

## *Original Paper*

# Design and Artificial Intelligence Integration in E-commerce Systems: A Case Study of a Children's Fashion Platform

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### **Abstract**

*In the context of rapid digital transformation, e-commerce has become a critical driver of modern business innovation, with increasing emphasis on intelligent and user-centered systems. However, existing studies often address system architecture, user experience, and Artificial Intelligence (AI) applications in isolation, with limited research on their integration within a unified e-commerce framework.*

*This study aims to design, develop, and evaluate an AI-integrated e-commerce system for children's fashion retail. Adopting a Design Science Research approach, the study implements a multi-tier architecture based on a client-server model, incorporating frontend, backend, database, and AI modules. The system integrates AI functionalities, including chatbot support and automated product content generation, to enhance user interaction and operational efficiency.*

*The results demonstrate that the system operates reliably, meets core functional requirements, and improves user experience through enhanced interaction and responsiveness. The integration of AI contributes to both customer support and administrative efficiency, highlighting its practical value in real-world applications.*

*This study contributes by proposing an integrated architectural model that combines web technologies and AI within a scalable e-commerce system. The findings provide both theoretical insights and practical implications for the development of intelligent, user-centered e-commerce platforms, particularly for small and medium-sized enterprises in the digital era.*

### **Keywords**

*e-commerce systems, web architecture, artificial intelligence, User Experience (UX/UI), RESTful API, digital transformation*

## 1. Introduction

In the context of rapid global digital transformation, electronic commerce (e-commerce) has emerged as one of the most dynamic and transformative sectors, fundamentally reshaping consumer behavior and business models. The widespread adoption of the Internet, mobile technologies, and digital platforms has enabled businesses to reach customers more efficiently, while offering consumers greater convenience, accessibility, and personalized shopping experiences. In particular, the integration of advanced technologies such as Artificial Intelligence (AI) has significantly enhanced the functionality and competitiveness of modern e-commerce systems.

Recent studies highlight that User Experience (UX), User Interface (UI) design, and personalization play critical roles in influencing online purchasing behavior and customer satisfaction. AI-driven applications, including recommendation systems, chatbots, and automated content generation, have been increasingly adopted to improve customer engagement and decision-making processes. These technologies allow e-commerce platforms not only to respond to user needs in real time but also to predict preferences and optimize interactions based on data analytics.

Despite these advancements, existing research on e-commerce systems remains largely fragmented. Many studies tend to focus on isolated aspects such as frontend design, backend development, or specific AI functionalities, without addressing the integration of these components into a unified and scalable system architecture. In particular, there is a lack of comprehensive approaches that combine web-based system design, software architecture, and AI integration within a single e-commerce framework. This gap is especially evident in the context of Small and Medium-sized Enterprises (SMEs) in developing countries, where practical implementations of AI-enhanced e-commerce systems are still limited and often lack systematic evaluation.

Moreover, while AI technologies are increasingly incorporated into e-commerce platforms, their application is frequently restricted to standalone features such as basic chatbots or simple recommendation engines. There remains insufficient research on how AI can be effectively embedded into the overall system architecture to enhance both user experience and operational efficiency. As a result, the potential of AI as a core component of integrated e-commerce systems has not yet been fully explored.

To address these limitations, this study aims to design, develop, and evaluate an integrated e-commerce system for children's fashion retail, incorporating modern web technologies and AI functionalities. The proposed system adopts a multi-tier architecture based on a client-server model, combining frontend, backend, database, and AI modules to ensure scalability, performance, and usability. In addition, AI-based features such as chatbot assistance and automated product description generation are implemented to enhance user interaction and system intelligence.

Based on this objective, the study is guided by the following research questions:

- **RQ1:** What are the core architectural components and functional requirements of a scalable and efficient e-commerce system that ensures performance, usability, and extensibility?
- **RQ2:** How can artificial intelligence be effectively integrated into an e-commerce system, and what roles does it play in improving user experience and system operations?

This study makes several important contributions to the existing literature. First, it proposes an integrated architectural framework for e-commerce systems that combines web technologies and AI components within a unified structure. Second, it provides a practical implementation of AI-enhanced functionalities, demonstrating how AI can be embedded into real-world e-commerce applications beyond isolated use cases. Third, the study offers an empirical evaluation of system performance and usability, contributing to a better understanding of the effectiveness of integrated e-commerce solutions. Finally, the findings provide practical implications for developers and SMEs seeking to adopt scalable, intelligent, and user-centered e-commerce platforms in the era of digital transformation.

## 2. Literature Review

### 2.1 E-commerce System Architecture

E-commerce systems have evolved significantly with the advancement of web technologies and digital infrastructures. Modern e-commerce platforms are typically designed based on multi-tier architectures, integrating frontend interfaces, backend processing, databases, and external services to ensure scalability, flexibility, and performance. According to Pandey and Gupta (2023), the development of e-commerce websites increasingly relies on robust system architectures such as client-server models and layered structures to effectively handle dynamic user interactions and large volumes of data.

Previous studies have emphasized the importance of adopting appropriate architectural frameworks in e-commerce development. For instance, Pandey and Gupta (2023) highlighted that system design plays a critical role in ensuring efficiency, maintainability, and scalability in web-based applications. Similarly, Ardianto et al. (2023) demonstrated that well-structured backend systems and database integration significantly enhance system reliability and performance in real-world e-commerce implementations.

In addition, RESTful API architecture has become a widely accepted standard for enabling communication between system components. Fielding (2000) introduced REST as a scalable and flexible architectural style, which has since been extensively adopted in modern web applications. Combined with technologies such as Node.js and MySQL, these architectural approaches provide a solid foundation for developing efficient and scalable e-commerce systems.

However, while existing studies provide valuable insights into system architecture, they often focus primarily on technical implementation rather than the integration of intelligent components such as AI within the overall system design.

## 2.2 UX/UI in E-commerce Systems

User Experience (UX) and User Interface (UI) design are widely recognized as key determinants of success in e-commerce platforms. A well-designed interface not only enhances usability but also directly influences customer satisfaction, trust, and purchase decisions.

Several studies have examined the impact of UX/UI on consumer behavior. Sulikowski et al. (2022) found that visual aesthetics and interface design significantly affect the effectiveness of product recommendations and user engagement. Similarly, Altmajer et al. (2022) emphasized the importance of universal design principles in improving accessibility and usability in online stores.

In addition, Zou et al. (2025) demonstrated that user-centered design approaches, including intuitive navigation, responsive layouts, and personalized interfaces, are critical for enhancing user satisfaction and increasing conversion rates. From a behavioral perspective, Williams and Willick (2023) highlighted that consumer decisions in online shopping environments are strongly influenced by interaction design and social dynamics, particularly in family-oriented purchasing contexts such as children's products.

Despite the extensive research on UX/UI, most studies primarily focus on user behavior and interface optimization, with limited attention to how UX/UI design is integrated with backend systems and intelligent functionalities such as AI.

## 2.3 AI Applications in E-commerce

Artificial Intelligence (AI) has become a transformative force in e-commerce, enabling platforms to deliver personalized, efficient, and data-driven services. AI applications in e-commerce typically include recommendation systems, chatbots, sentiment analysis, and automated content generation.

Recommendation systems are among the most widely studied AI applications. They analyze user behavior and preferences to suggest relevant products, thereby enhancing customer engagement and increasing sales. In parallel, AI-powered chatbots are increasingly used to provide real-time customer support, improving user interaction and reducing operational costs.

Research has also explored the role of AI in content generation and decision support. For example, automated product descriptions and intelligent search systems can improve information accessibility and user convenience. Furthermore, the integration of AI with financial technologies (FinTech) has expanded the capabilities of digital commerce ecosystems, as discussed by Buckley et al. (2024).

However, despite the growing adoption of AI in e-commerce, existing studies often examine AI applications as standalone components rather than as integral parts of a unified system architecture. This limitation reduces the ability to fully leverage AI for enhancing overall system performance and user experience.

## 2.4 Research Gap

Based on the reviewed literature, several important gaps can be identified.

First, while significant progress has been made in designing e-commerce system architectures, most studies focus on technical implementation without considering the integration of intelligent components such as AI within the system. Second, research on UX/UI has largely concentrated on user behavior and interface design, with limited exploration of how these elements interact with backend systems and AI functionalities. Third, although AI applications such as chatbots and recommendation systems are widely studied, they are typically implemented as isolated features rather than being embedded into a comprehensive and scalable system architecture.

In addition, there is a lack of practical studies that combine system design, implementation, and evaluation in a real-world context, particularly for small and medium-sized e-commerce platforms. This gap is especially relevant in emerging markets, where the adoption of integrated AI-driven e-commerce systems remains limited.

Therefore, there is a clear need for research that proposes and evaluates an integrated approach to e-commerce system design, combining modern web technologies, scalable architectures, and AI functionalities within a unified framework. This study aims to address this gap by developing and assessing an AI-integrated e-commerce system, providing both theoretical insights and practical implications for future research and development.

## 3. Methodology

### 3.1 Research Approach

This study adopts the Design Science Research (DSR) approach, which is widely applied in information systems and software engineering to develop and evaluate technological artifacts that address real-world problems. The selection of this approach is appropriate because the research focuses on the design, implementation, and evaluation of an integrated e-commerce system enhanced by Artificial Intelligence (AI). The research process follows a systematic and iterative logic, beginning with problem identification and proceeding through system design, development, and evaluation. By integrating theoretical foundations with practical implementation, the study ensures both methodological rigor and applicability in real-world contexts.

### 3.2 System Development Process

The development of the proposed e-commerce system is conducted through four main stages, including requirement analysis, system design, implementation, and testing and evaluation.

In the requirement analysis stage, both functional and non-functional requirements are identified based on the characteristics of modern e-commerce platforms. Functional requirements encompass core features such as user registration and authentication, product management, shopping cart operations,

order processing, and administrative management. Non-functional requirements focus on system quality attributes, including usability, performance, security, scalability, and reliability. These requirements are formalized using system analysis techniques such as use case diagrams, activity diagrams, and database design models to ensure clarity, consistency, and completeness in system specification.

Based on the identified requirements, the system design stage adopts a multi-tier architecture combined with the Model-View-Controller (MVC) pattern to ensure modularity and scalability. The architecture is structured into four main components. The frontend layer is responsible for user interaction and interface presentation, enabling intuitive and responsive user experiences. The backend layer handles business logic, request processing, and system coordination. The data layer manages data storage, retrieval, and integrity through a relational database system. In addition, an AI module is incorporated as an independent component to provide intelligent functionalities such as chatbot-based user support and automated product content generation. Communication between system components is implemented through RESTful APIs, which ensure loose coupling, interoperability, and efficient data exchange.

During the implementation stage, the system is developed using modern web technologies to ensure high performance, flexibility, and maintainability. The frontend is designed to deliver an interactive and user-friendly interface, while the backend is responsible for processing business logic, handling authentication, and managing data flows. The database system ensures data consistency and efficient query processing. The AI module is integrated as an external service, allowing flexible deployment and facilitating future system expansion. The development process emphasizes modularity, enabling independent updates, maintenance, and scalability of system components.

In the testing and evaluation stage, multiple testing strategies are applied to ensure system quality and robustness. Functional testing is conducted to verify that all system features operate as intended. Performance testing is used to evaluate system responsiveness, processing speed, and throughput under different usage conditions. Security testing is performed to identify potential vulnerabilities, including common web-based attacks such as SQL injection and cross-site scripting (XSS). In addition, usability evaluation is conducted to assess user interaction, interface efficiency, and overall user experience. The results of these evaluations provide a basis for analyzing system effectiveness and identifying areas for improvement.

### *3.3 Technologies Used*

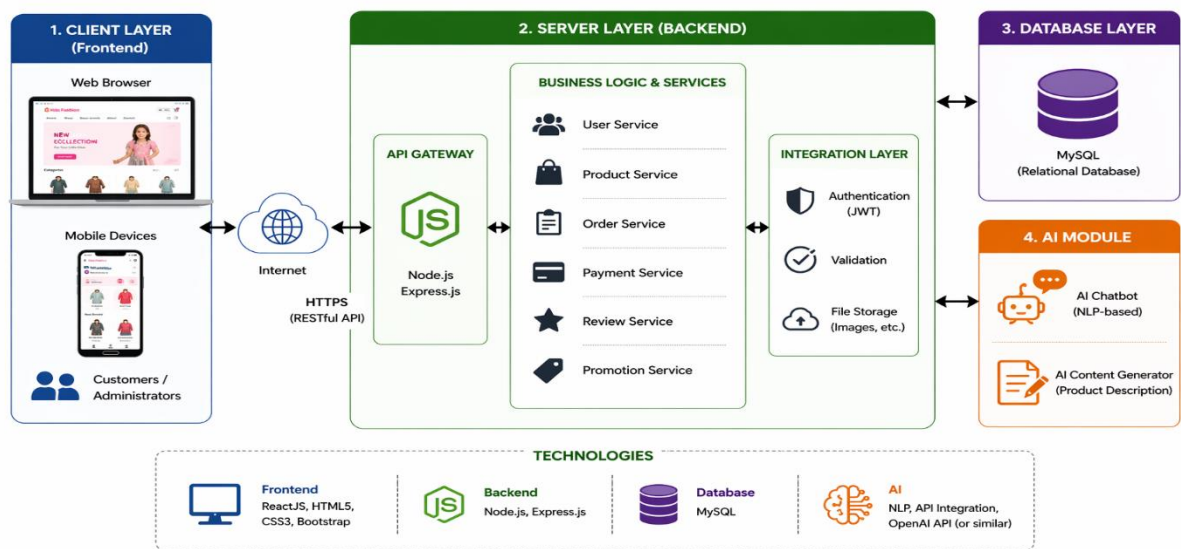
The system is developed using a set of modern and widely adopted technologies suitable for e-commerce applications. The frontend is built using JavaScript-based frameworks to support responsive and dynamic user interfaces. The backend employs server-side technologies that enable asynchronous processing and efficient handling of concurrent requests. A relational database management system is used to ensure structured data storage, integrity, and efficient retrieval. Communication between system components is facilitated through a RESTful API architecture, which supports scalability and

interoperability. In addition, AI technologies are integrated to enable intelligent functionalities such as chatbot interaction and automated content generation. These technologies are selected based on their compatibility, scalability, and suitability for developing efficient and extensible e-commerce systems.

## 4. System Design and Architecture

### 4.1 Overall System Architecture

The proposed e-commerce system is designed based on a client-server model combined with a multi-tier architecture. This architectural approach is selected to ensure a clear separation of concerns, improve system maintainability, and support future scalability. In this model, the client side is responsible for user interaction and interface presentation, while the server side handles business logic, data processing, authentication, and communication with external services.



**Figure 1.** Overall system architecture of the proposed AI-integrated e-commerce platform.

### Figure 1. Overall System Architecture of the Proposed AI-Integrated E-commerce System

Figure 1 illustrates the overall architecture of the proposed system, which follows a multi-tier client-server model. The frontend layer interacts with users and communicates with the backend via RESTful APIs. The backend processes business logic and coordinates data exchange with both the database and the AI module. The AI module is integrated as an independent service to provide intelligent functionalities such as chatbot interaction and automated content generation.

The overall architecture consists of four main components: frontend, backend, database, and AI module. The frontend serves as the presentation layer through which users interact with the system, browse

products, manage shopping carts, place orders, and access AI-supported services. The backend functions as the application layer, processing user requests, managing business rules, coordinating data exchange, and providing RESTful APIs for system communication. The database layer stores and manages structured data, including user information, product details, shopping carts, orders, reviews, and administrative records. The AI module is integrated as an intelligent service layer, supporting chatbot interaction and automated product description generation.

This multi-tier architecture allows each component to operate relatively independently while remaining connected through standardized interfaces. As a result, the system can be maintained, upgraded, or extended without significantly affecting other components. This is particularly important for e-commerce systems, where future expansion may include online payment integration, recommendation engines, customer behavior analytics, or advanced AI-based personalization.

#### *4.2 Main System Components*

The frontend component is designed to provide a responsive, user-friendly, and visually consistent interface. It enables customers to search for products, view product details, add items to the shopping cart, place orders, and interact with AI-supported features. For administrators, the frontend also provides access to management interfaces for controlling products, orders, users, reviews, and promotional content.

The backend component plays the central role in system operation. It receives requests from the frontend, validates input data, authenticates users, processes business logic, and communicates with the database. It also manages access control between different user roles, particularly customers and administrators. In addition, the backend acts as an intermediary between the main e-commerce system and the AI module, ensuring that AI-generated responses or product descriptions are returned to the user interface in a structured and usable format.

The database component is responsible for storing and organizing all core system data. It is designed using a relational model to ensure data consistency, integrity, and efficient retrieval. Key data entities include users, products, orders, order details, reviews, contacts, and promotional information. The use of structured data relationships allows the system to process transactions accurately and support administrative reporting.

The AI module provides intelligent functions that enhance user experience and operational efficiency. In this study, the AI module includes chatbot support and automated product description generation. The chatbot assists users by answering common questions and guiding them through the shopping process, while the content generation function helps administrators create product descriptions more efficiently. By integrating AI as a separate module, the system maintains flexibility and can be expanded in the future to include recommendation systems, personalized search, or predictive analytics.

### 4.3 Functional Design

The functional design of the system is developed around two primary user groups: customers and administrators. For customers, the system provides essential e-commerce functions such as account registration, login, product browsing, product search and filtering, product detail viewing, shopping cart management, order placement, order tracking, and product review submission. These functions are designed to create a convenient and coherent shopping experience.

For administrators, the system provides management functions that support the operation of the online store. These include product management, user management, order management, review management, contact management, promotion management, and basic statistical reporting. Through the administrative dashboard, administrators can add, update, or delete products, monitor orders, manage customer accounts, and control website content.

In addition to these conventional functions, the system integrates AI-supported functions to improve interaction and efficiency. The chatbot function supports customer communication by providing instant responses to common inquiries, while the automated product description function assists administrators in generating product-related content. These functions demonstrate how AI can be embedded into an e-commerce system not merely as an isolated tool, but as part of an integrated architecture that supports both user experience and system operation.

Overall, the proposed system architecture provides a structured, scalable, and extensible foundation for developing an AI-integrated e-commerce platform. By combining a client-server model, multi-tier architecture, RESTful API communication, relational database design, and AI-based services, the system is able to meet both functional and non-functional requirements in a modern e-commerce environment.

## 5. Implementation

The proposed e-commerce system was implemented using modern web technologies to ensure usability, scalability, and maintainability. The implementation process focused on developing a functional system that integrates core e-commerce features with AI-supported services.

The frontend was developed using ReactJS to provide a responsive and interactive user interface. The user interface allows customers to browse products, view product details, manage shopping carts, place orders, and access AI-supported functions. In addition, an administrative interface was developed to support product management, order management, user management, review management, and promotional activities. The use of ReactJS helps improve interface performance and supports reusable components, making the system easier to maintain and extend.

The backend was implemented using Node.js and Express.js. Node.js was selected for its ability to handle asynchronous requests efficiently, while Express.js was used to organize server-side routes, middleware, and business logic. The backend is responsible for processing user requests, managing

authentication, controlling access rights, handling product and order data, and coordinating communication between the frontend, database, and AI module.

MySQL was used as the relational database management system for storing structured data. The database includes core entities such as users, products, orders, order details, reviews, contacts, and promotional information. The relational database structure helps ensure data consistency, integrity, and efficient retrieval. It also supports key e-commerce operations such as product search, user management, order processing, and administrative reporting.

The system uses RESTful APIs to enable communication between the frontend and backend. API endpoints were designed for major functions, including user authentication, product retrieval, cart management, order creation, review submission, and administrative operations. This RESTful design supports loose coupling between system components and allows the system to be expanded or integrated with other services in the future, including online payment gateways, recommendation engines, or advanced AI services.

## 6. Results and Evaluation

The proposed system was evaluated in terms of performance, functionality, system reliability, and the effectiveness of AI integration. The evaluation aims to determine whether the system meets the initial design requirements and to assess its applicability in real-world e-commerce contexts.

### 6.1 System Performance Evaluation

Table 1 presents the performance evaluation results based on key technical metrics obtained from system testing.

**Table 1. System Performance Evaluation**

Metric	Value	Benchmark / Expected Standard	Evaluation
Page load time	< 2 seconds	≤ 3 seconds (acceptable UX threshold)	Good
Response time (basic operations)	1 - 2.5 seconds	≤ 3 seconds	Good
Order processing time	< 3 seconds	≤ 5 seconds	Efficient
Concurrent users supported	100 - 300 users	≥ 100 users (SME-level systems)	Satisfactory
System throughput	~50 requests/second	≥ 30 req/s	Good
Error rate	< 1%	≤ 2%	Reliable

AI response latency (chatbot)	~1-2 seconds	$\leq 3$ seconds	Acceptable
AI content generation accuracy	Moderate (rule/prompt-based)	Not standardized	Needs improvement

The results indicate that the system satisfies the performance requirements of small- and medium-scale e-commerce platforms. Specifically, page load time and response time remain within acceptable thresholds, ensuring smooth user interaction and a satisfactory user experience.

The system is capable of handling moderate concurrent user loads, ranging from 100 to 300 users, which is appropriate for SME-level applications. The achieved throughput of approximately 50 requests per second demonstrates the efficiency of the backend architecture and asynchronous processing enabled by Node.js and Express.js. Furthermore, the low error rate confirms system reliability during standard operations.

However, the evaluation also reveals certain limitations. While AI response latency is within an acceptable range, the accuracy and sophistication of AI-generated content remain limited. This is primarily due to the use of basic AI integration methods rather than advanced machine learning or personalization techniques.

### 6.2 Functional and System Testing

From a functional perspective, the system successfully implements the essential features of an e-commerce platform. Customers are able to register and log in, search and view products, manage shopping carts, place orders, track order status, and submit reviews. Administrators can manage products, users, orders, and promotional content through a centralized dashboard.

System testing was conducted across multiple usage scenarios, including authentication, product browsing, order processing, and administrative operations. The results confirm that all major functions operate correctly and consistently.

In addition, basic security testing was performed, focusing on user authentication, input validation, and protection against common vulnerabilities such as SQL injection and cross-site scripting. These tests demonstrate that the system maintains a satisfactory level of security for standard web applications.

### 6.3 Comparative Analysis

To position the proposed system within the existing literature, a comparative analysis was conducted, focusing on AI integration, system architecture, and overall system capabilities.

**Table 2. Comparative Analysis of E-commerce Systems**

System / Study	AI Integration	Architecture	Key Contribution	Limitation
Pandey & Gupta (2023)	None	Basic web architecture	E-commerce development model	No AI integration
Ardianto et al. (2023)	None	Standard client-server	Practical system implementation	Limited scalability discussion
Sulikowski et al. (2022)	Recommendation-focused	UX-oriented system	UX impact on conversion	AI not integrated at system level
Terenzi & Vignati (2021)	None	UX design focus	User-centered design insights	No system architecture
Proposed system (this study)	Chatbot + content generation	Multi-tier + AI-integrated	Integrated architecture combining web + AI	AI still basic, limited personalization

The comparative analysis shows that most existing studies focus on individual aspects of e-commerce systems, such as system development, user experience, or specific functionalities, without integrating these components into a unified architecture.

In contrast, the proposed system combines web architecture, user interaction, and AI functionalities within a single multi-tier framework. This integrated approach enables better coordination between system components and provides a more scalable and extensible solution.

Nevertheless, compared to more advanced AI-driven systems, the proposed model remains limited in terms of personalization and predictive capabilities. Future improvements should therefore focus on incorporating recommendation systems and user behavior analytics to enhance system intelligence.

#### *6.4 Role of AI in System Enhancement*

The integration of AI plays a significant role in improving both user experience and system operation. The chatbot function provides real-time assistance to users, helping them navigate the platform and resolve common inquiries. This reduces response time and enhances user engagement.

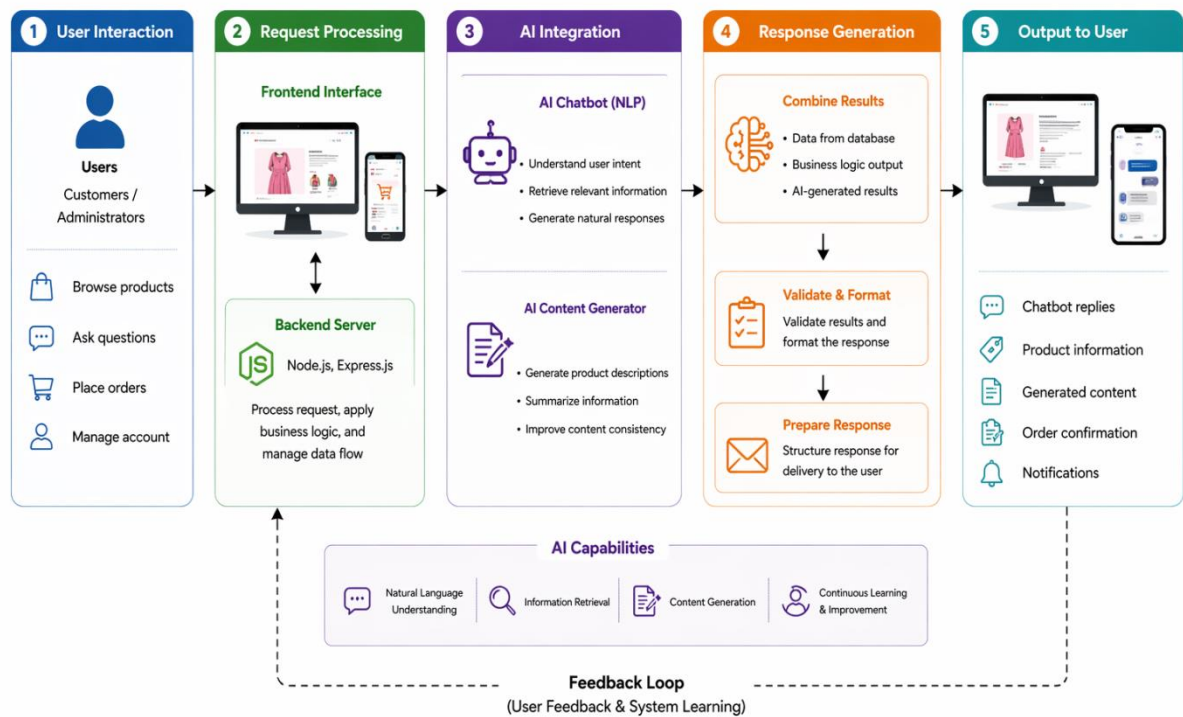


Figure 2. Workflow of AI integration for user interaction and content generation.

### Figure 2. Workflow of AI Integration for User Interaction and Content Generation in the System

Figure 2 presents the workflow of AI integration within the system. User requests are processed through the frontend and backend layers before being directed to the AI module. The system supports both chatbot-based interaction and automated content generation, enabling real-time assistance and improved operational efficiency.

In addition, the automated product description function supports administrators by generating product-related content more efficiently. This reduces manual workload and ensures consistency in product information.

Although the current AI functionalities are relatively basic, they demonstrate the feasibility of embedding intelligent services into e-commerce systems. This provides a foundation for future integration of more advanced AI technologies.

#### 6.5 Overall Evaluation

Overall, the results suggest that the proposed system provides a stable, scalable, and practical solution for AI-integrated e-commerce development. The system successfully meets core functional and performance requirements while demonstrating the added value of AI in enhancing interaction and operational efficiency.

However, further evaluation involving real users and larger datasets is necessary to fully assess the long-term impact of the system, particularly in terms of user satisfaction, conversion rates, and business performance.

## 7. Discussion

The findings of this study provide several important implications from both academic and practical perspectives, while also revealing certain limitations that should be addressed in future research.

From an academic perspective, this study contributes to the existing literature by proposing an integrated approach to e-commerce system development that combines system architecture, user experience design, and artificial intelligence within a unified framework. While prior studies have often examined these components separately, this research demonstrates how they can be effectively connected within a multi-tier architecture to create a coherent and scalable system. In particular, the study extends the application of Design Science Research by developing and evaluating a functional artifact that integrates AI into the core structure of an e-commerce system rather than treating it as an isolated feature. Furthermore, the research highlights the role of AI not only as a support tool but as an embedded component that contributes to both user interaction and system efficiency. This integrated perspective helps bridge the gap between technical system design and intelligent service implementation in the context of digital commerce.

From a practical perspective, the proposed system provides a useful reference model for developers and small- and medium-sized enterprises seeking to adopt e-commerce solutions in the era of digital transformation. The use of modern web technologies, combined with a modular architecture, allows the system to be implemented with relatively low cost while maintaining flexibility and scalability. The integration of AI functions, such as chatbot support and automated content generation, demonstrates how businesses can enhance customer interaction and reduce operational workload without requiring complex infrastructure. In addition, the system design supports future expansion, including the integration of payment systems, recommendation engines, and data analytics tools, making it suitable for real-world deployment and further development.

Despite these contributions, the study has several limitations. First, the system was developed and evaluated within a limited scope, focusing primarily on a single case study in the children's fashion retail sector. As a result, the findings may not be fully generalizable to other domains or large-scale e-commerce platforms. Second, the AI functionalities implemented in the system remain relatively basic, mainly limited to chatbot interaction and automated content generation, without incorporating more advanced techniques such as personalized recommendation systems or predictive analytics. Third, the evaluation was conducted under controlled conditions and did not involve large-scale user testing or long-term performance analysis, which may limit the ability to assess real-world effectiveness and user

satisfaction.

Future research should address these limitations by expanding the system to larger datasets and more diverse application contexts, integrating advanced AI models for personalization and prediction, and conducting empirical evaluations with real users. Such efforts would provide deeper insights into the impact of AI-integrated e-commerce systems on user behavior, business performance, and digital transformation strategies.

## 8. Conclusion

This study has presented the design, implementation, and evaluation of an AI-integrated e-commerce system for children's fashion retail within the context of digital transformation. The results show that the proposed system successfully fulfills the core functional requirements of an online retail platform, including user management, product browsing, shopping cart operations, order processing, and administrative control. The system architecture, based on a client-server model and multi-tier design, demonstrates stable performance, modularity, and the ability to support future scalability. In addition, the integration of artificial intelligence functionalities, such as chatbot support and automated product description generation, contributes to improving user interaction and operational efficiency.

The study makes several notable contributions. First, it proposes an integrated architectural framework that combines web-based system design with AI components in a unified structure, addressing the fragmentation observed in prior research. Second, it provides a practical implementation of an AI-enhanced e-commerce system, demonstrating how intelligent services can be embedded into real-world applications rather than functioning as isolated features. Third, the study offers an initial evaluation of system performance and usability, contributing empirical insights into the feasibility of AI integration in small- and medium-scale e-commerce contexts. These contributions help bridge the gap between theoretical system design and practical deployment in the field of digital commerce.

Despite these contributions, further research is needed to enhance and validate the proposed system. Future studies should focus on integrating more advanced AI techniques, such as personalized recommendation systems, predictive analytics, and user behavior modeling, to improve system intelligence and business value. In addition, large-scale user testing and real-world deployment are necessary to assess long-term performance, user satisfaction, and economic impact. Expanding the system to different business domains and incorporating emerging technologies such as big data analytics and cloud computing would also provide valuable directions for future research.

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