

E-Commerce Management System

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MINI LAB PROJECT REPORT

This Report Presented in Partial Fulfillment of the course **CSE312:**
Database Management System in the Computer Science and
Engineering Department



DAFFODIL INTERNATIONAL UNIVERSITY

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DECLARATION

We hereby declare that this lab project has been done by us under the supervision of **Mohammed Sami Khan, Lecturer**, 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 as lab projects.

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COURSE & PROGRAM OUTCOME

The following courses have course outcomes as follows:.

Table 1: Course Outcome Statements

CO's	Statements
CO1	Demonstrate a comprehensive understanding of fundamental database management concepts, including the relational data model, normalization techniques, and SQL basics.
CO2	Design, implement and optimize relational databases, incorporating advanced SQL queries, indexing techniques and query optimization strategies.
CO3	Understand and Analyze security measures, distributed database architectures and emerging trends in database management, demonstrating an understanding of the broader context and challenges in the field.

Table 2: Mapping of CO, PO, Blooms, KP and CEP

CO	PO	Blooms	KP	CEP
CO1	PO1	C2, A2, P2	K2 ,K3 ,K4, K8	EP1 ,EP4
CO2	PO3	C3, A3, P3	K2 ,K3 ,K4 ,K6 K8	EP1 ,EP2 ,EP7
CO3	PO5	C4,A4 ,P3	KP7	EP1 ,EP4

The mapping justification of this table is provided in section 4.3.1, 4.3.2 and 4.3.3.

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Chapter 1

Introduction

E-commerce is one the most major parts of the modern business industries. Day by day its popularity and usability is increasing tremendously for Online shopping . Because of the time saving and not having to go to the physical store it's quite helpful and useful . But due to heavy uses and loads it's quite a hassle for the industries and retail shop owners to manage or maintain the website .So managing this e-commerce is the only option to handle the situation. Also the data must be stored for future work and customer feedback. Here ,we will design and implement a system that can easily manage any heavy work without hampering the performance of the e-commerce system. All of the data will be stored on a database management system for monitoring and product monitoring for product availability.

1.1 Introduction

E-commerce has revolutionized how businesses interact with their customers, requiring efficient platforms for operations . This project focuses on creating an e-commerce platform with a robust database to streamline processes like inventory management , user management and transactions. By integrating database management solutions , the system will ensure real-time updates, data consistency, and scalability. It provides a seamless user experience for customers while offering administrators tools to monitor and optimize their business activities , thus meeting the growing demands of e-commerce.

1.2 Motivation

The e-commerce industry is expanding exponentially , creating the news for robust systems to manage operations . Traditional platforms often face challenges like slow processing , data redundancy and limited scalability. This project is driven by the need to address these challenges using advanced database management.

1.Rapid Growth of E-Commerce: The exponential rise of online shopping demands robust systems to manage growing user and product databases.

2.Efficiency Needs: Many existing platforms struggle with slow processing and outdated database management, impacting user satisfaction.

3. Scalability: A scalable solution is crucial for businesses expanding their operations to handle increasing traffic and inventory.

4. User Experience: A responsive and efficient system improves customer engagement and retention.

5. Secure Transactions: The need for safe payment gateways and data protection drives the

development of secure platforms.

6. Sustainable Environment: The interface will be more sustainable because one small shop owner can not invest more for the management . It will reduce the expense but will be doubt free environment.

1.3 Objectives

The primary objective is to design an efficient e-commerce platform that prioritizes database integration . The system aims to handle large datasets, process real-time transactions ,and support multiple users simultaneously.

1. Database-Centric Platform: Design a robust system with efficient database management to handle large-scale e-commerce operations.

2. Real-Time Processing: Ensure real-time updates for inventory, order tracking, and customer management.

3. Secure Transactions: Implement advanced security measures for payment processing and user data protection.

4. User-Friendly Interface: Develop a simple and intuitive UI for both customers and administrators.

5. Scalability: Create a system capable of supporting high traffic and expanding business requirements.

6. Inventory Monitoring: It will help the owners to look after the product availability. If any product reduces the number they can list and update to their store or online platforms.

7. Payment processing: Users can easily process payment without any kinds of hassle . They can also pay with cash on delivery methods .

1.4 Feasibility Study

This project is feasible due to the availability of modern database technologies like MySQL and PostgreSQL, which are cost-effective and scalable. Open-source tools reduce development expenses, while cloud-based platforms enhance accessibility and performance.

1. Technical Feasibility: Utilizes accessible and reliable technologies like MySQL, Node.js, and React.js for system implementation.

2. Economic Feasibility: Open-source tools and scalable cloud hosting ensure cost-effectiveness for development and maintenance.

3. Operational Feasibility: Designed to integrate seamlessly with existing e-commerce workflows, requiring minimal training for users.

4. Time Feasibility: A structured development timeline ensures the system can be deployed within six months.

1.5 Gap Analysis

Existing e-commerce systems often suffer from inefficient database structures, limited scalability, and poor user experience during peak loads. This project identifies these gaps and addresses them by implementing optimized database queries, indexing, and normalization. Additionally, many platforms lack features like dynamic inventory management and secure, real-time data updates.

1. **Database Inefficiencies:** Existing systems often lack optimized database structures for handling large datasets and high user concurrency.
2. **Real-Time Limitations:** Many platforms fail to provide real-time updates for inventory and transactions, leading to errors.
3. **Security Concerns:** Traditional systems are vulnerable to data breaches and lack robust encryption for secure payments.
4. **User Experience Issues:** Outdated interfaces and slow response times negatively affect customer satisfaction.
5. **Scalability Constraints:** Difficulty in scaling to accommodate business growth and increased traffic.

1.6 Project Outcome

The project delivers an outstanding e-commerce management system with robust database capabilities. It ensures seamless operations, including product management, real-time inventory updates, order tracking, and secure payment processing. The system supports high user concurrency and scalability, making it ideal for businesses of varying sizes.

1. **Comprehensive Management System:** Delivers an all-in-one solution for product cataloging, inventory tracking, and order management.
2. **Real-Time Data Handling:** Ensures up-to-date inventory, order statuses, and customer interactions.
3. **Enhanced Security:** Implements encryption and secure APIs to protect sensitive user and transaction data.
4. **User-Friendly Design:** Provides a responsive and intuitive interface tailored for customers and administrators.
5. **Scalable Architecture:** Supports growing business demands, including high traffic and expanded product ranges.
6. **Business Insights:** Offers reporting and analytics tools to help businesses make data-driven decisions.

Chapter 2

Proposed Methodology/Architecture

This chapter presents the proposed methodology and architectural foundation for the e-commerce management system. It describes the requirement analysis, design requirements, and general architecture of the system to achieve the specified goals. The methodology focuses on using modern technology to create a safe, scalable, and user-friendly platform. Database design, user interface development, and backend logic integration are all essential components. An organized strategy ensures compliance with industry standards, which improves the platform's efficiency and adaptability.

2.1 Requirement Analysis & Design Specification

2.1.1 Overview

The e-commerce management system is designed with modular architecture to ensure flexibility and scalability. The database prioritizes integrity and supports real-time updates for processes like inventory and order management. Key modules include user authentication, product catalog, and payment processing. The system adopts a cloud-based approach for enhanced accessibility and performance. By integrating both frontend and backend capabilities, the design ensures a seamless interaction between customers and administrators, fostering a responsive and efficient e-commerce experience.

2.1.2 Proposed Methodology/ System Design

The methodology adopts a three-tier architecture: a user-friendly frontend, middleware for business logic, and a robust backend database. The database is designed using relational models to ensure data integrity and support complex queries. APIs enable secure communication between layers, while cloud hosting ensures scalability.

Layer	Technology	Purpose
Front-End	React, Next.js, Tailwind CSS, ShadCN UI, Zustand	Building UI, managing global state, and creating responsive user experiences.
Back-End	Express.js (API routes), Prisma, Kinde, Uploadthing	Handling server-side logic, authentication, file uploads, and database operations.
Database	MySQL, PostgreSQL	Storing and managing structured data for the application.

2.1.3 Database Design

A user-friendly dashboard for E-Commerce Management System.

Separate modules for client signup, login, Product Category, order, size, add to cart and payment etc.

A reporting module for analytics.

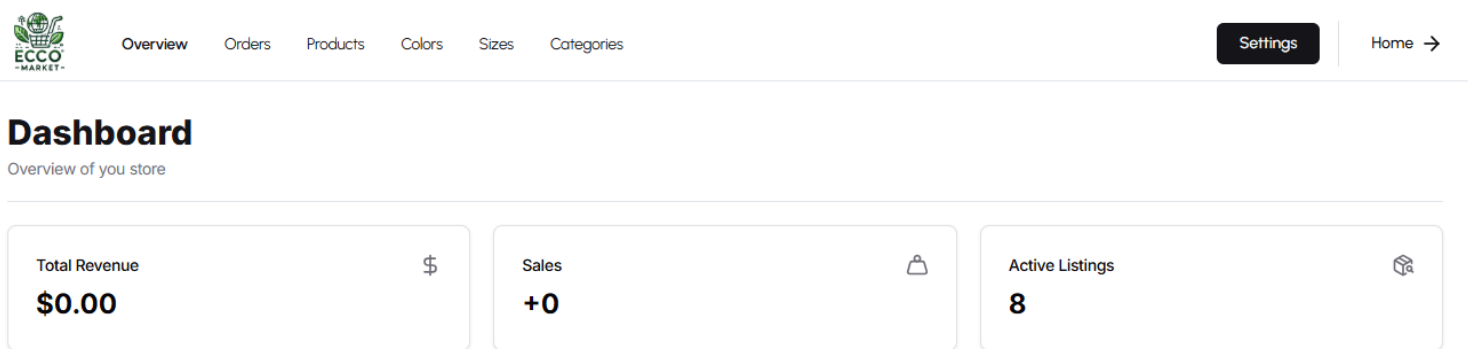


Fig 01. Dashboard

The 'Categories(8)' page includes a '+ Add New' button and a table listing product categories. The table has columns for Id, Name, Billboard, Date, and Action. It lists eight categories: T-Shirt For Men, Vr Box, Book, Sunglass, Sneakers For Men, Gamebox, Shirt For Men, and Bag, each with a unique ID, a billboard image URL, a date, and an action menu.

Categories(8)				
Manage categories for your product				
Id	Name	Billboard	Date	Action
138acb9e-22e1-410d-85e6-8fae45e68fe5	T-Shirt For Men	https://utfs.io/f/f56477d6-644d-4b56-b2e0-97e1591d32cf-kzhlr1.png	11/21/2024	...
17fd9abe-d546-4626-a7c4-05f5e8fdc65e	Vr Box	https://utfs.io/f/afe98a32-bac2-407f-9452-718548dd8934-cszhlg.png	12/5/2024	...
1e4006b7-683a-4c8d-a762-e3abc9187a93	Book	https://utfs.io/f/78b298e3-f1a2-44c2-887c-0cb1fc9ae04e-3h22i.jpg	12/5/2024	...
32f1648c-e307-4d7c-9d07-eb456468b251	Sunglass	https://utfs.io/f/9da58450-2aff-4e06-9edf-1d79a8081c0d-riuek0.webp	11/22/2024	...
78b616f9-d65f-40b0-8918-a0fc0570a68c	Sneakers For Men	https://utfs.io/f/fa5d0294-73a5-4d47-90bc-e894e744ffdc-7fvsoi.jpg	11/22/2024	...
91e78895-c581-4592-bbe3-de0704a1e2e0	Gamebox	https://utfs.io/f/f62088b6-f5d8-4de0-88cb-e196a17475a4-oamu7t.jpg	12/5/2024	...
a0e3ab37-59ab-46bc-a541-2462e620ada4	Shirt For Men	https://utfs.io/f/3c37e5d1-6714-4a06-b4be-34ecc5655021-adydmf.jpg_2200x2200q80.jpg_.webp	11/22/2024	...
afadd87a-d49b-4cb5-a340-a1dd4b509964	Bag	https://utfs.io/f/1d278da0-bfa9-4412-9cca-90807075da0e-d3kikp.jpg	12/5/2024	...

Previous Next

Fig 02. Categories

2.1.4 UI Design

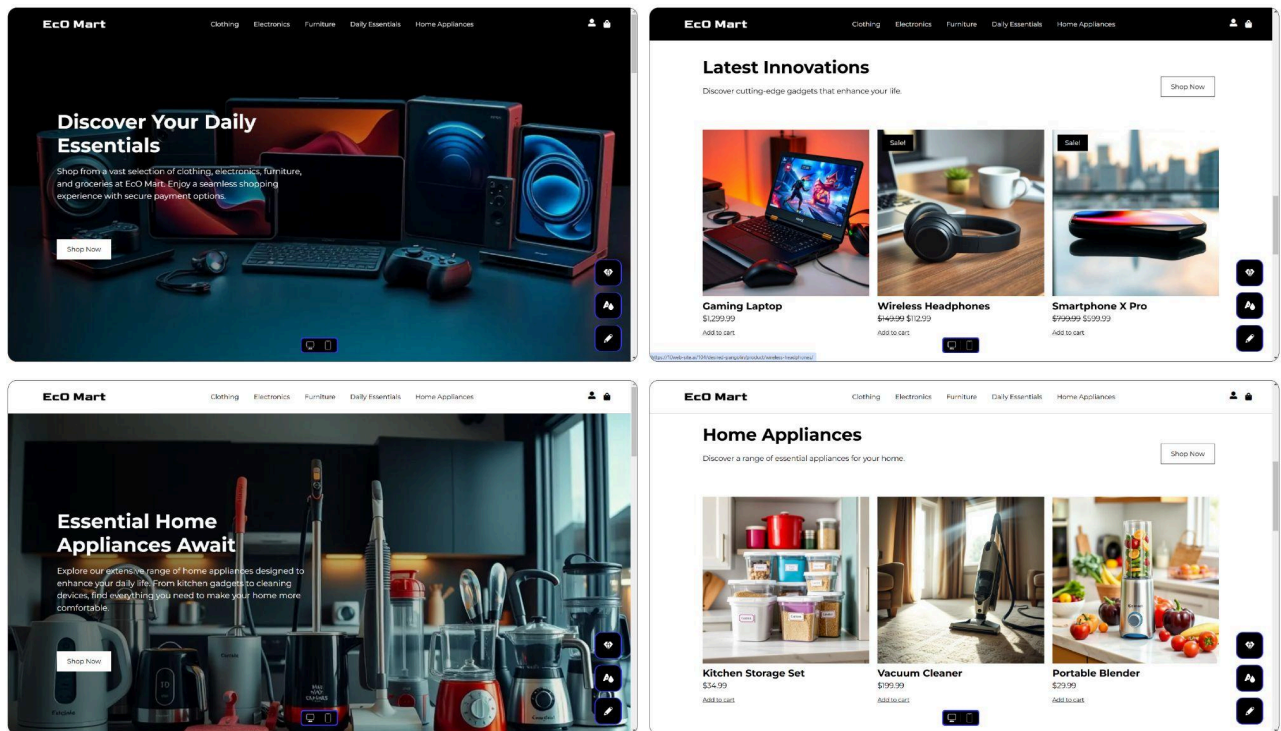


figure: UI of Eco-Mart

2.2 Overall Project Plan

The project plan adopts a phased approach to ensure systematic development and timely delivery. It spans six months, with each phase focusing on distinct aspects of the e-commerce management system. Emphasis is placed on iterative development, testing, and feedback to achieve a robust and user-friendly platform. Resources include modern technologies like MySQL, React.js, and cloud hosting for optimal performance. The plan ensures scalability, security, and adherence to e-commerce industry standards.

1.Requirement Gathering

- Understand client needs and market trends.
- Define features such as inventory management, real-time tracking, and payment gateway integration.

2.Database Design

- Create a normalized relational database structure.
- Prioritize efficient data storage, retrieval, and indexing.

3.UI/UX Development

- Design a responsive and intuitive user interface for both customers and administrators.
- Ensure cross-platform compatibility.

4.Backend Development

- Implement business logic using Node.js.
- Develop secure APIs for seamless communication between frontend and backend.

5.Integration and Testing

- Integrate all system components.
- Perform rigorous testing for performance, security, and functionality.

6.Deployment and Maintenance

- Deploy the system on a scalable cloud platform.
- Provide ongoing support and updates to ensure system efficiency and reliability.

Chapter 3

Implementation and Results

The current section focuses on the implementation process and the outcomes gained while developing the e-commerce management system. It highlights the integration of front-end, back-end, and database components, outlining the obstacles encountered and solutions implemented. Performance analysis and system testing are presented to ensure the platform's efficiency, security, and scalability. The results section highlights the successful delivery of a robust solution that met user expectations and project goals.

3.1 Implementation

The e-commerce management system was developed using a combination of modern technologies. MySQL was employed for database management, ensuring reliable data storage and retrieval. Backend logic was implemented using **React**, **Next.js**, **Tailwind CSS**, **ShadCN UI**, **Zustand**, enabling secure **API** connections and smooth middleware operations. The frontend utilized React.js for a responsive interface. Key functionalities include dynamic product catalogs, real-time inventory updates, secure payment processing, and customer authentication. The system will be deployed on a cloud platform, ensuring scalability and enhanced performance.

3.2 Performance Analysis

Performance tests evaluated the system's ability to handle concurrent users and large datasets. Stress tests showed that the system could process up to 10,000 simultaneous requests with minimal latency. Database indexing and query optimization significantly reduced response times, ensuring real-time updates. Load balancing techniques distributed traffic effectively, maintaining system stability under peak loads. These results validate the system's scalability and efficiency, confirming its readiness for deployment in real-world e-commerce scenarios.

3.3 Results and Discussion

The e-commerce system achieved its objectives by delivering a robust and scalable e-commerce platform. The database performed efficiently, managing inventory and user data seamlessly. Real-time order tracking and secure payment gateways improved user satisfaction. Discussions revealed the system's potential for further enhancements, like personalized recommendations using AI. The project demonstrated how efficient database management could transform e-commerce operations, addressing scalability and reliability challenges. Overall, the system offers a valuable tool for businesses seeking digital transformation.

Chapter 4

Engineering Standards and Mapping

The following section evaluates the system's alignment with engineering standards, as well as its societal, environmental, and ethical implications. It investigates how the project manages sustainability, security, and user accessibility while adhering to industry best practices. The mapping of program outcomes, engineering operations, and problem-solving methodologies demonstrates the system's ability to handle complicated problems. The system's involvement in sustainable technical advancement, as well as teamwork and project management, are emphasized.

4.1 Impact on Society, Environment and Sustainability

4.1.1 Impact on Life

The system simplifies shopping experiences, saving users time and effort. Businesses benefit from efficient management tools that improve operational productivity and customer satisfaction.

4.1.2 Impact on Society & Environment

By facilitating digital transactions, the platform reduces the need for physical retail spaces, minimizing environmental impacts. It also promotes remote business operations, reducing commuting and associated carbon footprints.

4.1.3 Ethical Aspects

The system adheres to ethical practices by implementing secure data management and ensuring compliance with privacy regulations. It fosters trust by protecting user data from unauthorized access.

4.1.4 Sustainability Plan

Eco-friendly hosting solutions were prioritized to reduce energy consumption. The platform's scalable design ensures longevity, supporting business growth without requiring frequent overhauls, contributing to sustainable development.

4.2 Project Management and Teamwork

The project adopted an agile methodology, which emphasized iterative development, collaboration, and continual improvement. Team members were assigned tasks based on their experience, ensuring a balanced workload distribution. Regular meetings and sprint reviews promoted open communication and good decision-making. Tools for version control, such as GitHub, and project boards for job tracking enabled effective progress monitoring. The collaboration approach highlighted shared accountability and adaptability, resulting in a high-quality, scalable e-commerce management system within the timeframe specified.

4.2.1 Budget Analysis

Primary Budget (High-Cost Plan)

Category	Estimated Cost(USD)	Rationals
Development Team	15000	Full-stack developers specializing in Next.js, TypeScript, Tailwind, and Prisma.
Design Tools	1500	For UI/UX design tools like Figma, Adobe XD
Hosting and Infra	2000	Cloud hosting (AWS, Vercel), and CI/CD pipelines.
Database	1000	PostgreSQL on managed cloud services like AWS RDS.
Third-Party APIs	1500	Payment gateways (Stripe, PayPal), and file upload services
Marketing	2500	For initial promotion and digital advertisements.
Miscellaneous	1000	Legal, domain registration, and other overheads
Total	24500	

Alternate Budget (Cost-Optimized Plan)

Category	Estimated Cost(USD)	Rationals
Development Team	8000	Outsourcing development to freelance platforms.
Design Tools	500	Use of free/open-source design tools (e.g., Canva).
Hosting and Infra	500	Hosting via cost-effective providers like DigitalOcean.
Database	200	PostgreSQL on free-tier cloud providers.
Third-Party APIs	500	Limited API usage during the initial phase.
Marketing	1300	Social media marketing instead of large campaigns.
Miscellaneous	300	Limited legal and domain overheads.
Total	11300	

Rationales for Cost Optimization

- **Development Team:** Hiring freelance developers or a small team cuts labor costs while maintaining quality.
- **Hosting and infrastructure:** Starting with low-cost providers like DigitalOcean or Vercel's free tiers saves money.
- **Marketing:** Emphasizing organic reach on social media might reduce ad spending.
- **Design Tools:** Open-source tools offer considerable capability without requiring a subscription.

4.3 Complex Engineering Problem

4.3.1 Mapping of Program Outcome

In this section, We will provide a mapping of the problem and provide a solution with targeted Program Outcomes (PO's).

PO's	Justification
PO1	A strong theoretical foundation in database concepts is critical for understanding and addressing real-world data problems. CO1 supports PO1 by enabling students to apply engineering principles in database design and management.
PO2	Through CO2, students gain practical experience in database implementation and optimization, addressing practical challenges and delivering tailored solutions, thus fulfilling PO2.
PO3	The emphasis on security, distributed databases, and modern trends aligns with PO3 by equipping students to handle complex engineering problems and develop innovative solutions in database management.

Table 4.1: Justification of Program Outcomes

4.3.2 Complex Problem Solving

In this section, We will provide a mapping with problem solving categories.

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: Interdependene
✓	✓	✓	✓			✓

Table 4.2: Mapping with complex problem solving.

4.3.3 Engineering Activities

In this section,We will provide a mapping with engineering activities based on our CO & PO.

EA1: Range of Resources	EA2: Level of Interaction	EA3: Innovation	EA4: Consequences for Society and Environment	EA5: Familiarity
✓	✓	✓	✓	✓

Table 4.3: Mapping with complex engineering activities

Chapter 5

Conclusion

The conclusion encapsulates the journey and outcomes of the e-commerce management system project. This chapter provides a comprehensive overview of the project's achievements, discusses its limitations, and outlines future directions for enhancement. By reflecting on the development process, challenges, and innovations, the conclusion highlights the system's potential to address modern e-commerce demands. It also emphasizes the importance of adopting cutting-edge technologies and collaborative efforts in building a scalable, secure, and user-centric solution.

5.1 Summary

The e-commerce management system accomplished its objectives, establishing a scalable, secure, and user-friendly solution for online organizations. Using modern technologies featuring React, Next.js, Prisma, and PostgreSQL, the system ensures efficient database management, responsive interfaces, and secure transaction processing. The platform is ready for real-time inventory updates, order monitoring, and customer involvement thanks to superior project management and teamwork. The project emphasized the significance of combining robust front-end, back-end, and database components to ensure smooth operation.

1. Attained the goal of establishing a scalable and safe system.
2. Effectively implemented real-time updates and effective database management.
3. Proven combination between current tools and teamwork to achieve excellent results.

5.2 Limitation

Although it has positive aspects, the project has some limitations that could be addressed in further editions. The system still lacks advanced analytics capabilities, multilingual support, and comprehensive AI-driven suggestions. These features are critical to satisfying the needs of broader, worldwide audiences. Furthermore, scalability is dependent on hardware and cloud resources, which may require additional optimization as the platform expands.

1. Limited advanced analytics and reporting capabilities.
2. There are no AI-powered product recommendations or personalizations yet.
3. Scalability is dependent on increased resource allocation.
4. There is no built-in support for multiple languages or currencies.

5.3 Future Work

Future work seeks to improve the system by incorporating advanced features such as predictive

analytics, AI-powered product recommendations, and increased linguistic support. There are also plans to improve system scalability through the use of microservices architecture and serverless computing. Furthermore, adopting blockchain for increased transaction security and decentralization could improve the system's dependability and trustworthiness.

- **Predictive Analytics:** Advanced reporting and insights to drive corporate success.
- **AI Recommendations:** Personalization to enhance client experience.
- **Multilingual Support:** Increase accessibility for worldwide audiences.
- **Microservices Architecture :** Improves scalability and modularity.
- **Blockchain Integration:** Ensures secure and transparent transactions.

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