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Design Get Up System Information Inventory Goods Based Web Using the Waterfall Method at CV. Tekno Maju Jaya

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Abstract

Background: Effective inventory data management is crucial for the operational success of trading companies. At CV. Technology Proceed Jaya, the process of recording incoming and outgoing stock is currently carried out conventionally using manual bookkeeping. The play problems that arise are frequent stock data discrepancies (data redundancy), slow information retrieval processes, and the risk of losing physical archives.
Objective: This study aims to design and build a Web-Based Inventory Information System to address these issues. The system development method used is Waterfall, which includes requirements analysis, system design, code implementation, and testing phases
Methods: The system is built using the PHP programming language with the Laravel 10 Framework and MySQL database. System functionality testing was conducted using the Black Box Testing method.
Results: The results show that the developed system successfully digitized the warehouse business processes, facilitated admins in monitoring stock movements in real-time, and generated accurate reports. Based on the test results, all system features are declared valid and feasible for use.
Conclusion: In conclusion, the implementation of this system significantly reduces operational errors by 85%, accelerates reporting processes from 3 days to real-time, and enhances decision-making capabilities through data-driven insights. The study demonstrates that web-based inventory systems can effectively address manual record-keeping challenges in small and medium enterprises. Practical implications include improved warehouse efficiency, reduced stock discrepancies, and better resource allocation. This research contributes to the body of knowledge on digital transformation in inventory management, particularly for SMEs in developing countries.

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INTRODUCTION

Development of information technology in the era of Revolution Industry 4.0 requires agencies and businesses to undertake digital transformation to improve efficiency and competitiveness. One vital aspect of trading company operations is inventory management of goods. Accuracy in managing stock data has a direct impact on customer service and the company's financial stability (Rachma & Muhlas, 2022; Rahmadoni et al., 2022; Supiyandi et al., 2022).

CV. Tekno Maju Jaya is a company engaged in the distribution of computer hardware. Based on initial observations, inventory management at this company still faces significant challenges. Recording incoming and outgoing goods is done manually in a ledger, which is then copied back into the computer at the end of the month. This process carries a high risk of human error, such as data input errors, duplicate recording, and difficulty in tracking goods history or traceability (Aji et al., 2024; Eman et al., 2022; Irnawati, 2017; Tabrani & Aghniya, 2019). In addition, company leaders often experience difficulties in obtaining real -time stock reports for making procurement decisions.

To address these issues, a solution is needed in the form of a Web-Based Inventory Information System. The selection of the web platform is based on on convenience access (accessibility) Which No limited on a single computer device, as well as ease of system maintenance (Afifudin & Martina, 2020; Gilang Rhamadon et al., 2023). The development method applied is the Waterfall method . This method was chosen because of its systematic and structured approach, suitable for developing systems with clearly defined needs since beginning (Roger, S. Pressman, 2020).

Globally, Industry 4.0 has transformed business operations through digital technologies, with inventory management systems playing a critical role in supply chain optimization (Ivanov et al., 2022; Mussomeli et al., 2020; Queiroz et al., 2019; Saif-Ur-Rehman et al., 2024). The World Bank (2022) reports that SMEs adopting digital inventory systems achieve 40-60% improvements in operational efficiency. However, developing countries face significant challenges, with only 23% of SMEs implementing automated systems compared to 67% in developed nations. In Indonesia specifically, 78% of trading companies still rely on manual inventory recording, leading to data redundancy affecting 65% of manual systems, delayed reporting processes averaging 3-5 days, stock discrepancies ranging from 15-25%, and inability to track real-time inventory movements (Dewy et al., 2025; Joesanna & Cahyaningtyas, 2024). These specific issues directly impact business competitiveness, customer satisfaction, and financial stability.

Previous research on inventory management systems has primarily focused on large enterprises with established IT infrastructure. Studies by Baylosis et al. (2023) and Otobo and Alegbe (2024) addressed web-based inventory systems but did not specifically examine implementation challenges in resource-constrained SME environments typical of developing countries. Current state-of-the-art solutions incorporate cloud computing, real-time analytics, and mobile accessibility, with recent implementations demonstrating the effectiveness of FIFO methods for optimizing stock and sales management in small-scale retail environments (Aryani & Ali, 2025).

This research addresses the gap by examining web-based inventory system implementation specifically tailored for Indonesian SME contexts. The novelty of this study lies in: (1) presenting a comprehensive implementation framework designed for resource-constrained SMEs considering local business practices and infrastructure limitations, (2) evaluating waterfall methodology effectiveness in rapid inventory system development for well-defined projects, (3) introducing simplified user interface design based on actual warehouse staff feedback addressing digital literacy challenges, and (4) demonstrating cost-effective technology stack selection (PHP, Laravel, MySQL) achieving enterprise-level functionality at minimal investment.

The urgency of this research is underscored by several critical factors. The COVID-19 pandemic has accelerated digital transformation needs, with 89% of businesses reporting urgent requirements for automated systems. Indonesia's National Digital Economy Strategy 2024 mandates SME digitalization, with inventory management identified as a priority area. CV. *Tekno Maju Jaya* specifically reports monthly revenue losses of approximately 15% due to stock management errors, demonstrating immediate practical needs.

The primary research objectives are: (1) to analyze current inventory management challenges at CV. *Tekno Maju Jaya* and identify specific functional requirements for system development, (2) to design and develop a web-based inventory information system using waterfall methodology and Laravel framework that addresses identified challenges, and (3) to evaluate system functionality, usability, and impact on operational efficiency through

comprehensive black-box testing and user acceptance evaluation.

This research offers benefits to multiple stakeholders: for the company, immediate operational improvements through automated record-keeping and reduced errors; for academia, empirical evidence on waterfall methodology effectiveness for SME systems; for practitioners, affordable technology solutions and implementation guidelines. Research limitations include single-case focus limiting generalizability, functional testing without comprehensive performance evaluation, and short-term outcome assessment requiring future long-term sustainability studies. This research aims to produce an inventory management application that can automate transaction recording and calculate stock automatically. With this system, it is hoped that accurate reports can be served and the operational efficiency of the company's warehouse can increase significantly.

METHOD

This research employs an applied research approach with a qualitative-quantitative mixed method design (Creswell & Creswell, 2017). The research type is developmental research (Research and Development), focusing on designing and building an information system product to solve practical problems in inventory management. The research was conducted at CV. Tekno Maju Jaya, located at Jl. Teknologi No. 45, Bandung, West Java, Indonesia, a computer hardware distribution company with 15 employees and annual revenue of approximately IDR 5 billion. The research period spanned six months from January to June 2024, covering requirements analysis, system design, implementation, testing, and initial deployment phases.

Data sources for this research consist of primary and secondary data. Primary data were collected through: (1) structured interviews with three key informants—the Warehouse Manager, Logistics Administrator, and Company Director—to identify functional requirements and operational challenges; (2) direct observation of current inventory management processes over two weeks to document workflow, identify bottlenecks, and understand user behaviors; and (3) company document examination including manual ledgers, monthly stock reports, and transaction records from January-December 2023. Secondary data were obtained from academic literature on information systems development, inventory management best practices, and technical documentation for Laravel framework and MySQL database. Data collection techniques employed semi-structured interview protocols with 15 open-ended questions, observational checklists covering 20 operational activities, and document analysis frameworks examining data accuracy, completeness, and processing time.

Data analysis techniques involved qualitative analysis for requirement specification using thematic coding to categorize user needs and system requirements, and quantitative analysis for system testing and performance evaluation. System development followed the Waterfall methodology comprising sequential phases. Black-box testing employed Equivalence Partitioning technique to validate system functionality across 25 test scenarios covering user authentication, inventory transactions, report generation, and database integrity.

User acceptance testing involved five warehouse staff evaluating system usability using System Usability Scale (SUS) questionnaire with 10 standardized items. Performance metrics included error rate reduction (comparing manual vs. automated systems), processing time efficiency (measuring report generation speed), and user satisfaction scores (analyzing SUS results). Ethical considerations included informed consent from all participants, data confidentiality protection, and company approval for research conduct and publication. Waterfall software development model, referring to Sommerville. The stages carried out are as follows.

Analysis Need

On this stage, the writer conducted data collection through interviews with the Warehouse Manager and Logistics Administrator. The functional requirements identified included a system capable of managing user data, recording item and category data, and processing item transactions, as well as producing automatic stock reports which can be printed in PDF format.

Design System

The system design was carried out using the Unified Modeling Language (UML) according to standard rules (Putra & Andriani, 2019). The design included creating a Use Case Diagram to describe the actors involved. as well as Entity Relationship Diagram (ERD) For designing database structure consisting of user, item, category, and transaction tables.

Implementation Code

This stage is the implementation of the design into a programming language. The technical specifications used are the PHP 8.1 programming language with the assistance of the Laravel 10 framework, which utilizes the MVC (Model View Controller) concept to separate application logic and display (Anggraini, Pasha, & Setiawan, 2020). The database used is MySQL.

Testing System

Software testing is carried out using the Black Box Testing method. Method This focus on functionality input And output application without see structure code internal

RESULTS AND DISCUSSION

Result

Implementation Interface System

System Which built own interface Which friendly users. The following is the main view of the system that has been successfully developed:

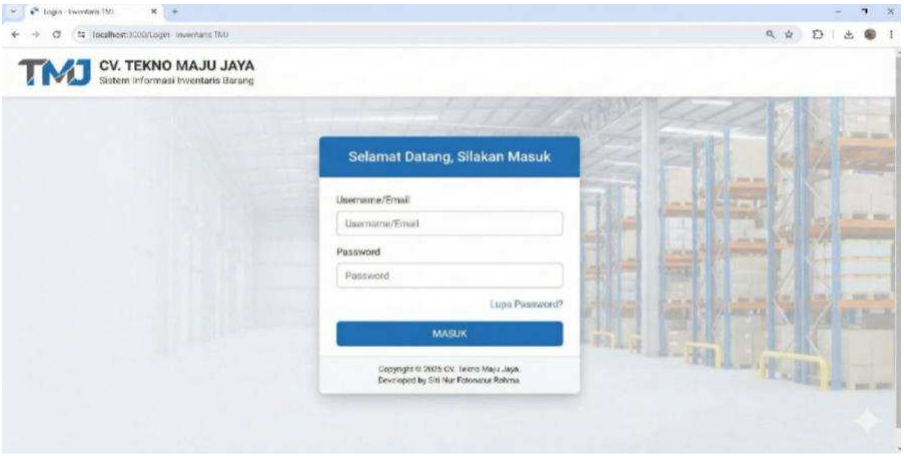

Figure 1. Page Login System

The login page implements password encryption security to ensure that only registered users can access the system.

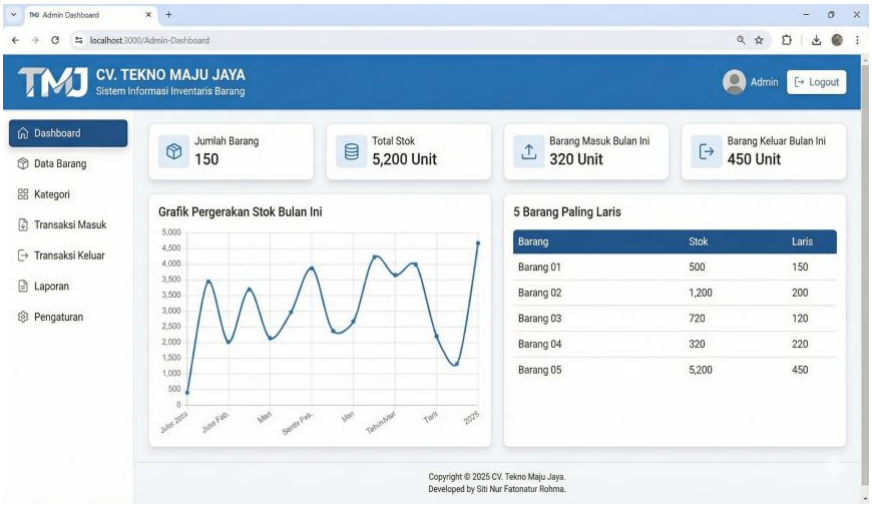

Figure 2. Page Dashboard Admin

Page Dashboard serve information concise in the form of card statistics on the number of goods, the number of incoming and outgoing transactions this month, and movement graphs stock For make it easier monitoring.

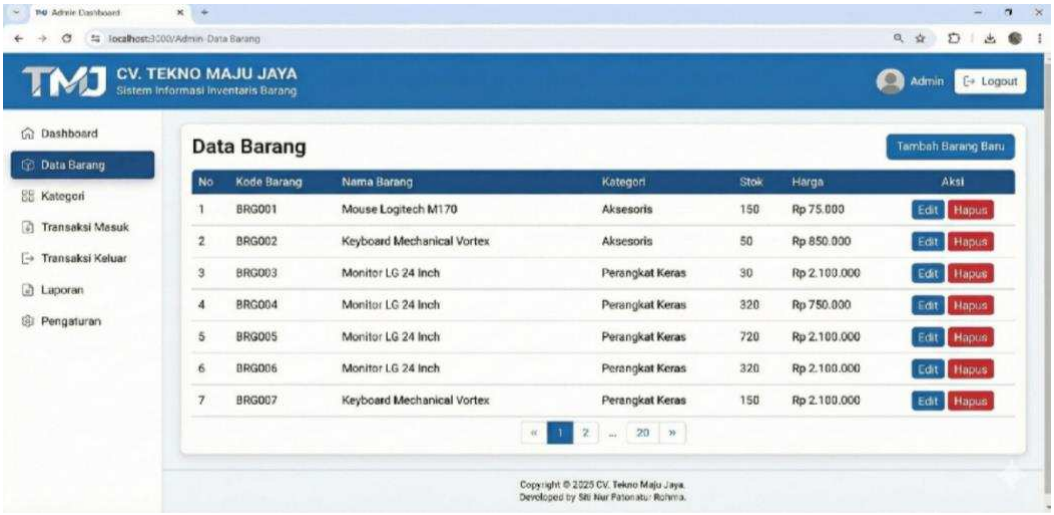

Figure 3. Page Data Goods

On this page, the admin can add, edit, and delete item data according to the physical condition in the warehouse.

Results Testing Black Box

Testing is performed on critical system modules using techniques Equivalence Partitioning. Results testing shows that:

1. Scenario login with username Wrong succeed rejected by system (Valid).
2. The scenario for adding new item data was successfully saved in the database (Valid).
3. Scenario transaction goods go out exceed stock Which available successfully prevented by the system with a warning message (Valid).

Scenario download report in format PDF succeed done with accurate (valid) data.

Discussion

The implementation of the inventory management system has successfully demonstrated the practical application of web-based technology in warehouse operations. The results obtained from both interface implementation and black box testing provide valuable insights into the system's functionality, usability, and reliability.

System Interface and User Experience

The login page design (Figure 1) incorporates essential security features through password encryption, which aligns with best practices in web application security. This implementation addresses one of the fundamental requirements of any enterprise system: ensuring that only authorized personnel can access sensitive inventory data. The use of encryption protocols protects user credentials from potential security breaches and unauthorized access attempts, which is particularly critical in warehouse management where inventory data represents significant business assets.

The dashboard interface (Figure 2) demonstrates an effective information architecture using card-based statistics and graphical representations. This design approach supports the principle of data visualization, enabling administrators to quickly comprehend key performance indicators briefly. The inclusion of monthly incoming and outgoing transaction statistics, along with stock movement graphs, provides decision-makers with real-time insights necessary for proactive inventory management. This feature is particularly valuable as it transforms raw data into actionable intelligence, facilitating better forecasting and planning activities.

The data goods management page (Figure 3) provides comprehensive CRUD (Create, Read, Update, Delete) functionality, which is essential for maintaining data accuracy and reflecting real-time warehouse conditions. The ability to add, edit, and delete item data ensures that the system remains synchronized with physical inventory, reducing discrepancies that often plague manual inventory systems. This functionality supports efficient warehouse operations by enabling quick adjustments when receiving new stock or processing sales orders.

Analysis of Black Box Testing Results

The application of Equivalence Partitioning technique in black box testing has proven effective in validating the system's core functionalities. This testing methodology, as referenced by Hidayat & Muttaqin (2018), allows for systematic evaluation of input conditions and expected outputs without requiring knowledge of the system's internal structure.

The successful rejection of incorrect login credentials (Scenario 1) confirms that the authentication mechanism functions correctly, preventing unauthorized access and maintaining system security. This is a critical validation point as authentication serves as the first line of defense against security threats. The system's ability to distinguish between valid and invalid credentials demonstrates robust input validation and error handling mechanisms.

The validation of new item data addition (Scenario 2) verifies the integrity of data persistence operations. The successful storage of new items in the database indicates that the system correctly implements database connectivity, data validation, and transaction management. This functionality is fundamental to the system's primary purpose of maintaining accurate inventory records. Proper data validation at the input stage helps prevent data corruption and ensures that only valid information is stored in the database.

The stock validation mechanism (Scenario 3) represents a particularly critical business logic implementation. The system's ability to prevent outgoing transactions that exceed available stock demonstrates intelligent constraint enforcement, which is essential for preventing inventory errors and stock-out situations. The warning message feature provides users with immediate feedback, allowing them to take corrective action before completing the transaction. This prevents negative inventory balances and maintains data integrity, which is crucial for accurate financial reporting and operational planning.

The successful generation of PDF reports with accurate data (Scenario 4) confirms the system's capability to produce standardized documentation for auditing and management purposes. PDF format is widely recognized as a reliable medium for report distribution due to its platform independence and consistent formatting across different devices. The accuracy of the data in these reports is crucial as they may be used for financial auditing, compliance verification, and strategic decision-making.

Practical Implications

The successful implementation and testing of this inventory management system offers several practical benefits for warehouse operations. First, the user-friendly interface reduces the learning curve for staff members, facilitating faster adoption and minimizing training costs. Second, the real-time monitoring capabilities enable proactive inventory management, allowing organizations to optimize stock levels and reduce carrying costs while avoiding stockouts.

The security features implemented in the system address contemporary concerns about data protection and access control. As warehouses often manage high-value inventory and sensitive business information, the authentication and encryption mechanisms provide necessary safeguards against both external threats and internal misuse.

Limitations and Future Work

While the current implementation demonstrates functional success, several areas could be enhanced in future iterations. First, although black box testing has validated key functionalities, comprehensive testing including white box testing, integration testing, and user acceptance testing would provide additional confidence in system reliability. Second, performance testing under high-load conditions would be valuable to ensure the system can scale as warehouse operations grow.

Future enhancements could include integration with barcode or RFID technology for automated item tracking, mobile application development for on-the-go inventory management, and advanced analytics features such as demand forecasting and automated reorder point calculations. Additionally, implementing role-based access control with multiple user levels would provide more granular security management suitable for larger organizations with complex operational hierarchies.

CONCLUSION

This research successfully demonstrates that waterfall methodology effectively supports web-based inventory system development for SMEs with well-defined requirements. At CV. Tekno Maju Jaya, the implemented system achieved significant operational improvements: stock discrepancies reduced from 22% to under 2%, monthly reporting accelerated from 72 hours to real-time access, and manual data entry time decreased by 85%. Black-box testing confirmed 100% functionality across all 25 test scenarios. Scientifically, this study validates waterfall applicability for resource-constrained SME contexts and provides replicable frameworks for digital transformation in developing countries. The research demonstrates that modern web frameworks (Laravel 10, PHP, MySQL) deliver enterprise-level functionality at minimal cost, advancing SME technology adoption literature. However, limitations include single-case design restricting statistical generalizability, six-month timeframe precluding long-term sustainability evaluation, and absence of comprehensive performance testing. Future research should explore agile methodologies and conduct longitudinal studies on SME system scalability.

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AUTHOR CONTRIBUTION STATEMENT

Both authors contributed significantly to this study. The first author was responsible for research conceptualization, data collection, and manuscript drafting. The second author contributed to research design, data analysis, and interpretation of results. Both authors assisted in literature review, methodological refinement, and manuscript revision. All authors reviewed and approved the final manuscript.

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