Mobile Based E-Commerce Application with Whatsapp Notification for Transactions

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Abstract

Online shopping has become an essential part of modern society. Various e-commerce platforms have emerged offering a wide range of products, yet most still focus primarily on selling new items. In fact, there is a growing need for a platform that can accommodate both new and used goods transactions within a single, user-friendly application. Moreover, many existing platforms lack direct integration with instant messaging services such as WhatsApp, resulting in delayed transaction information and potentially leading to miscommunication. To address these challenges, a mobile-based e-commerce application was developed using Flutter as the frontend framework, Flask as the backend API, and MySQL as the database. The main advantage of this application lies in its automatic WhatsApp integration, which enables real-time transaction notifications. Testing results show that the application functions properly and remains stable. The main features include registration, login, product addition, and product listing, along with additional features such as favorites marking, live streaming, and automatic WhatsApp notifications. This application is expected to serve as an effective solution to overcome current platform limitations and to support efficient and convenient buying and selling of both new and used goods.

Keywords: E-Commerce; Flutter; Flask; WhatsApp; Mobile Application.

1. Introduction

Advances in digital technology have brought significant changes to people's lifestyles, including their shopping habits. Today's rapidly evolving technology has provided numerous benefits in various areas of progress, including the economy (Maulana et al., 2024). and the increasing need for responsive mobile platforms (Manik & Istiyowati, 2025).

a. Background

E-commerce is a very big concept in the world of the Internet. This platform enables large-scale product sales transactions between producers and consumers by leveraging the rapid growth of the internet (Sumarni et al., 2024). It can benefit many parties, including consumers, producers, and sellers (Hendriawan et al., 2021). Currently, e-commerce applications offer convenience for users in conducting purchasing and selling transactions . It has become a common habit that makes it easier for people to obtain various needs quickly and practically. However, most existing e-commerce platforms still focus on selling new products.

b. Problem

In the evolution of society, consumers are not only looking for new items, but are also interested in used goods. This phenomenon has created a trend in society in which many prefer used goods for collecting,

hobbyism, or cost efficiency (Safitri ika & Kurniadi, 2024). Unfortunately, most available systems do not provide an optimal experience. Some obstacles that are still often encountered include limited information on the condition of the goods and the possibility of duplication in search results in e-commerce applications (Agustin et al., 2023). And user security is not fully guaranteed. In addition, communication between sellers and buyers is often a major obstacle. Delayed transaction information can cause inconvenience, delay the buying and selling process, and even lead to cancellations. In April 2014, this number more than doubled to 500 million. Users continued to grow, reaching around 900 million in September 2015 (Trisnawati, 2022). WhatsApp is one of the most widely used instant messaging applications globally, including among e-commerce users (Guyen & Prihanto, 2025), because it allows users to receive transaction notifications automatically and in real time.

c. Proposed Solution

Based on these problems, a mobile-based e-commerce application was developed that not only focuses on new products, but also supports used goods transactions. The application is designed with Android Studio as an IDE, or in other words, an official integrated development environment that is specifically designed for the development of the Google Android operating system (Mabe Parenreng et al., 2023). Flutter was chosen for the user interface because it is designed to make it easier for developers to build user interfaces. The entire UI in Flutter is built using widgets. Being able to customize each widget will determine the display's appearance based on the existing configuration and state (Setiawan et al., 2022). Currently, Flutter is being widely used because it is considered fast (Prasetyo et al., 2022). Flask is a backend framework that provides tools and frameworks for server-side application development (A. Putri & Awangga, 2023). In the software collection and for data storage using PhpMyAdmin MySQL, these tools make it easier for developers and users to store, search, and maintain data, eliminating the need for paper media that is easily lost, like a manual system (Prabowo, 2022). MySQL is used to store transaction and stock data with high security and the ability to handle complex queries (Alwi & Ma'sum, 2025). The main features developed include registration, login, product search, adding items, and automatic notifications via WhatsApp. The primary goal of this development is to create an easy-to-use, secure, and efficient platform for users to transact new and used goods. In addition to providing convenience, the app is also expected to encourage sustainable lifestyles by increasing interest in reusing used goods.

d. Literature Review

As society evolves, consumers are no longer just looking for new items but are also drawn to secondhand goods. This phenomenon has created a trend in society where many people now prefer secondhand goods, whether for collections, hobbies, or to save money. On the other hand, sellers also benefit from using sales profits to expand their businesses (Safitri ika & Kurniadi, 2024). Flutter offers three advantages in system development: fast runtime, easy code updates via hot reload (productive), and developer freedom to create custom designs. The Flutter framework is a high-performance, attractive application development framework. Flutter is built using Dart. Thanks to Dart, Flutter is the fastest cross-platform framework available, offering native-like performance. Why? Because Dart supports multiple architectures, including IA-32, X64, MIPS, ARMv5TE, ARMv6, ARMv7, and ARM64 (A. S. Putri et al., 2023). WhatsApp is one of the most widely used instant messaging apps globally, including by e-commerce users. Compared to email, users open and respond to messages on WhatsApp more frequently, making it a highly promising tool for fast, direct marketing communications. Additionally, WhatsApp provides features that support message personalization, such as sending notifications relevant to customer preferences (Guyen & Prihanto, 2025) . This application is very popular worldwide because of its easy-to-use features and can be accessed with an internet connection (Bimantoro et al., 2024). Some of the literature reviews that form the basis will be shown in Table I.

Table 1. Literature Review

No	Title	Author(yrs)	Technology	Method & Tools	User
1	E-Commerce Application Development at PT. Putra Sumber Abadi Using Flutter	M. Hendriawan *et al.*, (2021).	Mobile	Waterfall, Flutter, DFD, postgresSQL	PT. Putra Sumber Abadi
2	Design and Construction of an Android-Based E-Commerce Application at the Suryamart Store Using the Flutter Framework	A. Putri *et al.*, (2023).	Mobile	Waterfall, Flutter, Flowchart, DFD, ERD, CDM	Admin, Customer
3	Design of an Android-Based E-Commerce Mobile Application at Natasya Butik	M. Sari and S. Andriasari, (2023).	Mobile	Waterfall, DFD, CD	Natasya Butik
4	Design and Development of an Android-Based Secondhand Goods Buying and Selling Application in the UNP Community (Secondapps)	M. I. Safitri and D. Kurniadi, (2024).	Mobile	Waterfall, Dart, Flutter	Padang State University Community
5	E-Commerce Marketing Application Development to Increase MSME Sales: A Case Study on MSMEs in Bengkalis	T. Sumarni *et al.*, (2024).	Mobile	DC, CRM, Social Media	Bengkalis
6	Real Time E-Commerce Product Information Notification Using Whatsapp Push Message and Bot Menu	H. Guyen and A. Prihanto, (2025).	Web Mobile	Waterfall, Flutter, XAMPP,MySql	Admin, Customer

Based on the comparison presented in Table 1, previous studies predominantly focused on conventional mobile-based e-commerce applications. Several studies were designed for specific organizations or limited user communities and generally required users to register before accessing product information. Research on secondhand goods transactions was largely confined to specific environments and did not emphasize real-time transaction confirmation. In addition, although some studies explored notification mechanisms, integrating automatic WhatsApp-based transaction notifications into a complete mobile e-commerce transaction flow was rarely implemented. Most existing systems focus either on product information dissemination or on conventional e-commerce features, without integrating end-to-end transaction processing and instant messaging services. Therefore, a research gap exists in the development of a mobile e-commerce application that supports the buying and selling of both new and used goods on a single platform, allows product browsing in guest mode without prior registration, and provides automatic transaction notifications via WhatsApp. This research addresses the identified gap by proposing a Flutter, Flask, MySQL-based application with simplified administrative roles focused on transaction verification to enhance usability, transparency, and user experience.

1. Research Method

This research applies the Waterfall development methodology to build a mobile-based e-commerce application. The Waterfall method is selected because it provides a clear, structured, and sequential development process, making it suitable for systems with well-defined and stable requirements understand system development in a structured and systematic manner to meet existing needs (Fadzli et al., 2025). that there are 5 stages in the waterfall method, namely Analysis, Design, Development, Testing, and

Maintenance (Agustina et al., 2025). The information obtained is then processed and analyzed to obtain complete data or information regarding the user requirements specifications for the software to be developed(Sari & Andriasari, 2023). The research process begins with problem identification and determination of research objectives, followed by requirement analysis to identify functional and non-functional system requirements. These requirements are derived from observations of existing e-commerce applications and literature studies. The identified requirements include user registration and login, product management, transaction processing, and automatic delivery of WhatsApp notifications. The next stage is system design, which defines the system architecture, application workflow, user interface layout, and database structure. This design serves as a blueprint for the implementation stage. The implementation stage involves developing the mobile application using Flutter as the frontend framework, Flask as the backend service, and MySQL as the database management system for storing user, product, and transaction data. System testing is conducted during the testing stage to ensure that all functionalities operate as specified. Black-box testing is applied to validate core features such as login, registration, product management, transaction processing, and WhatsApp notification delivery. The final stage is evaluation and maintenance, which aims to assess system performance and identify potential improvements for future development. The overall research flow is illustrated in Figure 1.
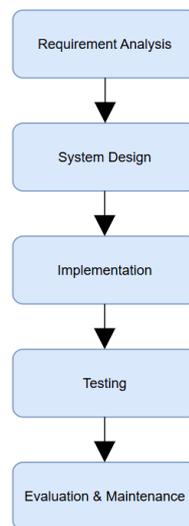

Figure 1. WaterFall Method Mobile-Based E-Commerce Application

a. Research Data

Research data plays an important role in determining system requirements and supporting the application design process. In this study, data were obtained through observational analysis and literature review. The data collection approach focuses on identifying functional requirements rather than conducting quantitative user behavior analysis.

[1] Data source: This research uses both primary and secondary data. Primary data were obtained through direct observation of existing mobile e-commerce applications, Second, secondary data was obtained through literature review by collecting relevant references to serve as the basis for the research (Fau, 2024).

[2] Data Collection Method: Primary data were collected by observing the features and workflows of popular e-commerce platforms such as Shopee and Lazada. This observation aimed to identify commonly implemented functionalities, user interaction patterns, and transaction processes. No questionnaires or interviews were conducted, as the focus of this research is on system design and implementation rather than statistical user analysis. Secondary data were obtained through a literature

review of scientific journals and books on mobile e-commerce development, Flutter, Flask, database management, and WhatsApp-based notification systems. A summary of the explanation is shown in Table 2 below.

[3] **Data Collection Period:** Data collection was conducted from January to May 2025. During this period, observations and literature reviews were conducted iteratively to support each stage of the application development process.

Table 2. Research Data Collection Methods

No	Data Type	Data Collection Method	Data source	Description
1	Primary Data	Direct observation	E-commerce applications such as Shopee and Lazada	Observing system features, workflows, user interaction patterns, and transaction processes
2	Secondary Data	Literature review	Scientific journals, and reference books	Discussing mobile e-commerce development, user experience, Flutter, Flask, database management, and WhatsApp-based notification systems

b. System Analysis and Design

System analysis is conducted to identify user and administrator requirements in supporting digital buying and selling activities. Based on the analysis results, the system is designed to support core e-commerce functionalities, including user registration and login, product management, product search, favorite item tagging, purchase transactions, and administrative management. Additionally, the system integrates automatic transaction notifications delivered via WhatsApp to provide users with real-time information.

[1] **System Design:** The system is designed using a client–server architecture. Flutter is used for the mobile application interface, Flask serves as the backend for application logic and data processing, and MySQL is used as the database management system. Communication between the frontend and backend is performed over HTTP using the JSON data format. This architectural separation improves system scalability, maintainability, and development efficiency. The overall system architecture is illustrated in Figure 2.
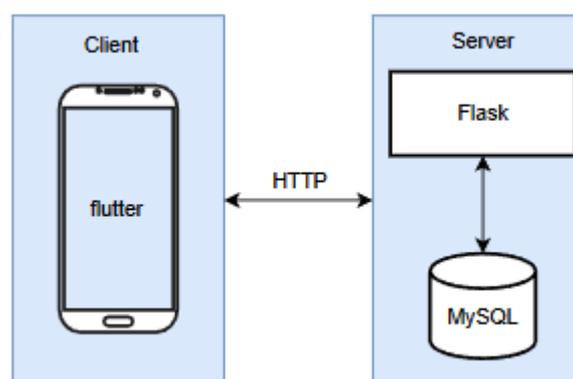

Figure 2. Client-Server System Architecture for Mobile-Based E-Commerce Application

[2] **Use Case and Activity Diagram Design:** To describe system functionality and user interaction, this research employs use case diagrams and activity diagrams. The use case diagram illustrates the interactions between two main actors, namely administrators and customers, with the system. Customers

are responsible for activities such as user registration, product browsing, and transaction execution, while administrators are limited to verifying transactions. The activity diagrams describe the flow of key processes, including user registration, product browsing, transaction execution, and transaction verification. These diagrams provide a clear representation of system behavior and process logic. The use case and activity diagrams are shown in Figures 3 and 4, respectively.
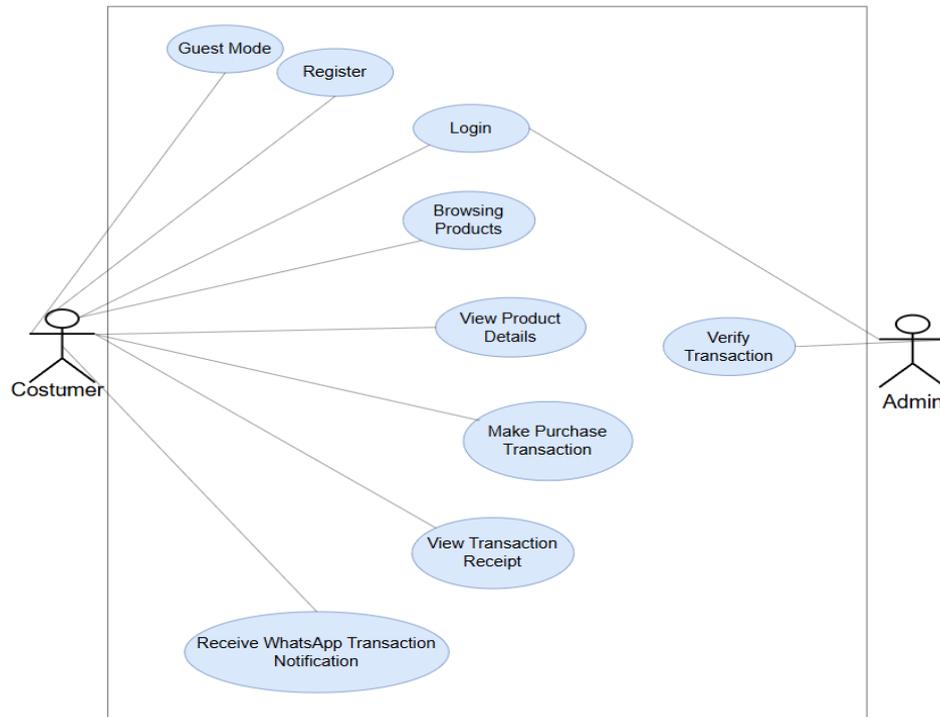

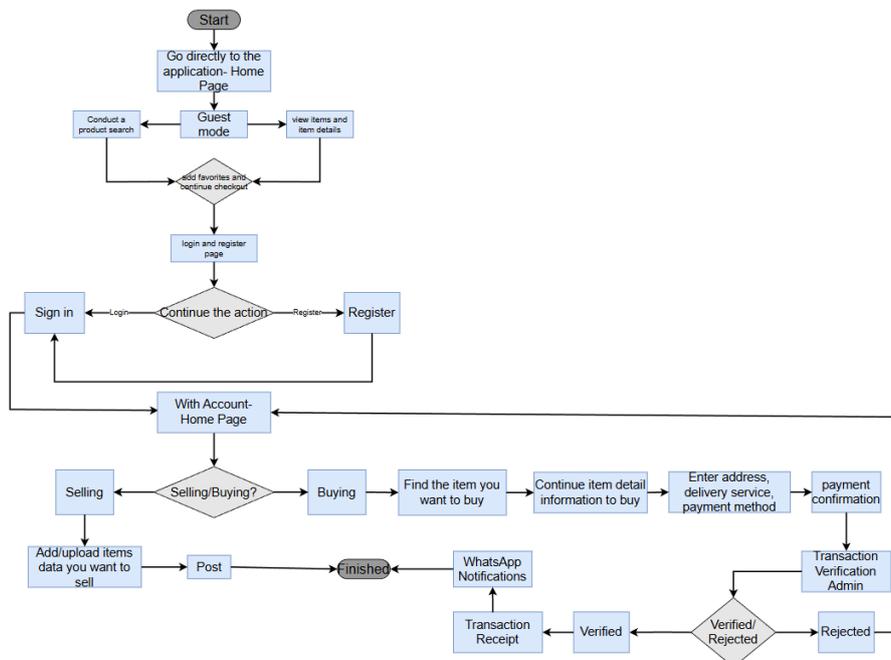Figure 3. Use Case Diagram Mobile-Based E-Commerce Application

Figure 4. Activity Diagram Mobile-Based E-Commerce Application

[3] Database Design: The database design is represented using an Entity Relationship Diagram (ERD) to describe the structure of the database and the relationships between entities. The main entities include users, products, transactions, favorites, and chat messages. The ERD ensures data consistency and supports the operational requirements of the e-commerce system. The database schema is illustrated in Figure 5.
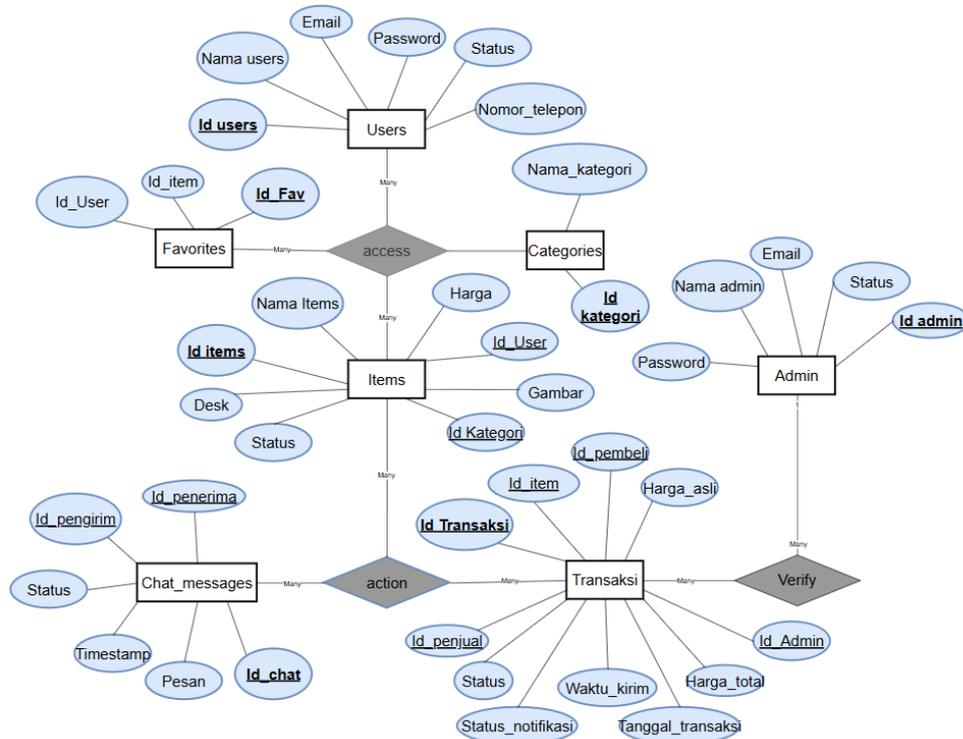

Figure. 5 Entity Relationship Diagram Mobile-Based E-Commerce Application

2. Result and Discussion

This section presents the implementation results of the developed mobile-based e-commerce application. The discussion focuses on system workflow, interface appearance, and user interaction processes. The results are described based on system functionality rather than solely on visual presentation to evaluate how well the application meets user needs. Before logging in or registering, users can explore products in guest mode. Before logging in or registering, users can explore products in guest mode. This feature allows users to browse product listings and view product details without providing personal information. Figure 6 illustrates the main page in guest mode, while Figure 7 shows browsing results using guest mode. Figure 8 shows the product detail page in guest mode. This approach aims to increase user trust and usability by allowing users to understand the application flow before registering.

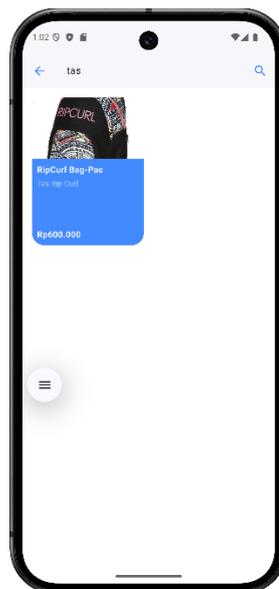Figure. 6. Home Page (Guest Mode) Mobile-Based E-Commerce Application

Figure. 7. Browsing product (Guest Mode) Mobile-Based E-Commerce Application
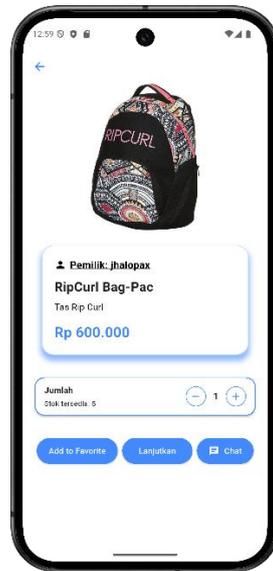
Figure. 8 Detail Page (Guest Mode) Mobile-Based E-Commerce Application

When users intend to perform restricted actions, such as making a purchase or marking products as favorites, the system requires users to register or log in. The registration and login processes are illustrated in Figure 9. After successful authentication, users can proceed to the checkout process as shown in Figure 10, where transaction details and payment methods are reviewed before submission.
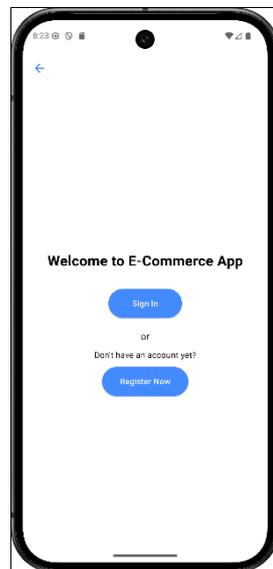

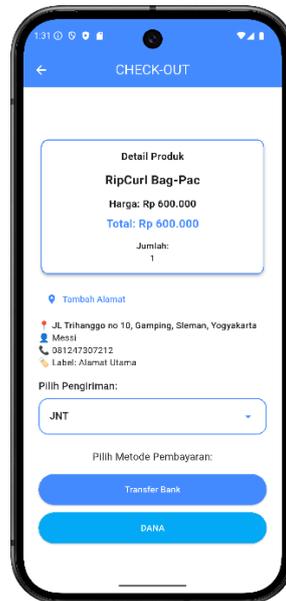Figure. 9. Registration and Login Page Mobile-Based E-Commerce Application

Figure. 10. Check-Out Page Mobile-Based E-Commerce Application

Once a transaction is successfully processed and verified, the system generates a digital transaction receipt containing product details, pricing information, and transaction status (Figure 11). In addition, the system automatically sends a transaction confirmation notification via WhatsApp to the user, as shown in Figure 12. This notification mechanism is designed to provide real-time confirmation and improve user experience.
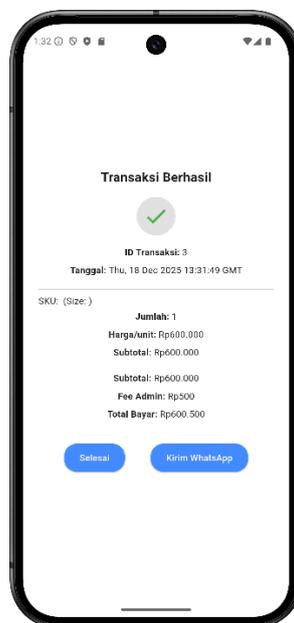

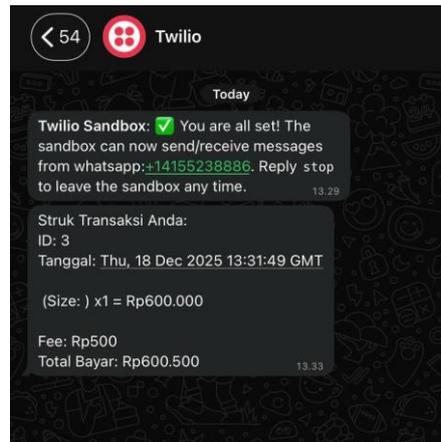Figure. 11. Transaction Structure Mobile-Based E-Commerce Application

Figure 12. WhatsApp Transaction Notifications for Mobile-Based E-Commerce Application

a. System Testing

To ensure the developed application meets the specified requirements, system testing was conducted using black-box testing. This method focuses on validating system functionality without examining the internal program structure. Testing was carried out on the main features of the application, including authentication, product browsing, transaction processing, and WhatsApp notification delivery.

[1] Functional Testing: Functional testing was performed to verify whether each system function operates as expected. Table 3 presents the summary of functional test cases and results.

Table 3. Functional Testing Results

No	Feature Tested	Test Scenario	Expected Result	Result
1	User Registration	User inputs valid data	Account created successfully	Pass
2	User Login	User inputs correct credentials	User logged in successfully	Pass
3	Guest Mode Browsing	User accesses product list	Products displayed	Pass
4	Purchase Transaction	User completes checkout	Transaction recorded	Pass
5	Transaction Verification	Admin verifies transaction	Status updated	Pass
6	WhatsApp Notification	Transaction completed	Notification sent	Pass

Table 3 shows that all core features function as expected. User registration, login, and guest browsing work reliably, while transactions are correctly recorded and verified by the admin. WhatsApp notifications are delivered successfully, confirming that the system functions as intended.

[2] Performance Testing: The system's operational performance is assessed under normal usage conditions, with a focus on key functions such as browsing, registration, login, transaction processing, and WhatsApp notifications. The performance results are shown in Table 4.

Table 4. Perfomance Testing Result

No	Feature	Avg Respone Time	Max Respone Time	Result
1	Browsing	0.9 s	1.2s	Pass
2	Registration	1.3 s	1.7s	Pass
3	Login	1.4 s	2.0s	Pass
4	Transaction Processing	2.1 s	3.6s	Pass
5	WhatsApp Notification	1.1s	1.8s	Pass

Table 4 shows that the system responds efficiently under normal usage conditions. All key features, including browsing, registration, login, transaction processing, and WhatsApp notifications, meet acceptable response times, indicating that the application is stable and performs reliably.

[3] WhatsApp Notification Testing: Special testing was conducted on the WhatsApp notification feature, as it is a key system functionality. The testing focused on verifying notification delivery under various conditions, including with valid user data and under network constraints. The test scenarios and results are summarized in Table 5.

Table 5. WhatsApp Notification Testing Results

No	Test Scenario	Input Condition	Expected Result	Actual Result	Status
1	Valid WhatsApp Number	Registered and active number	Notification delivered	Delivered successfully	Pass
2	Invalid WhatsApp Number	Incorrect or unregistered number	Notification failed, system remains stable	Failed delivery, no crash	Pass
3	Delayed Network	Slow internet connection	Notification sent with delay	Delivered with delay	Pass

The test results indicate that the WhatsApp notification feature functions reliably under normal conditions. Notifications are delivered successfully to valid WhatsApp numbers, while invalid numbers are handled gracefully without affecting system stability. Network delays may affect delivery time, but do not interrupt the transaction process, confirming the robustness of the notification mechanism.

[4] User Experience Evaluation: A small-scale user trial was conducted with 5 participants to evaluate usability and satisfaction. Participants were asked to rate key aspects on a scale of 1–5 (1 = poor, 5 = excellent). The results are shown in Table 6.

Table 6. User Satisfaction Scores

No	Aspec	Avg Score
1	Ease of Use	4.7
2	Speed of Transaction	4.5
3	Guest Mode Usability	4.6
4	Reliability of WhatsApp Notification	4.4
5	Overall Satisfaction	4.5

The results indicate that the application is Easy to understand, provides quick access to features, and the guest mode is particularly appreciated. WhatsApp notification reliability is good, though it is slightly affected by invalid numbers or network delays.

b. Discussion and System Limitations

Based on the implementation and testing results, the developed application successfully supports essential buying and selling activities for new and used goods. The guest mode feature provides flexibility for users who prefer to explore products before registering, addressing common privacy concerns on many existing e-commerce platforms. However, several limitations were identified. The WhatsApp notification feature relies on third-party integration, which may be affected by service availability and policy changes. In addition, performance testing under high user loads was not conducted in this study, and usability evaluation was limited to functional validation without quantitative user satisfaction measurements such as SUS scoring. Despite these limitations, the system demonstrates that integrating mobile applications with real-time messaging notifications can enhance transaction transparency and user experience. Future work may include performance optimization, usability testing with real users, and adopting official WhatsApp Business APIs to improve system reliability.

3. Conclusion

This research successfully developed a mobile e-commerce application that supports transactions for both new and used goods, with automatic integration with WhatsApp notifications. Based on black-box testing results, the core functionalities, including user registration, login, product browsing in guest mode, transaction processing, and WhatsApp notification delivery, operated according to the specified system requirements. Implementing Flutter as the frontend framework and Flask as the backend service enabled a stable client-server architecture, while MySQL effectively managed user, product, and transaction data. The guest mode feature allows users to browse products without prior registration, supporting data privacy while maintaining transaction security through authenticated access. In addition, testing of the WhatsApp notification feature confirmed that transaction confirmations were delivered successfully under normal conditions. Although the system has achieved its primary objectives, this research is limited to functional testing and does not include performance benchmarking, large-scale user evaluation, or security penetration testing. Future development may include adding live product promotion features, user review mechanisms, and digital payment integration to enhance system functionality and the user experience.

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