Design and Development of an Inventory Management System at Toko Rizky Grosir Using the SDLC Method

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Abstract
Toko Rizky Grosir is a daily essential goods retail store whose inventory management is still carried out manually by an owner who also holds other occupational responsibilities outside the store. This situation gives rise to several operational issues, including data recording errors, difficulty in remotely monitoring stock levels, delays in report generation, and the risk of stock shortages or overstocking. This study aims to design and develop a web-based inventory management system for Toko Rizky Grosir using the Software Development Life Cycle (SDLC) method with the Waterfall model. The development stages consist of requirements analysis, system design, implementation, testing, deployment, and maintenance. The system was built using PHP with the Laravel framework and a MySQL database, incorporating two levels of user access: Super Admin and Staff. The novelty of this research lies in the integration of ABC classification for stock categorization, FIFO-based item dispatch prioritized by expiration date, and automated notifications for low stock and items approaching expiry all within a single system specifically designed for a grocery store managed remotely. System testing was conducted using the Black Box Testing method in collaboration with the store owner and employees to verify all system functionalities. The test results indicate that all system features performed in accordance with the defined requirements, demonstrating the system's capability to improve operational efficiency, facilitate real-time stock monitoring, and reduce the risk of recording errors and financial losses due to expired goods.

1. Introduction

Advances in information technology have encouraged various business sectors to adopt digital systems in order to improve the effectiveness and efficiency of their operational activities. As technology continues to become more advanced and complex, humans as technology users are required to continuously improve and update its use so that it can meet expectations and support daily activities more effectively [1]. One sector that requires effective information management is the wholesale and basic necessities trade [2]. Inventory management that is still conducted manually often leads to various problems, such as data recording errors, difficulties in monitoring stock availability, and a report preparation process that takes a considerable

amount of time [3]. These conditions can hinder decision-making and reduce the quality of customer service. Therefore, the implementation of information systems has become a critical need to support more accurate, integrated, and easily accessible data management [4].

The use of information systems in inventory management has proven capable of improving a company's operational efficiency through faster, more accurate, and integrated data management processes [5]. The implementation of an information system enables structured inventory recording, thereby minimizing the risk of human error that frequently occurs in manual recording processes [6]. Additionally, information systems can provide real-time inventory information that can be used to support warehouse management activities, goods distribution, and continuous monitoring of stock availability. The integration of sales transaction data with inventory data also makes it easier for business owners to monitor stock levels, identify restocking needs [7], and reduce the risk of excess or shortage of inventory.

Toko Rizky is a business that specializes in the sale of daily necessities and continues to face challenges in operational management. Transaction and inventory tracking are still done manually, making them prone to errors and delays in information. This issue is further complicated by the fact that the store owner has other commitments outside the business and is therefore unable to provide full oversight. On the other hand, the limited number of employees and suboptimal communication between the owner and employees result in an ineffective information dissemination process, which impacts the overall management of the store.

Previous studies have developed web-based inventory management systems for retail and wholesale businesses, demonstrating positive results in improving recording accuracy, ease of inventory monitoring, and operational efficiency [8]. Other studies also indicate that the implementation of web-based inventory information systems can enhance real-time inventory data visibility, accelerate data processing, and reduce recording errors commonly found in manual systems [2]. However, most of these studies focus on modern retail businesses, stores of a certain scale, or business sectors with relatively adequate technological resources and supervision. There has been little research specifically addressing the implementation of inventory management systems in grocery stores or small-scale wholesale businesses that face limitations in direct supervision by business owners and have limited human resources [9]. Consequently, there remains a research gap regarding the application of information systems capable of effectively integrating inventory management and sales transactions in wholesale businesses with such operational characteristics.

Given the various issues and gaps identified in this study, this project focuses on the development and implementation of an online Point of Sale (POS) system at Toko Rizky Grosir using the Software Development Life Cycle (SDLC) approach. The objective of this new system is to integrate sales transaction processes with inventory management, which includes tracking goods as they enter and leave the store, monitoring inventory levels in real time, and generating reports quickly and accurately. This research contributes by building a POS system that not only facilitates transactions but also allows store owners to oversee their operations and make decisions even when they are not on-site. Thus, the developed system is expected to improve operational efficiency, reduce recording errors, and help maintain inventory levels in line with customer needs.

2. Research Methods

The System Development Life Cycle (SDLC) approach with the Waterfall model is used in this study. This approach was selected due to its methodical and sequential system development phases, which include requirements analysis, system design, implementation, testing, and maintenance. [10]. The use of the SDLC/Waterfall method is suitable for Point of Sale (POS) system development because the system being built requires a structured process for identifying user needs, designing transaction features, managing inventory, and testing the system [11].

Fig. 1 SDLC stages

This study was conducted at Toko Rizky Grosir, with the research subjects being the sales transaction process, inventory data management, stock recording, payment recording, transaction receipt printing, and sales report generation. Research data was obtained through direct observation, interviews, and literature review. Observations were conducted to understand the sales transaction workflow and inventory recording processes in the store. Interviews were conducted with the store owner to gather information regarding the challenges of the manual system, user needs, and required features in the POS system. The literature review involved analyzing journal articles related to Point of Sale systems, cash register systems, inventory management, SDLC, the Waterfall model, Laravel, MySQL, and black-box testing.

2.1 Requirements Analysis

The requirements analysis phase was conducted to identify issues occurring in the business processes at Toko Rizky Grosir. Therefore, an analysis of functional and non-functional requirements is essential. Analyze functional and non-functional requirements to ensure the system is efficient, safe, scalable, and aligned with business processes and user needs [12]. Based on the results of observations and interviews, sales transaction and inventory recording processes are still performed manually, posing risks of recording errors, delayed report generation, inventory discrepancies, and difficulties in retrieving transaction data. Similar issues were also found in study [13], which explains that manual transaction recording can lead to inaccurate data, slow reporting processes, and inefficient inventory management.

Based on the analysis, the system's functional requirements include user login features, product data management, product category management, sales transactions, total payment calculation, automatic inventory deduction, receipt printing, product data search, sales reports, and inventory reports. Meanwhile, the system's non-functional requirements include ease of use, user access security, transaction processing speed, data accuracy, and the system's ability to display inventory and sales information in real-time. These requirements align with the study [14], which explains that a POS system must support transaction management, product data, inventory management, sales reports, and user access rights.

2.2 System Design

The system design phase is carried out after analyzing the requirements. The purpose of system design is to describe how the POS system operates to meet user needs. [15]. During this phase, the researcher develops the business process design for the system, including use case diagrams, activity diagrams, class diagrams, database structures, and user interface designs. Use case diagrams illustrate how users interact with the system, while activity diagrams show the flow of activities within the system. Class diagrams depict the data structure and relationships between different classes. At the same time, the database structure is designed to store data regarding users, products, categories, transactions, transaction details, inventory, and reports [16]. The design of a web-based POS system must be structured so that the developed system can effectively support transaction processing and inventory management [17]. Research shows that a web-based POS system can be developed using the Laravel framework to assist with sales transaction management. Research [18], also explains that web-based POS systems can support multipayment transactions for MSME.

2.3 System Implementation

The implementation phase is the process of translating the system design into an application. The Point of Sale system at Toko Rizky Grosir was developed as a web-based system to facilitate sales transactions and store data management more quickly, accurately, and seamlessly. System implementation includes the creation of login features, a dashboard, product data management, product category management, sales transactions, payment calculations, automatic stock deduction, receipt printing, sales reports, and stock reports. The system uses a database to store all transaction and product data so that information can be managed in a more structured manner. The development of web-based POS systems using frameworks and databases has been widely used in previous research. Research [19], developed a web-based POS application using the Laravel Framework to support the management of categories, products, transactions, and reports. [20], also developed a web-based inventory and POS application using Laravel to assist with inventory and sales tracking. Thus, the implementation of the POS system at Toko Rizky Grosir is expected to replace manual processes with a more effective and efficient digital process.

2.4 System Testing

To make sure that every system function complies with user requirements, testing was carried out. The black-box testing method, which concentrates on system functionality based on inputs and outputs without looking at the program code structure, was used for testing. [21]. The features tested include login, item data management, item category management, sales transactions, total payment calculation, automatic stock deduction, receipt printing, sales reports, and stock reports. Black box testing was chosen because it is suitable for testing the functionality of the POS system based on the correspondence between the given input and the resulting output.

2.5 System Maintenance

The maintenance phase is carried out after the system has been fully tested and is in use by users. Maintenance aims to fix any errors that may arise, adapt the system to the store's operational needs, and ensure the system continues to function properly. During this phase, users can provide feedback on the features they have used, so that the POS system can be further developed to meet the needs of Rizky Grosir. The maintenance phase is also a crucial part of the SDLC method because the implemented system must be evaluated to ensure it remains aligned with user needs and the evolving business processes of the store. By implementing the SDLC phases, the developed Point of Sale system is expected to assist Toko Rizky Grosir in managing sales transactions, product data, inventory, payments, receipt printing, and sales reports more effectively, accurately, and systematically.

3. Result and Discussion

This section explains the research results based on the System Development Life Cycle (SDLC) method stages that have been carried out. The research results include system requirements analysis, system design, Point of Sale (POS) system implementation, and system testing. The POS system built is intended to assist with sales transaction processes, product data management, inventory tracking, receipt printing, and sales report generation at Toko Rizky Grosir.

3.1 Results of the Requirements Analysis

Based on observations and interviews with the owner of Toko Rizky Grosir, sales transactions and inventory tracking were previously conducted manually. This situation led to several Issues such as the risk of transaction recording errors, delays in generating sales reports, difficulties in checking inventory levels, and a lack of efficiency in customer service processes. Therefore, a web-based Point of Sale system is needed that can manage sales transactions and inventory more quickly, accurately, and systematically.

The system requirements derived from the analysis phase include both functional and non-functional requirements. Functional requirements consist of login features, inventory data management, product category management, sales transactions, total payment calculation, automatic inventory deduction, receipt printing, sales reports, and inventory reports. Meanwhile, non-functional requirements include system

usability, user access security, transaction processing speed, data accuracy, and the system's ability to present information in real-time.

Table 1. Functional Requirements

No	Functional Requirement	Description
1	User login	Used to restrict user access based on registered accounts
2	Manage product data	Used to add, edit, delete, and view product data.
3	Manage product categories	Used to group products based on specific types or categories.
4	Sales transactions	Used to record the process of selling products to customers.
5	Payment Calculation	Used to calculate the total price, amount due, and change.
6	Automatic Inventory Adjustment	Used to update inventory levels after a transaction is completed.
7	Print Receipt	Used to print a sales transaction receipt.
8	Sales Report	Used to display sales transaction data for a specific period.
9	Inventory Report	Used to display product inventory information.

Table 1 shows the main functional requirements that must be available in the Toko Rizky Grosir POS system. These requirements form the basis for the system design and implementation process. The sales transaction and automatic inventory reduction features are crucial because both are directly related to the store's core business processes.

3.2 System Design Results

The system design phase produces a system workflow design, use case diagrams, activity diagrams, class diagrams, a database design, and a user interface design. Use case diagrams are used to illustrate the relationship between users and system features. Activity diagrams are used to explain the system's activity flow, particularly in the sales transaction process. Class diagrams are used to illustrate data structures and relationships between entities within the system. The database design serves as the foundation for storing data on products, categories, users, transactions, transaction details, and reports.

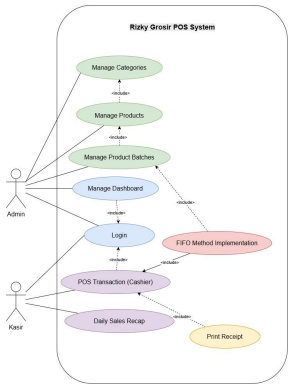

Fig. 2 Use Case Diagram

Figure 2 shows the interaction between users and the POS system. System users can log in, manage product data, manage product categories, perform sales transactions, print receipts, view sales reports, and view inventory reports. This use case diagram shows that the system is designed to make it easier for users to carry out transaction processes and manage store data.

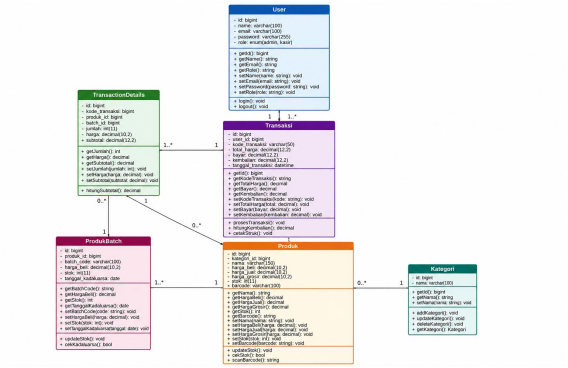

Fig. 3 Class Diagram

Figure 3 shows the class structure used in the POS system. The main classes used include user, item, category, transaction, transaction details, and reports. The relationships between classes are designed so that transaction data can be linked to item and user data. With this structure, every transaction performed is automatically recorded and can be used as the basis for generating sales reports and inventory reports.

3.3 System Implementation Results

The implementation phase resulted in a web-based Point of Sale system designed to facilitate transaction processing and data management at Rizky Grosir. This system features several key functions, including user login, a dashboard, product data management, product category management, sales transactions, payment calculations, receipt printing, sales reports, and inventory reports.

On the login page, users must enter a username and password to access the system. The dashboard page displays summary information such as the number of items, number of transactions, and total sales. The product data page is used to manage product information, including product name, category, price, and stock quantity. The transaction page is used to record product sales, calculate the total payment, and automatically update stock after a transaction is successfully saved.

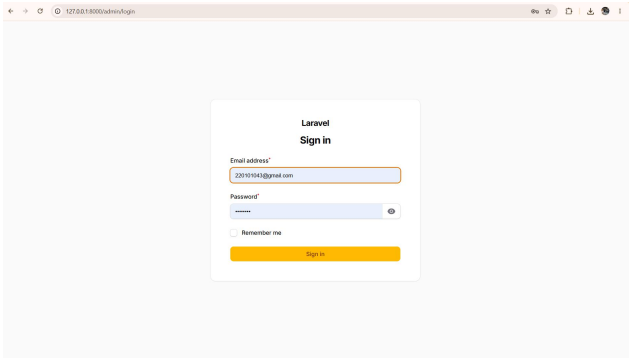

Fig. 4 Login Page

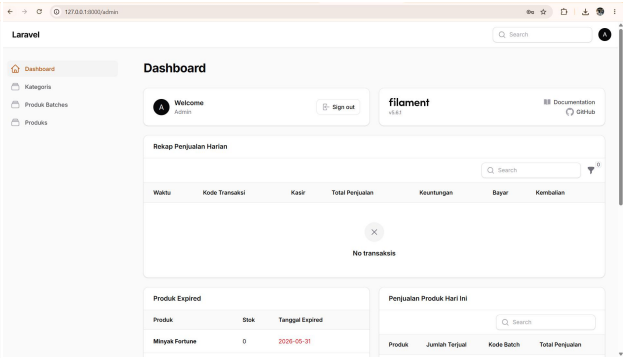

Fig. 5 Dashboard

Figure 4 shows the login page used as the entry point to the system. The login feature serves to maintain data security and ensure that only users with accounts can access the system. Figure 5 shows the POS system dashboard. The dashboard is used to display summary information about store data, such as the number of items, the number of transactions, and total sales. This information helps users quickly monitor the store's status.

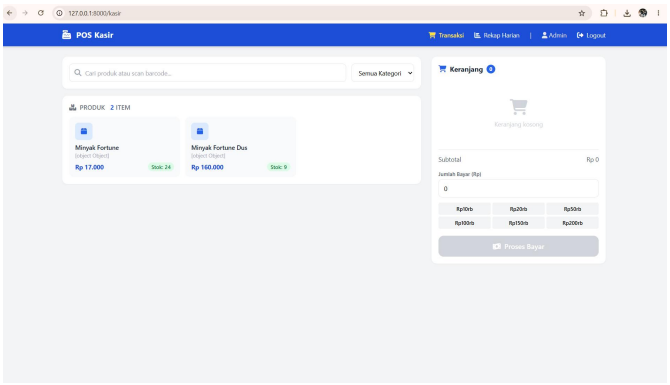

Fig. 6 Transaction cashier

Figure 6 shows the sales transaction page. On this page, users can select items, enter the purchase quantity, view the total price, calculate the payment, and print the transaction receipt. After the transaction is saved, the item stock will automatically decrease by the quantity of items sold.

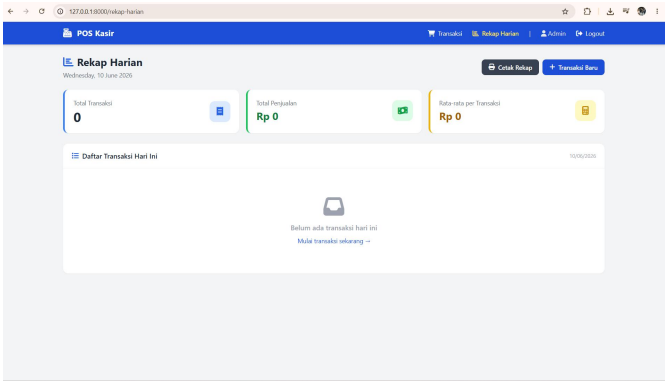

Fig. 7 Sales Report

Figure 7 shows the sales report page, which is used to view transaction data for a specific period. This reporting feature helps store owners monitor sales results and generate reports more quickly than manual record-keeping.

3.4 System Testing Results

System testing was conducted using the black box testing method. This testing aims to ensure that each feature operates in accordance with the specified requirements. Testing was performed by providing inputs to each feature, then comparing the system's output with the expected results.

Table 2 Black Box Testing Results

No	Feature Tested	Test Scenario	Expected Result	Test Result	Description
1	Login	User enters the correct username and password	System displays the dashboard	Valid	Success
2	Login	User enters an incorrect username or password	System displays a login failure message	Valid	Success
3	Product Data	User adds new product data	Product data is saved to the database	Valid	Success
4	Product	User modifies product data	Product data is successfully	Valid	Success

	Data		updated		
5	Product Data	User deletes product data	Product data is successfully deleted	Valid	Success
6	Product Categories	User adds a product category	Category data is saved	Valid	Success
7	Sales Transaction	User selects products and enters purchase quantity	System calculates total payment	Valid	Success
8	Sales Transaction	Transaction successfully saved	Product stock automatically decreases	Valid	Success
9	Print receipt	User selects the print receipt button	ystem displays or prints the transaction receipt	Valid	Success
10	Sales report	User selects the report period	System displays the sales report for the selected period	Valid	Success
11	Inventory report	User opens the inventory report page	System displays the product stock levels	Valid	Success

Table 2 displays the findings of black-box testing on the POS system's key components. According to the test results, every tested functionality performed as anticipated. This shows that the functional requirements established during the requirements analysis stage have been satisfied by the created Point of Sale system. Black-box testing resulted in eleven validations out of eleven items tested. This indicates that black-box testing achieved a perfect score of 100%.

3.5 System Maintenance Results

The system maintenance phase is carried out after the Point of Sale system has been fully implemented and tested. Maintenance aims to ensure the system continues to run smoothly, correct errors discovered during use, and adapt the system to the operational needs of Rizky Grosir. During this phase, the store owner, as the system user, can provide feedback regarding features that are not yet suitable, interfaces that need improvement, or processes that need to be adjusted to the store's workflow.

System maintenance is carried out through several activities, including periodic system function checks, correction of input errors or transaction processes, database backups, product data updates, and evaluation of sales and inventory reports. Additionally, maintenance includes configuring user access rights to ensure the security of transaction and product data is maintained. With this maintenance, the POS system can be used sustainably and remain aligned with the store's needs.

The results of the maintenance phase indicate that the system can still be further developed to meet user needs. Some potential developments for the next phase include adding barcode scanner features, minimum stock notifications, product returns, profit and loss reports, and digital payment integration. These developments are expected to enhance the POS system's functionality so that it not only facilitates sales transactions but also supports decision-making in business management.

3.5 Discussion

The research results show that the developed Point of Sale system is capable of assisting sales transaction processes and inventory management at Toko Rizky Grosir. This system facilitates recording transactions, calculating total payments, printing receipts, automatically updating inventory, and generating sales reports. With this system, processes previously performed manually can be replaced with faster and more structured digital processes.

These findings align with previous research stating that web-based POS systems can help improve transaction efficiency, inventory data accuracy, and the ease of compiling sales reports. The similarity between this study and previous research lies in the use of a POS system to assist with transaction processes

and inventory data management. Additionally, the use of the SDLC method demonstrates that system development can be carried out systematically, from requirements analysis through to system testing.

The uniqueness of this study lies in its research subject and the system requirements tailored to the specific conditions of Rizky Grosir. The developed system not only focuses on recording sales transactions but also integrates inventory management, automatic stock adjustment, receipt printing, and sales reporting. Thus, the contribution of this study is to produce a POS system that meets the operational needs of a wholesale store and can assist the store owner in managing transactions and inventory more effectively.

4. Conclusions

By implementing the Software Development Life Cycle (SDLC) process, this research successfully designed and developed a web-based Point of Sale (POS) system for Rizky Grosir. The developed system is capable of managing sales transactions, product information, inventory levels, payment calculations, receipt printing, and the generation of sales reports in a more organized manner. Black-box testing results indicate that all major system features function in accordance with user requirements.

The implementation of this system helps reduce manual recording errors, speeds up transaction processes, facilitates inventory monitoring, and improves the speed and accuracy of report generation. Additionally, the system has integrated the FIFO method for managing items based on expiration dates, ABC classification for inventory prioritization, and notifications regarding minimum stock levels and products nearing their expiration dates.

However, the system still has limitations in terms of feature coverage. Therefore, further research is recommended to develop additional features such as barcode scanners, returns management, supplier and purchasing management, accounts receivable and payable reports, and digital payment integration to improve the effectiveness of inventory management and business decision-making.

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