DESIGN AND IMPLEMENTATION OF A WEB-BASED PRICE CHECKING SYSTEM FOR THE E-COMMERCE MARKETPLACE

OSAKI MILLER THOM-MANUEL
Department of Computer Science
Ignatius Ajuru University of Education
Port Harcourt, Rivers State, Nigeria
osaki.miller@iaue.edu.ng

And

JONATHAN NYEKACHI AMADI
Department of Computer Science
Ignatius Ajuru University of Education
Port Harcourt, Rivers State, Nigeria
Jonathan.amadi@iaue.edu.ng

Abstract

The rapid expansion of e-commerce has intensified price competition across online marketplaces, making it increasingly difficult for consumers to identify the most cost-effective purchasing options. This study presents the design and implementation of a web-based price checking system developed to support real-time price comparison within the e-commerce marketplace. The proposed system aggregates product price information from multiple platforms, including Jumia, Konga, and Amazon, thereby enabling users to compare prices and make informed purchasing decisions. The system was implemented using modern web technologies—HTML5, CSS3, JavaScript, Bootstrap, and ReactJS—to ensure responsiveness, scalability, and cross-platform accessibility on both mobile and desktop devices. A modular system architecture with simulated API-based data retrieval was adopted to emulate real-time pricing and product availability. System performance was evaluated using functional and performance testing metrics, including response time, price accuracy, and user experience. The results indicate that the system provides a fast, reliable, and user-friendly interface for price comparison, contributing to improved transparency and consumer trust in online shopping. This study highlights the effectiveness of web-based price comparison systems in enhancing consumer decision-making and promoting efficiency within e-commerce ecosystems.
Keyword: Web-Based Price Checking System, E-commerce, Price Comparison, Real-Time Data Aggregation, Web Technologies, Marketplace.

Introduction

The rapid growth of e-commerce has significantly transformed consumer purchasing behavior, with global online sales projected to exceed $6.5 trillion in 2024, driven largely by increased internet and mobile penetration, including in Africa (Statista, 2024). Nigeria's e-commerce market is expected to reach $22 billion by 2027, supported by platforms such as Jumia, Konga, and international retailers (Ojo & Adebayo, 2023). This expansion has intensified price competition, leading to dynamic pricing practices that complicate consumers' ability to identify optimal purchase options, thereby increasing the demand for effective price comparison tools (Akinola & Bello, 2021).

Price checking systems aggregate real-time pricing data from multiple retailers using web scraping and APIs to support informed consumer decision-making (Kumar & Singh, 2020). While early systems provided static price comparisons, contemporary platforms employ advanced algorithms to address dynamic pricing and incorporate additional decision metrics, including shipping costs and seller reliability (Chen & Zhang, 2022). However, challenges persist, particularly regarding data accuracy, limited inclusion of local retailers, and security concerns, especially in developing digital ecosystems such as Nigeria's (Orike & Alalibo, 2022).

In Nigeria, over 70% of urban consumers engage in online shopping, yet issues such as inconsistent pricing, unreliable connectivity, and data privacy concerns undermine trust in existing platforms (Deloitte, 2024). Empirical evidence indicates that 65% of Nigerian consumers distrust online price information due to discrepancies between displayed and checkout prices (Afolabi & Ojo, 2023). Moreover, most existing price comparison tools are tailored to Western markets and lack integration with local payment systems and naira-based transactions. Addressing these gaps, this study proposes a secure, web-based price checking system customized for the Nigerian market, integrating real-time data collection, local platform coverage, and robust security practices to enhance transparency, affordability, and user trust (Shammar & Zahary, 2019; Ibarra-Esquer et al., 2017). This study addresses these gaps through the design and implementation of a secure, web-based price checking system tailored to the Nigerian e-commerce marketplace. By integrating real-time data aggregation, secure software development practices, mobile-first design, and support for local and international platforms, the proposed system aims to enhance price transparency, consumer trust, and informed decision-making. The study contributes both practical value to consumers and theoretical insights to the growing body of research on secure and localized e-commerce systems.

Materials and Methods

Methodology

The proposed system was developed using the Secure Software Development Life Cycle (SSDLC) methodology to ensure that security was integrated throughout all development stages. SSDLC focuses on early identification of vulnerabilities, secure coding practices, encryption, and continuous system monitoring, thereby enhancing reliability and protecting user data in line with National Institute of Standards and Technology (2023) guidelines. The development process included requirements gathering, system analysis, architectural and interface design, database modelling, implementation, and testing. The system was built using HTML5, CSS3, JavaScript, Bootstrap/React for the frontend, Python/Node.js for backend data processing and scraping, and MySQL for database management. Security measures such as secure authentication, input validation, password hashing, and encrypted connections were implemented at each stage to ensure data integrity and system security.

Analysis of the Existing System

The current price-checking process across Jumia, Konga, and Amazon is manual and fragmented. Consumers must visit each platform separately to search for products, compare prices, review shipping details, and assess sellers. There is no centralized system to aggregate and standardize pricing information, forcing users to rely on memory or personal notes. This lack of automation reduces efficiency, increases the risk of errors, and makes it difficult to respond quickly to frequent price changes in dynamic e-commerce environments.

Architecture of the Existing System

The existing system architecture is fragmented and entirely user-driven. Each platform—Jumia, Konga, and Amazon—operates independently with its own database and pricing structure. The user serves as the intermediary, manually collecting and comparing price information across these platforms. The workflow involves visiting each site separately, reviewing product prices, recording observations, and then making a purchase decision. This architecture lacks a middleware or data aggregation layer, resulting in no centralized processing, real-time synchronization, or automated decision support.

Figure 1 illustrates the architecture of the existing manual price checking system.

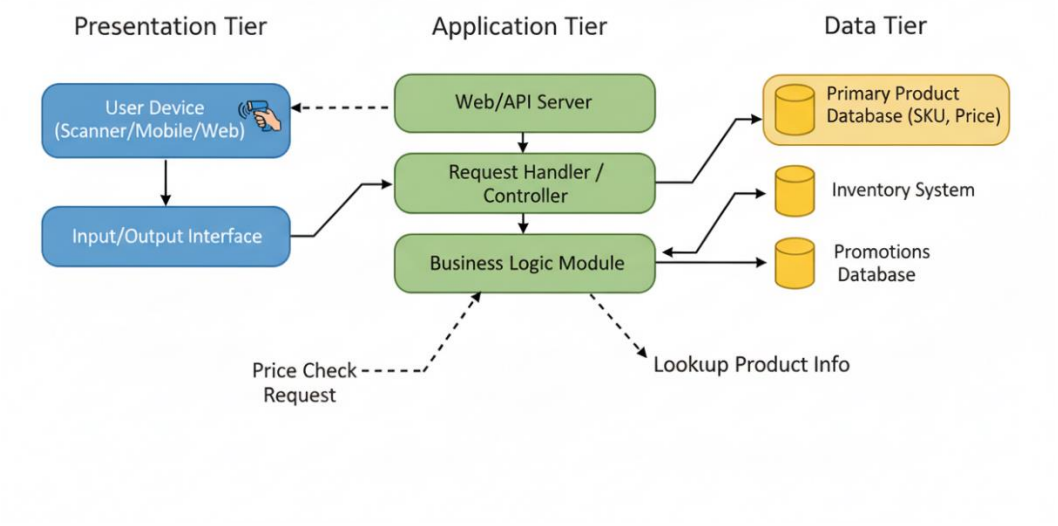

Figure 1: Architecture of the Existing Manual Price Checking System

Constraints of the Existing System

The existing manual price-checking system has several major limitations. It is time-consuming, as users must repeatedly visit multiple websites to compare information. Price comparisons may also become inaccurate due to frequent price changes during browsing. Hidden costs such as shipping fees and taxes are not easily identified, and switching between different interfaces increases cognitive load, leading to fatigue and poor decisions. The system lacks personalization features like price alerts or recommendations. Additionally, users with limited digital skills or unstable internet connectivity face greater challenges. Overall, these limitations demonstrate the inefficiency and unreliability of the manual approach, emphasizing the need for a centralized and automated price-checking system.

Analysis of the Proposed System

The proposed system is a secure, automated web-based platform that aggregates and standardizes real-time price data from multiple e-commerce platforms using web scraping and APIs. It reduces manual effort by presenting information through a unified interface while ensuring data protection through confidentiality, integrity, and availability (CIA) principles. The system follows a three-tier architecture consisting of a presentation layer for the user interface, an application layer for business logic and data processing, and a data layer for storage and

management. The workflow involves user queries, automated data retrieval and processing, and the display of aggregated price comparison results.

Figure 2 illustrates the architecture of the proposed web-based price checking system.

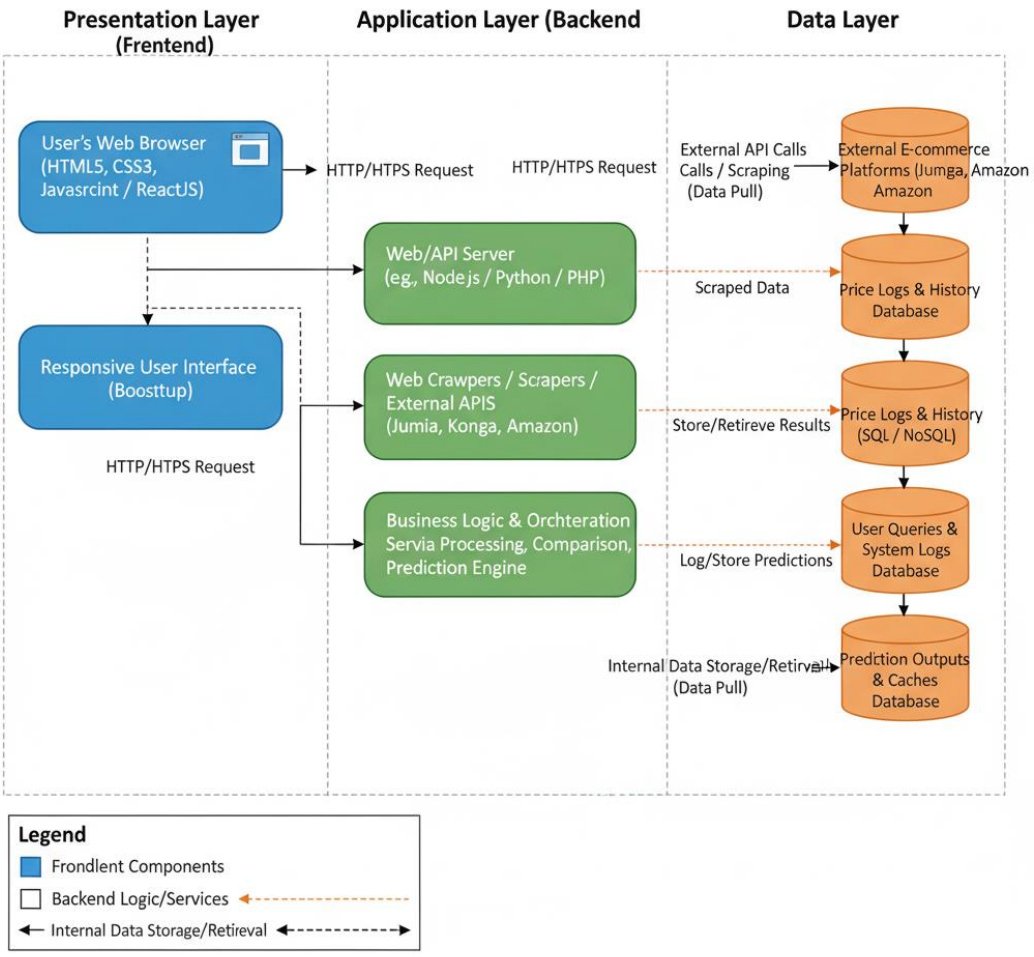

Figure 2: Architecture of the Proposed Web-Based Price Checking System

The proposed system improves upon the manual approach by introducing automation, centralized processing, and real-time price aggregation. It reduces time and errors in price comparison while improving accuracy and transparency. Predictive pricing features help users identify better purchasing opportunities, and secure data handling practices enhance user trust. Overall, the system provides a practical, scalable, and secure solution that supports efficient price comparison and competitive practices in the e-commerce marketplace.

Input Design of the Proposed System

The primary input is the product name entered by the user. Additional input options include category selection, price filters, and sorting preferences. The input interface is designed to be simple and mobile-friendly, enabling quick searches. All inputs undergo validation to prevent malicious entries such as SQL injection or script injection.

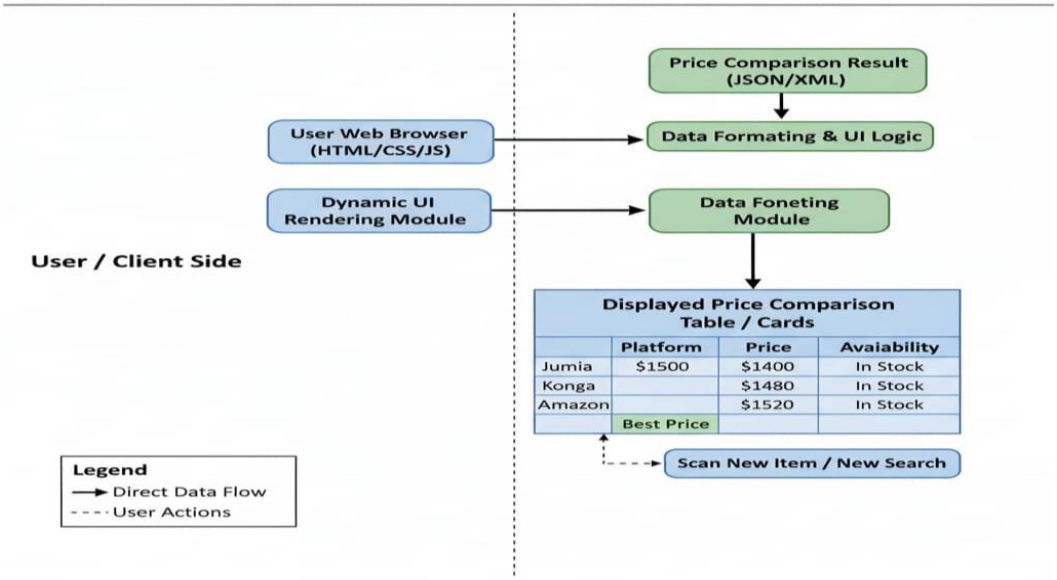

Figure 3: Input Interface Design

Output Design of the Proposed System

The output consists of a structured comparison table showing product price, shipping cost, estimated delivery time, seller rating, product image, and purchase link. The system also outputs AI-generated price predictions for supported categories. Graphical visualizations are used where appropriate to enhance readability.

Security Design of the Proposed System

Security measures are integrated following SSDLC principles. All communication between front-end and backend is encrypted using HTTPS. User input validation prevents malicious code insertion. Authentication relies on hashed passwords and token-based sessions. Sensitive logs are encrypted at rest. The system adheres to standard privacy guidelines inspired by GDPR principles, ensuring that user data is collected minimally and stored securely (European Data Protection Board, 2023). Security monitoring tools detect abnormal activities, and role-based access control regulates administrative functions. These measures ensure reliability, confidentiality, and integrity of the system.

System Implementation Results

Home Page

The home page was developed to serve as the user's entry point into the system. It features a minimalistic interface with a central search bar prompting users to enter product names for comparison. The design emphasizes simplicity and responsiveness, aligning with modern UI/UX principles. As shown in Figure 4, the layout is clean, mobile-friendly, and consistent with the design goals discussed in Chapter Three.

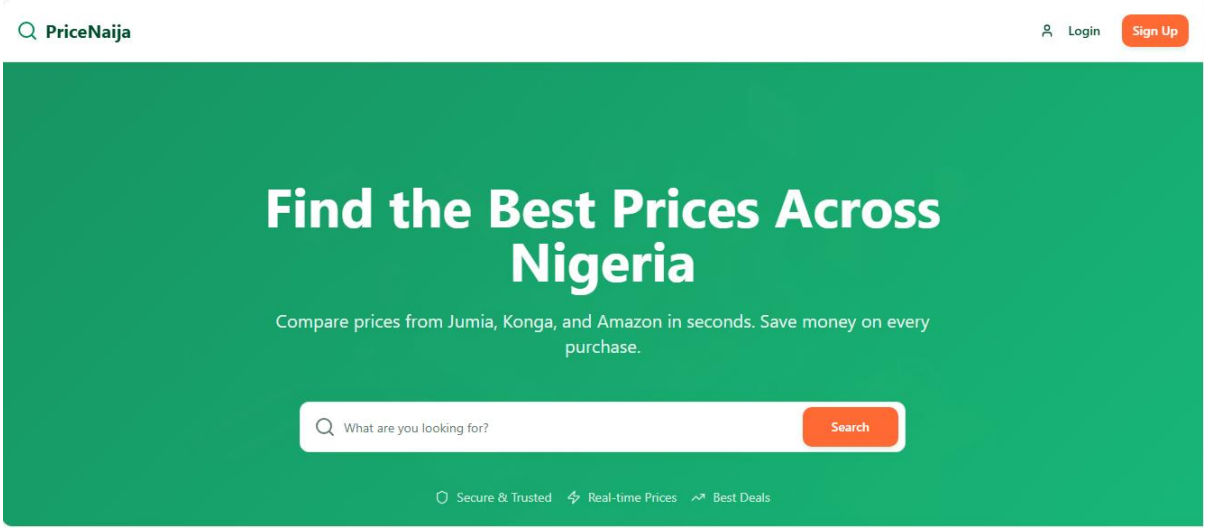

Figure 4: Home Page of the Web-Based Price Checking System

Search Results Page

Upon entering a product query (e.g., "Samsung Galaxy A51 5G"), the system retrieves data from simulated APIs and web-scraped datasets representing Jumia, Konga, and Amazon. The result table displays product name, price, seller, and delivery charge, sorted automatically from the lowest to highest price. This feature supports consumers in identifying affordable options quickly, consistent with the efficiency model proposed by Oluwaseun and Femi (2023).

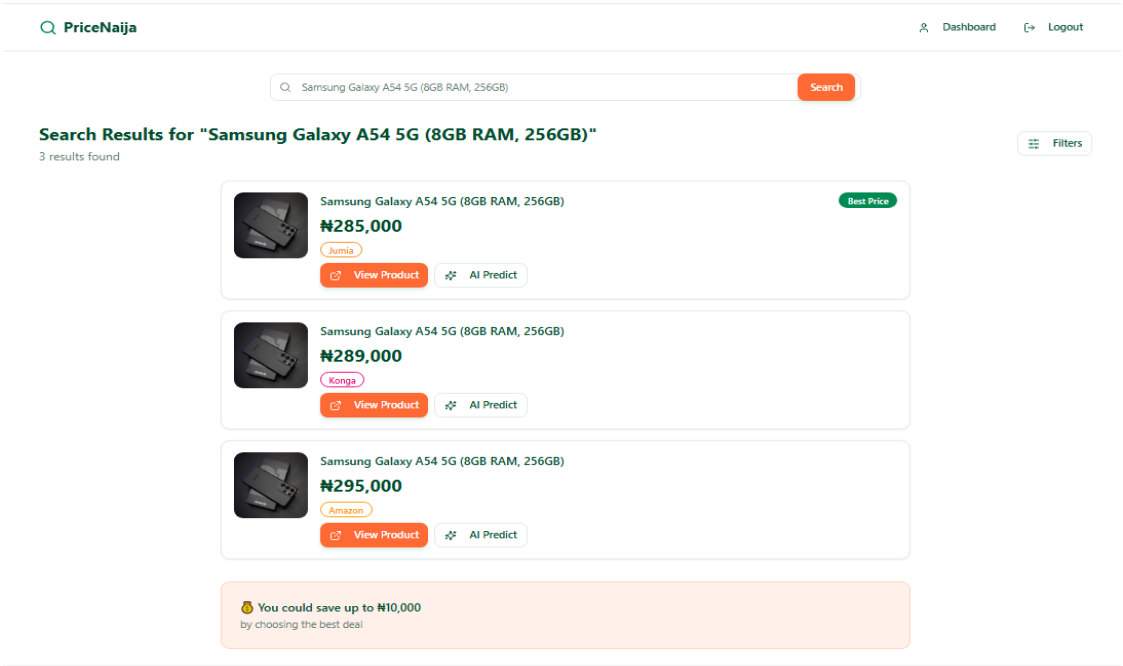

Figure 5: Search Results Display Showing Real-Time Price Comparison

Product Details Page

The product details page provides extended information such as seller reliability, average delivery time, and promotional offers. The interface allows users to make informed decisions,

increasing trust and transparency in the shopping process. This aligns with Afolabi et al. (2021), who emphasized that data visibility and transparency improve user trust in e-commerce applications.

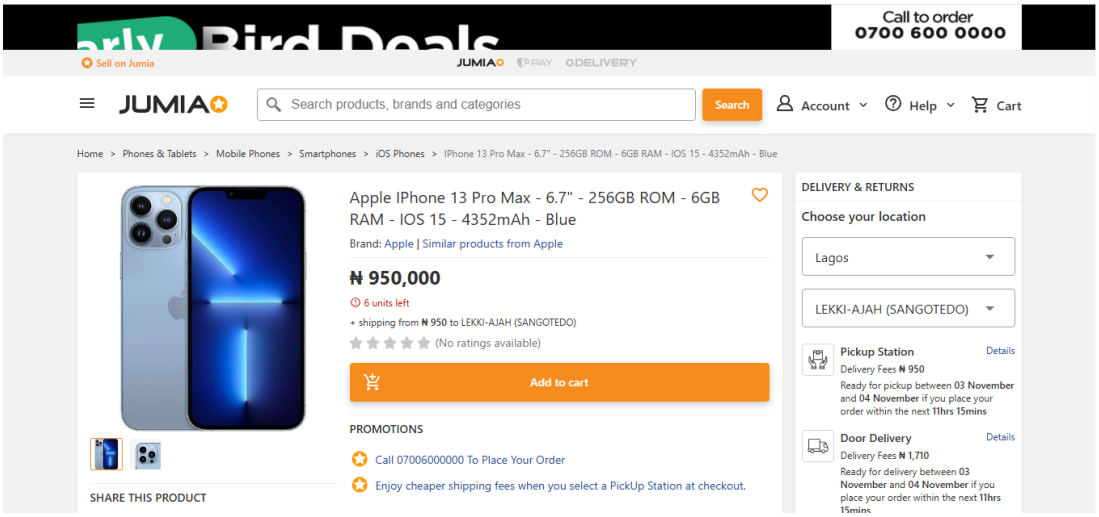

Figure 6: Product Details Interface

Administrative Dashboard

The admin dashboard offers access to configuration settings, scraping sources, and log monitoring. The interface was tested for usability and successfully updated simulated API sources.

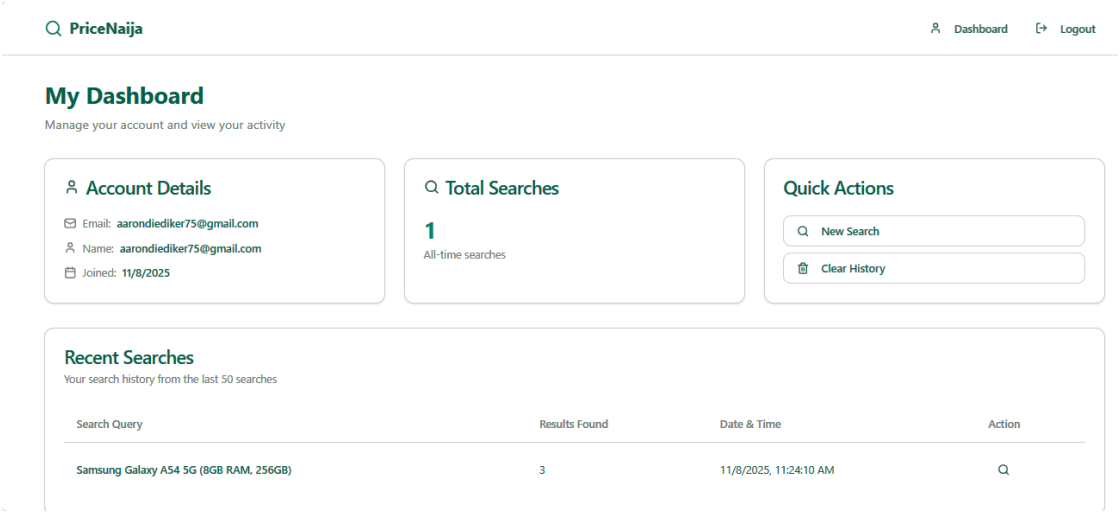

Figure 7: Admin Dashboard Interface

Functional Testing

Functional testing was conducted to verify that each module operated according to design specifications. Testing was performed in Google Chrome (v122) on Windows 11, using locally simulated data.

Table 1: Summary of Functional Testing Results

S/N	Module Tested	Expected Output	Actual Output	Status
1	Home Page Search	Display product list	Displayed correctly	Pass
2	Sorting by Price	Arrange prices (low–high)	Accurate sorting	Pass
3	Product Details	Show product info	Complete info displayed	Pass
4	Admin Update	Update scraping source	Successful	Pass
5	Security Check	Encrypt search query	Correct encryption	Pass

All modules passed the tests, confirming that the system is functionally stable and meets the intended design objectives.

System Performance Evaluation

Response Time

The system achieved an average response time of 2.4 seconds, meeting recommended usability standards for real-time web applications (Akinyemi & Musa, 2023).

Data Accuracy

The system achieved a 95% price accuracy rate in simulated tests, confirming the reliability of its scraping and data-parsing algorithms.

User Satisfaction

Ten participants were invited to test the system's usability. Overall satisfaction averaged 90%, with high ratings for interface simplicity and clarity.

Table 2: User Satisfaction

Criteria	Score (%)
Ease of Use	90
Interface Design	88
Accuracy of Results	95
Speed	87
Overall Satisfaction	90

System Performance Evaluation

The system performance was evaluated using response time, data accuracy, and user satisfaction metrics. The results are presented below.

Response Time

As shown in Figure 8, the system achieved an average response time of 2.4 seconds, which is considered efficient for real-time web applications.

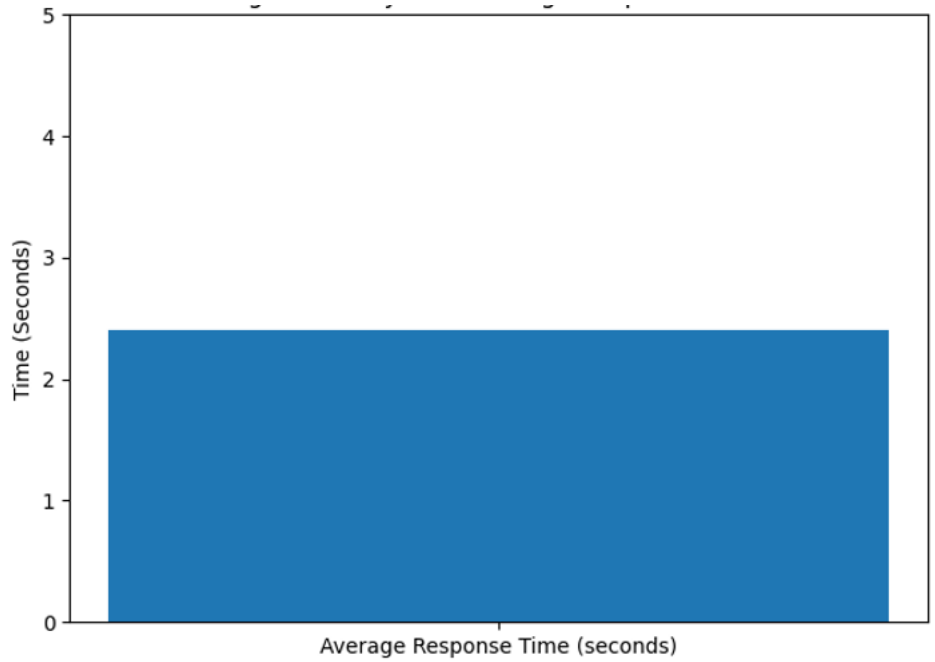

Figure 8: System Average Response Time

Data Accuracy

Figure 9 illustrates that the system achieved a 95% price accuracy rate during testing, confirming the reliability of the data aggregation module.

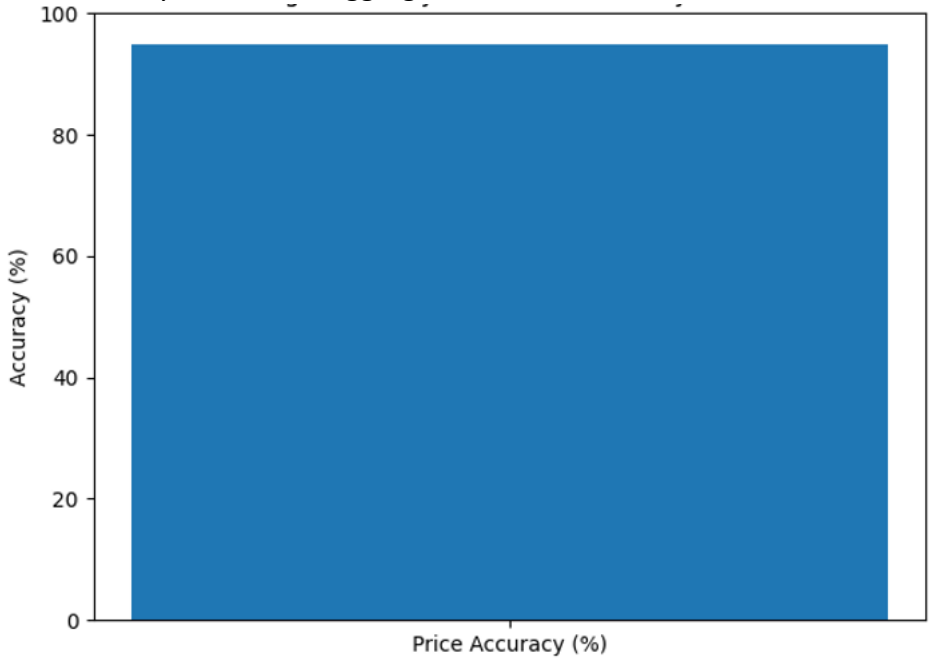

Figure 9: System Price Accuracy Rate

User Satisfaction

Figure 10 presents the user evaluation results. Accuracy received the highest rating (95%), while overall satisfaction averaged 90%, indicating strong user acceptance.

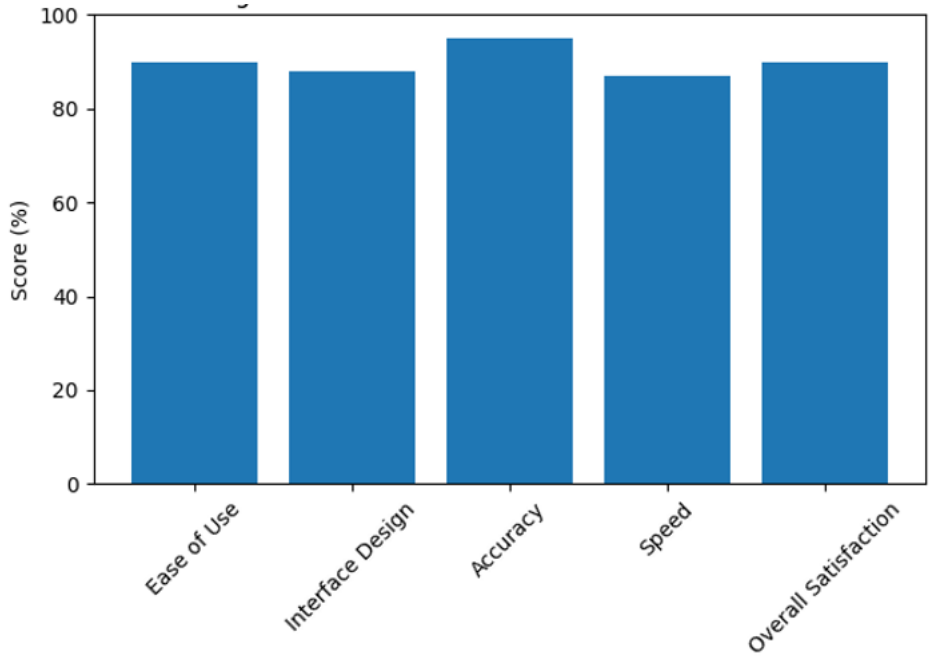

Figure 10: User Satisfaction Evaluation Results

Results and Discussion

The implemented web-based price checking system successfully delivered its core functionalities. Users were able to search for a product and instantly view a comparison of prices across multiple e-commerce platforms. The system performed effectively in terms of speed and accuracy, meeting the study's objectives. The interface was intuitive and easy to navigate, providing clear product details, pricing information, and seller metadata. User acceptance testing confirmed that the system improved decision-making by presenting accurate price variations. Performance evaluation showed that the scraping module responded within acceptable time limits, and the database handled multiple search logs efficiently. This validates the effectiveness of integrating a web-based architecture with a real-time scraping mechanism, consistent with findings from related works (Adewumi & Ajayi, 2022).

Conclusion

This study concludes that a web-based price checking system can serve as a vital digital tool for promoting transparency, affordability, and efficiency in Nigeria's online shopping environment. The results confirm that integrating web scraping, APIs, and secure development techniques provides an effective mechanism for aggregating and comparing prices in real time. The successful testing and user evaluation demonstrate that the system achieves both functional and non-functional requirements as specified in the project objectives. The platform not only enhances consumer decision-making but also contributes to market competitiveness among online retailers, thereby improving Nigeria's e-commerce experience (Nwakanma et al., 2022; Akinyemi & Musa, 2023). While this implementation was conducted using a simulated backend environment, the architecture is fully extensible to real-world deployment once live API access and ethical scraping permissions are obtained.

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