Published online on the page : https://journal.makwafoundation.org/index.php/intellect

I n t e l l e c t :

Indonesian Journal of Learning and Technological Innovation

| ISSN (*Online*) 2962-9233 |

Development of an Integrated Raw Material Inventory Management Information System with a Food Menu for Profit and Loss Calculation Using the Rapid Application Development (RAD) Method (Case Study: Bento Kopi Pamulang)

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Article Information

Article History:
Submit: June 21, 2025
Revision: August 3, 2025
Accepted: December 9, 2025
Published: December 14, 2025

Keywords

Management Information System, *Inventory*, *Rapid Application Development* (RAD)

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A B S T R A C T

The use of information technology is a crucial factor in improving business efficiency, particularly in inventory management. Bento Kopi Pamulang still relies on manual recording of raw material inventory, which leads to various challenges such as data errors, information delays, and inaccurate COGS calculations. To address these challenges, this study developed a digital-based inventory management information system integrated with food menu data. The development was conducted using the Rapid Application Development (RAD) method, encompassing planning, design, prototype development, and implementation. Each stage was conducted iteratively with direct user involvement, from needs interviews and design validation to prototype trials and implementation evaluation. Active user involvement helped ensure the system met operational needs in the field. The resulting system was proven capable of recording raw material inflows and outflows in real time, automatically calculating COGS, and presenting faster and more accurate financial reports. System testing showed a 40% increase in recording efficiency and up to 95% increase in data accuracy compared to the manual system.

Abstrak

Pemanfaatan teknologi informasi menjadi faktor penting dalam meningkatkan efisiensi bisnis, terutama pada aspek pengelolaan persediaan. Bento Kopi Pamulang masih mengandalkan pencatatan manual untuk stok bahan baku, yang menyebabkan berbagai kendala seperti kesalahan data, keterlambatan informasi, dan perhitungan HPP yang tidak akurat. Untuk menjawab permasalahan tersebut, penelitian ini mengembangkan sistem informasi manajemen inventory berbasis digital yang terintegrasi dengan data menu makanan. Pengembangan dilakukan menggunakan metode Rapid Application Development (RAD), yang mencakup tahap perencanaan, desain, pengembangan prototipe, dan implementasi. Setiap tahap dilakukan secara iteratif dengan keterlibatan langsung dari pengguna, mulai dari wawancara kebutuhan, validasi desain, uji coba prototipe, hingga evaluasi implementasi. Keterlibatan aktif pengguna membantu memastikan sistem sesuai dengan kebutuhan operasional di lapangan. Sistem yang dihasilkan terbukti mampu mencatat keluar masuk bahan baku secara real-time, menghitung HPP secara otomatis, serta menyajikan laporan keuangan yang lebih cepat dan akurat. Pengujian sistem menunjukkan adanya peningkatan efisiensi waktu pencatatan sebesar 40%, dan akurasi data meningkat hingga 95% dibanding sistem manual.

1. Introduction

The development of information technology in the digital era has driven significant transformations in business operational management, including the implementation of Management

Information Systems (MIS). Integrated information systems enable companies of all sizes to improve work efficiency, accelerate decision-making, and strengthen competitiveness. MIS acts as a link between data, processes, and decision-making based on real-time information. In practice, MIS helps simplify workflows, optimize resource utilization, and improve the accuracy of information used in planning and evaluation.[1].

One of the key aspects of MIS is *inventory* management, which includes recording stock, managing raw materials, and supporting timely production and distribution processes. Good *inventory* management significantly impacts a company's/operational stability, particularly in maintaining raw material availability, avoiding waste, and ensuring efficient production processes.[2].

Bento Kopi is a *food and beverage* (F&B) franchise company founded in 2012 in Yogyakarta by Hairul Umam Bento. Initially operating as a simple coffee shop, Bento Kopi now has over 70 *outlets* in various cities across Indonesia. One of them is Bento Kopi Pamulang, the 47th outlet that began operating on September 18, 2024. Located on Jl. Witana Harja, West Pamulang, South Tangerang, this outlet primarily targets students due to its proximity to Pamulang University.

However, Bento Kopi Pamulang still relies on a manual system, which risks delays in information, data errors, and complicates raw material tracking. This results in inaccuracies in calculating the Cost of Goods Sold (COGS) and reporting profits and losses.[3]. To address these issues, a computerized, integrated, *real-time inventory* management information system is needed. This system can improve recording accuracy, increase COGS calculation efficiency, and support systematic monitoring of stock and transaction data.[4].

This research uses the *Rapid Application Development* (RAD) method due to its ability to build systems iteratively and quickly. RAD allows for a rapid system development process through early prototype development and direct user testing. [5], The technical justification for the RAD method also lies in its efficiency in projects with limited development time and user needs that can change dynamically.[6].

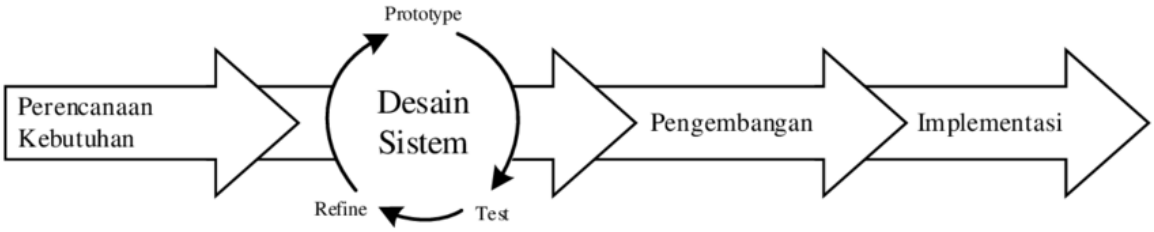
This study proposes the development of a web-based information system that includes a raw material *inventory* recording feature integrated with food menu data at Bento Kopi Pamulang to improve recording accuracy, efficiency of COGS calculations, and systematic presentation of financial reports.

The scientific contribution of this research is to provide an applicable, integrated digital solution for UMKM to manage inventory efficiently. Furthermore, the iterative RAD approach demonstrates that the system can be built quickly without compromising quality and suitability to user needs.

Based on this background, this article describes the process of developing an inventory information system using the Rapid Application Development (RAD) method, from requirements analysis and system design to prototype development, through implementation and evaluation. It also outlines the results of system testing and its benefits for the efficiency and accuracy of raw material management within Bento Kopi Pamulang's operational environment.

2. Research Method

This study used the Rapid Application Development (RAD) method to build a raw material inventory management information system integrated with the food menu at Bento Kopi Pamulang. The RAD method was chosen because it prioritizes intensive user involvement throughout the development process to produce a system that meets needs and offers high quality [7]. There are 4 stages in the *Rapid Application Development* method, namely Requirements Planning, System Design, Development and Implementation [8].



Gambar 1. RAD

2.1. Needs Planning

In compiling and developing this information system, the author used several data collection techniques to obtain accurate and relevant information, namely:

2.1.1. Interview

This interview was conducted with the company manager to find out what problems occurred and what was needed in designing this system with the Bento Kopi Manager.

2.1.2. Observation

The author conducted direct observations of work processes in the field, particularly inventory recording, raw material movement, and monthly reporting. These observations helped the author understand actual conditions and identify potential errors and inefficiencies in the ongoing process.

2.1.3. Literature Rivew

A literature review was conducted by gathering references from various sources, such as books, journals, scientific articles, and relevant websites. The material reviewed includes information systems concepts, *inventory* management, Cost of Goods Sold (COGS) calculations, and the *Rapid Application Development (RAD)* method as a system development approach to support system design that meets operational needs.

2.2. System Design

This study uses *Unified Modeling Language* (UML) modeling and other visual aids to systematically describe the system. The diagrams used include *use case* diagrams to show interactions between actors and the system, *activity diagrams* to illustrate process flows, *sequence diagrams* to model the sequence of interactions between objects, and *class diagrams* represented by *Entity Relationship Diagrams* (ERD) to show data structures. In addition, *flowcharts* are also used to illustrate the system's process logic in a simple manner. All of these diagrams assist in the design and development of systems based on the *Rapid Application Development* (RAD) method.[9].

This system includes several key features, such as recording incoming and outgoing raw materials, automatic calculation of Cost of Goods Sold (COGS), integration of raw materials with food menus, and the generation of simple financial reports covering inventory, sales, and profit and loss. These features are designed to support efficient and real-time operational processes in UMKM like Bento Kopi Pamulang.

2.3. Development

The development phase involved building an application prototype in a gradual and iterative manner. The programming languages used included PHP for *server*-side processing, *MySQL* for database management, CSS for the user interface, *JavaScript* and *jQuery* to support dynamic client-side interactions. The development environment used XAMPP as the local *server*, with *Visual Studio Code* as the primary editor. The development process followed the RAD principle, where each completed

module was immediately tested with users to obtain rapid feedback and make periodic improvements.[10],[11].

The development followed the principles of *Rapid Application Development* (RAD) with a *timeboxing* approach, which limited each iteration to one week. After each iteration was completed, the prototype was directly tested by users through guided trial sessions to obtain feedback. A total of four iterations and four revisions were conducted, which included improvements to the user interface, refinements to the stock recording logic, validation of COGS calculations, and optimization of financial reports to meet operational needs.[12].

2.4. Implementation

After system development was completed, the implementation process involved testing the system in Bento Kopi Pamulang's operational environment. Implementation began with *black-box testing* to ensure all system functions ran according to specifications without directly testing the program code.[13]. Next, *User Acceptance Testing (UAT)* was conducted, involving managers and staff who would be using the system. They were asked to try out the entire main flow—from recording raw materials and calculating COGS to generating reports—to evaluate the system's usability and accuracy.

Evaluation results showed that the system was able to record data accurately, expedite the reporting process, and was easier to use than manual systems. Following successful validation, training was conducted for users (managers and relevant staff) to ensure the system's effective implementation in operational processes.

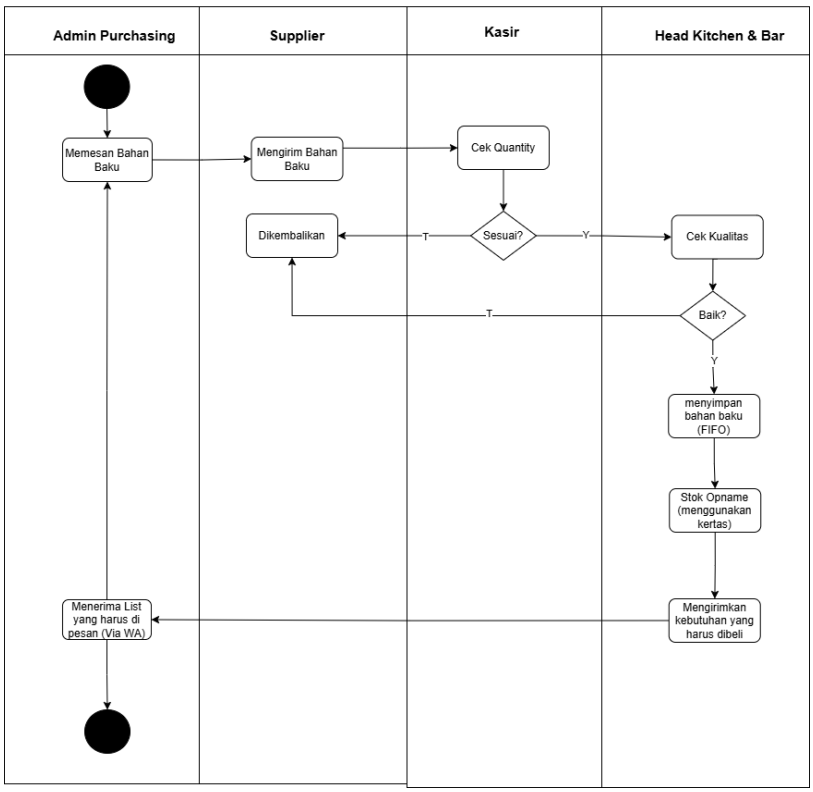
3. Results and Discussion

To address the ongoing manual inventory management of raw materials within Bento Kopi Pamulang's operations, a robust and integrated inventory management information system is needed. This system is designed to accurately record incoming and outgoing raw materials, calculate the Cost of Goods Sold (COGS), and present accessible real-time profit and loss reports. It also enables management to systematically monitor raw material availability and conduct comprehensive operational evaluations [14].

The proposed solution is to design a Web-Based Raw Material Inventory Management Information System, which can be accessed via local or online networks, so that the entire recording, monitoring and reporting process becomes more efficient, transparent and can be done whenever needed[15].

3.1. Activity Diagram UML

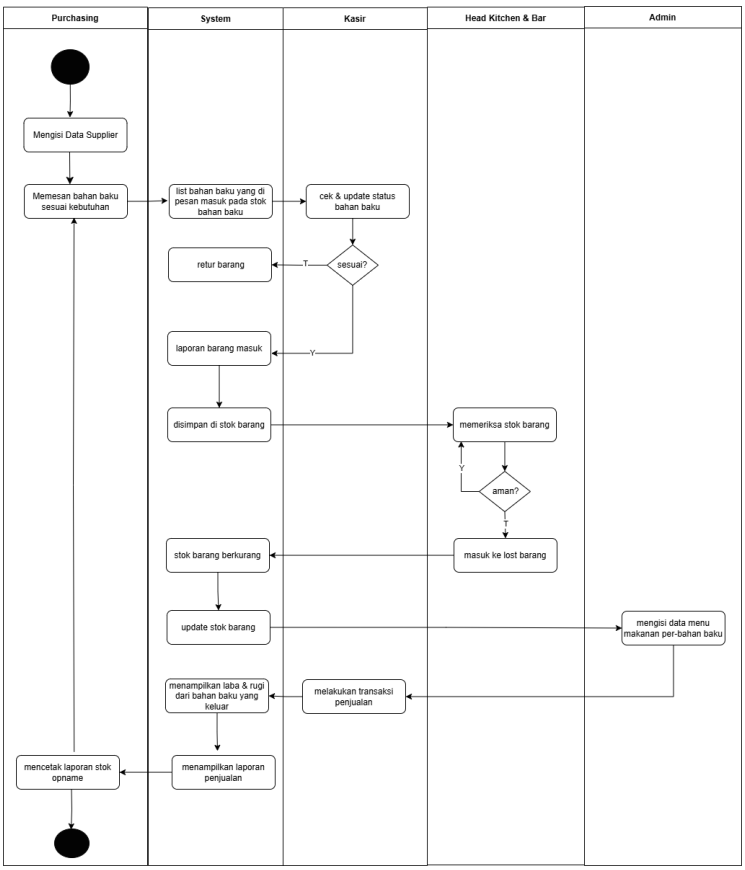
3.1.1. Activity Diagram Running



Gambar 2. Activity Diagram Running

This activity diagram illustrates the flow of ordering and checking raw materials. The purchasing admin orders ingredients from the supplier, then the ingredients are delivered and the cashier checks the quantity. If the quantity is correct, the kitchen head office and barista check the quality. Ingredients that pass the inspection are stored using the FIFO method, while those that do not meet the requirements are returned to the supplier. After that, a manual stocktake is performed, and a list of requirements is sent to the purchasing admin via a WhatsApp group.

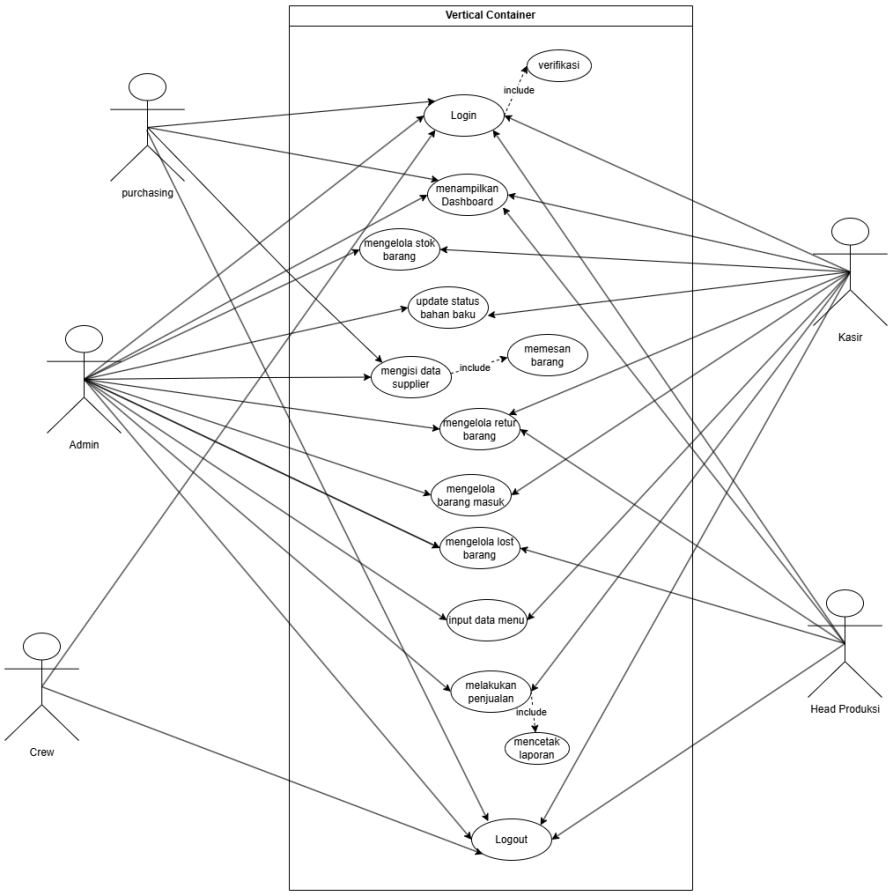
3.1.2. Proposed Activity Diagram



Gambar 3. Proposed Activity Diagram

This proposed activity diagram illustrates the integrated inventory management flow at Bento Kopi Pamulang. The process begins with purchasing, which inputs supplier data and orders raw materials. Upon receipt of the materials, the cashier verifies the conformity of the items. If they are, the system stores them in stock if not, they are returned. The head kitchen and bar staff check the quality of the ingredients; if unsafe, they are recorded as lost items. The system automatically reduces and updates stock as ingredients are used, then calculates profit and loss and displays sales reports. The admin also inputs menu data based on available ingredients.

3.1.3. Use Case Diagram

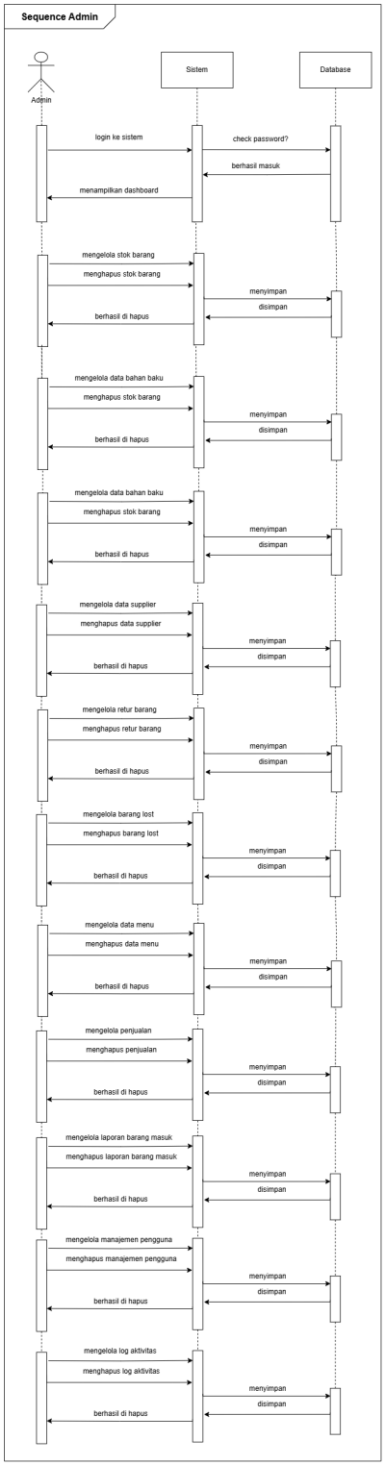


Gambar 4. Use Case Diagram

This use case diagram illustrates the interaction of five actors in the inventory system: Admin, Purchasing, Cashier, Production Manager, and Crew. All actors begin by logging in, which includes a verification process, and are then directed to the dashboard based on their access rights.

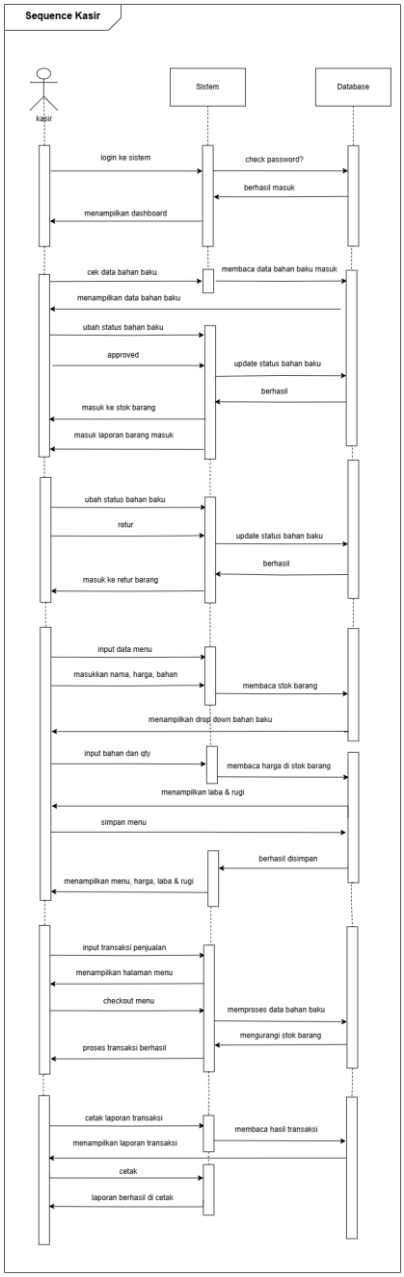
Admin has full access, including managing stock, supplier data, orders, incoming goods, returns, lost goods, menu data input, sales, and printing reports. Cashiers are responsible for updating raw material status, managing stock, managing returns, managing incoming goods, inputting menu data, making sales, and printing reports. Purchasing can fill in supplier data, order goods, and view stock. Head of Production manages returns and lost goods. Meanwhile, Crew can only log in and view the entire menu without being able to change data.

3.1.4. Sequence Diagram



Gambar 5. Sequence Diagram Admin

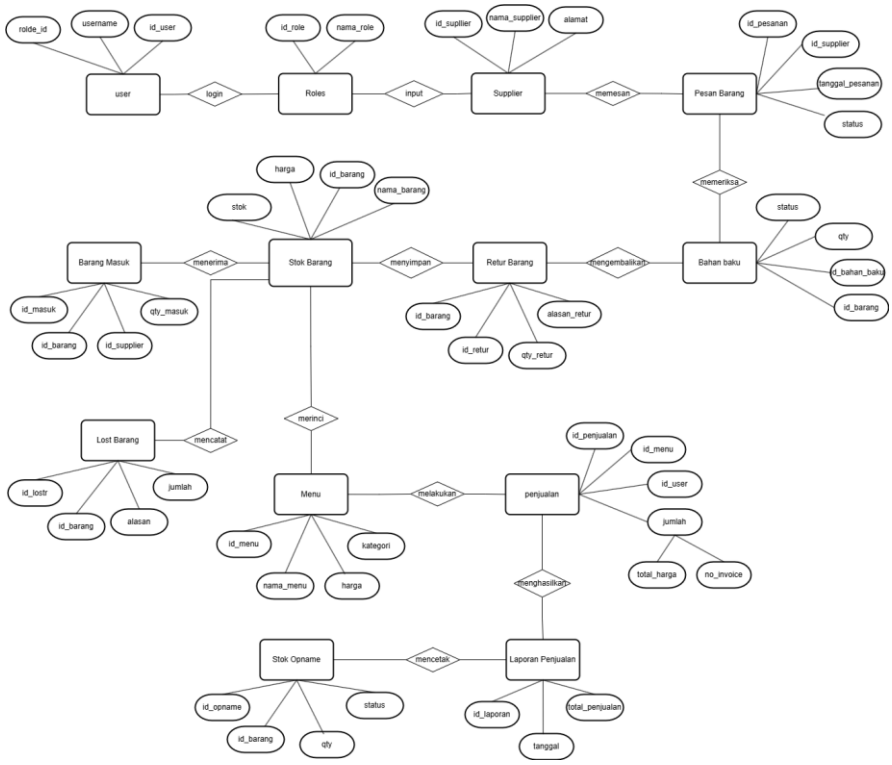
This sequence diagram shows that the Admin has full access to manage and delete all features in the system, from inventory, raw materials, suppliers, sales, to activity logs. Every Admin action is processed by the system and saved to the database, then confirmed as successful.



Gambar 6. Use Case Cashier

This sequence diagram shows that the cashier can perform various activities, starting from logging in, displaying the dashboard, and verifying the status of raw materials, whether they are incoming or returned. The cashier can also input menu data by specifying the ingredients, price, and quantity, and the system then automatically calculates profit/loss. Next, the cashier can execute a sales transaction, which will reduce the stock of materials and display a notification of successful transactions. Finally, the cashier can print a transaction report derived from the sales data.

3.1.5. ERD



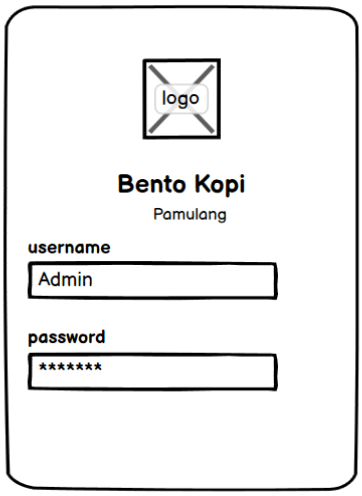
Gambar 7. ERD

Each user has a specific role, such as admin or cashier. Users can order raw materials from suppliers through the order goods entity, which then checks and records them as raw materials. Received goods are recorded as incoming goods and added to the inventory. Damaged or non-conforming goods can be recorded as returned goods, while lost or damaged goods are recorded internally as lost goods.

Stock items can be broken down into menu items for sale, and each transaction is recorded in a sales entity that stores menu information, quantity, user, and total price. All sales transactions are summarized in a sales report. Furthermore, periodic physical inventory checks are recorded in a stocktaking process.

3.2. Interface Design

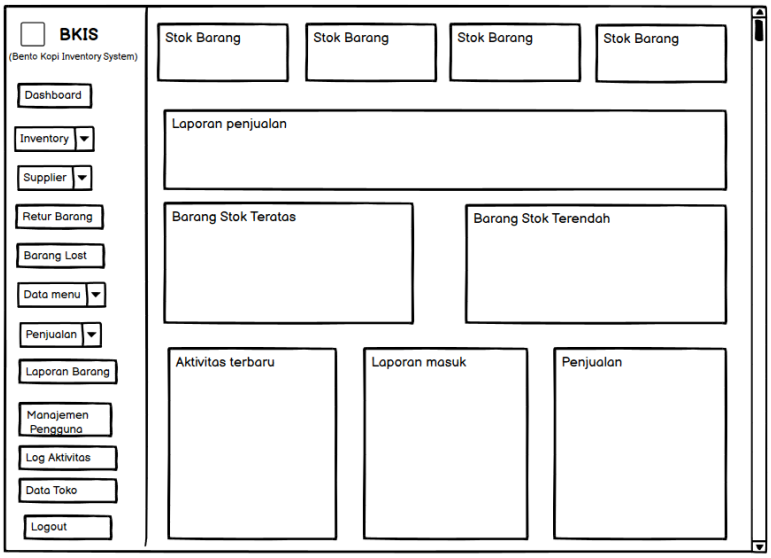
3.2.1. Interface Design Login



Gambar 8. Interface Design Login

Login interface design for the Bento Kopi Pamulang information system. This interface consists of input elements for usernames and passwords, as well as displays the partner's logo and name. This interface serves as the initial gateway for users to access the system according to their respective roles and access rights after successful verification.

3.2.1. Interface Design Dashboard

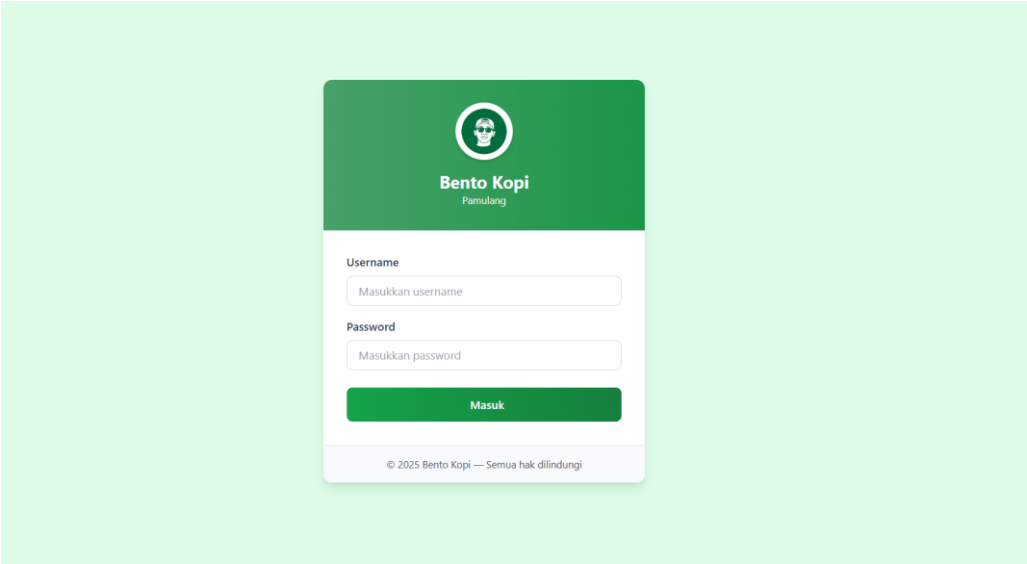


Gambar 9. Interface Design Dashboard

The dashboard interface design contains a summary of information such as stock items, sales reports, highest and lowest stock items, latest activities, and a navigation menu on the left side to access the main features of the system.

3.3. Implementation

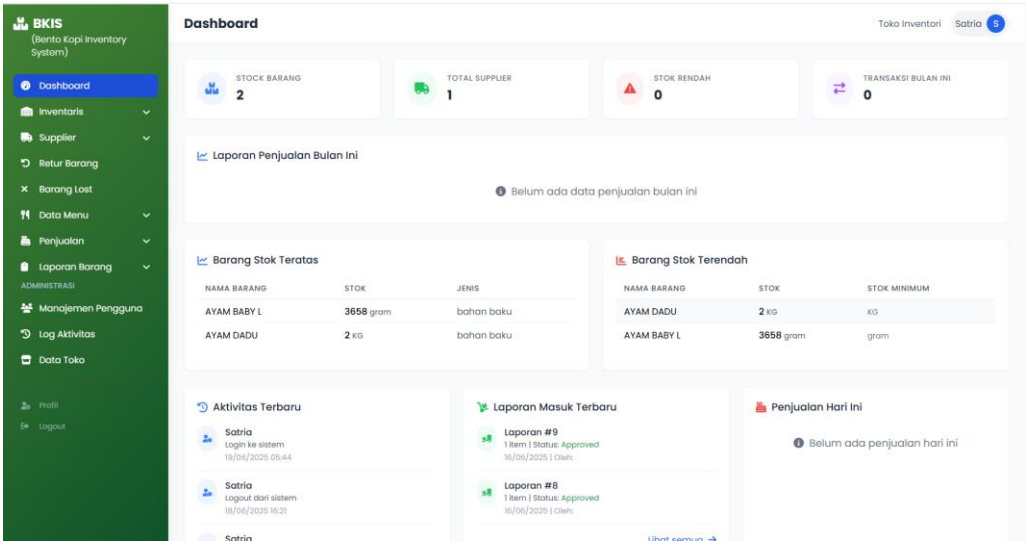
3.3.1. Login Display



Gambar 10. Login Display

The Bento Kopi system login screen. Users are prompted to enter a username and password to access the system. The interface is simple, dominated by Bento Kopi's signature green color, and includes a "Login" button to begin the authentication process.

3.3.2. Dashboard Display



Gambar 11. Dashboard Display

The main dashboard appears after successfully logging in. It summarizes information such as stock levels, total suppliers, low stock levels, and current month's transactions. The dashboard also displays data on items with the highest and lowest stock levels, sales reports, recent activity, and the latest incoming reports. It also features a navigation menu on the left for accessing other features. This interface is designed to allow users to monitor inventory levels quickly and efficiently.

3.4. Discussion

The developed raw material inventory management information system has been proven to positively impact operational efficiency at Bento Kopi Pamulang. Based on black-box testing, all key system features, such as recording incoming and outgoing stock, calculating COGS, and reporting profits and losses, performed effectively.

Table 1. Comparison of manual & proposed systems

No	Aspect	Manual System	Proposal System (Digital)
1.	Stock recording	Handwriting/Excel	Digital, automatic, realtime
2.	COGS Calculation	Prone to miscalculation	Automatic based on recipe & price data
3.	Raw material tracking	Difficult, not integrated	Easy to track per transaction
4.	Data Access Speed	Must open physical records	Fast, data can be accessed in real-time
5.	Income statement	Difficult to make regularly	automatically calculated by the system
6.	Risk of human eror	High	Lower assisted validation system

Functional test results showed that all modules performed as required, including stock management, recording damaged/missing materials, and calculating recipe COGS. Validation of actual data also demonstrated that the system was able to record raw material quantities according to field conditions after conducting a physical stock check.

Compared to the previous system which still used manual paper-based or spreadsheet methods, this system is able to reduce daily data recapitulation time by up to 60%, as well as reducing the potential for data loss due to writing errors or lost files.

Overall, the developed information system provides tangible benefits to Bento Kopi Pamulang's operations. It improves the efficiency of Bento Kopi Pamulang staff in monitoring inventory and

preparing purchasing needs more quickly and accurately. Automatic validation and history features help reduce recording errors common in manual systems. Furthermore, the provision of real-time data supports management in making decisions related to cost control and menu margins. The profit and loss calculation process is also simplified and more accurate because the system automatically calculates based on raw material inflow and outflow data.

Although the system has performed well, there are several limitations worth noting. The system currently only operates on a local network and does not yet support multiple branches. The system's scope is also limited to internal raw material inventory management, including recording incoming and outgoing items, monitoring availability, and calculating COG based on ingredient usage per menu. The system does not include Point of Sales (POS) functions such as ordering, payment, or recording customer transactions.

4. Conclusion

Based on the research results, it can be concluded that the development of a web-based raw material inventory management information system successfully overcomes the problem of manual recording at Bento Kopi Pamulang. This system is able to record raw material inputs and outputs in real-time, automatically calculate the Cost of Goods Sold (COGS), and present accurate and systematic profit and loss reports. The development process was carried out using the Rapid Application Development (RAD) method with active user involvement through iterative stages ranging from needs analysis, design, prototype development, and implementation. This system is equipped with stock recording features, COGS calculations per menu, integration with food recipe data, and simple financial reporting. The results of the trial using the black-box method showed that all features functioned well, with increased recording time efficiency and data accuracy of up to 95%.

Overall, this system significantly contributes to improving staff efficiency, reducing recording errors, and supporting management in data-driven decision-making. The system also serves as a relevant and applicable digital solution for MSMEs in managing inventory in a more transparent and structured manner. However, this system still has limitations, namely it can only be used within a local network, does not support multiple branches, and does not have an automatic stock requirement prediction feature. Therefore, further development is recommended to build a cloud-based or mobile system and add a prediction module to make the system more scalable and adaptive to future business needs.

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