses on providing a clean, intuitive user experience.

A pilot implementation of E-Mart was conducted with select wholesalers and retailers in different sectors, including electronics, consumer goods, and textiles. The results showed significant improvements in order accuracy, reduced lead times, and cost savings for both buyers and sellers. Furthermore, feedback from early adopters has been overwhelmingly positive, highlighting the platform's potential to transform wholesale e-commerce.

In conclusion, E-Mart presents a comprehensive solution to the challenges faced in the wholesale market by integrating technology-driven innovations with industry best practices. As the platform evolves, future enhancements will include AI-driven analytics, dynamic pricing models, and further customization options to enhance user experience and profitability..

Keywords: E-Mart

I. INTRODUCTION

The idea of developing an e-commerce wholesale website comes from the need to make traditional wholesale operations easier and more modern. These operations are often complicated and don't work well with regular retail e-commerce platforms. By creating a website specifically for wholesalers, this project aims to make bulk transactions smoother and provide businesses with online tools to stay competitive. This project not only meets the growing need for B2B (business-to-business) e- commerce solutions but also offers a chance to learn and practice various technical and business skills.

Wholesale e-commerce involves business transactions that take place through online communication networks. It is the process of buying and selling products in bulk over a digital platform. Wholesale e- commerce connects businesses, such as suppliers and retailers, through electronic transactions and the exchange of information. When wholesale

transactions occur between businesses, it's known as business-to-business or B2B e-commerce. This type of e-commerce allows wholesalers to sell products in large quantities to other businesses, rather than directly to individual consumers. In a wholesale e-commerce app, businesses can directly connect with wholesalers online, usually through the app, without needing an intermediary.

1.1 Motivation

In today's rapidly evolving digital marketplace, e-commerce platforms have become a critical component of both retail and wholesale industries. However, many wholesale businesses, particularly small and medium enterprises (SMEs), face barriers in transitioning from traditional business models to digital platforms. Despite the presence of numerous e-commerce platforms, there is a significant gap in solutions tailored specifically for wholesale transactions, where bulk orders, price negotiations and customized offerings are standard practices.

The motivation behind this project stems from the need to develop an e-commerce app specifically designed for wholesale businesses. Unlike retail platforms that focus on single-item purchases, wholesalers need features like bulk ordering, tiered pricing, and streamlined communication between buyers and suppliers. Our app aims to bridge this gap by offering a comprehensive platform that supports wholesalers in optimizing their business operations and expanding their market reach, especially within industries like clothing, accessories, and eyewear.

1.2 Outline of the Problem

Wholesale businesses face unique challenges that are not adequately addressed by existing e-commerce platforms, which typically cater to retail customers. Key issues include managing large volumes of inventory, negotiating bulk pricing, handling shipping logistics, and maintaining direct communication between buyers and sellers. Traditional platforms lack the functionalities needed to support such complex interactions, forcing wholesalers to rely on outdated methods like manual order processing and direct phone calls, which can lead to inefficiencies and missed business opportunities.

This project addresses the critical need for a specialized e-commerce wholesale platform. By focusing on features like bulk product listings, dynamic pricing based on order quantity, and integrated negotiation tools, the app will cater to the specific needs of wholesalers. In doing so, it will streamline business operations, reduce manual workload, and facilitate better buyer-supplier relationships.

1.3 Aims and Goals

The core objective of this project is to design and develop a robust e-commerce platform specifically tailored to wholesale businesses. Unlike traditional B2C platforms, the system will address the complex needs of wholesalers, focusing on bulk orders, inventory management, flexible pricing models, and efficient communication between buyers and sellers. This platform will serve as a comprehensive digital marketplace, offering tools that streamline the entire wholesale process, from order placement to payment processing. The system will be designed to simplify and enhance various aspects of wholesale operations, including product listing, order fulfillment, inventory tracking, and customer communication. By providing a tailored solution, this platform aims to increase operational efficiency, reduce errors, and drive profitability for wholesalers.

Specific goals for this project include:

- Product Management: Allow sellers to list products in bulk with options for tiered pricing based on order volume.
- Order and Inventory Management: Provide wholesalers with a tool to track large orders and maintain real-time inventory levels.
- Communication Tools: Implement a messaging and negotiation system that allows buyers and sellers to discuss order specifics directly within the platform.
- Secure Payment Gateway: Integrate a reliable payment processing system to handle large transactions securely.
- User-Friendly Interface: Design an intuitive user experience that simplifies the ordering process for wholesale buyers, minimizing errors and saving time.

1.4 Project Approach and Software Development Model

This project follows a structured, multi-phase development process, beginning with market research to identify the challenges faced by wholesale businesses in adopting e-commerce platforms. Key pain points, such as inefficient order fulfillment, lack of bulk ordering, and limited communication tools, were identified, guiding the design of a tailored solution. The design phase focused on creating a user- friendly platform with features like bulk ordering, price negotiations, and inventory management, while ensuring a responsive interface for both desktop and mobile devices.

For development, Flutter was used for cross-platform compatibility, allowing the app to run on both iOS and Android from a single codebase. Firebase provided backend support for real-time data management and secure user authentication, while Razorpay was integrated for secure payment processing. An agile, iterative approach was followed, with continuous feedback and testing to refine features and ensure usability.

The platform underwent extensive testing, including functional, performance, and security checks, to ensure it was stable, user-friendly, and secure. The result is a scalable, secure e-commerce solution that meets the complex needs of wholesale businesses, streamlining bulk ordering, inventory tracking, and communication between buyers and sellers.

1.5 Overview of the Report Structure

This report is organized into several chapters, each detailing a specific aspect of the project's development process. Below is a brief outline of the structure:

Chapter 2: Market Analysis – This chapter reviews the challenges faced by wholesale businesses in the digital age and analyzes the gap in existing e-commerce platforms.

Chapter 3: Project Statement – This chapter defines the problem and elaborates on the project's approach to creating a solution tailored for wholesale businesses.

Chapter 4: System Requirements and Specifications – The chapter outlines the technical requirements, including the software and hardware needed to develop the system.

Chapter 5: System Design – Detailed diagrams and descriptions of the platform's architecture, including use-case and sequence diagrams, are provided in this chapter.

Chapter 6: Conclusion – The final chapter summarizes the progress made, including key achievements such as the integration of bulk ordering and negotiation features, and discusses next steps for future development.

II. LITERATURE SURVEY

Wholesale e-commerce platforms have transformed the traditional bulk purchasing process by providing seamless, scalable, and data-driven solutions. These websites cater to businesses by offering features like dynamic pricing, tiered discounts, and real-time inventory management. Research highlights the importance of competitive pricing, user-friendly interfaces, and efficient logistics to attract and retain B2B buyers. Studies also explore the integration of technologies like AI for demand forecasting, personalization, and fraud prevention, which enhance the efficiency of wholesale operations. Additionally, adopting flexible payment systems and localized strategies is crucial to addressing diverse market needs in the global wholesale sector.

Related Work and Survey of Existing Solutions

1. Asian Journal of Management Analytics (AJMA) Vol. 2, No. 4, 2023: 379-390: Pricing Strategies Application Amongst the Top E-commerce Southeast Asian Countries.
2. Recommender Systems in E-Commerce J. Ben Schafer, Joseph Konstan, John Riedl GroupLens Research Project Department of Computer Science and Engineering University of Minnesota Minneapolis, MN 55455 1-612-625-4002
3. Li Y Zhang, R.; Jiang, D. Order-Picking Efficiency in E-Commerce Warehouses: A Literature Review. J. Theor. Appl. Electron. Commer. Res. 2022, 17, 1812–1830.
4. A Literature Review of E-commerce Supply Chain Management Hao Sun* Department of Monash University, Melbourne, Australia.
5. Personalizing the E-Commerce – Experience: A Recommendation System Mangalagiri Lakshmi Kanth1* , Mohd Abdul Mujeeb1, Manda Harshitha1, Chennoju Rajinesh1, Bhukya Madhu1, G. vijendar reddy , Rajeev

Sobti Department of Computer Science and Engineering, KG Reddy College of Engineering & Technology, Hyderabad, Telangana, India 2Department of IT, GRIET, Hyderabad, Telangana, India 3Lovely Professional University, Phagwara, Punjab, India.

6. E-commerce websites, consumer order fulfillment and after-sales service satisfaction. By Mark Anthony Camilleri1, University of Malta, Malta and University of Edinburgh, Scotland.

7. Journal of Universal Computer Science, vol. 18, no. 10 (2012), 1238-1258 submitted: 30/6/11, accepted: 25/5/12, appeared: 28/5/12 © J.UCS.
   The Method of Logistic Optimization in E-commerce.

8. 8. Enhancing Data Security in E-commerce: Strategies, Impacts, and Improvements. Libunao, M.1, Sarmiento, P.2, Sugimoto, H.3, Regalario, J.4, Mauricio, K.5, Vallespin, , Institute of Accounts, Business, and Finance, Far Eastern University-Manila, Sampaloc, Manila, 1008, Metro Manila, Philippines.

Summary of research papers:

1. Asian Journal of Management Analytics (AJMA) Vol. 2, No. 4, 2023: 379-390: Pricing Strategies Application Amongst the Top E-commerce Southeast Asian Countries

Technologies and Strategies Used:

1. Dynamic Pricing: Algorithms for flexible, demand-based pricing and demographic-specific price discrimination.
2. Penetration Pricing: Low-price guarantees and free shipping to attract price-sensitive users.
3. Data Analytics: Platforms like Lazada use regional customer insights for tailored pricing.
4. Odd-Even Pricing: Using "9" at the end of prices to create a perception of lower cost.

Drawbacks of Current Tech:

1. Over-reliance on discounts harms long-term profitability.
2. Limited personalization for customer-specific pricing.
3. Flexible pricing may create dissatisfaction due to perceived inequality.
4. Smaller platforms lack scalability and advanced systems.

2. Recommender Systems in E-Commerce J. Ben Schafer, Joseph Konstan, John Riedl GroupLens Research Project Department of Computer Science and Engineering University of Minnesota Minneapolis, MN 55455 1-612-625-4002 Current recommender systems in e-commerce primarily rely on user input and collaborative filtering to suggest products, enhancing customer experience and increasing sales Proposed technologies aim to integrate more advanced algorithms and machine learning techniques to provide personalized recommendations while addressing limitations such as data sharing reluctance and the underutilization of implicit feedback. However, challenges remain in achieving a balance between automation and user engagement, as many systems require manual input to foster customer loyalty.

3. The paper titled "Order-Picking Efficiency in E-Commerce Warehouses" provides a comprehensive review of research conducted between 2020 and 2022 on improving order- picking efficiency in e-commerce warehouses. It focuses on two primary systems:

1. Picker-to-Parts: Human pickers retrieve items directly from storage locations.
2. Parts-to-Picker: Items are transported to pickers using automated systems like robots or automated storage and retrieval systems (AS/RS).

The paper identifies key strategies such as storage assignment, order batching, and routing to enhance efficiency. Additionally, it explores automation technologies like mobile robots and shuttle-based systems for optimizing order throughput and reducing costs. Future research suggestions include combining strategies across systems and considering dynamic uncertainties.

4. A Literature Review of E-commerce Supply Chain Management Hao Sun* Department of Monash University, Melbourne, Australia.

The paper discusses various e-commerce supply chain management models, particularly focusing on the integration of technology such as the Vendor Managed Inventory (VMI) system and third-party logistics (3PL) HUB models. The VMI system enhances inventory management by allowing manufacturers to manage stock levels based on real-time data, which can lead to reduced inventory costs and improved response times to consumer demands Additionally, the third-party logistics HUB model facilitates information sharing among e-commerce enterprises, manufacturers, and logistics partners, optimizing the distribution process, and reducing overall supply chain costs. However, these technologies face limitations, such as the dependency on accurate data sharing and the need for robust relationships among supply chain partners to mitigate issues like unstable supplier relationships Furthermore, the limited reach of offline stores in models like O2O (Online to Offline) can restrict consumer access, highlighting the need for more physical locations to enhance service coverage .Overall, while these technologies present significant advantages in streamlining e-commerce supply chains, their effectiveness is contingent upon overcoming relational and operational challenges.

5. Personalizing the E-Commerce – Experience: A Recommendation System Mangalagiri Lakshmi Kanth, Mohd Abdul Mujeeb1, Manda Harshitha1, Chennoju Rajinesh1, Bhukya Madhu1, G. Vijendra Reddy.

The paper discusses the development of a recommendation system for e-commerce, utilizing machine learning algorithms to enhance user experience and boost sales. Key technologies include collaborative filtering and matrix factorization, which improve recommendation accuracy and address the cold-start problem for new users. However, limitations arise as user bases grow, leading to scalability challenges that necessitate ongoing algorithmic refinement. Additionally, while personalization is crucial for customer retention, an overemphasis on popular products may result in user disinterest, highlighting the need for variety in recommendations.

6. Enhancing Data Security in E-commerce: Strategies, Impacts, and Improvements. In the realm of e-commerce, various technologies enhance data security, including encryption protocols like HTTPS, which protect user data during transactions. However, these technologies face limitations such as the need for regular updates to address vulnerabilities, as many devices only receive limited software support. Additionally, while security features can improve user trust and website aesthetics, they may also lead to increased costs for businesses if privacy is compromised. Furthermore, educating users about security threats is crucial, yet many remain uninformed, which can lead to security breaches.

7. The Method of Logistic Optimization in E-commerce.

Modelling and Simulation: The paper emphasizes the use of modeling and simulation techniques to optimize logistics and supply chains in e-commerce. Heuristic Algorithms: Heuristic algorithms are mentioned to control logistics structures effectively. Computational Logistics: This involves the use of advanced computer systems to manage logistics tasks. Data Integration: The paper highlights the importance of accurate and timely data for effective logistics optimization. Mathematical Representations: The use of mathematical models to represent logistics processes is crucial for optimization. In summary, while various technologies enhance e-commerce logistics, they come with limitations that can affect their effectiveness and reliability.

8. E-commerce websites, consumer order fulfilment and after-sales service satisfaction.

By Mark Anthony Camilleri1, University of Malta, Malta and University of Edinburgh, Scotland.

E-commerce websites utilize various technologies to enhance user experience, including robust website functionality, which ensures smooth navigation but can falter on mobile devices if not optimized. Visual appeal through high-quality graphics attracts consumers, yet overly complex designs may overwhelm them. Security measures are crucial for protecting consumer data, but lengthy verification processes can frustrate users. Accurate inventory management systems are essential for real-time product availability; however, delays in updates can lead to customer dissatisfaction. Personalized services improve customer satisfaction, but effectively gathering and analysing consumer data without

infringing on privacy remains a challenge. Lastly, while e-SERVQUAL measures provide insights into service quality, they may not capture all nuances of user experience across diverse cultural contexts. Overall, addressing these limitations is vital for enhancing service quality in the online shopping environment.

Ref. No.	Year of Publication	Improvement Goal	Algorithm	Metric Used	Topography	Usage
1	2023	Improve pricing strategy	Dynamic pricing, Machine Learning	Revenue, profit margin	Real-world e-commerce data	Price optimization
2	2023	Improve product recommendation accuracy	Collaborative Filtering	RMSE, MAE	E-commerce dataset	Product recommendation
3	2022	Optimize inventory management	Deep Learning	Inventory turnover ratio, stockout rate	Simulated warehouse	Inventory optimization
4	2022	Enhance supply chain visibility	Blockchain	Transaction time, traceability	Supply chain network	Supply chain tracking
5	2022	Improve order fulfilment efficiency	Reinforcement Learning	Order fulfilment time, accuracy	Simulated warehouse	Order fulfilment optimization
6	2019	Personalize customer experience	Machine Learning	Customer satisfaction, purchase frequency	E-commerce platform	Customer segmentation and personalization
7	2024	Enhance cybersecurity	Cryptography, Machine Learning	Intrusion detection rate, false positive rate	Simulated network	Network security
8	2022	Optimize logistics and delivery	Vehicle Routing Problem, Metaheuristics	Delivery time, cost	Real-world delivery data	Route optimization

III. PROJECT STATEMENT

3.1 What is to developed

The wholesale industry has long been burdened by outdated, offline processes that hinder operational efficiency and growth. Many wholesalers still rely on manual methods for procurement, logistics, and payment handling, which leads to delays, errors, and a lack of visibility across the supply chain. Wholesalers and bulk buyers alike struggle with time-consuming procurement processes, limited transparency, and fragmented supply chain management. Buyers, for example, often face challenges when trying to compare products and prices across multiple suppliers, making it difficult to make informed purchasing decisions. At the same time, sellers find it increasingly difficult to manage inventory levels, track orders in real-time, and reach new customers, especially without the support of a modern digital platform. The absence of a unified e-commerce solution means that wholesalers miss opportunities for growth and scalability, while buyers are left with limited options and inefficient ways to access bulk products.

Moreover, traditional wholesale operations often lack the data-driven insights that could significantly optimize critical aspects of the business, such as pricing strategies, inventory management, and customer engagement. Without access to real-time analytics, wholesalers cannot easily adjust to market trends or better understand customer preferences. This gap in data also prevents sellers from effectively targeting buyers with personalized offers or promotions that could drive sales. The overall lack of integration between procurement, sales, and logistics systems only exacerbates inefficiencies, leaving businesses operating in silos.

E-Mart aims to address these challenges by offering a comprehensive, digital marketplace that serves as a one-stop solution for both wholesalers and buyers. The platform will provide a seamless, user-friendly environment where buyers can easily compare products, access tiered pricing based on order volume, and securely complete transactions

via integrated payment gateways. For wholesalers, E-Mart offers real-time inventory tracking, automated order management, and customer insights that can be used to optimize pricing and improve overall business operations. By leveraging data-driven analytics, the platform empowers both buyers and sellers to make informed decisions, improving pricing strategies, streamlining logistics, and enhancing customer engagement. In doing so, E-Mart helps modernize the wholesale industry, enabling businesses to scale more effectively while providing buyers with more efficient, transparent, and secure purchasing options.

3.2 Proposed Algorithm/Methodology

1. Cloud Firestore: Cloud Firestore is a NoSQL database provided by Google Firebase. It is designed to store and sync data for client-side applications in real time. In our app, Cloud Firestore is responsible for storing critical information about products, users, and orders.
• Real-Time Data Sync: Data in Firestore is updated instantly across all clients, which means any changes to products, user data, or orders are reflected on all devices in real-time.
• Structure: Data is organized in collections and documents. Each collection contains multiple documents, and each document can contain various fields with different data types (e.g., strings, numbers, dates, arrays).
• Scalability: It is highly scalable, making it ideal for apps that need to support a growing number of users and data.

2. Payment Integration(Razorpay): Razorpay is a payment gateway that facilitates online transactions. It provides a secure and easy way to handle payments directly within our app. In our case, Razorpay handles all payment operations, allowing users to pay for products or services using multiple payment methods:
• Credit/Debit Cards
• Digital Wallets (e.g., Paytm, Google Pay)
• Net Banking
• UPI (Unified Payments Interface) Integration Steps typically involve:
• Frontend: Implementing the Razorpay SDK on the app to initiate payments.
• Backend: Handling payment verifications, order status updates, and security checks.
• Security: Razorpay ensures compliance with PCI-DSS (Payment Card Industry Data Security Standard), safeguarding users' sensitive payment data.

3. Firebase Authentication: Firebase Authentication provides backend services to help authenticate users and manage user sessions in our app. It simplifies the process of implementing sign-up, sign-in, and identity verification.
• Multiple Authentication Methods:
o Email/Password Authentication: Users can sign up using their email and a password.
o Social Sign-In: Allows users to log in using their Google, Facebook, or Twitter accounts.
o Anonymous Authentication: Useful for scenarios where you want to provide access to the app without requiring user registration initially.
o Phone Authentication: Users can sign in using their phone number, receiving an OTP for verification.
• Security: Firebase Authentication uses industry-standard methods (OAuth, OpenID) to ensure that user data and credentials are secure.

4. Database [sqflite] : sqflite is a Flutter plugin that provides SQLite support for local database storage. It's useful when the app needs to store data on the user's device, allowing the app to function even when there is no internet connection (offline functionality).
• Use Case: This is ideal for scenarios like saving user preferences, order history, product details, or cart items.
• SQLite: Underlying SQLite is a relational database, meaning data is stored in tables and can be queried using SQL commands.
• Offline Support: Data stored using sqflite is persistent and remains available even when the app is closed or when there's no network connectivity.

5. RestApi :In our app, REST APIs are used to communicate with a server to perform CRUD (Create, Read, Update, Delete) operations.

• GET: Used to retrieve data from the server, such as fetching product details, user info, or order history.

• POST: Sends data to the server to create a new resource, such as creating a new user or submitting an order.

• PUT: Used to update an existing resource. In your case, it could be used to update product details, user information, or order status.

• PATCH: This is similar to PUT but is used for partial updates. For example, updating only one field of a user profile (e.g., email) without affecting the rest of the data.

• DELETE: Removes a resource from the server, such as deleting an order or a user account.

6. State Management (Provider): State management in Flutter refers to the way the app maintains and updates its state (the data that drives the UI). Provider is one of the most popular state management solutions in Flutter due to its simplicity and efficiency.

There are different types of providers in our app that help manage the flow of data between the UI and business logic:

• Provider: The basic provider that supplies data to the widget tree. It listens to changes in the data and rebuilds the UI when necessary.

• ChangeNotifierProvider: A specialized provider that allows the use of a ChangeNotifier class to notify listeners when the data changes. It's useful for managing mutable states that need to update the UI in response to changes.

• ProxyProvider: A provider that allows combining multiple providers into a single provider. It's useful when you need to create a value that depends on other providers.

• MultiProvider: A way to combine multiple providers in a single widget. It's useful when you have several dependencies that need to be provided at once.

• Consumer: A widget that listens to a provider and rebuilds whenever the provided value changes. It allows the widget to react to changes in state, making the UI dynamic and responsive to updates.

Each type of provider offers specific features, and using the right provider type is essential for optimizing performance and maintaining clean architecture in the app.

IV. SYSTEM REQUIREMENTS AND SPECIFICATIONS

1. Requirements Specification

1.1 Functional Requirements

1. User Registration & Login: The platform will provide a secure sign-up and login process for both buyers and sellers. Users will be required to create accounts using email or social media logins (such as Google or Facebook) to ensure smooth authentication. The system will employ multi-factor authentication (MFA) to enhance security and ensure that only authorized users can access sensitive data. Account verification will be conducted through email confirmation or phone number validation to ensure authenticity.

2. Product Management: Sellers will have the ability to add, update, and delete products in their catalog. Each product listing will include detailed descriptions, high-quality images, and relevant attributes such as size, color, or material. Sellers will also be able to set tiered pricing based on bulk order quantities and apply special discounts for large orders. The system will support bulk uploads through CSV or Excel files, making it easy for sellers to manage large inventories. Additionally, sellers can track stock levels and set minimum stock alerts to avoid out-of-stock situations.

3. Product Search & Filters: Buyers will be able to search for products using a powerful search bar that supports keyword-based queries. In addition to basic product search by name, the system will provide advanced filters to refine search results based on parameters such as price range, category, brand, ratings, and availability. The search algorithm will prioritize relevant products and allow for sorting by price, popularity, or newest arrivals. This feature will significantly improve the user experience by helping buyers quickly find the products they need, saving time and reducing frustration.

4. Order Management: The platform will allow buyers to place orders for one or more products, while enabling sellers to manage and fulfill those orders. Buyers will be able to view order history, check the status of active orders, and easily cancel or modify orders before they are processed. Sellers will have a detailed order management dashboard,

where they can view incoming orders, track fulfillment status, update delivery timelines, and process cancellations or returns. Both parties will receive notifications about order status changes, shipment updates, and delivery confirmations, ensuring transparency and real-time tracking.

5. Secure Payments: The platform will integrate multiple payment gateways to allow buyers to complete transactions securely using various payment methods, including credit/debit cards, net banking, wallets, and UPI. Payments will be processed via trusted gateways such as Razorpay or Stripe, ensuring a secure transaction environment. The system will support both one-time payments and recurring payments for subscription-based orders. To prevent fraud, the platform will also include anti-fraud measures, such as 3D secure verification for card payments and encrypted data storage. Buyers will receive instant payment confirmations, and sellers will be notified when payments are completed or pending.

6. Shipping & Tracking: The platform will integrate with third-party logistics providers (such as FedEx, DHL, or UPS) to offer real-time tracking for shipped orders. Once an order is fulfilled, buyers will receive an email or SMS with a tracking number and a link to view the status of their shipment in real time. Sellers will have the ability to update the shipping status manually or via API integration with their logistics partners.

7. Notifications: The platform will send real-time notifications to users for various events, including order placement, payment status updates, shipping notifications, and product restocks. These notifications will be sent via email, SMS, or push notifications within the app, depending on the user's preference.

8. Ratings & Reviews: After receiving their orders, buyers will be encouraged to rate the products and leave reviews based on their experiences. These ratings and reviews will help build trust within the platform by providing valuable feedback to other buyers and sellers.

9. Reports: Sellers will have access to a comprehensive reporting and analytics dashboard to track various aspects of their business. This will include sales reports, which display total sales, revenue, and profits over different time periods, as well as inventory reports to help manage stock levels efficiently.

1.2 Non-Functional Requirements

1. Scalability: The platform must be designed to handle a large and growing number of users and transactions without compromising performance. This includes ensuring that both the application's front-end (user interface) and back-end (servers and databases) can scale seamlessly as traffic increases.

2. Security: Data encryption, secure login, and compliance with regulations. Security is a foundational component of the platform, particularly since it will handle sensitive user data, including personal information, payment details, and transactional data.

3. Usability: The platform will be designed with an emphasis on ease of use and an intuitive user experience. A clean, well-organized interface will ensure that both buyers and sellers can navigate the platform with minimal effort. Buyers will be able to browse products, place orders, and manage their profiles efficiently, while sellers will have easy access to their product catalogs, order management tools, and analytics.

4. Availability & Performance: The platform must ensure a high level of availability and fast response times to provide a seamless user experience. A target uptime of 99.5% will be set, meaning the platform should experience no more than a few hours of downtime per year.

1.3 Current System Problems

• Manual, outdated processes leading to errors, delays, and poor customer reach.

2. Use Cases

1. User Registration & Login: This use case involves users (buyers and sellers) registering an account or logging into the platform. Users can sign up using an email address or social media accounts (such as Google or Facebook) for easy access. During registration, users will provide basic details like name, business information (for sellers), contact information, and payment preferences.

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2. Manage Products: Sellers can manage their product listings through an intuitive interface. This includes adding new products by entering product details such as name, description, price, quantity, and images. Sellers can also update existing product information, including price changes, quantity adjustments, or new product variations.

3. Search and Filter Products: Buyers can search for products based on keywords, categories, or other attributes (e.g., brand, price range, ratings). The app will offer advanced filtering options, such as price ranges, product types, or availability, allowing buyers to refine their search results based on their preferences.

4. Place Orders: Buyers can place orders for one or more products through a simple and secure checkout process. After adding items to their shopping cart, buyers will proceed to review the order, select shipping preferences, and choose a payment method. The platform will support multiple payment options, including credit/debit cards, wallets, UPI, and other local payment methods.

5. Manage Orders: Sellers will have access to a dedicated order management dashboard where they can view all incoming orders. Sellers can mark orders as "in-progress," "shipped," or "delivered" based on the order status, ensuring clear communication with buyers.

6. Payment Processing: This use case involves secure handling of payments. Once the buyer confirms their order, the system will process the payment through a payment gateway like Razorpay.

7. Shipping & Delivery: After an order is confirmed, the seller will arrange for shipping. The platform will integrate with third-party logistics providers (e.g., FedEx, UPS, or local courier services) for real-time shipping and delivery tracking.

8. Rate & Review Products: After receiving their orders, buyers will be encouraged to rate the products they purchased and leave reviews based on their experience.

3. Software and Hardware Requirements
3.1 Software
1. OS: Linux (Server), Windows/macOS (Client)

2. Frontend: Flutter will be used as the primary framework for the frontend, offering a powerful and efficient way to build cross-platform mobile and desktop applications. Flutter enables the development of highly responsive, fast, and visually attractive user interfaces with a single codebase, reducing both development and maintenance costs.

3. Backend: Firebase will serve as the backend for the platform, offering a range of services such as real-time data synchronization, authentication, cloud storage, and serverless computing. Firebase provides an easily scalable infrastructure and seamless integration with the frontend, allowing developers to quickly implement features without managing complex backend infrastructure.

4. Database: Cloud Firestore, a NoSQL database provided by Firebase, will be used to store real- time, scalable data such as product listings, orders, user profiles, and transaction records. sqflite, a lightweight SQLite database, will be used for local data storage on the client-side, ensuring that users can continue to interact with the app offline.

5. Payment Gateway: Razorpay will be integrated as the payment gateway for secure and seamless payment processing. Razorpay is a widely used and trusted payment gateway, offering multiple payment options, including credit/debit cards, UPI, net banking, and popular digital wallets (like Google Pay and Paytm).

6. Logistics API: The Logistics API will be integrated into the platform via a RESTful API, which will connect with third-party logistics providers for real-time shipment tracking and order fulfillment.

3.2 Hardware
1. Server: 2.5 GHz quad-core CPU, 8 GB RAM, 500 GB SSD, 1 Gbps network
2. Client: 2 GHz CPU, 4 GB RAM, 20 GB storage, stable internet

V. SYSTEM DESIGN

5.1 System Architecture:

E-Mart uses a three-tier architecture:

1. Presentation Layer (Frontend):

1.1 Buyer's Experience:

• Product Discovery:

1. Category navigation, search bar with filters (price, brand, rating).
2. Bulk pricing and discounts clearly displayed.
3. Product details with descriptions, specs, availability, and seller info.

• Cart & Order Management:

1. Multiple cart support, order summary with discounts, taxes, shipping.
2. Real-time stock updates for products.

• Checkout & Payment:

1. Multiple payment options: credit card, PayPal, bank transfer, COD.
2. Bulk invoice generation and tax details for B2B transactions.

• Shipping & Tracking:

1. Real-time tracking, multiple shipping options, estimated delivery date.
2. Shipping carrier integration (e.g., FedEx, UPS).

• Customer Support:

1. Live chat support and detailed FAQ section.

• Reviews & Ratings:

a. Product reviews based on bulk purchase experiences.

1.2 Seller's Experience:

• Seller Dashboard:

1. Manage product listings (add/update), bulk uploads (CSV).
2. Set and manage bulk discounts, inventory alerts.

• Order Management:

1. View and manage orders, mark as shipped, upload tracking info.

• Sales Analytics:

1. Revenue tracking, order trends, customer insights.

• Pricing & Stock Management:

1. Dynamic pricing based on demand, low-stock alerts.

• Shipping Integration:

1. Integrate with shipping carriers for real-time rates and labels.
2. Bulk shipping processing.

• Tax & Invoice Management:

1. Automatic invoice generation with tax details (VAT/GST).

• Promotions & Discounts:
1. Create flash sales, discount codes for buyers.

• Customer Support & Messaging:
1. Real-time messaging with buyers, support ticketing system.

1.3 Design & UI/UX Considerations:
• Responsive Design:
1. Adaptive layout for different screen sizes (mobile, tablet, desktop).

• Minimalist, Professional Design:
1. Clean, user-friendly interface with clear product navigation.

• Intuitive Navigation:
1. Easy-to-access product categories, cart, and order management.

• Speed & Performance:
1. Lazy loading, infinite scrolling, real-time updates for smooth experience.

• Accessibility:
1. Screen reader support, high contrast themes, large touch targets.

2. Business Logic Layer (Backend):
• Authentication:
1. User authentication with Firebase Authentication (email/password, phone, and social login).
2. Role-based authentication (buyer, seller, admin) using Firebase Security Rules.

• Order Processing:
1. Custom logic to handle wholesale order processing with bulk discounts, payment handling, and order validation.
2. Multi-step checkout process: From cart to order summary, payment, and confirmation.

• Payment Handling:
1. Integration with third-party payment gateways Razorpayfor handling large transactions.
2. Support for invoicing, VAT/GST calculations, and other tax-related operations for B2B transactions.
3. Secure handling of payments with Firebase Functions for server-side validation.

• Inventory Management:
1. Syncing real-time stock availability across multiple sellers and warehouses.
2. Automatic stock updates and alerts for low inventory.

• Shipping & Logistics:
1. Integration with third-party APIs like FedEx, UPS, or local carriers to provide shipping rates, track orders, and manage returns.
2. Integration with a logistics partner for bulk shipments and freight calculation.

3. Database Layer:
• Firestore:
1. Users: Store buyer and seller details, including roles, shipping addresses, and order history.
2. Products: A collection for product details (name, description, price, stock level, seller info).

3. Orders: Store order data, including buyer info, items, quantity, total price, payment status, and shipping details.
4. Transactions: Store transaction details including payment status, method, and payment confirmation data.

• Sqflite (SQLite):
• Use Sqflite for local storage on the device for offline use cases (product details, cart info, last viewed items).
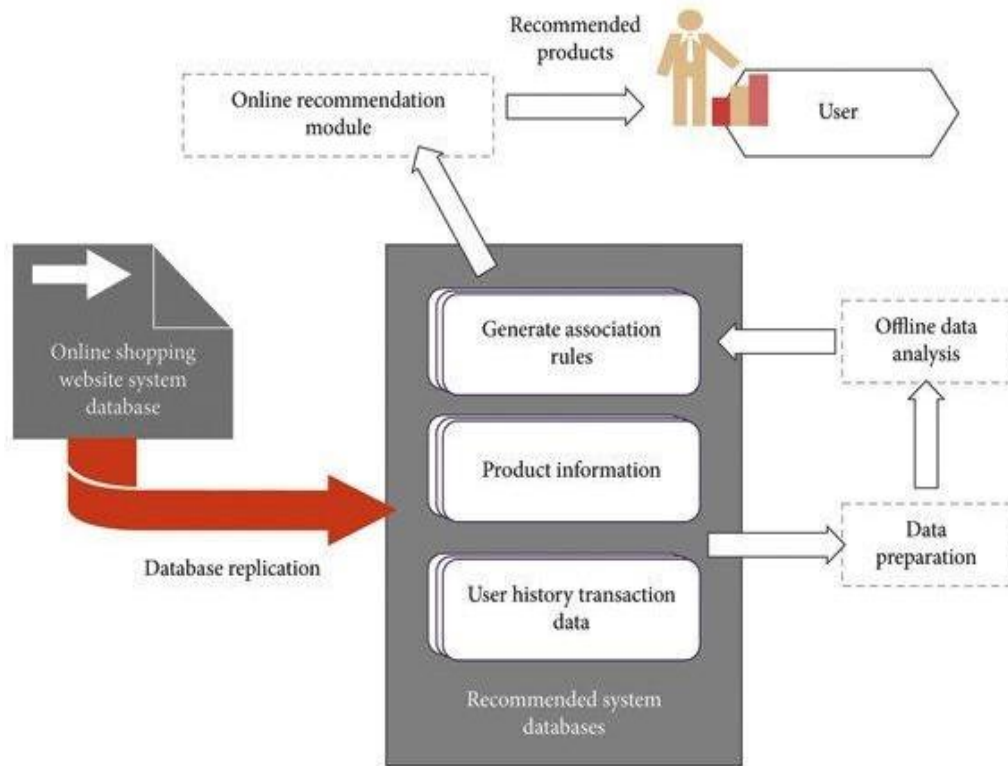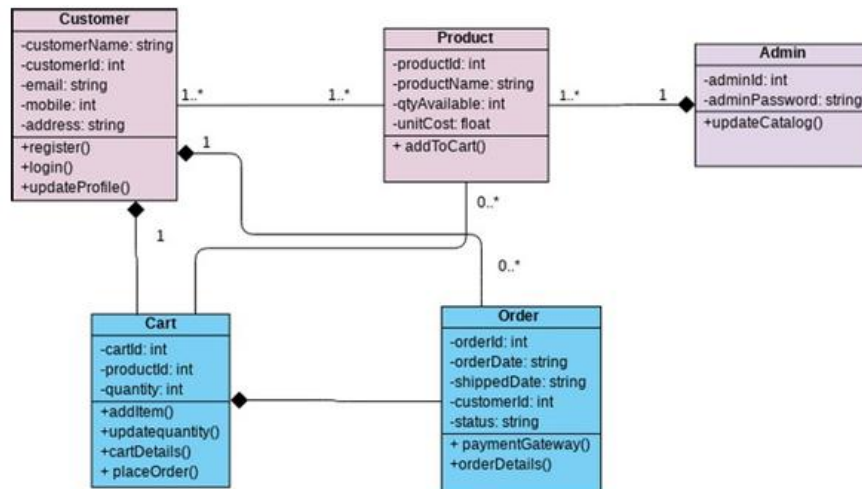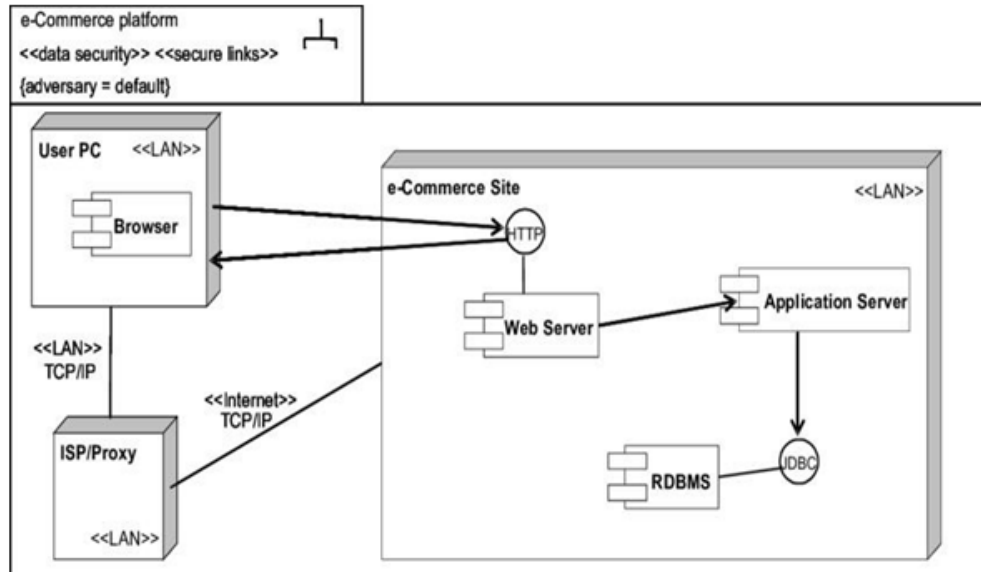• Sync local data with Firestore when the user is back online.
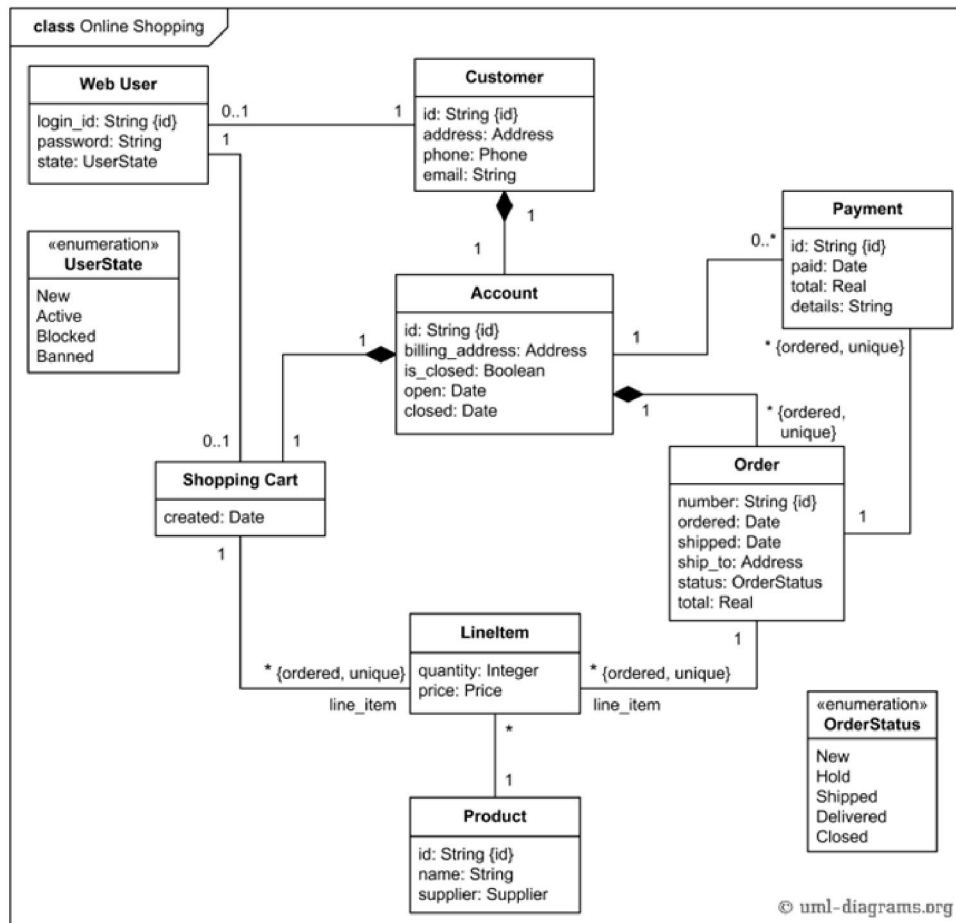

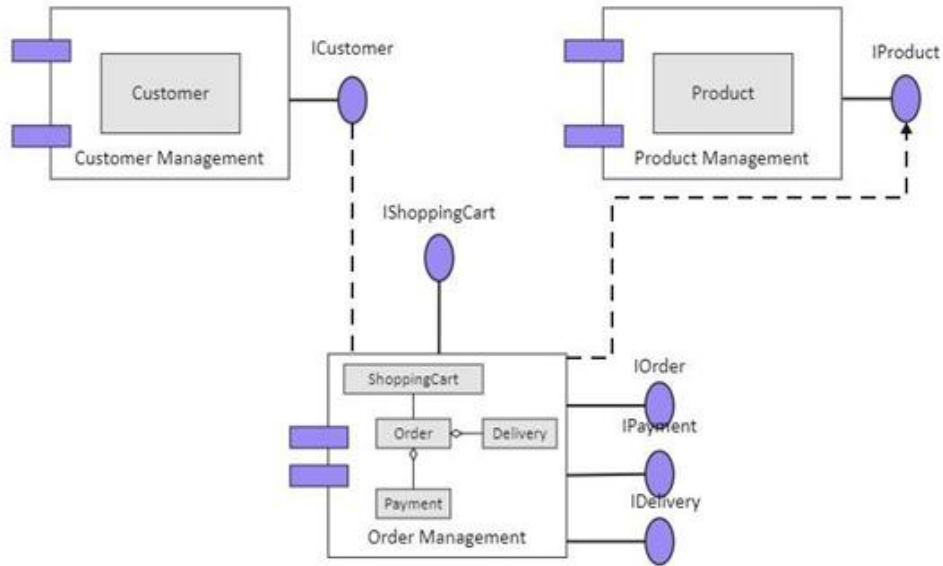Fig 5.1 System Architecture

5.2 UML diagram :
Class Diagram:
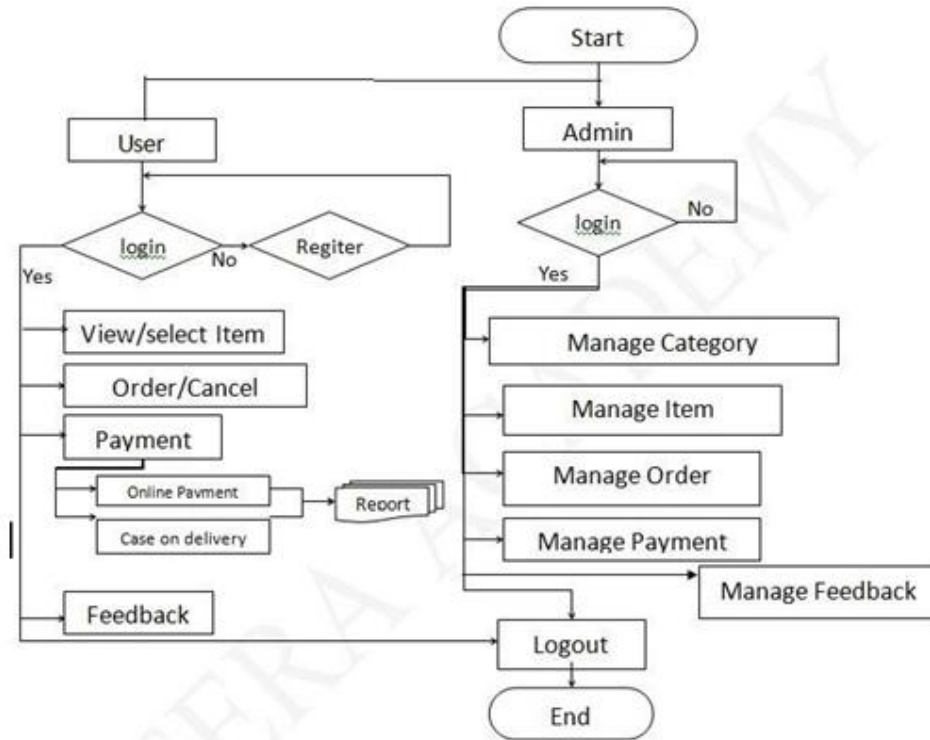
Deployment Diagram:

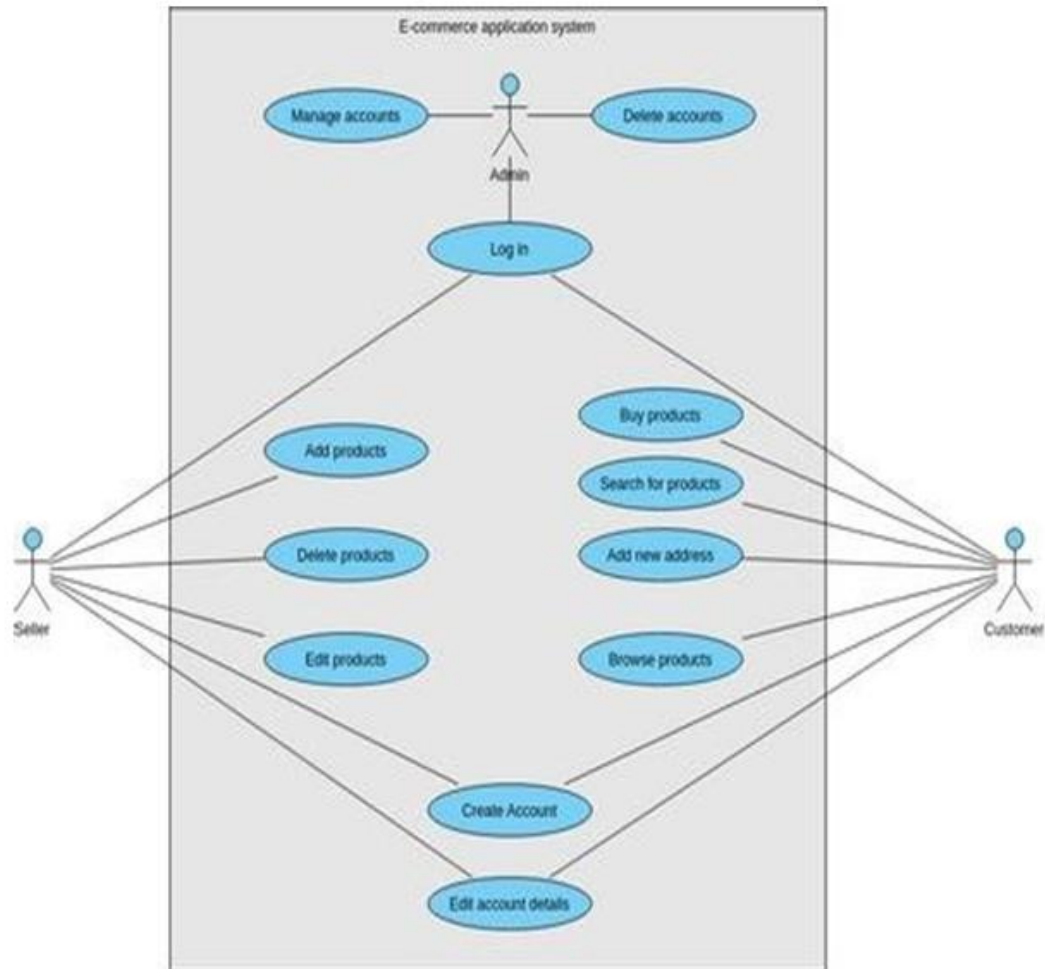

Activity Diagram:

Component Diagram:

Sequence Diagram:

Usecase Diagram:

VI. CONCLUSION

The E-Mart : (Wholesale E-Commerce Platform) revolutionizes the traditional wholesale industry by digitizing and streamlining key processes like procurement, inventory management, and order tracking. By automating these tasks, E-Mart enhances supply chain efficiency, reduces manual errors, and simplifies business operations for wholesalers and retailers. The platform offers secure transaction processing, dynamic pricing, and a user-friendly interface, addressing common challenges in the wholesale market and fostering stronger relationships between buyers and sellers. With features like bulk ordering, price negotiations, and real-time shipping tracking, E-Mart creates a seamless experience for both parties, ensuring greater transparency and control over the supply chain.

This project demonstrates the transformative potential of digital technologies in modernizing wholesale commerce. Beyond its immediate impact, E-Mart provides valuable learning experiences in full-stack development, database management, and user-centric design. These insights will not only guide the future evolution of the platform but also inform the development of other e-commerce solutions. Looking ahead, the platform's architecture is designed to support advanced features like AI- driven insights, predictive inventory management, and personalized pricing models, ensuring long- term scalability and adaptability to changing market needs.

With a robust and scalable infrastructure, E-Mart is well-positioned to meet the evolving demands of wholesale businesses and foster growth within the industry. As the platform continues to scale and integrate emerging

technologies, it will remain at the forefront of the wholesale e-commerce landscape, helping businesses optimize their operations and stay competitive in a rapidly changing market.

Ultimately, this project highlights the power of digital transformation in the wholesale sector, offering both a practical solution for today's challenges and a visionary pathway for the industry's evolution. As E-Mart grows and evolves, it will play a crucial role in shaping the future of B2B e-commerce, ensuring that wholesalers and retailers can thrive in an increasingly digital and interconnected world.

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