



Research article

Design of a Web-Based Inventory Information System at BM Mart

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ABSTRACT

Advances in information technology have driven digital transformation across various sectors, including retail businesses such as minimarkets. However, BM Mart Minimarket currently still uses conventional inventory recording methods, which carry a high risk of data errors, reporting delays, and decreased operational efficiency. This impacts the difficulty of real-time stock monitoring, the emergence of dead stock, and slow decision-making. The purpose of this research is to design a web-based inventory information system to improve accuracy, efficiency, and reporting speed. Using a quantitative approach with data collection techniques including observation, interviews, and literature studies, the system was subsequently developed using the Waterfall method and PIECES analysis to ensure quality in terms of performance, information, control, efficiency, and service. This system is beneficial for accelerating the inventory recording and reporting process, improving stock supervision, and having a positive impact.

1. Introduction

In today's digital era, the transformation of information technology has become a crucial factor in supporting the efficiency and effectiveness of operational activities across various business fields, including the modern retail sector like minimarkets. Increasingly competitive business demands require business actors to adapt to technology in order to provide fast, accurate, and targeted services. One crucial aspect of minimarket operations is the inventory management system.

Inventory is very important for businesses because a good inventory system allows companies to manage stock in the warehouse properly, meet customer needs, and increase company revenue [1]. Poor inventory management can lead to significant losses such as stockouts, dead stock, recording errors, and decreased customer satisfaction.

BM Mart is a minimarket selling various daily necessities. This minimarket was founded by Erlina, located on Jl. M. Boya, and has been operating since April 14, 2023. BM Mart still uses conventional inventory recording, which allows for recording errors and takes a long time. Data inaccuracies and long reporting times often occur because the inventory system is still done manually. As a result, management faces challenges in monitoring real-time product availability, which can complicate purchasing and sales decisions [2].

This condition not only impacts operational efficiency but also customer satisfaction. Inaccuracies in inventory records can lead to shortages of goods needed by customers, which can ultimately reduce customer loyalty. Furthermore, time-consuming conventional processes can divert employees' attention from other important tasks, such as customer service. Therefore, improvements in the inventory management system are crucial to enhance the overall performance of the minimarket [3].

This design aims to improve the accuracy of inventory data at BM Mart minimarket, facilitate inventory management, provide complete and accurate inventory reports, reduce the occurrence of long-term unsold goods causing product expiration (dead stock), and simplify decision-making [4].

With the design of a Web-Based Inventory Information System at BM Mart Minimarket, it is expected to facilitate the minimarket in processing inventory data and make it easier for employees to obtain information on stock levels, either overall or based on nearly depleted stock. This system will not only improve data accuracy but also accelerate the decision-making process related to procurement. With more precise and faster information, BM Mart can be more responsive to market demand.

2. Metode Penelitian

This research uses a quantitative method as it focuses on developing a web-based stock information system designed to address problems in monitoring stock inventory, dead stock, errors in recording inventory, and time-consuming recording processes. A quantitative approach is used to obtain numerical and objective data, such as the amount of available stock, incoming goods, and outgoing goods. This data is then processed to serve as the basis for designing an information system capable of providing accurate and real-time results.

2.1 Data Collection

The data required for this research was obtained through observation, interviews, and literature studies.

1. Observation

Direct observation was conducted at BM MART to understand the daily operational patterns related to inventory, including the process of recording incoming and outgoing goods [5].

2. Interview

Interviews were conducted with the store owner, employees, and several regular customers. Interviews were conducted directly to explore problems and potential solutions [6].

3. Literature Study

Data was also collected through articles, journals, books, the internet, and other sources related to the research topic to add necessary information [7].

2.2 System Development Design

The Waterfall model is the method used in this research. This model is worked on sequentially from top to bottom correctly in a linear sequential flow [8]. If an error occurs in a stage, repetition of the previous stage is required.

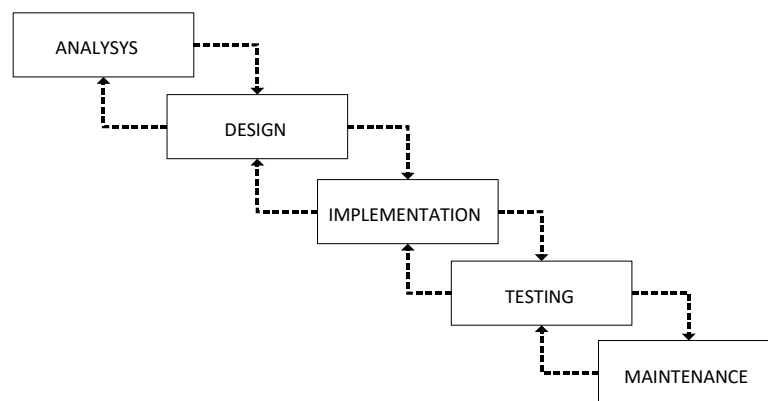


Figure 2. Waterfall Model

Figure 2 shows the stages of the waterfall model starting from Requirement Analysis, Design, Implementation, Testing, and Maintenance.

1. **Requirement Analysis**

In the initial stage, data collection and analysis related to BM MART are carried out to thoroughly understand the required needs. The data obtained is then analyzed using the PIECES approach [9], which includes the following six main dimensions:

- a. **Performance**

Performance analysis focuses on how quickly and accurately the system can process goods data. The system must be able to record incoming and outgoing transactions quickly and generate real-time stock availability reports. Good performance will support store operational smoothness, such as in the restocking process or customer service

- b. **Information**

The system is expected to present accurate, relevant, and easily understandable information for both the owner and store employees. Information such as inventory levels, expiration dates, and transaction history should be presented clearly and on time. Quality information will assist in decision-making, such as when to reorder specific items.

- c. **Economy**

The economic aspect analysis includes comparing the development and operational costs of the system with the benefits to be obtained. The inventory management system is expected to reduce the risk of

stockouts, minimize excess stock, and save time and effort in manual recording. Thus, this system is expected to provide economically beneficial value for the store.

d. **Control**

The system needs to have good control features, such as user authentication and role-based access restrictions (e.g., owner and employee). This is to maintain stock data security, prevent unauthorized data changes, and ensure system reliability. Good control also allows monitoring of user activities within the system.

e. **Efficiency**

Efficiency is measured by the system's ability to save time and labor in the stock management process. An efficient system will facilitate automatic recording, reduce dependence on manual records, and speed up the process of searching for goods data, which can improve overall store operational productivity.

f. **Service**

The developed system must also provide good service to its users, especially in terms of ease of use, technical support, and responsiveness to potential issues. The availability of assistance when users encounter difficulties will increase satisfaction and trust in the system.

2. **Design**

After gathering information on requirements specifications during the analysis phase, the next step is to implement them into the development design. The purpose of the design plan is to provide a comprehensive overview of the tasks to be performed. This phase also helps designers prepare hardware requirements when building the overall software system architecture.

a. **System Architecture Design:** Designing the system structure with main modules, such as stock recording, reporting, and notification modules.

b. **User Interface (UI) Design:** Creating a simple prototype of the application interface to be used by the store owner and employees.

c. **System Modeling:** Using diagrams such as UML (Unified Modeling Language) to visualize the system.

3. **Implementation**

In this stage, software creation is divided into small programs (units) using specific programming language code without affecting the overall system. Each small program is tested, and its functionality is checked to see if it meets the required standards. When writing code (coding), Visual Studio Code is used as a text editor, along with PHP and MySQL as the database management system.

4. **Testing**

In this stage, the created code and design are systematically tested to ensure every system function works according to the design. Ensuring modules within the system can function together smoothly. Evaluating system performance in a real working environment and identifying possible errors. Black box testing is used for functional testing, and white box testing is used to test unit functionalities such as login, logout, and others.

5. **Maintenance**

Software that is ready to be run and operated by users requires maintenance in the form of bug fixes, security enhancements, feature additions, and system updates to keep the application running optimally.

However, in this research, the implementation, testing, and maintenance stages are not carried out in depth; they are only explained conceptually as an overview of the system flow.

3. **Results and Discussion**

The results of the analysis and design of the web-based inventory information system at BM Mart Minimarket will be presented as a system overview designed to address the problems identified in the previous stage.

3.1 **Data Collection Results**

Through observations, interviews, and literature studies conducted, it was found that the inventory recording process is still done conventionally using books and spreadsheets, causing data retrieval to be slow and prone to errors. This impacts the obstruction of the reporting process and the lack of real-time information for owners and employees in making purchasing decisions.

Interviews with the owner and employees revealed frequent discrepancies between recorded stock data and actual conditions in the warehouse, as well as the absence of a warning system when stock is nearly depleted. Employees also experience difficulties in compiling daily and weekly transaction reports because everything is done manually.

Meanwhile, literature studies were conducted to understand trends and solutions developed in similar research. Several journals and references indicate that web-based inventory information systems have proven capable of improving data accuracy, work efficiency, and accelerating the decision-making process.

3.2 System Design Results

The data obtained from the field will be designed using the waterfall model to replace the conventional recording process previously used. The system design will use PIECES and UML in its development.

3.2.1 Requirement Analysis

PIECES analysis (Performance, Information, Economy, Control, Efficiency, Service) is used in this research to identify problems in the conventional inventory recording system at BM Mart and formulate solutions through the development of a web-based system. The following table summarizes the comparison between the current system condition and the proposed improvements based on each PIECES aspect.

Table 1. PIECES Analysis Results

No	PIECES	Current System	Proposed Improvement
1.	Performance	Inventory data management is still done conventionally using recording in books or simple spreadsheets, causing data search processes to be slow and prone to errors.	Development of a web-based system capable of processing transactions with a response time of less than 2 seconds. The system will automatically record all stock movements, thereby speeding up the recording and data search process and supporting store operational efficiency.
2.	Information	Inventory information such as stock levels, prices, and transaction history is not presented completely and in real-time. Reports are still compiled conventionally, so they are not always accurate and are often delayed.	The system will provide accurate and up-to-date data regarding item names, stock levels, prices, and availability status. Reports can be generated automatically on a daily, weekly, and monthly basis to support faster and more precise decision-making [10].
3.	Economy	The conventional process causes waste of time and labor, and has the potential to incur additional costs due to recording errors or restocking delays.	The web-based system will reduce dependence on manual recording, minimize human error, and save operational costs. The system development cost is expected to be comparable to the efficiency and savings obtained in the long term [11].
4.	Control	There is no strong control in the conventional system. Anyone with access to documents can change data without clear supervision, increasing the risk of data misuse.	The system will be equipped with user authentication features and role-based access restrictions (e.g., owner and employee). All user activities will be automatically recorded in a system log to enhance data security and integrity [12].
5.	Efficiency	Conventional recording is time-consuming and carries the risk of data duplication. The reporting process is also slow because it is done separately from transaction recording.	With a computerized system, all recording and reporting processes are done automatically and integrated. This will save time, reduce employee workload, and accelerate the stock management process [13].
6.	Service	There is no adequate help system or technical support when problems occur, and the interface for recording is still confusing for some employees.	The system will be designed with a user-friendly and easy-to-understand interface. Technical support will also be prepared to assist users if they experience difficulties, to improve comfort and satisfaction in using the system.

Table 1 shows that the current system has various weaknesses, such as slow data retrieval, non-real-time information, and a lack of control and efficiency. The proposed improvements are directed towards developing an integrated, responsive web system equipped with security features and automated reporting.

3.2.2 System Design

UML modeling is used to visualize the design of the system to be developed. UML diagrams provide a complete picture of user interaction with the system, internal system processes, and the data structure used [14].

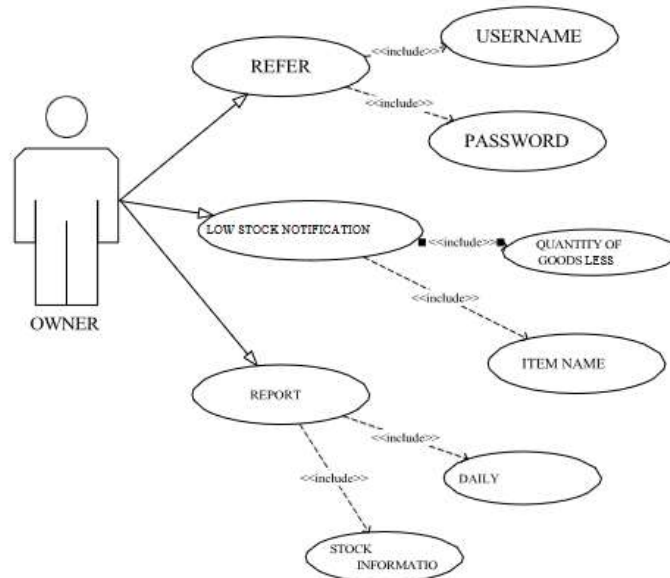
1. Use Case Diagram



Gambar 3 Usecase Diagram

Figure 3 shows the activities where the owner logs into the website, can view stock information, and see reports. Meanwhile, the employee logs into the website, manages transactions, manages incoming or outgoing stock, and views reports.

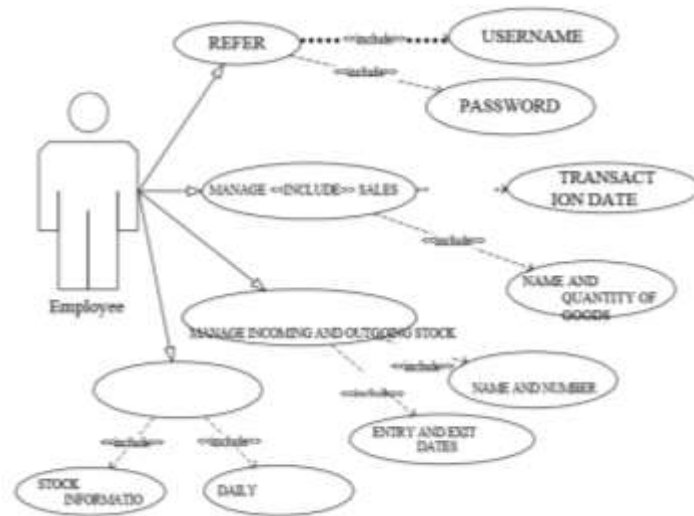
a. Use Owner



Gambar 4 Case Owner

Figure 4 illustrates the activities of the owner, who can log in by entering a username and password (include), receive notifications for nearly depleted stock (items with quantity less than 15) including item names (include). The owner can also view daily transaction reports and stock information (include).

b. Use Employee



Gambar 5 Case Karyawan

Figure 5 illustrates the employee, who can log in to the website by entering a username and password, manage sales transactions based on transaction date, item name, and quantity, manage incoming and outgoing stock based on item name/quantity or date of entry/exit, and then create daily sales transaction reports and stock information reports. Activity Diagram

a. Activity Owner

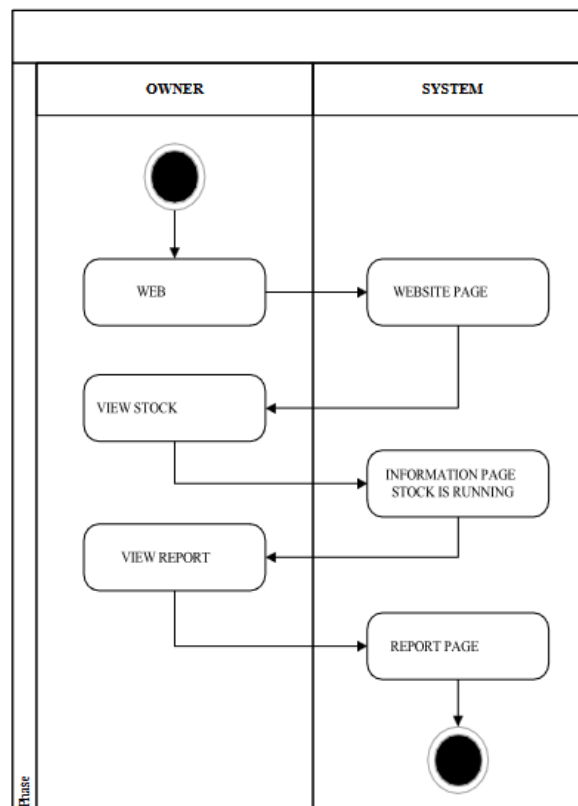
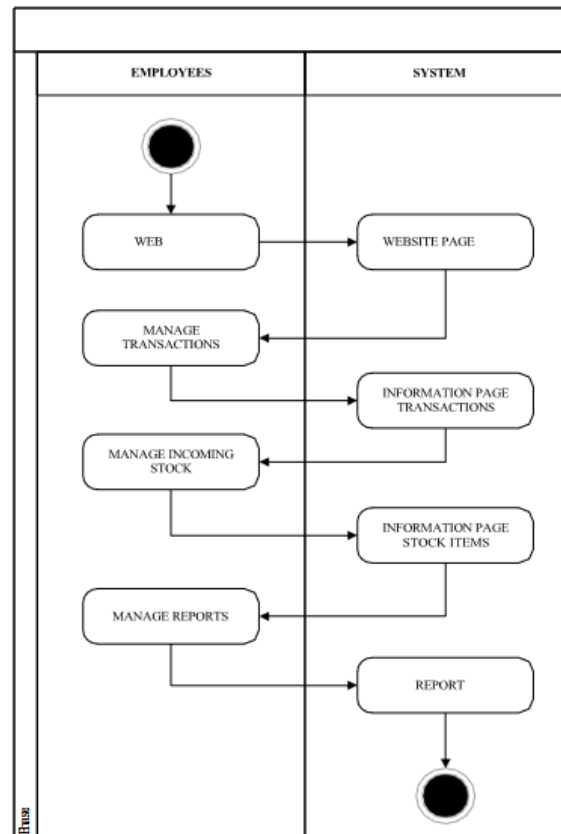


Figure 6. Owner Activity Diagram

Figure 6 shows the activities performed by the Owner on the system: accessing the website, viewing stock information, and viewing reports. Meanwhile, the system will provide the website page, stock information page, and report page.

b. Employee Activity



Gambar 7 Aktiviy Karyawan

Figure 7 shows the Employee accessing the website, and the system processes the website page. Then, the employee manages sales transactions, the system displays the transaction information page. The employee manages incoming/outgoing stock and manages reports, the system will display the stock information page and the report page.

3. Sequence Diagram

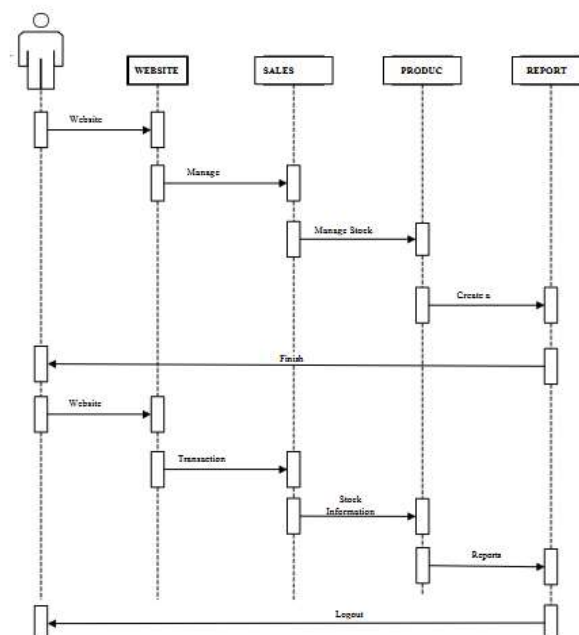
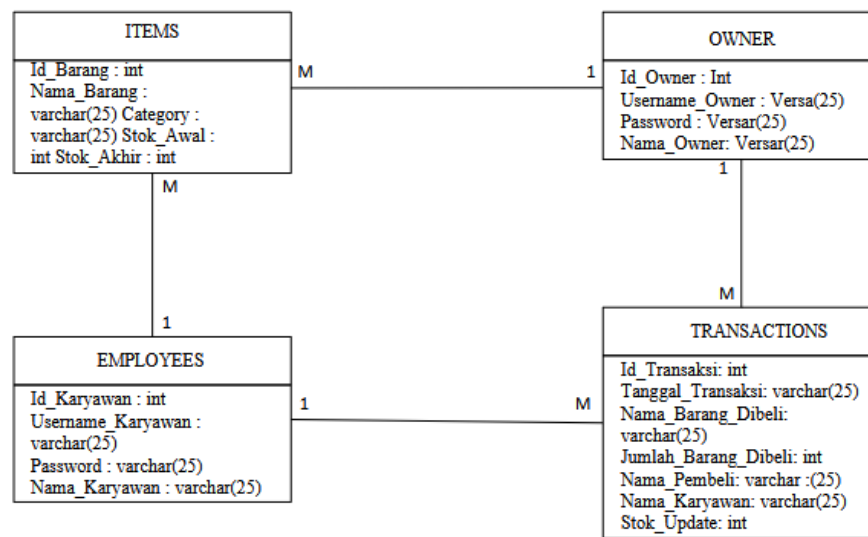


Figure 7. Employee Activity Diagram

4. Class Diagram



Gambar 9 Class Diagram

Figure 9. Class Diagram

Figure 9 shows a diagram modeling the static structure of the system by indicating important entity classes, attributes, operations, and relationships between classes [15]. The classes included are:

1. **Item Class** has attributes such as item ID, item name, category, initial stock, and final stock.
2. **Owner Class** has attributes such as owner ID, owner username, password, and owner name.
3. **Employee Class** has attributes such as employee ID, employee username, password, and employee name.
4. **Transaction Class** has attributes such as transaction ID, transaction date, item name, quantity, buyer name, employee name, and stock update.
5. **Relationships Between Classes** are also depicted, such as one owner provides many items, many items are sold by one employee, and one employee conducts many transactions.

4. Conclusion

The design of the web-based inventory information system for BM Mart Minimarket can be an effective solution to overcome various manual recording problems, such as data errors, reporting delays, and difficulties in real-time stock monitoring. This system conceptually improves operational efficiency, information accuracy, and supports more precise decision-making through automated reporting features, user authentication, and stock notifications. The impact of this research not only improves the quality of inventory management at BM Mart but also makes a real contribution to encouraging digitalization in small and medium-scale retail business sectors and opens opportunities for replicating similar systems in other similar business units.

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