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Optimizing Inventory Management Through the Inventory Information System at PT Lintas Cakrawala

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Keywords

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Abstract

The issue of stock management Optimization at PT. Lintas Cakrawala has so far been handled manually; the company lacks a proper inventory information system, which often leads to inaccurate results and increases the likelihood of recording errors, resulting in financial losses for the company. The objective of this research is to analyse system requirements and design a web-based inventory information system as a solution to optimise stock management at PT. Lintas Cakrawala. Furthermore, this research aims to address the issue of data discrepancies between manual records and the physical condition of goods, which can hinder decision-making. The method used in this study is the Waterfall software development model, which comprises the stages of requirements analysis, system design, implementation, testing, and maintenance. Data collection was carried out through observation and a review of documentation relating to the existing system. The performance test results showed that the new system had an average response time of 1.2 seconds for real-time stock tracking. It also cut down the time needed to create inventory reports from about 120 minutes when done manually to just 1.8 minutes with the automated system. These results show a big boost in how well the operations are running and back up how good the new inventory information system is working. This system is expected to minimise human error, prevent stockouts and overstocking, and improve operational efficiency within the warehouse division of PT. Lintas Cakrawala

1. Introduction

Inventory management is a critical component of operations for companies in the distribution and retail sectors [1]. The ability to maintain a balance between product availability and storage costs is a key factor in determining the success of the customer order supply chain [2] . A lack of effectiveness in inventory

management can lead to various problems, such as lost sales due to stockouts and increased costs due to excess inventory [1] . There are three main types of inventory costs: holding costs, ordering costs, and shortage costs [3]. In the era of digitalization, access to accurate, real-time inventory data is no longer merely an advantage but a basic necessity for survival and competition. PT. Lintas Cakrawala, a company operating in the distribution sector, currently still uses manual methods to manage its inventory. The process of recording incoming and outgoing stock is done using notebooks and spreadsheets. This is prone to data entry errors, information inconsistencies, and duplicate entries. These limitations result in a lack of real-time stock visibility, making it difficult for management to make timely and accurate decisions regarding reordering or sales strategies. This situation creates potential risks that could harm the company's efficiency and profitability. The issues examined include a manual inventory recording process that is inefficient and prone to human error, thereby reducing the accuracy of stock data; a lack of real-time visibility into inventory data, which makes it difficult to monitor stock levels and risks causing stockouts or overstocking; and the time-consuming and often untimely generation of inventory reports, thereby failing to support strategic managerial decision-making.

Even though earlier research shows that using web-based inventory systems can help make inventory records more accurate and reports more efficient, most of these studies mainly look at automating transactions and keeping inventory records. Not much focus has been placed on using real-time stock tracking and automatic alerts as ways to control inventory ahead of time, especially in companies that handle distribution. This study is different from earlier ones because it doesn't just focus on keeping track of and sharing inventory information. Instead, it adds real-time stock checking and automatic alerts inside a web-based inventory system. These features help manage inventory better by showing stock levels right away and sending alerts when inventory gets low according to set limits. In addition, this study looks at how these features are used in the actual work setting of PT. Lintas Cakrawala, which offers real-world examples showing how effective they are in improving inventory management. This research has three objectives: (1) to analyze the current inventory management system at PT. Lintas Cakrawala and identify its functional shortcomings; (2) to design and develop a web-based inventory information system capable of automating recording and reporting processes; and (3) to optimize inventory management through the implementation of the developed system, thereby improving accuracy, efficiency, and effectiveness. The pressing need for PT drives the urgency of this research. Lintas Cakrawala is to transition from a manual system to an automated one. Reliance on manual processes has been shown to hinder a company's productivity. Small and medium-sized enterprises (SMEs) that still use traditional methods to manage inventory tend to experience operational cost inefficiencies of up to 20% and miss out on sales opportunities due to inventory uncertainty[4].

PT. Lintas Cakrawala faced a similar situation, where inaccuracies in inventory data directly impacted customer service and the company's cash flow. The use of information technology emerged as a rational and relevant solution. Web-based information systems have been empirically proven to provide comprehensive solutions to inventory problems [5] . An Information System (IS) is a combination of interconnected components that function to collect, process, store, and distribute information to support decision-making, coordination, and control within an organization [6]. The implementation of an inventory information system can address various challenges encountered with manual Excel-based methods, such as data redundancy, delays in updating information, and a high potential for input errors [7] . The choice of a web-based solution was also based on considerations of easy accessibility from various locations, more cost-effective development, and scalability to support future business growth. Therefore, this study is crucial to prevent ongoing operational losses and establish a strong technological foundation for PT. Lintas Cakrawala aims to achieve optimal inventory management and enhance its competitiveness. Several studies indicate that implementing an Inventory Information System positively impacts inventory management. An Inventory Information System is a type of information system specifically designed to manage various aspects of inventory [8] . A study of retail companies found that a web-based Inventory Information System was able to reduce inventory recording errors by up to 90% and speed up the monthly inventory process from 3 days to just half a day [9] . Additionally, this system provides data visibility that was previously lacking, allowing

management to identify slow-moving products and develop appropriate discount strategies. A study of SMEs in the food sector found that after implementing an Inventory Information System, companies were able to reduce storage costs by 15% through more effective inventory control [10], [11]. The automatic reorder point feature also prevents stockouts of flagship products, thereby increasing customer satisfaction. The use of web-based technology for inventory management is no longer an option but a necessity for companies seeking to remain competitive, as real-time data access is key to responding quickly to market changes [12].

From this literature review, it is evident that web-based Inventory Information System is an effective solution for addressing challenges in inventory management. However, its implementation must be tailored to the company's specific conditions and needs. This research will focus on the analysis and development of an appropriate system for the specific case at PT. Lintas Cakrawala is expected to bridge the gap between theory and practice in the field.

Some of the key features of modern Inventory Information System include [13]:

1. Master Product Data Management: Storage of detailed information for each product, including codes, names, suppliers, prices, and minimum and maximum stock limits.
2. Transaction Recording: Automation of the recording process for purchases and sales.
3. Real-time Stock Monitoring: Display of the latest stock levels accessible to authorized personnel.
4. Automated Reporting: Automatic and rapid generation of inventory reports, goods received/shipped, and stock movement reports.
5. Stock Notifications: The system provides automatic alerts when a product's stock approaches the minimum threshold.

Many past studies have shown that using web-based inventory systems can help make inventory records more accurate, cut down on repeated data entry, and speed up the process of creating reports. Most of these studies mainly look at how transactions are handled and how inventory is recorded. Not much focus has been placed on combining real-time stock tracking with automatic warning systems that help with better inventory management and making smarter decisions. There is not much research available that looks at these features in companies that focus on distributing products. This limitation leaves a gap in research because companies need more than just correct inventory records—they also need up-to-date information and automatic alerts to avoid running out of stock or having too much of it. This study is different from earlier research that mostly looked at handling and reporting inventory transactions. Instead, it combines real-time tracking of stock levels and automatic alerts into a web-based inventory management system. The suggested method is meant to improve the ability to track inventory, help make decisions more quickly, and better manage stock levels at PT. Lintas Cakrawala. So, this study aims to create and test a web-based inventory system that can make inventory management better by using real-time tracking and automatic control features.

2. Research Method

This study falls under the category of Applied Research, which focuses on solving practical problems faced by an organization, in this case, PT. Lintas Cakrawala. More specifically, this study is a Research and Development (R&D) project, as its primary objective is to produce a product in the form of a Web-Based Inventory Information System that can be implemented and evaluated for its benefits. This study adopts the Waterfall system development model [5]. Through the initial observation and in-depth interviews conducted with the management and warehouse staff of PT. Lintas Cakrawala, the functional requirements for the inventory system were fully defined, clearly understood, and locked in before the development phase began. Because the project scope was fixed and the client organization did not require incremental software deliveries, the sequential and structured workflow of the Waterfall model (analysis, design, implementation, testing, maintenance) proved to be the most appropriate, efficient, and logical choice for this specific system development[14].

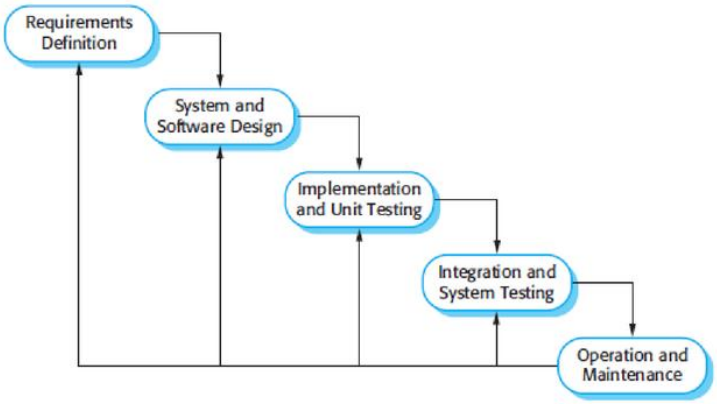

Figure 1. The Waterfall Method
Source: [15]

1. Requirement Analysis
   The analysis phase focused on evaluating the existing manual inventory workflow at PT. Lintas Cakrawala aims to establish a clear foundation for the new system. This was carried out through direct observation in the warehouse and semi-structured interviews with administrative and warehouse staff to understand the day-to-day operational challenges they face, whilst analysing the current stock ledger and Excel files. As a result, this phase successfully identified critical bottlenecks, such as data redundancy and delays in stock reporting, which were then translated into a comprehensive list of functional and non-functional requirements.
2. System Design Phase (System Design)
   Following the requirements gathering, the design phase was executed to create the technical blueprints of the proposed system. This process involved utilizing Unified Modeling Language (UML) diagrams, specifically Use Case, Activity, and Class diagrams, to map out the system's architecture and user interactions logically. Furthermore, the user interface was sketched to ensure an intuitive user experience. The outcome of this phase was a structured database schema and a clear visual guide that directly addressed the operational shortcomings identified previously[16].
3. Implementation Phase (Implementation)
   The implementation phase involved translating the design blueprints into a functional web-based application. This was achieved by writing the source code using the PHP programming language and managing the data architecture through a MySQL database[17].. The development environment was set up locally to systematically build the automated recording, real-time monitoring, and reporting modules. Consequently, this phase yielded a working prototype of the inventory information system ready for quality assurance.
4. Testing Phase
   To ensure system reliability, the testing phase was conducted to verify that the built application met all initial requirements. This was done through black-box testing techniques, where each input and output of the system's features—such as stock entry, stock out, and report generation—was evaluated without examining the internal code structure [18] . The outcome of this rigorous testing confirmed that all functional features operated accurately, and any minor logical errors discovered were immediately debugged and resolved.
5. Evaluation and Conclusion Phase:
   The final phase addressed the system's post-deployment sustainability to ensure its continuous alignment with company operations. This was carried out by deploying the system to a local server, providing a brief user manual, and establishing a protocol for future bug fixes or feature updates as the company grows. Ultimately, this phase ensured that the transition from the old manual method to the

new automated system at PT. Lintas Cakrawala was smooth, secure, and supported by a clear maintenance framework.

3. Result and Discussions

3.1 Analysis of the Current System

Based on the observation and interview phase conducted at PT. An analysis of the current inventory management system was conducted. The current business process is entirely manual. When goods arrive from suppliers, the Warehouse Manager records them in a logbook. At the end of the day, the administrative staff transfers the data from the logbook into a spreadsheet (Excel) to calculate the total inventory. A similar process occurs for goods issued due to sales. This business process has several weaknesses.

Figure 2. Business Process Flow

The description of Figure 2 begins with the Goods In/Out process, followed by manual recording in a ledger by the warehouse, data transfer to Excel by the administrator, and finally manual report generation. The notes regarding the risk of human error and the lack of real-time data refer to the data transfer and report generation processes.

The analysis identified three main issues:

a. Process Inefficiencies: There is duplication of work (recording in ledgers and Excel) that consumes time and resources.
b. Prone to Errors: The repetitive manual data entry process is highly prone to typos, incorrect item names, or calculation errors.
c. Delayed Information: Inventory data in Excel is updated only once a day. As a result, management cannot determine the actual inventory status in real time, leading to reorder decisions that are often late or inaccurate.

These findings provide a strong foundation for designing an information system solution capable of addressing all these weaknesses.

3.2 System Design Results

Based on the requirements analysis, a structured Web-Based Inventory Information System was designed.

1. Process Design Using UML

Use Case diagrams were used to illustrate the system's functionality. These diagrams show the interactions between users (actors) and the features available within the system.

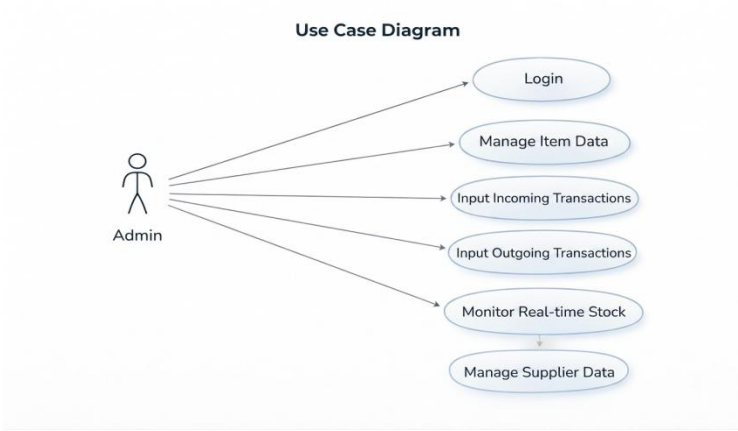

Figure 3. Use Case Diagram of the Inventory

Figure Description: The main actor, Admin, performs the login process and can carry out the following processes: Manage Product Data, Enter Inbound Transactions, Enter Outbound Transactions, Monitor Real-time Stock, Print Inventory Reports, and Manage Supplier Data.

2. System Architecture Diagram

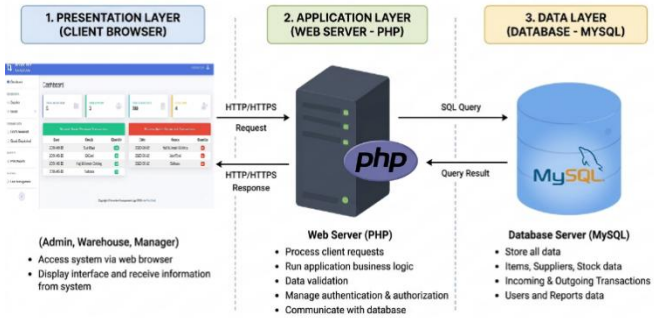

Figure 4. Three-Tier System Architecture

Description: Figure 4 The system adopts a three-tier architecture consisting of a presentation layer, application layer, and data layer. Users access the system through a web browser (client layer). Requests are processed by the PHP-based web server (application layer), which handles business logic such as inventory transactions, stock monitoring, and report generation. The MySQL database (data layer) stores all inventory, supplier, and transaction records. This architecture improves scalability, maintainability, and data consistency.

3. Database Design

The database structure is designed to ensure data integrity and avoid redundancy. Relationships between entities are modeled using an Entity-Relationship Diagram (ERD).

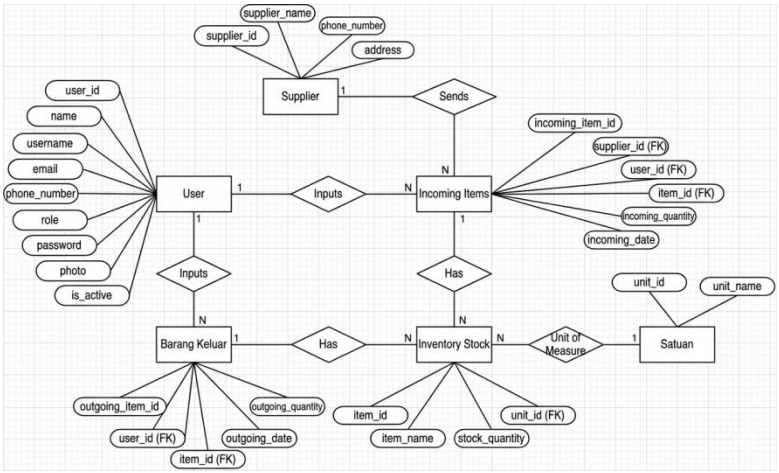

Figure 5. Diagram of the Inventory

Description: Figure 5 shows that the system is designed in a structured manner with clear relationships between entities, enabling effective data integration and inventory management. With the interconnections between tables, the system can generate accurate, real-time inventory information and support decision-making processes in inventory management.

3.3 System Implementation Results

The design was then implemented as a functional web application using the PHP programming language and a MySQL database. This system has several key features to optimize inventory management.

a. Real-time Monitoring Dashboard

The home page (dashboard) provides an instant overview of inventory status.

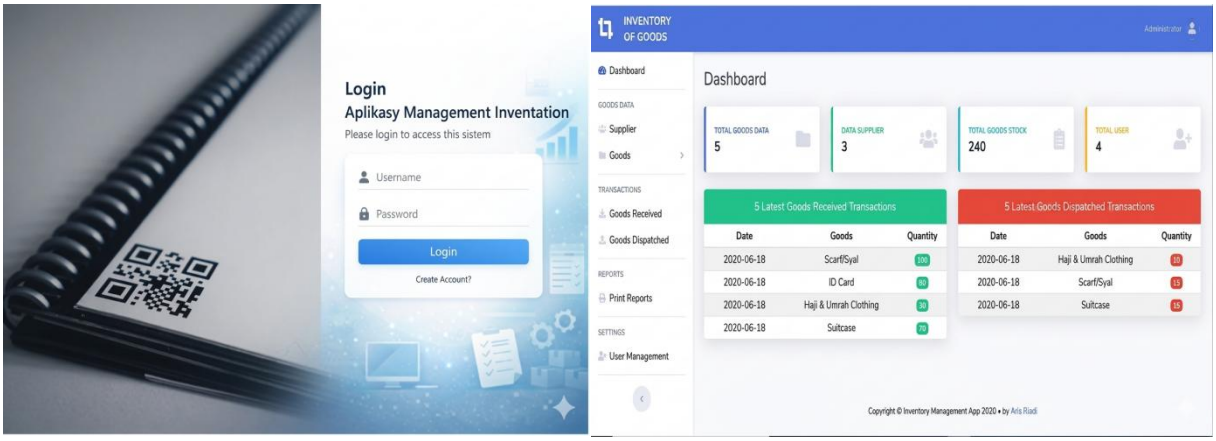

Figure 6. Dashboard displays

Figure 6 Description: The dashboard page displays information on the total number of items, items received today, and items shipped today. It also provides a summary of items that have reached their reorder point (marked in red), allowing managers to take immediate purchasing action without having to open the report menu.

b. Integrated Transaction Recording

The system provides structured forms for recording incoming and outgoing items. Every transaction saved will automatically update the stock quantity in the item master data.

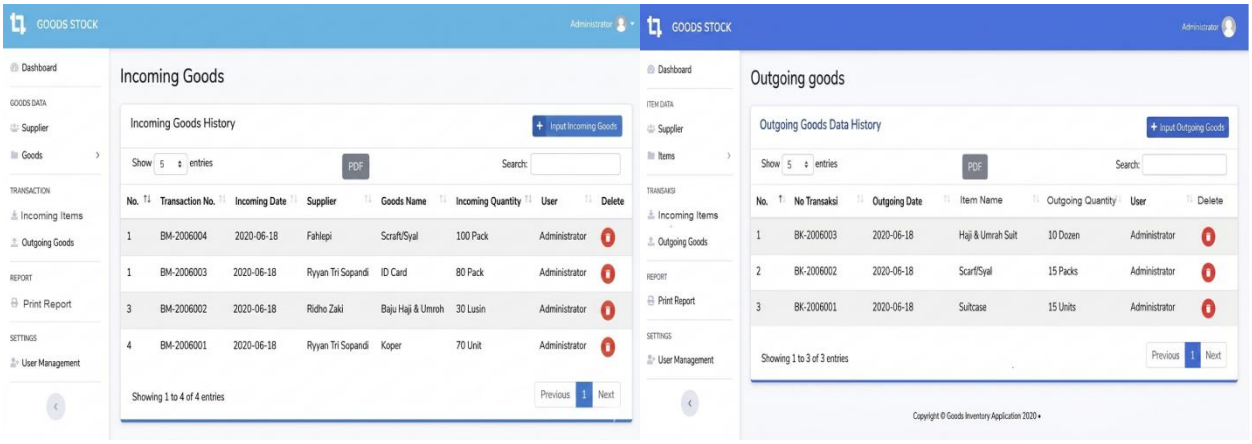

Figure 7. Transaction Input Form

Description: Figure 7 shows the input form with the following fields: No. Transaction Date (date picker), Select Supplier (dropdown from database), Select Item (dropdown from database), and Quantity (numeric input). There is a "Save" button to process the data.)

4. Automatic Inventory Reports

The system can generate inventory reports, goods-in reports, and goods-out reports with just one click. Reports can be filtered by date and printed in a neat format.

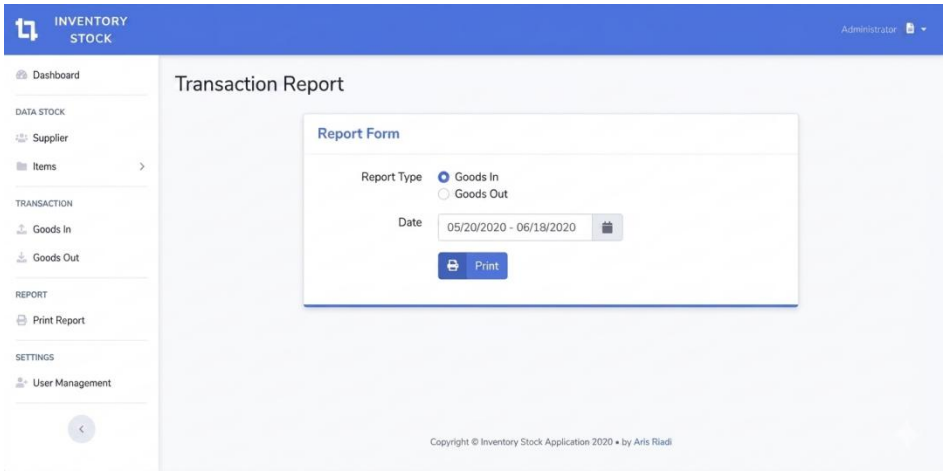

Figure 8. Inventory Report Display

Description of Figure 8 page report displaying a table with the following columns: Item Code, Item Name, Opening Stock, Total In, Total Out, and Closing Stock. At the top, there is a date range filter and a "Print Report" button.

3.4 System Testing Results

To ensure the system functions as required, testing was conducted using the Black Box method. The testing focused on functionality without examining the underlying program code. The following are examples of test results for several key features.

Table 1. Test Results

Test ID	Case Under Test	Input	Expected Output	Actual Output	Status
TC-01	Login Authentication	Username: admin, Password: admin123	User successfully logs into the dashboard	User successfully logged into the dashboard	Passed
TC-02	Add Product Data	Product Code: A001, Product Name: Laptop	Product data saved successfully	Product data saved successfully	Passed
TC-03	Edit Product Data	Product Name changed to "Gaming Laptop"	Product data updated successfully	Product data updated successfully	Passed
TC-04	Delete Product Data	Delete Product A001	Product data deleted successfully	Product data deleted successfully	Passed
TC-05	Incoming Goods Entry	Product: A001, Quantity: 50	Stock increased by 50 units	Stock increased by 50 units	Passed
TC-06	Outgoing Goods Entry	Product: A001, Quantity: 20	Stock decreased by 20 units	Stock decreased by 20 units	Passed
TC-07	Supplier Data Entry	Supplier Name: ABC Supplier	Supplier data stored successfully	Supplier data stored successfully	Passed
TC-08	Real-Time Stock Monitoring	Open inventory dashboard	Updated stock displayed correctly	Updated stock displayed correctly	Passed
TC-09	Low Stock Notification	Product stock below minimum limit	Notification displayed successfully	Notification displayed successfully	Passed
TC-10	Report Generation	Filter: October 2023	Transaction report generated correctly	Transaction report generated correctly	Passed
TC-11	Print Report	Click print button	Printable report displayed	Printable report displayed	Passed
TC-12	Logout Function	Click logout button	User successfully logged out	User successfully logged out	Passed

Test results show that all the key features designed are functioning properly and meet the specified requirements.

3.5 Performance Testing Results

Besides checking if the system works properly, they also tested how well it performs to see how fast and efficient it is. The testing was done on two important tasks: keeping track of stock in real time and creating inventory reports. The tests were done on a regular office computer that was linked to a local network. Each task was done ten times, and the average time it took to complete each task was noted. To check how well the system works, they also compared the old manual method with the new automatic system. The time it took to process things was checked and studied to see how much better the system performed after it was put in place.

Table 2. System Performance Test Results (Average Response Time)

Operation	Manual System	Proposed System	Improvement
Inventory Data Search	5 minutes	2.3 seconds	99.2%
Real-Time Stock Monitoring	Not Available	1.2 seconds	Real-Time

Operation	Manual System	Proposed System	Improvement
Inventory Report Generation	120 minutes	1.8 minutes	98.5%
Stock Availability Verification	15 minutes	3.1 seconds	99.7%

The results from the performance testing show a big boost in how well the operations are running after the web-based inventory information system was put in place. Real-time stock monitoring had an average response time of 1.2 seconds, making it possible to get inventory information almost immediately. The time it takes to create a report was cut down from about 120 minutes in the old manual system to an average of 1.8 minutes with the new automated system, which means the processing time dropped by 98.5%. These results show that the suggested system does more than just automatically track inventory; it also makes information more accessible and helps make faster decisions. The results back up the numbers mentioned in the abstract and show that the system works well for improving inventory management at PT. Lintas Cakrawala.

Figure 9. Image of Apache JMeter application performance testing

Figure 9. The performance testing results of the proposed inventory information system, conducted using Apache JMeter, show the average response time measured through Apache JMeter. The new system cut down the time needed for processing a lot compared to doing it by hand, and it worked smoothly without any mistakes during testing.

Based on performance testing, the proposed Web-Based Inventory Information System is believed to significantly enhance the efficiency of inventory management at PT. Lintas Cakrawala. The system had an average response time of 1.2 seconds for real-time stock monitoring and cut down the time needed to create reports from about 120 minutes when done manually to just 1.8 minutes with the automated system. These results show that the suggested solution works well in giving up-to-date inventory details and speeding up the work processes. Previous studies have shown that web-based inventory systems can enhance operational efficiency and data accuracy, and these findings are in line with these findings. Using inventory information systems has been found to make it easier to track inventory and lessen the amount of paperwork needed [7]. A separate study reported that recording mistakes dropped by 90%, and the time it took to process inventory went down from three days to just half a day[9]. When compared to these studies, this research shows similar improvements in how efficiently processes run, but it also includes features like real-time tracking of inventory and automatic alerts. Proactive inventory control is supported by these additions, not just

automating transaction recording. The quick response time seen in this study could be because of a few different reasons. The system was set up in a local organization where there wasn't a very high number of transactions, which meant the servers didn't have as much work to do compared to bigger warehouse systems. Second, the database was built using organized inventory tables and improved query processes, which helps get stock information quicker. As a result, the proposed system performed similarly to other inventory management systems that have been discussed in research studies. A comparable web-based inventory management information system implemented at a minimarket setting likewise automated recording, reporting, and stock monitoring processes in real time [19] , supporting the consistency of these efficiency gains across different retail contexts.

Even though these results look encouraging, there are some important things about the way the study was done that need to be mentioned. At first, the system was only checked through testing its features and measuring how well it performs, and all this was done in a controlled setting within the organization. The study didn't test how the system performs when there are a lot of transactions happening at the same time or when many users are using it together. Second, the level of user satisfaction and how easy the system was to use were not measured using standard tools like the System Usability Scale. Third, the study mainly looked at how inventory is managed during operations and didn't include more advanced features like connecting to point-of-sale systems[20], predicting customer demand, or using analytics to forecast inventory needs. These limitations might make it harder to apply the results to bigger companies that have more complicated inventory systems. Future studies should include big tests of performance using tools like Apache JMeter, do user-friendly checks with proven tools, and use forecasting methods to help with predicting inventory needs. These changes would offer a better way to assess how well inventory is managed and help make the suggested system more useful in real-world situations.

4. Conclusions and Future Works

This study successfully designed and developed a web-based inventory management information system for PT. Lintas Cakrawala using the Waterfall development model. The developed system was able to automate inventory recording, reporting, and stock monitoring processes in real time. Based on system testing, the application operated successfully according to functional requirements and contributed to reducing manual recording errors and improving operational efficiency. The implementation of the system also improved the availability of accurate inventory data, enabling faster and more effective decision-making within the company. These findings indicate that the adoption of information technology can significantly support inventory management optimization and strengthen business competitiveness.

Future works The new inventory information system helped make managing inventory more efficient, but there are still some areas where it can be improved. Future research should focus on the following improvements:

1. Demand Forecasting Module Future research should include a demand forecasting part that uses statistical and machine learning methods like ARIMA, Exponential Smoothing, or Random Forest. This change would fix the problem of only using past inventory data and would allow for better planning of inventory levels to lower the chances of running out of stock or having too much inventory.
2. Point-of-Sale (POS) Integration
   The current system works on its own, separate from the sales transaction systems. Future studies should use RESTful API integration to connect the inventory system with the point-of-sale platforms. This integration would let inventory levels update automatically after each sale, which helps keep track of inventory accurately as it happens.
3. Barcode and QR Code-Based Inventory Tracking
   Future growth should include using barcode and QR code technologies to make it easier to record transactions in the warehouse automatically. Experimental studies can check how fast transactions are processed, how many errors are reduced, and how much productivity improves when compared to using manual data entry methods.
4. System Scalability and Load Testing

This study looked at how well the system worked when it was operating as usual. Future studies should do big tests with many users at the same time using tools like Apache JMeter or others to check how stable the system is, how much work it can handle, and how fast it responds.

5. Usability Evaluation
   Future research should check how satisfied users are and how easy the system is to use by using standard tools like the System Usability Scale or the Technology Acceptance Model. This evaluation would give clear numbers showing how well users like the system and how effectively it works in real situations.

These future improvements are likely to make the inventory information system more scalable, smarter, and easier to use in real situations, while also fixing the issues found in the current study.

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