International Journal Software Engineering and Computer Science (IJSECS)
6 (2), 2026, 672-684
Published Online August 2026 in IJSECS (http://www.journal.lembagakita.com/index.php/ijsecs)
P-ISSN: 2776-4869, E-ISSN: 2776-3242. DOI: https://doi.org/10.35870/ijsecs.v6i2.7341.

RESEARCH ARTICLE Open Access

Analysis and Design of a Stock and Sales Management System Using the FIFO Method at Pakis Medika Utama Pharmacy

Annisa Zalzabilla Rahmawati [1*], **Eko Purwanto** [2], **Sundari** [3]

[1*,2,3] Department of Information Systems, Universitas Duta Bangsa, Surakarta City, Central Java Province, Indonesia.

**Corresponding author*: 22010181@mhs.udb.ac.id

Received: May 30, 2026; Accepted: June 28, 2026; Published: August 1, 2026.

Abstract: Apotek Pakis Medika Utama still uses manual methods for managing drug inventory and recording sales, resulting in several problems, including recording errors, difficulties in monitoring stock levels in real time, delays in preparing reports, and the absence of notifications for drugs approaching their expiration dates. In addition, the pharmacy frequently receives drug supplies from Pharmaceutical Wholesalers (PBF) with relatively short expiration periods, requiring more structured inventory management to minimize the risk of stock accumulation and losses caused by expired drugs. This study aims to analyze and design a drug inventory and sales management system using the FIFO (First In, First Out) method by considering drug batch numbers and expiration dates. The system development method used is Prototyping, which includes requirements gathering through observation, interviews, and documentation, followed by system design. The proposed system is designed using the Laravel framework and MySQL database. The design results indicate that the proposed system is designed to manage drug data, support sales transactions based on the FIFO method, monitor drug stock and expiration dates, provide notifications for minimum stock levels and drugs approaching expiration through the dashboard and email, and generate inventory and sales reports automatically. This system design is expected to support more effective, integrated, and structured inventory and sales management at Apotek Pakis Medika Utama.

Keywords: Information System; FIFO; Drug Stock Management; Drug Sales; Prototyping.

1. Introduction

Technological development has encouraged digital transformation in various types of services, including pharmaceutical services. The application of information systems can support the processing, storage, and distribution of data more quickly and in an integrated manner, allowing information to be used to support operational activities. In the healthcare sector, the digitalization of information systems can also support operational effectiveness and service quality. Evykasari *et al*. (2025) stated that the digitalization of health information systems can support operational performance and service quality in healthcare institutions. In pharmaceutical services, accurate information is required to support drug management, from receiving and storing drugs to distributing them to consumers. Proper inventory management is necessary to maintain drug availability while reducing the risk of losses caused by expired drugs. Kertapradja *et al*. (2026) explained that proper stock management can support operational effectiveness and reduce errors in drug management.

Apotek Pakis Medika Utama is a pharmaceutical service facility located in Pakis Village, Wonosari District, Klaten Regency. In its daily operations, drug inventory management and sales transaction recording are still carried out manually using notebooks and simple records. This condition creates several problems, including errors in recording incoming and outgoing drugs, difficulties in monitoring inventory in real time, delays in preparing reports, and the risk of accumulating drugs that are approaching their expiration dates. Akuntansi (2022) explained that the use of manual systems can slow down service processes, increase the possibility of human error, and make accurate stock monitoring more difficult. In addition, Asfi and Nas (2023) showed that errors in inventory management can lead to excess inventory, potentially resulting in losses due to expired drugs, as well as stock shortages during certain periods. These conditions indicate the need for a system that can provide inventory information more quickly and accurately to support the pharmacy's operational activities.

Drug inventory management presents particular challenges because drugs have limited expiration periods. One method that can be used to regulate the order in which inventory is released is FIFO (First In, First Out), which prioritizes items that enter the inventory first to be released or used first. Hamidy *et al*. (2022) stated that the application of FIFO can support drug inventory control and reduce the risk of stock accumulation. Devega *et al*. (2024) also explained that FIFO prioritizes items that enter the inventory earlier to be released or sold first. However, drug management in pharmacies also needs to consider expiration dates. In certain situations, newly received drugs may have earlier expiration dates than drugs that have already been stored. Therefore, expiration dates need to be considered when determining the order of drug release to reduce the risk of losses caused by expired drugs. In this study, the FIFO method is applied by considering drug batch numbers and expiration dates in the inventory management process.

Several previous studies have developed information systems to support web- and mobile-based drug inventory and sales management. Muhammad Khulaimi and Mufti Syawaludin (2023) developed a web-based pharmacy management system that supports automated inventory recording and sales transactions. Putri *et al*. (2025) developed a pharmacy management application using the Agile method to support transaction recording and automated report preparation. Meanwhile, Suhesti *et al*. (2023) applied the FIFO and FEFO methods to drug management in hospitals using the Waterfall development model. These studies demonstrate that information systems can support drug data and inventory management. However, differences remain in the features and approaches implemented, particularly in the integration of inventory management and sales transactions, expiration-date monitoring, and automatic notifications for minimum stock levels.

Other studies have also applied FIFO and FEFO methods to drug inventory management. Devega *et al*. (2024) developed a pharmacy inventory system using a combination of FIFO and FEFO to reduce the risk of drug expiration. Evykasari *et al*. (2025) developed a drug inventory management system using FEFO and Reorder Point (ROP), equipped with barcode scanning and WhatsApp notifications. These studies demonstrate the importance of considering expiration dates and inventory control in drug management. However, the present study is directed toward the operational needs of Apotek Pakis Medika Utama, particularly the integration of inventory management and sales transactions within a single system, monitoring of inventory and expiration dates, and notifications for minimum stock levels and drugs approaching expiration.

Based on the problems identified at Apotek Pakis Medika Utama and the findings of previous studies, this research is directed toward designing a web-based drug inventory and sales management system using the FIFO method. The proposed system integrates inventory data with sales transactions so that stock records can be updated based on completed transactions. The system is also designed to manage drug batch numbers and expiration dates, provide inventory and expiration-date monitoring, and send notifications for minimum stock levels and drugs approaching expiration through the dashboard and email. In addition, the system is designed with three user access levels, namely warehouse administrator, pharmacist, and cashier, according to their respective operational responsibilities. The system is developed using the Prototyping method so that user requirements can be collected and used as the basis for the system design process.

Based on these problems, the objectives of this study are: (1) to analyze and design a web-based drug inventory and sales management system for Apotek Pakis Medika Utama; (2) to apply the FIFO method in the design of the drug stock release process by considering batch numbers and expiration dates; (3) to design notification features for minimum stock levels and drugs approaching expiration through the dashboard and email; and (4) to produce a system design that can support more accurate inventory management and operational efficiency at the pharmacy. This study discusses the analysis and design of a drug inventory and sales management system using the FIFO method at Apotek Pakis Medika Utama. The study covers the identification of system requirements, system development using the Prototyping method, system design using UML, and the design of inventory management, sales transactions, expiration-date monitoring, and reporting features. The study focuses on the analysis and design stage; therefore, direct system implementation and testing are not included in the current research.

2. Related Work

2.1 State-of-the-Art Research

Research on digital information systems for drug inventory and sales management has been widely conducted to support the management of drug data in pharmacies and healthcare institutions. Previous studies have generally focused on inventory management, sales transactions, stock monitoring, expiration-date control, and the application of inventory management methods such as FIFO and FEFO. The following discussion groups previous studies based on their main focus and contribution.

Several studies have developed web- and mobile-based pharmacy information systems to support drug inventory management and sales transactions. Mulyani *et al*. (2022) developed an Android-based application for drug sales and inventory management using Extreme Programming (XP) and UML. The system supports sales activities and stock monitoring, but the study did not provide automatic monitoring of drugs approaching expiration or minimum-stock notifications. Suherni *et al*. (2021) developed a drug sales service information system using the Waterfall method to address conventional pharmacy service processes. The system supports service activities and report preparation, but it did not apply FIFO or FEFO for inventory management or provide expiration-date monitoring. Perdana *et al*. (2023) developed a drug sales and inventory system using Java and MySQL. The system supports transaction processing and inventory reporting, but it did not provide automatic minimum-stock notifications or expiration monitoring. Weriza *et al*. (2023) developed a drug inventory information system using PHP, MySQL, and the SDLC method. The system supports stock checking and report preparation; however, FIFO and real-time stock monitoring were not implemented. Rachman *et al*. (2024) developed a web-based drug inventory system to address manual recording using stock books and Microsoft Excel. The system supports more integrated inventory data and report preparation, but it did not apply FIFO or FEFO. These studies indicate that computerized information systems can support drug inventory and sales activities. However, differences remain in the integration of inventory management, sales transactions, expiration-date monitoring, and automatic notifications.

Several studies have applied FIFO and FEFO to address inventory rotation and the risk of drug expiration. Hamidy *et al*. (2022) developed a drug inventory accounting information system using the Prototype method, PIECES analysis, UML, and FIFO. The system manages drug data, suppliers, and incoming and outgoing inventory in a structured manner, although expiration monitoring was not included. Devega *et al*. (2024) applied a combination of FIFO and FEFO to a pharmacy inventory system. FIFO prioritizes items based on their order of arrival, while FEFO prioritizes drugs with the nearest expiration dates. The combination of these methods is intended to improve inventory rotation and reduce the risk of expired drugs. However, the system was not fully integrated with sales transactions and automatic notifications. Irwansyah *et al*. (2024) applied FIFO to a drug stock management system for the Medan City Health Office using the Waterfall model. The study focused on pharmaceutical warehouse inventory management and drug distribution rather than the operational requirements of private pharmacies. Kudus *et al*. (2022) developed a web-based drug inventory system using FIFO, Waterfall, UML, and web technologies. The system supports integrated inventory management and reduces duplicate data entry, but the research was conducted in a healthcare institution rather than a private pharmacy. These studies demonstrate the usefulness of FIFO and FEFO in managing drug inventory. Nevertheless, the application of inventory rotation methods needs to be considered together with the operational characteristics of pharmacies, particularly when newly received drugs have earlier expiration dates than existing inventory.

Recent studies have also focused on stock monitoring and automatic notification features. Evykasari *et al*. (2025) developed a drug inventory management system using FEFO and Reorder Point (ROP), equipped with barcode scanning and WhatsApp notifications. The system addresses inventory control and expiration risks, but it does not combine FIFO with the specific condition in which newly received drugs may have earlier expiration dates than existing stock. Tasia *et al*. (2025) developed a FEFO-based system using barcode scanning and the V-Model. The study reported 100% black-box testing results and a user acceptance rate of 80.53%. The system focuses on controlling drug expiration, but the inventory management and sales processes were not fully integrated into a single platform. Kertapradja *et al*. (2026) developed a web-based drug inventory system using FIFO and Min-Max Stock Level. The system includes real-time stock monitoring, automatic notifications, and inventory reports. However, the study focuses primarily on inventory control and does not comprehensively integrate sales transactions. Ziyan Walidanaen Fandol *et al*. (2023) developed a web-based drug availability management system using the Rapid Application Development (RAD) approach. The system supports stock visibility and inventory reporting, but FIFO and FEFO were not applied to stock rotation. Previous studies have addressed several important aspects of drug inventory management, including computerized stock recording, FIFO and FEFO implementation, expiration monitoring, automatic notifications, and inventory reporting. However, the combination of these functions within an integrated pharmacy inventory and sales system remains an area that requires further development, particularly for the operational needs of Apotek Pakis Medika Utama.

2.2 Comparison with Previous Studies

Table 1. Comparison of Previous Studies

No.	Researcher and Year	Method/Technology	Research Focus	Main Result	Strength	Limitation
1	Mulyani *et al.* (2022)	Extreme Programming (XP), Android, UML	Android-based drug sales and inventory system	Supports drug sales and stock monitoring	Mobile-based system supporting transactions and receipts	No expiration monitoring or minimum-stock notification
2	Hamidy *et al.* (2022)	Prototype, PIECES, UML, FIFO	Drug inventory accounting information system	Manages drug, supplier, and incoming/outgoing stock data	Applies FIFO to inventory management	No expiration monitoring
3	Suherni *et al.* (2021)	Waterfall	Drug sales service system	Supports pharmacy services and reporting	Supports service and report preparation	Does not apply FIFO/FEFO
4	Perdana *et al.* (2023)	Java, MySQL	Drug sales and inventory management	Supports transactions and stock reports	Computerized transaction and inventory management	No minimum-stock notification or expiration monitoring
5	Weriza *et al.* (2023)	SDLC, PHP, MySQL	Drug inventory information system	Supports stock checking and reporting	More structured than manual recording	Does not apply FIFO or real-time monitoring
6	Devega *et al.* (2024)	FIFO and FEFO	Pharmacy inventory system	Addresses inventory rotation and expiration risk	Combines FIFO and FEFO	Not fully integrated with sales and automatic notifications
7	Fadillah *et al.* (2024)	Prototype, FIFO, Web	Web-based inventory system	Supports inventory management	Uses FIFO and web-based technology	Research object is not a pharmacy
8	Evykasari *et al.* (2025)	FEFO, ROP, Barcode Scanning, WhatsApp Notification	Drug inventory management	Supports expiration and reorder control	Automatic notifications and barcode scanning	Does not integrate FIFO and sales transactions
9	Tasia *et al.* (2025)	FEFO, Barcode Scanning, V-Model	Drug expiration control	100% black-box testing and 80.53% UAT	Includes expiration control and barcode scanning	Not fully integrated with sales transactions
10	Kertapradja *et al.* (2026)	FIFO, Min-Max Stock Level, Web	Drug inventory management	Provides stock monitoring and automatic notifications	Real-time monitoring and notification features	Does not comprehensively integrate sales
11	Rachman *et al.* (2024)	Waterfall, Web	Web-based drug inventory system	Supports integrated drug inventory data	More integrated inventory management	Does not apply FIFO/FEFO

12	Irwansyah *et al.* (2024)	FIFO, Waterfall	Pharmaceutical warehouse inventory	Supports stock and drug distribution management	Evaluates functionality, accuracy, and effectiveness	Focuses on large-scale pharmaceutical warehouses
13	Kudus *et al.* (2022)	FIFO, Waterfall, UML, Web	Drug inventory management in healthcare institutions	Reduces duplicate data entry and supports inventory management	Integrated web-based system	Focuses on healthcare institutions rather than private pharmacies
14	Ziyan Walidanaen Fandol *et al.* (2023)	RAD, Web, Database	Drug availability management	Supports stock visibility and inventory reporting	Faster and more integrated data management	Does not apply FIFO/FEFO

2.3 Positioning of the Research

Based on previous studies, research on drug inventory information systems has addressed several aspects, including computerized inventory management, sales transactions, FIFO and FEFO implementation, expiration monitoring, stock-level control, and automatic notifications. However, these functions are not consistently integrated into a single system. Some studies focus primarily on inventory management, while others focus on sales transactions or expiration control. Devega *et al.* (2024) applied a combination of FIFO and FEFO to reduce the risk of drug expiration, but the system was not fully integrated with sales transactions and automatic monitoring features. Evykasari *et al.* (2025) developed a system using FEFO and Reorder Point (ROP), supported by WhatsApp notifications and barcode scanning. However, the study focused on FEFO-based inventory management rather than the combination of inventory management and sales transactions using FIFO. Irwansyah *et al.* (2024) applied FIFO to pharmaceutical warehouse inventory, but the research focused on large-scale drug distribution and did not specifically address the operational requirements of private pharmacies. Based on these findings, the research gap identified in this study concerns the design of an integrated web-based system that connects drug inventory management and sales transactions while providing stock monitoring, expiration-date monitoring, and automatic minimum-stock notifications. Therefore, this research proposes the design of a drug inventory and sales management system using the FIFO method at Apotek Pakis Medika Utama. The proposed system is positioned through the following aspects:

1) Integration of drug inventory management and sales transactions within a single web-based platform.
2) Application of the FIFO method to organize drug inventory release based on the order of stock entry.
3) Management and monitoring of drug batch numbers and expiration dates.
4) Provision of minimum-stock notifications through the dashboard and email.
5) Automated generation of inventory and sales reports.
6) Reduction of manual recording activities through integrated inventory and transaction data.

Through these functions, the proposed system is expected to support more structured drug inventory management, facilitate sales transactions, reduce the risk of expired drugs, and improve the accuracy of inventory data at Apotek Pakis Medika Utama.

2.4 Comparative Analysis and Research Positioning

An information system is a combination of physical and non-physical components used to process data into useful information (Fatawa Imam Al Muftin & Fendi Hidayat, 2024). In the healthcare sector, particularly in pharmacies, information systems can support drug data management, sales transactions, inventory control, and report preparation. The implementation of an information system can support operational activities, reduce errors associated with manual recording, and facilitate inventory monitoring. In pharmacy operations, the availability of accurate and organized information is needed to support inventory management and transaction processing. A pharmacy information system is a computer-based system designed to support pharmacy operational activities, including supplier data management, drug sales transactions, incoming and outgoing drug management, and inventory reporting. The system is intended to support service activities and decision-making related to drug inventory management. Through an integrated pharmacy information system, data retrieval, stock monitoring, and report preparation can be performed more systematically. Rachman *et al.* (2024) reported that a web-based drug inventory information system can support more efficient drug data

management, integrate inventory data, reduce input errors, and accelerate operational report preparation. Perdana *et al.* (2023) also reported that an information system for drug sales and inventory management can support transaction processing and inventory management compared with manual processes.

FIFO (First In, First Out) is an inventory management method that prioritizes products received earlier to be released first (Devega *et al.*, 2024). In pharmacy inventory management, FIFO can be used to organize stock rotation by prioritizing older inventory for sales or distribution. The method is based on the order in which items enter the inventory, so drugs received earlier are prioritized during the stock release process. The application of FIFO in drug inventory management can help organize the movement of stock and reduce the accumulation of older inventory. However, FIFO needs to be distinguished from FEFO (First Expired, First Out), which determines the release priority based on the nearest expiration date. Therefore, if expiration dates are used as a determining factor in the proposed system, the specific decision rule needs to be clearly described in the system design and implementation.

Prototyping is a system development approach that uses a prototype to represent system requirements and obtain feedback from users (Informatika *et al.*, 2024). This approach allows users to provide feedback during the development process so that the proposed system can be adjusted to their requirements. In this research, the Prototyping method is used to support the identification and refinement of system requirements for Apotek Pakis Medika Utama. The stages of the Prototyping method consist of communication, quick planning, modeling and quick design, construction of the prototype, and deployment, delivery, and feedback. The use of this method allows the proposed system design to be adjusted based on the requirements identified during the development process. Unified Modeling Language (UML) is a standardized modeling language used to represent and design software systems (Uml *et al.*, 2023). In this study, UML is used to describe the functional and structural aspects of the proposed pharmacy information system. The Use Case Diagram is used to describe the interactions between actors and the functions provided by the system. The Activity Diagram is used to describe the sequence and flow of activities within the system. The Class Diagram is used to describe the structure of classes, including their attributes, methods, and relationships within the system. These UML diagrams are used as part of the system design to represent the processes and components of the proposed drug inventory and sales management system.

3. Methodology

3.1 System Architecture and Design

The proposed system is a web-based drug inventory and sales management information system that applies the FIFO (First In, First Out) method. The system is designed to support drug inventory management, sales transactions, stock monitoring, expiration-date monitoring, and report preparation at Apotek Pakis Medika Utama. The system provides three user access levels, namely warehouse administrator, pharmacist, and cashier. Each user has different access rights according to their respective roles and responsibilities. The warehouse administrator is responsible for managing drug data, supplier data, incoming drug records, stock opname, inventory reports, and user management. The pharmacist is responsible for monitoring drug inventory, monitoring drugs approaching their expiration dates, validating incoming drug records, and viewing inventory reports. The cashier is responsible for processing drug sales transactions and viewing sales reports. The separation of access rights is intended to ensure that each user can perform activities according to their respective operational responsibilities.

The proposed system applies the FIFO method to the drug sales process. When a sales transaction is completed, the system automatically reduces the available drug stock based on the order in which the drug batches were received. Therefore, the batch that entered the inventory earlier is prioritized for release. Each incoming drug record includes information such as the invoice number, invoice date, supplier, drug name, batch number, quantity, and expiration date. This information is stored in the system to support stock tracking and expiration-date monitoring. The system also provides monitoring features for drug inventory and expiration dates. Information regarding available stock and drugs approaching their expiration dates can be monitored through the system. In addition, the system provides notifications for minimum stock levels and drugs approaching their expiration dates through the dashboard and email. These features are designed to assist users in identifying inventory conditions that require attention and to support more organized stock management.

The system also supports drug sales transactions. During the transaction process, the cashier selects the drug and enters the quantity purchased. After the transaction is completed, the system records the sales data and automatically updates the available stock according to the FIFO sequence. The system then generates a payment receipt and records the transaction for sales reporting. Inventory and sales data can subsequently be used to generate stock and sales reports. In the proposed system, FIFO determines the order in which drug stock is released based on the date the stock is received. The expiration date is recorded as an additional

attribute for each drug batch and is used for expiration-date monitoring and notification. Therefore, the expiration date does not replace the FIFO sequence in determining stock release unless a different stock-release rule is explicitly defined in the system.

3.2 System Development Process

This research applies the Prototyping method because it allows system requirements to be identified and developed gradually through communication and feedback from users. The method is used to ensure that the proposed system corresponds to the operational requirements of Apotek Pakis Medika Utama. The Prototyping process consists of five stages: communication, quick plan, modeling quick design, construction of prototype, and deployment and feedback. The Communication stage is the initial stage of system requirements collection. Data are collected through direct observation, interviews, and documentation at Apotek Pakis Medika Utama. Interviews are conducted with two main informants, namely the pharmacy owner and pharmacist, who are directly involved in pharmacy operations and drug inventory management. The selection of these informants is based on their knowledge of drug procurement, incoming and outgoing drug management, sales transactions, stock monitoring, and monitoring of drugs approaching their expiration dates.

During this stage, the existing business processes and problems are identified. The identified problems include drug stock recording that is still performed manually using notebooks and simple records, difficulties in monitoring inventory, slow retrieval of drug information, delays in preparing reports, and the risk of recording errors in incoming and outgoing drug transactions. The communication stage also identifies the information and functions required by each user based on their respective responsibilities. The results of observation, interviews, and documentation are then used as the basis for determining the functional and non-functional requirements of the proposed system. The Quick Plan stage involves planning the system requirements, determining the main functions to be developed, and defining the workflow of the proposed system based on the business processes identified during the communication stage. The planned functions include user management, drug data management, supplier data management, incoming drug recording, batch and expiration-date recording, inventory management, stock opname, drug sales transactions, FIFO-based stock reduction, stock monitoring, expiration-date monitoring, minimum-stock notifications, expiration-date notifications, and report generation.

The Modeling Quick Design stage involves designing the proposed system based on the requirements identified in the previous stages. UML (Unified Modeling Language) is used to describe the structure and behavior of the proposed system. The UML models used in this research consist of Use Case Diagrams, Activity Diagrams, and Class Diagrams. The Use Case Diagram describes the relationship between users and the functions available in the system. The Activity Diagram describes the flow of activities performed by users and the system. The Class Diagram describes the classes, attributes, methods, and relationships required in the proposed system. The Construction of Prototype stage involves constructing the system prototype based on the requirements and design produced in the previous stages. The prototype includes the main system functions, such as login and user access management, drug and supplier data management, incoming drug recording, batch and expiration-date management, stock management, stock opname, FIFO-based sales transactions, stock monitoring, expiration-date monitoring, notifications, and report generation. The prototype is developed using PHP and MySQL, with XAMPP used as the local web server environment and Visual Studio Code used as the code editor. The Deployment and Feedback stage involves presenting the prototype to the users for evaluation. The users provide feedback regarding the functions, interface, workflow, and suitability of the prototype to the operational requirements of the pharmacy. The feedback is used to identify parts of the prototype that require adjustment or improvement. The prototype is subsequently revised based on the feedback obtained so that the proposed system is more consistent with the requirements identified during the communication stage.

3.3 Activity Diagram

The Activity Diagrams are used to describe the sequence of activities performed by users and the system in the main processes of the proposed drug inventory and sales management system. The diagrams presented in this study include the incoming drug recording process and the FIFO-based sales transaction process.

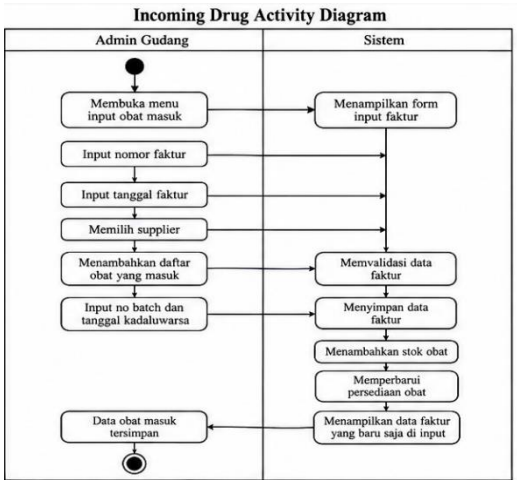

Figure 1. Incoming Drug Activity Diagram

The incoming drug activity diagram illustrates the process of recording drugs received from suppliers. The process begins when the warehouse administrator opens the incoming drug menu, after which the system displays the input form. The administrator enters the invoice number and date, selects the supplier, and adds the received drugs along with their quantities, batch numbers, and expiration dates. The system then validates the entered data. If the data are valid, the system saves the incoming drug transaction, records the batch information, adds the received quantity to the inventory, updates the stock, and displays the recorded transaction.

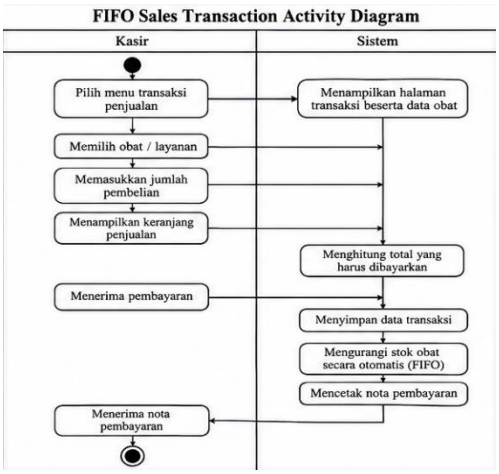

Figure 2. FIFO Sales Transaction Activity Diagram

The FIFO sales transaction activity diagram illustrates the process of selling drugs using the FIFO method. The process begins when the cashier opens the sales transaction menu and selects the required drug. The cashier enters the purchase quantity, and the system displays the selected items and calculates the total payment. After receiving the customer's payment, the cashier confirms the transaction. The system then saves the sales transaction and automatically reduces the drug stock based on the FIFO sequence, starting from the batch that entered the inventory first. After the stock is updated, the system generates the payment receipt, which is printed and given to the customer.

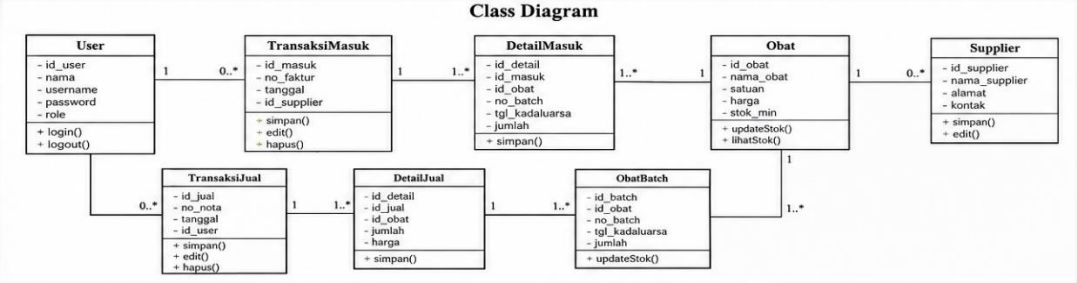

Figure 3. Class Diagram

The Class Diagram illustrates the structure of the proposed drug inventory and sales management system, including the classes, attributes, methods, and relationships among system components. The main classes represent users, drugs, suppliers, incoming drug transactions, drug batches, sales transactions, and sales transaction details. The relationships among these classes support the management of drug inventory, incoming transactions, sales transactions, and the FIFO-based stock-release process.

3.4 Tools and Technologies

The proposed system uses several tools and technologies to support the system design and development process. PHP is used as the programming language for developing the web-based application. MySQL is used as the database management system for storing and managing drug, supplier, user, inventory, batch, sales, and report data. XAMPP is used as the local web server environment during the development process, while Visual Studio Code is used as the code editor. UML is used as a system modeling tool to describe the proposed system through Use Case Diagrams, Activity Diagrams, and Class Diagrams. The Use Case Diagram is used to describe user interactions with the system, the Activity Diagram is used to describe the flow of system activities, and the Class Diagram is used to describe the structure and relationships among system components. The combination of these tools and technologies supports the design and development of the proposed web-based drug inventory and sales management system at Apotek Pakis Medika Utama.

4. Result and Discussion

4.1 Results

4.1.1 System Analysis Results

Based on the observations and interviews conducted at Apotek Pakis Medika Utama, drug inventory management and sales transactions are still carried out manually. The recording of incoming drugs, inventory data, and sales transactions relies on conventional records, which can result in discrepancies between physical and recorded stock, delays in report preparation, and difficulties in monitoring drugs approaching their expiration dates. In addition, the current stock release process does not apply the FIFO method, which may result in older drug batches remaining in inventory for longer periods. Therefore, a computerized and integrated information system is proposed to support drug inventory management and sales activities at Apotek Pakis Medika Utama. The proposed system provides three user access levels: warehouse administrator, pharmacist, and cashier. The warehouse administrator is responsible for managing drug data, supplier data, incoming drug records, stock opname, stock monitoring, expiration-date monitoring, reports, and user management. The pharmacist is responsible for validating incoming drugs, monitoring drug inventory and expiration dates, and viewing inventory reports. The cashier is responsible for processing drug sales transactions and viewing sales transaction records. The separation of access rights is designed according to the operational responsibilities of each user.

4.1.2 System Interface Design Results

After successful login, users are directed to the dashboard according to their respective access rights. The warehouse administrator dashboard is designed to display the total number of drugs, drugs with low stock levels, and drugs approaching their expiration dates. The dashboard also provides a Quick Access menu, an activity table for inventory-related activities, and a weekly chart to provide an overview of stock movement.

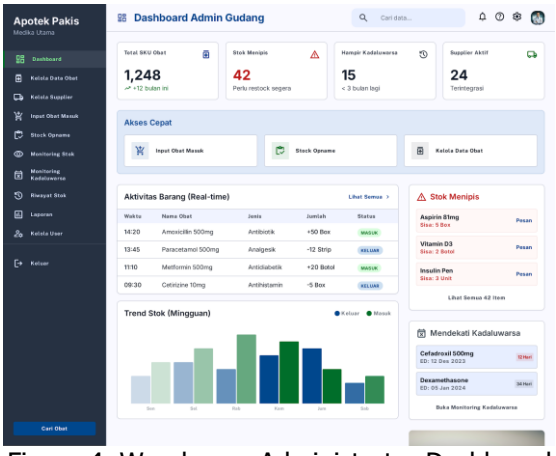

Figure 4. Warehouse Administrator Dashboard

The dashboard is designed to provide the warehouse administrator with access to important inventory information from a single interface. The displayed information can be used as a reference for monitoring stock conditions and identifying drugs that require further attention. The stock opname page is designed to support the warehouse administrator in comparing physical drug quantities with the quantities recorded in the system. The page displays drug information, system stock, physical stock, and the difference between the two quantities. When a discrepancy is identified, the warehouse administrator can adjust the stock according to the physical inventory conditions. This feature is intended to support inventory control and maintain consistency between physical stock and system records.

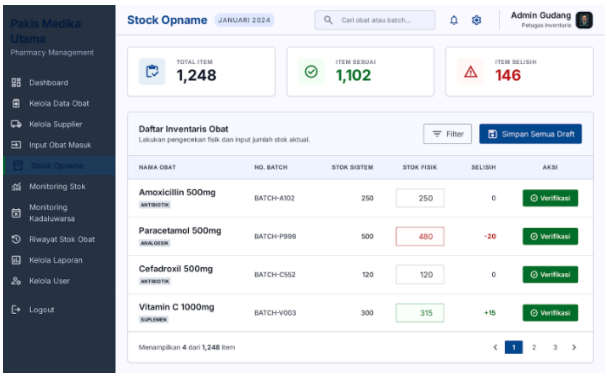

Figure 5. Stock Opname Page

The sales transaction page is designed for the cashier to process drug sales to customers. The page displays the available drugs, healthcare services, prescription packages, transaction cart, subtotal, and total payment. The system is designed to connect sales transactions with inventory data so that stock records can be updated after a transaction is completed. The proposed sales process applies the FIFO method by prioritizing the drug batch that entered the inventory first. When a sales transaction is processed, the system reduces the available quantity according to the defined FIFO sequence. This mechanism is intended to support systematic stock rotation and reduce the possibility of older batches remaining in inventory for extended periods.

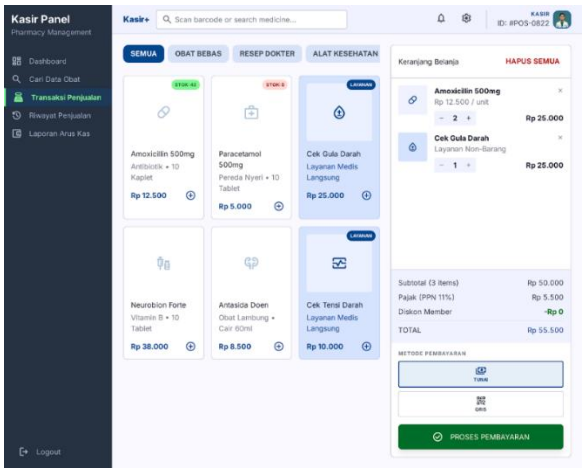

Figure 6. Cashier Sales Transaction Page

The expiration monitoring page is designed to display information about drugs and their expiration dates. The page provides information regarding drugs that have expired and drugs approaching their expiration dates. Summary information is displayed through information cards, while the table provides details of the relevant drugs. The page also provides a printing function and filtering options to assist the administrator in identifying drugs based on their expiration period.

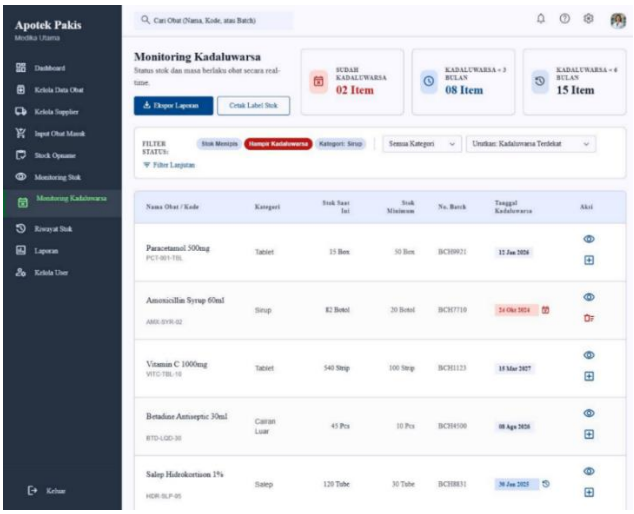

Figure 7. Expiration Monitoring Page

The expiration monitoring feature is designed to support early identification of drugs that require attention based on their expiration dates. The feature can be used as a reference for inventory management and follow-up actions by the responsible users.

4.2 Discussion

The results of the system analysis and design indicate that the proposed web-based drug inventory and sales management system is designed to address several problems identified at Apotek Pakis Medika Utama. The previous manual recording process created difficulties in retrieving inventory information, maintaining consistent stock records, preparing reports, and monitoring drugs approaching their expiration dates. The proposed system addresses these problems through integrated drug data management, inventory recording, sales transactions, stock monitoring, expiration-date monitoring, and reporting features. The FIFO method is applied to the proposed stock-release process by organizing drug inventory based on batch numbers and the order in which the drugs are received. During a sales transaction, the system is designed to prioritize the batch that entered the inventory first. If the quantity available in the earliest batch is insufficient to fulfill the transaction, the system continues to the next available batch according to the FIFO sequence. This mechanism is designed to support systematic stock rotation and reduce the possibility of older inventory remaining in stock for an extended period.

The proposed system also provides an expiration-date monitoring feature to identify drugs that have expired or are approaching their expiration dates. This feature allows users to monitor the expiration status of each drug batch separately from the FIFO stock-release process. FIFO determines the stock-release priority based on the order in which the inventory is received, while expiration-date monitoring provides information about the remaining shelf life of each drug. Therefore, the expiration-date monitoring feature does not change the FIFO rule used for stock release. If the system is intended to prioritize drugs based on their nearest expiration dates, the stock-release mechanism would need to be defined using the FEFO method or a combination of FIFO and FEFO. The division of user access into warehouse administrator, pharmacist, and cashier is designed to separate operational responsibilities within the pharmacy. The warehouse administrator manages drug data, supplier data, incoming drug records, stock opname, inventory monitoring, reports, and user management. The pharmacist is responsible for validating incoming drugs, monitoring inventory and expiration dates, and reviewing inventory reports. The cashier handles sales transactions and sales records. This division of access is designed to ensure that each user can access system functions according to their respective responsibilities.

The proposed system also provides several functions that support the management of drug inventory and sales activities, including stock opname, FIFO-based stock reduction, expiration-date monitoring, and sales transaction recording. These functions are designed based on the operational requirements identified during the observation and interview processes at Apotek Pakis Medika Utama. However, because the research is limited to the analysis and design stage, the proposed system has not yet been implemented and tested directly in the pharmacy's operational environment. Therefore, this study does not yet provide quantitative evidence of improvements in inventory accuracy, transaction processing time, or operational efficiency. Further research is required to implement the proposed system and conduct system testing in the actual operational environment of Apotek Pakis Medika Utama. Functional testing can be conducted to verify whether each system feature operates according to the specified requirements, while user acceptance testing can be used

to evaluate the suitability of the system from the users' perspective. The results of these tests can provide empirical evidence regarding the effectiveness and usability of the proposed system.

5. Conclusion and Recommendations

Based on the results of the analysis and design, this study produced a design for a web-based drug inventory and sales management system using the FIFO (First In, First Out) method at Apotek Pakis Medika Utama. The proposed system is designed to support drug inventory management, sales transactions, expiration-date monitoring, and report preparation in a more systematic and integrated manner. The system also provides role-based access for the warehouse administrator, pharmacist, and cashier to separate operational responsibilities and control access to system functions. The system design includes Use Case Diagrams, Activity Diagrams, Class Diagrams, and database design based on the operational requirements of the pharmacy. The proposed system applies FIFO to the drug stock-release process based on the order in which drug batches are received. In addition, the system includes stock monitoring and expiration-date monitoring features to support inventory control. The main contribution of this study is the design of an integrated web-based system that combines drug inventory management and sales transactions with FIFO-based stock release at Apotek Pakis Medika Utama.

This study is limited to the analysis and design stage. The proposed system has not yet been implemented and tested directly in the operational environment of the pharmacy. Therefore, the effectiveness of the proposed system in improving inventory accuracy, transaction processing, and operational efficiency cannot yet be quantitatively established. Features such as stock monitoring, expiration-date monitoring, dashboard functions, and email notifications remain part of the proposed system design. The study is also limited to Apotek Pakis Medika Utama and does not provide an in-depth analysis of system security. Further research is recommended to continue the proposed system through the implementation and testing stages. Functional testing and user acceptance testing can be conducted to evaluate whether the system functions according to the identified requirements and is suitable for use by pharmacy personnel. The system may also be developed with additional features such as barcode scanning, a mobile application, a more interactive dashboard, real-time notifications, automatic database backup, and improved protection of user data through appropriate security mechanisms.

References

Devega, M., Yuhelmi, Y., & Darmayunata, Y. (2024). Pembangunan sistem inventori apotek menggunakan metode FIFO dan FEFO. *ZONAsi: Jurnal Sistem Informasi, 6*(1), 159–172. https://doi.org/10.31849/zn.v6i1.17318

Evykasari, N. P., Darmanto, E., & Muzid, S. (2025). Sistem informasi manajemen persediaan obat di Apotek Jekulo menggunakan metode FEFO dan ROP. *JEKIN: Jurnal Teknik Informatika, 5*(2), 936–949. https://doi.org/10.58794/jekin.v5i2.1618

Fachrurrazi, S., Muthmainnah, & Maulana, M. F. (2023). Application of the FIFO model in the drug inventory information system at the Asyfa Krueng Mane Pharmacy. *Multica Science and Technology, 3*(1), 142–146. https://doi.org/10.47002/mst.v3i1.427

Fadillah, N. S., & Sutopo, J. (2024). Implementasi metode FIFO pada sistem informasi dalam mengelola persediaan barang berbasis web. *Jurnal Riset dan Aplikasi Mahasiswa Informatika, 5*(2), 357–366.

Hamidy, F., Surahman, A., & Famelia, R. H. (2022). Perancangan sistem informasi akuntansi apotek menggunakan metode MPKP (FIFO). *Jurnal Tekno Kompak, 16*(2), 188–199.

Natsir, F., Nastiti, T. I., & Acep. (2025). Desain sistem informasi manajemen stok obat berbasis metode FIFO pada Apotek Ban Cun Kramat Jaya. *JUTEK: Jurnal Teknologi, 2*(1), 1–7.

Ogbewele, E., Mbata, A. O., & Nwosu, N. T. (2024). Optimizing pharmaceutical inventory management: A global framework for efficiency and cost reduction. *International Journal of Management & Entrepreneurship Research, 6*(10), 3357–3371. https://doi.org/10.51594/ijmer.v6i10.1638

Prasetyo, M. A. P., *et al*. (2023). Perancangan sistem informasi persediaan obat menggunakan metode FIFO berbasis web pada Apotek Risma. *JIFORTY: Jurnal Informatika Fortuity, 4*(1), 25–34.

Rezeki, D. S., Silaen, M., Girsang, E., & Nasution, S. R. (2022). Evaluation of drug storage using FIFO/FEFO methods in Royal Prima Medan Hospital Pharmacy Installation. *International Journal of Health and Pharmaceutical, 2*(1), 45–53.

Wulanndari, G., *et al*. (2026). Penerapan metode FIFO FEFO sistem informasi penjualan obat berbasis website pada Apotek Mitra Ummat Mandiraja. *Jurnal Sistematis, 5*(1), 23–38.