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Implementation of a Web-Based Goods Delivery Service System Using the Waterfall Method

Reynaldy Langgeng Phambudy[1], Novrindah Alvi Hasanah[2*], Luthfi Atikah[3]

[1]Teknik Informatika, UIN Maulana Malik Ibrahim Malang, Indonesia
[2]Teknik Elektro, UIN Maulana Malik Ibrahim Malang, Indonesia
[3]Manajemen Informatika, Politeknik Astra, Indonesia
[*]novrindah@uin-malang.ac.id

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ABSTRACT

The development of information technology is driving changes in people's transaction patterns, particularly in online buying and selling activities. However, not all consumer needs can be met through available e-commerce platforms, especially for certain products that are limited or not always available. Therefore, consignment services have become a popular alternative solution. This study aims to implement a web-based consignment service system that can facilitate the ordering process, product data management, and transactions between customers and service providers in a structured and efficient manner. The system development method used is the Waterfall method, which consists of the stages of needs analysis, system design, implementation, testing, and maintenance. The system built has two main types of users, namely admin and customer, with different interfaces and access rights. The implementation results show that the system is able to support the online consignment service process, from product search, ordering, transaction management, to report presentation, thereby increasing the ease, speed, and accuracy of the web-based consignment service.

1. INTRODUCTION

The rapid development of information technology has driven significant changes in people's transaction patterns, particularly in online buying and selling activities. Utilizing the internet as a transaction medium allows consumers to obtain goods and services more quickly and efficiently, without the constraints of space and time. This digital transformation has increased the use of web-based information systems in various service sectors, including trade and services [1].

Despite the rapid growth of e-commerce platforms, not all products consumers need are always available, especially those with limited availability, specific variants, or products that are only available in certain locations. This situation has led to the emergence of consignment services as an alternative to meet consumer needs. Several studies have shown that consignment services act as an intermediary purchasing solution when direct access to products is not possible through conventional e-commerce platforms [2].

However, in practice, the management of consignment services is still often done manually or through social media, potentially giving rise to various problems, such as errors in order recording, lack of transaction transparency, and difficulties in managing order data and reports. Therefore, a web-based consignment system is needed that can integrate the ordering process, product data management, and transactions in a structured and well-documented manner [3].

Developing a web-based information system requires a systematic development method to ensure the resulting system meets user needs. The Waterfall method is a widely used software development method because it has clear and structured stages, from requirements analysis to system testing. Several studies over the past five years

have shown that the Waterfall method is effective for developing web-based information systems, particularly for systems with well-defined requirements [4].

Based on these problems, this research aims to implement a web-based consignment service system using the Waterfall method. The developed system is expected to improve the efficiency of the consignment service process, minimize recording errors, and provide convenience for customers and service managers in conducting transactions and managing data in an integrated manner.

Although several studies have discussed e-commerce platforms and consignment services, most existing systems focus primarily on general online marketplaces and lack structured features for consignment-based ordering and transaction management. Furthermore, many consignment services are still managed manually or through informal digital platforms, resulting in data inconsistency and limited transaction transparency. Therefore, this study addresses this research gap by developing a dedicated web-based consignment service system with integrated product management, transaction processing, and reporting features using a structured development approach.

2. Research Methods

This research uses the Waterfall software development method to implement a web-based consignment service system. The Waterfall method was chosen because it has structured and systematic development stages, making it suitable for developing systems with clearly defined needs from the start. This method is still widely used in the development of web-based information systems that are applied and oriented towards specific functional needs [5], [6].

The Waterfall method was selected because the system requirements for the consignment service were clearly defined from the beginning and relatively stable throughout development. Compared to iterative methods such as Agile, the Waterfall model provides a structured and well-documented development process, which is suitable for systems that prioritize functional completeness and documentation.

2.1. Requirements Analysis

The requirements analysis stage is carried out to identify the functional and non-functional requirements of the system. Functional requirements include product data management, ordering goods, transaction management, and user data management consisting of admin and customer data. Non-functional requirements include data security, ease of use, and accessibility of the web-based system. The requirements analysis stage is a crucial stage in the Waterfall method because errors at this stage can impact the entire system development process [7].

2.2. System Design

The system design stage is carried out to model system requirements into a structured design form. System modeling uses the Unified Modeling Language (UML), which includes use case diagrams to describe actor interactions with the system, class diagrams to describe data structures and relationships between classes, and sequence diagrams to describe the system's process flow. The use of UML in designing web-based information systems has been proven to help improve understanding of system flow and minimize implementation errors [8], [9].

2.3. System Implementation

The implementation phase is the process of translating the system design into a web-based application. At this stage, the system's main features are developed according to the design, including product data management, ordering, transaction management, and user management. Implementing a web-based information system using the Waterfall approach allows for controlled and well-documented system development [10].

2.4. System Testing

System testing is conducted to ensure that the developed system meets user needs and runs according to established specifications. The testing used in this study is functional testing (black box testing), which is done by testing each main function of the system without paying attention to the internal structure of the program code. Functional testing is widely used in web-based information systems to ensure feature reliability and minimize errors before the system is used by end users [11], [12].

2.5. Maintenance

The maintenance phase is carried out after the system is implemented and used by users. This phase includes fixing errors discovered during system use as well as adapting the system to new needs. In the Waterfall method,

the maintenance phase is still necessary to maintain the system's sustainability and performance in the long term [13].

3. RESULT AND DISCUSSION

3.1. System Implementation Jasa Titip Barang

The web-based Jasa Titip Barang system was successfully implemented in accordance with the functional requirements analyzed in the previous stage [14]. The system was designed to support the ordering process, product data management, and transaction management between customers and consignment providers in an integrated manner. The system was implemented by differentiating user access rights, so that each actor can only access features appropriate to their role in the system.

3.2. Use Case Diagram

Use case diagrams are used to illustrate the interactions between actors and the system in general. In this consignment system, there are three main actors: the administrator, the officer, and the customer, as shown in Figure 1. Use case diagrams serve as a visual tool to enhance understanding of system functional requirements and guide subsequent development stages [15].

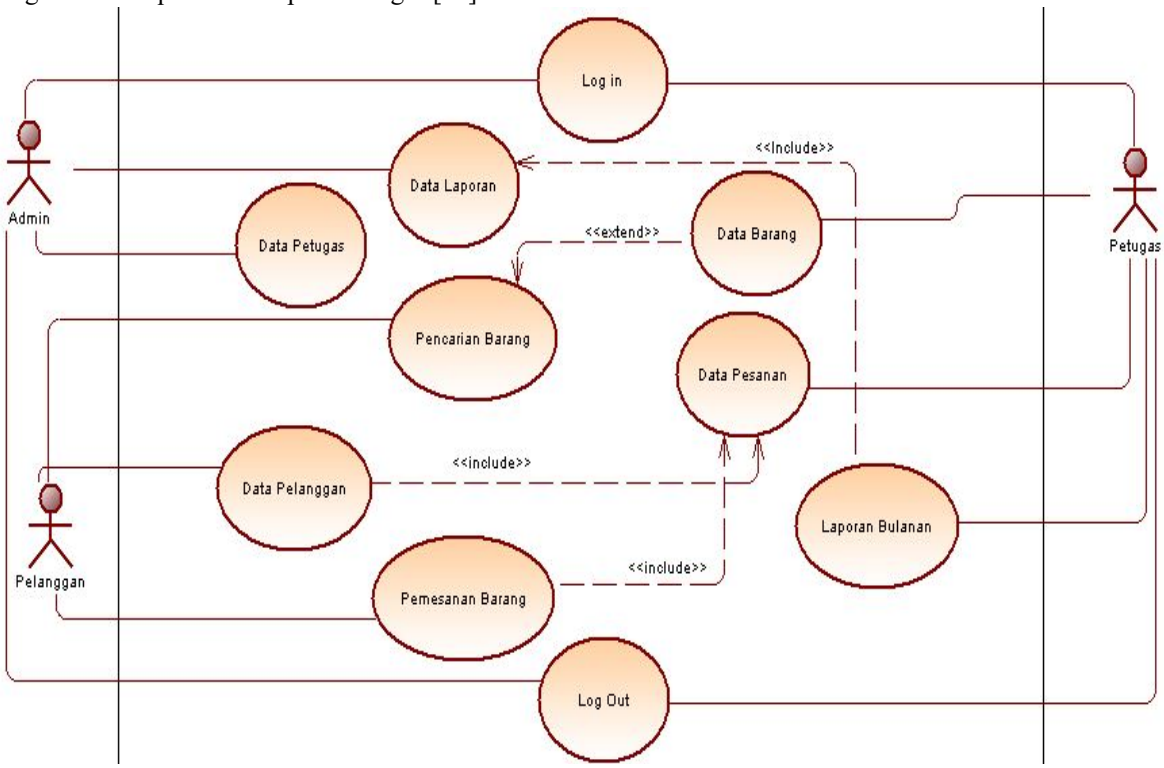


Figure 1. Use Case Diagram System Jasa Titip Barang

Admins have access rights to manage staff data, monitor transaction reports, and manage the overall system. Staff are responsible for managing item data, processing orders, and generating transaction reports. Meanwhile, customers interact with the system to search for items, place orders, and input transaction data. This use case diagram demonstrates the system's ability to facilitate the entire consignment process in a structured manner, tailored to the roles of each actor..

3.3. Class Diagram

Class diagrams are used to illustrate the data structure and relationships between classes within a system. The class diagram for this consignment service system is shown in Figure 2, which shows the main classes, such as admin, officer, customer, product, transaction, and transaction details.

The relationships between classes show how data is managed and interacts within the system. Each transaction can consist of one or more transaction details, while transaction details cannot exist independently of each other. This structure demonstrates the application of relationship and aggregation concepts in system design, thus supporting consistent and integrated data management.

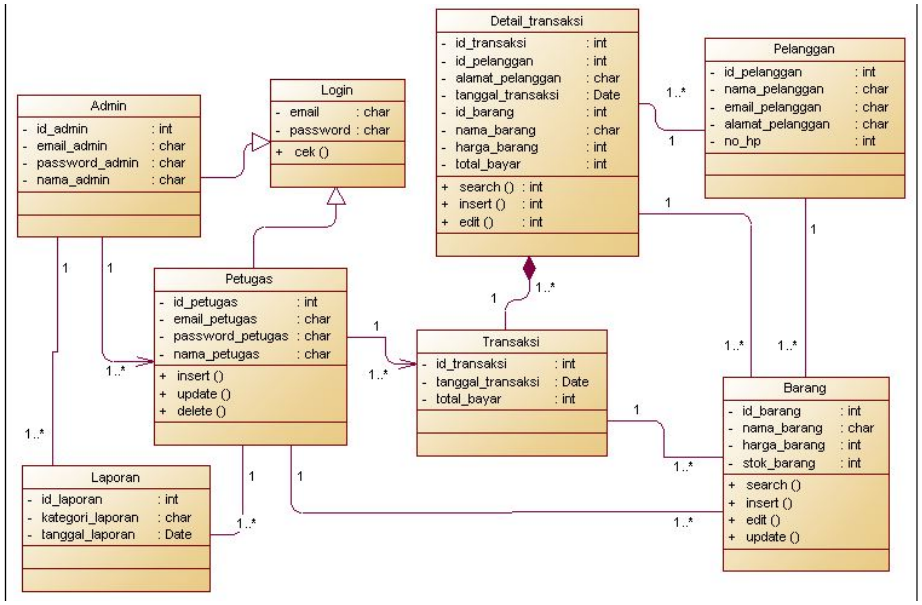


Figure 2. Class Diagram System Jasa Titip Barang

3.4. Sequence Diagram

This sequence diagram illustrates the main transaction flow from item selection to payment confirmation, demonstrating how the system supports an integrated ordering and payment process.

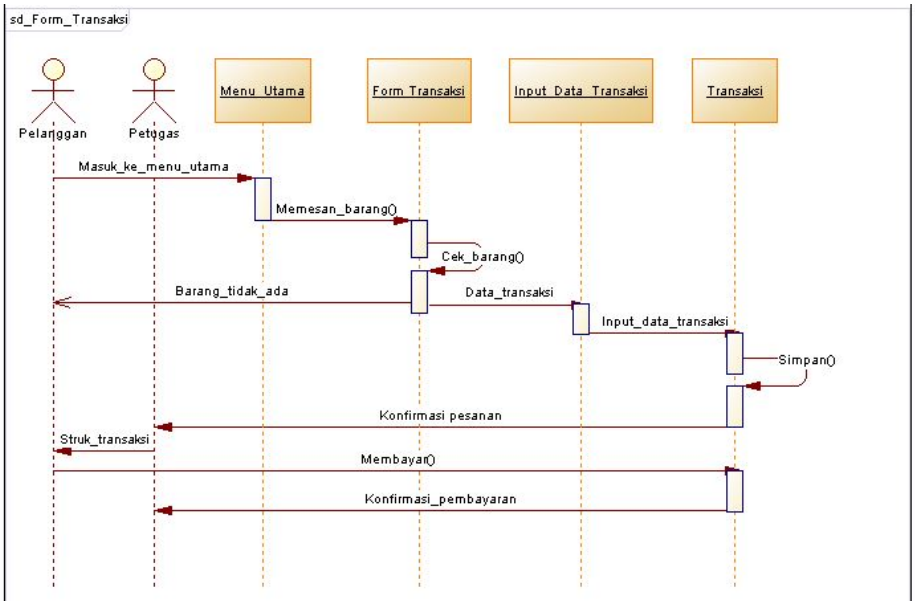


Figure 3. Sequence Diagram

The process begins when a customer enters the system's main menu to place an order. Next, the customer selects the item(s) they wish to order using the transaction form. The system then checks the item's availability. If the item is unavailable, the system will inform the customer to return to the main menu and select another item.

If the item is available, the customer continues the ordering process by entering the required transaction data. This data is then processed by the system and saved in the transaction database. Once the transaction data is successfully saved, the system displays the order confirmation information to the customer.

The next stage is the payment process, where the customer makes the payment according to the predetermined total transaction amount. After payment is made, the officer confirms the payment through the system. The system then generates proof of the transaction, or receipt, as proof that the ordering and payment process has been successfully completed.

This sequence diagram demonstrates that the transaction flow for the consignment service has been systematically and structured, enabling it to support an integrated ordering, payment, and transaction confirmation process.

3.5. Interface System

The system interface is designed to support usability and clarity of information for users, depending on their role and access rights. This web-based consignment system has a main interface for both admins and customers, with a display and features tailored to each user's needs.

A. Admin Interface – Product Data Management

The admin interface provides product data management features that encompass brand management, product categories, and overall product data. This feature allows admins to add, modify, display, and archive product data as needed. Product archiving is used to store inactive product data without permanently deleting it, thus maintaining data integrity.

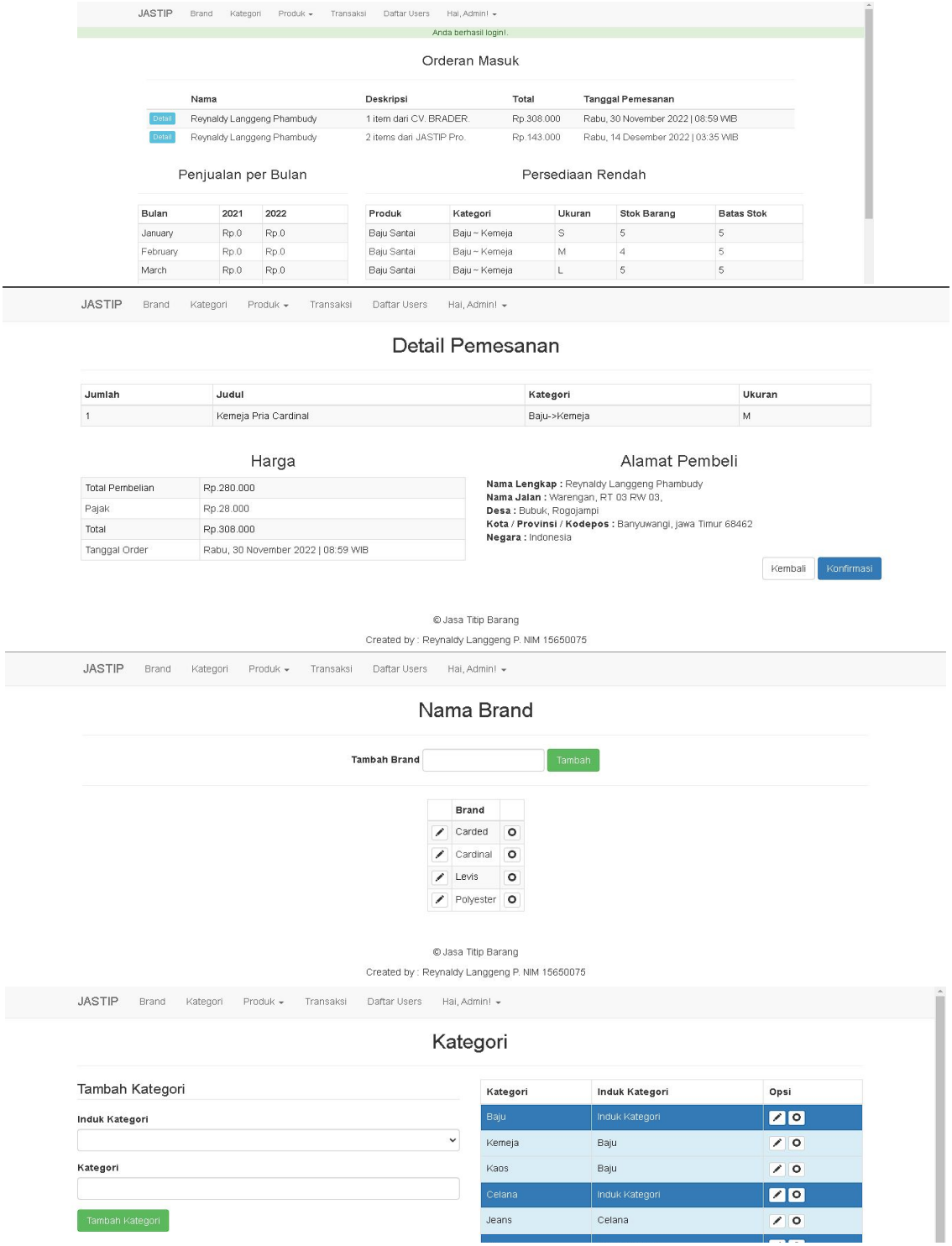


Figure 4. Product Data Management Page

B. Admin Interface – Transaction Management and Monitoring

The system provides an interface for managing and monitoring transactions, which administrators use to track customer orders. This feature displays incoming order information, order details, and a history of past transactions. Centralized transaction data presentation makes it easier for administrators to verify orders, confirm payments, and monitor overall transaction activity.

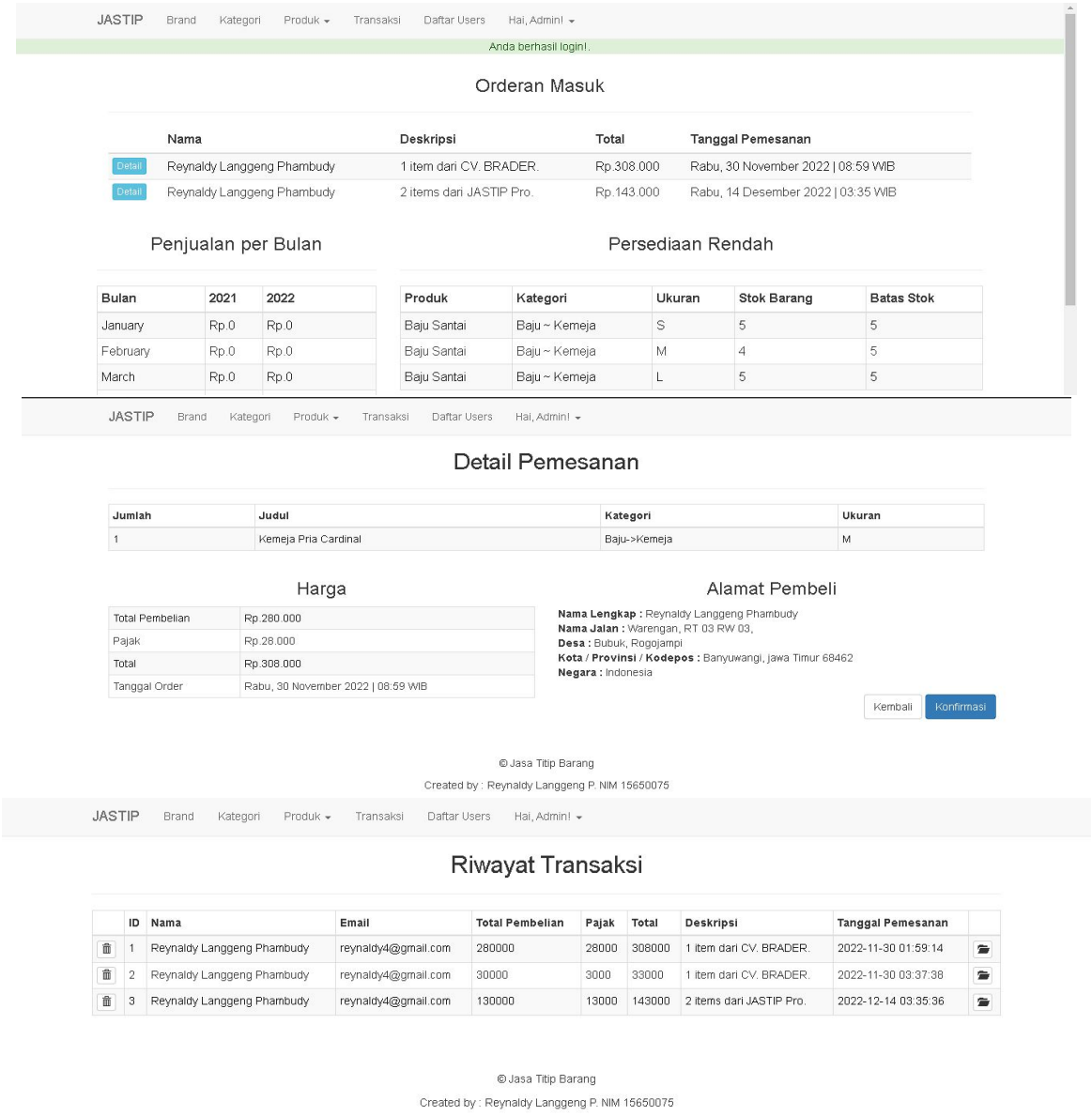


Figure 5. System Management and Monitoring Page

C. Admin Interface – User Management

The user management interface is used to manage admin and system officer accounts. This feature includes adding new users, setting access rights, and changing passwords. This mechanism aims to maintain system security and ensure that only authorized users can access certain features within the system.

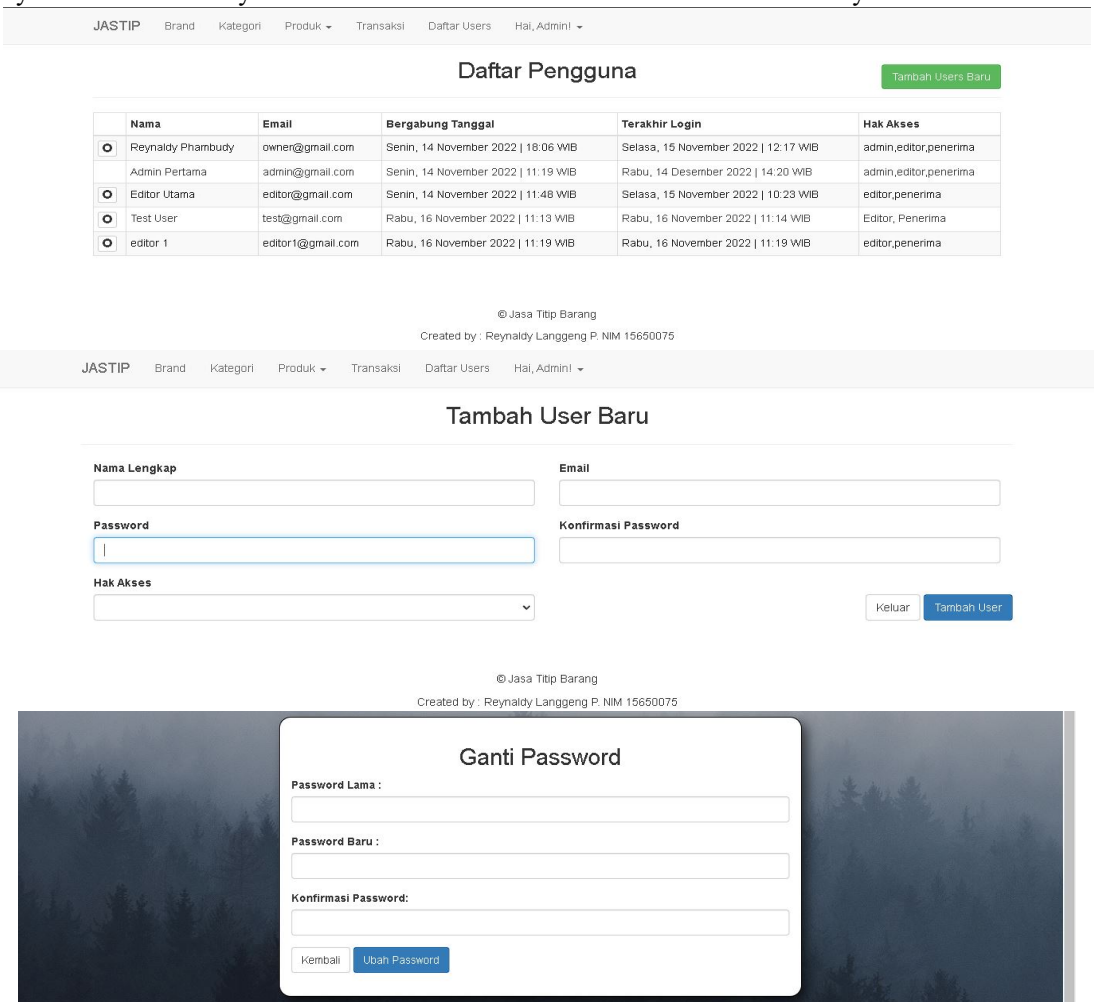
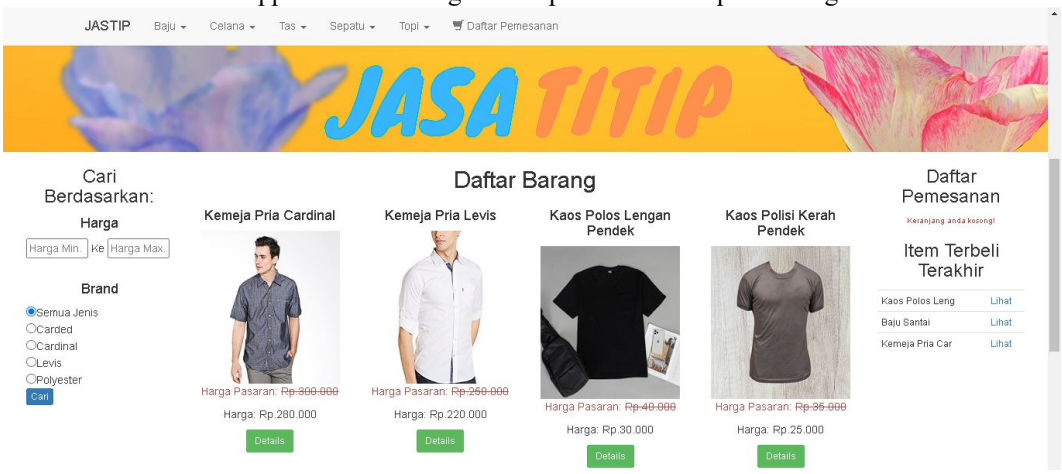


Figure 6. User Management Page

D. Customer Interface – Goods Ordering Process

The customer interface is designed to support the end-to-end ordering process. The process begins with searching and selecting a product, viewing product details, adding items to the cart, and then completing customer details and processing payment. Once the transaction is complete, the system displays a receipt as order confirmation. This interface supports the ordering flow depicted in the sequence diagram.



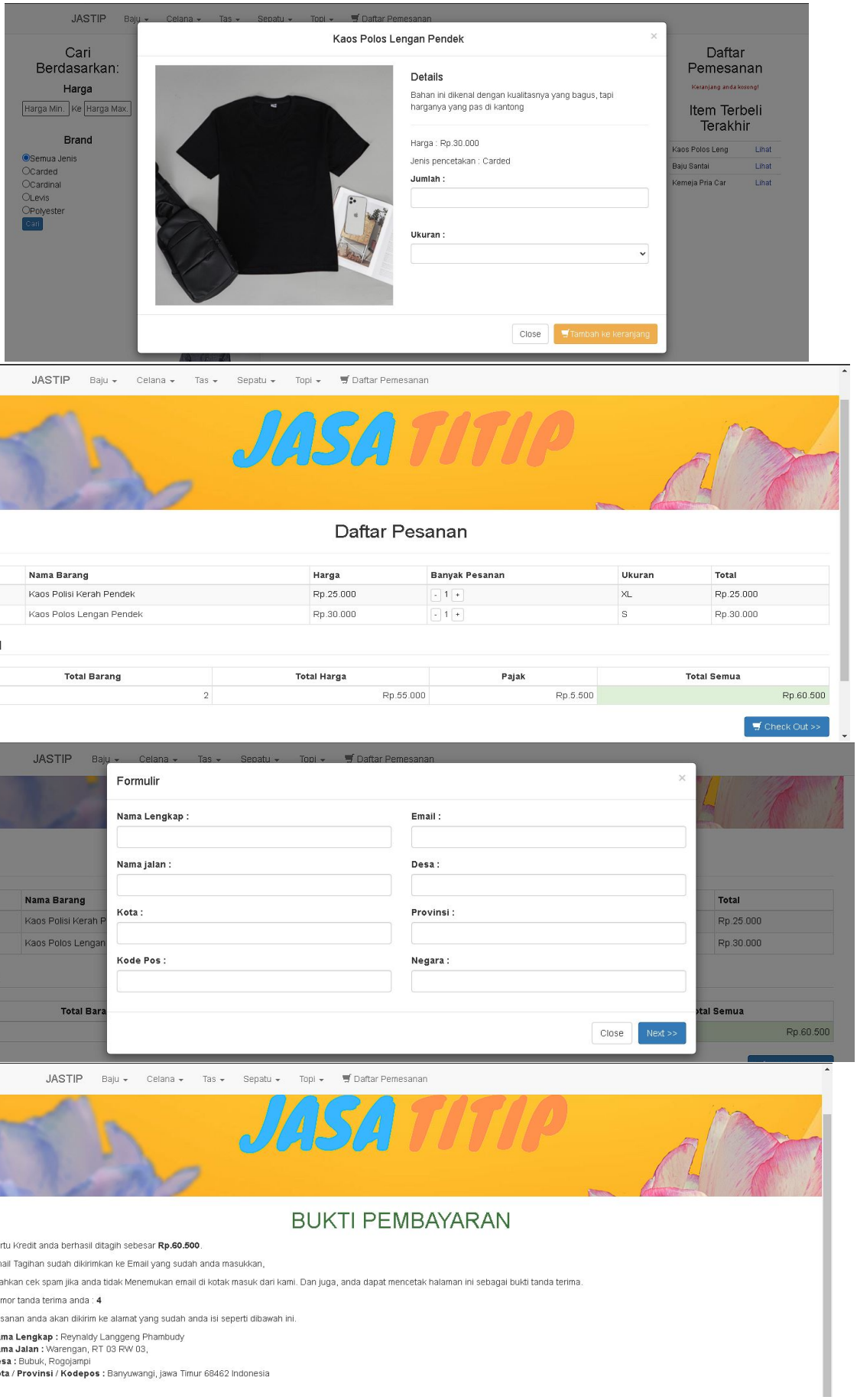


Figure 7. Customer Ordering Process

3.6. System Testing Result

System testing is conducted to ensure that all key functions of the web-based consignment system operate according to established requirements. The testing method used is functional testing (black box testing), which involves testing each system feature based on expected input and output without considering the program's internal structure. This testing aims to verify the system's functional suitability before it is used by users.

Table 1. Black Box Testing Results

No	Tested features	Testing Scenario	Expected results	Results
1	Admin Login	Admin enters valid email and password	The system displays the admin dashboard	Success
2	Product Management	Admin adds product data	Product data is saved and appears in the product list	Success
3	Order Items	Customer places order	Order data is saved in the system	Success
4	Shopping Cart	Customer adds/removes items	The system updates the cart data	Success
5	Payment Transactions	Customer makes payment	The system displays proof of transaction	Success
6	Order Confirmation	Admin confirms order	Order status changes to processed	Success

Based on the results of functional testing, all key system features operate according to the specified requirements. Test results indicate that the system can handle login processes, product data management, ordering, and transactions and order confirmations without experiencing any functional issues. This demonstrates that the web-based consignment system meets user functional requirements.

3.7. Discussion

Based on the results of the system implementation and testing, this web-based consignment service system is capable of performing all primary functions according to the requirements established during the analysis phase. The system successfully supports the goods ordering process, product data management, and transaction management in an integrated manner, thereby reducing manual processes that previously had the potential to lead to recording errors and service delays.

The application of the Waterfall method in system development provides a structured and systematic workflow. Each development stage, from requirements analysis to system testing, can be carried out sequentially and is well-documented. This simplifies the system implementation process and ensures alignment between user needs and the resulting system. These results align with previous research that found the Waterfall method effective in developing web-based information systems with relatively stable requirements.

Functional testing results indicate that all key system features, such as user login, product data management, ordering, transaction management, and order confirmation, operate as expected. Therefore, the developed system meets the functional needs of both admin and customer users.

Although the system performed well, there are still several limitations that could be addressed in further research. The system does not yet include an order cancellation feature after checkout and does not support real-time automatic payment methods. Therefore, further development can focus on improving payment features, data security, and developing the system into a mobile application to increase user accessibility.

Compared to previous studies on web-based consignment or e-commerce systems, this research emphasizes a structured consignment workflow supported by role-based access and integrated transaction management. While earlier studies mainly focused on general e-commerce functionalities, the developed system specifically addresses the needs of consignment services, including order monitoring, transaction confirmation, and reporting. This distinguishes the proposed system from related works and highlights its practical contribution.

4. CONCLUSION

Based on the implementation and testing results, it can be concluded that the web-based consignment system has been successfully developed and is capable of performing all key functions according to user needs. This system can support the ordering process, product data management, and transaction management in an integrated manner, thereby helping to improve the efficiency and accuracy of consignment services.

The application of the Waterfall method to system development provides a structured and systematic workflow, from requirements analysis to system testing. This method streamlines the development process and ensures alignment between user needs and the resulting system. Functional testing results indicate that all key system features function well and meet the expected scenarios.

Therefore, the developed web-based consignment system can be used as an alternative solution to support online consignment services. Further development of this system can include the addition of an order cancellation feature, integration of automatic payment methods, enhanced data security, and mobile platform development to enhance user convenience and accessibility.

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AUTHOR BIOGRAPHY

Reynaldy Langgeng Phambudy is a is a student in the Informatics Engineering who is actively engaged in academic activities and scholarly development in the field of information technology. She has a strong interest in the application of digital technologies to address real-world problems, as well as in the development of computer-based systems.

Novrindah Alvi Hasanah is a lecturer in Electrical Engineering in the Undergraduate Informatics Engineering at UIN Maulana Malik Ibrahim Malang. She earned her master's degree in Informatics Engineering from the Institut Teknologi Sepuluh Nopember (ITS) Surabaya. Her research interests include machine learning, data mining, artificial intelligence, and the Internet of Things (IoT), with an emphasis on web-based system development as well as data analysis and processing to support decision-making, including approaches based on spatial information. She can be contacted at: novrindah@uin-malang.ac.id

Luthfi Atikah earned a Master's degree (M.S.) from the Faculty of Intelligent Electrical and Informatics Technology, Institut Teknologi Sepuluh Nopember (ITS) Surabaya, graduating in 2021. She is currently an active lecturer at Politeknik Astra, teaching Database Systems, Data Structures, and Information Systems, and is involved in various research activities in the fields of Medical Imaging, Information Retrieval, and Machine Learning. She can be contacted at: luthfi.atikah@polytechnic.astra.c.id