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Warehouse Inventory System With Min Max Stock And QR Code Method In One Of The Printing Companies

Abstract

The swift advancement of computer-based information systems has markedly enhanced the efficacy of many operational tasks within organizations, especially in inventory management, which necessitates precision and efficiency. A printing company continues to rely on a manual system for documenting incoming and outgoing goods, retrieving item information, and overseeing stock levels, leading to frequent delays, inaccuracies, and inefficient workflows. This study formulates a comprehensive warehouse inventory system that uses the Min-Max Stock approach as a regulatory framework to establish minimum and maximum inventory thresholds, thereby averting shortages and excess stock. The system incorporates QR Code technology to enhance item identification, streamline recording, and deliver detailed item information. The deployment of this system is anticipated to improve operational efficiency, minimize recording errors, expedite data retrieval operations, and facilitate more precise decision-making in stock management at the printing company.

Keywords : *Inventory System, Min-Max Stock Method, QR Code, Warehouse Management, Stock Control*

INTRODUCTION

The advancement of information technology has driven substantial transformations across numerous industrial sectors, particularly in inventory management, which demands precision, speed, and efficiency. Computerized systems have emerged as a principal solution for delivering rapid and precise information in commercial operations. Inventory is essential to ensuring a company's seamless operations, as it is directly linked to storage, distribution, and meeting production requirements. Inventory management is a crucial component of the supply chain. Warehouses serve as storage facilities that require systematic organization and management to enhance material handling operations (Avuduri et al., 2025; Balaji et al., 2024).

Nevertheless, numerous organizations, especially those in the printing industry, continue to rely on manual inventory management. The procedures for documenting incoming and outgoing items, monitoring inventory levels, and retrieving product information are performed manually and maintained in distinct computer files. This scenario results in inefficiencies in data retrieval, service delays, and possible mismatches between actual inventory and recorded data. Moreover, data on items, including prices, descriptions, and photos, is not consolidated into a unified system, complicating employees' ability to find and verify information.

An integrated inventory system is required to enhance the effectiveness of inventory management. The Min-Max Stock approach serves as a regulatory tool to establish minimum and maximum inventory thresholds, hence averting shortages and surplus stock. The adoption of QR Code technology is perceived as a means to accelerate item recognition, streamline recording, and boost data accuracy. Implementing an inventory system that integrates the Min-Max Stock approach with QR Code technology enables organizations to enhance operational efficiency, reduce recording errors, accelerate information retrieval, and facilitate improved decision-making in inventory management.

A. Information

The term "information" originates from the French word "information," which derives from

the Latin "informationem," signifying thought, idea, or outline. The term 'information' denotes the process of knowledge transmission. It comprises a compilation of data or facts that are transformed into a valuable resource for the recipient. Information is typically processed initially to facilitate comprehension by the recipient; in other words, it is presented in a format that is valuable or relevant (Ngan Ton et al., 2024).

B. Inventory System

An inventory system is used to enter inventory data into a database, minimizing input and output errors while facilitating the generation of reports tailored to individual requirements. The data is organized according to specific protocols, ensuring its readiness for use and proper maintenance within the database (Hernandoko & Widyo Laksono, 2023).

C. Min-Max Approach

The min-max stock method is a technique for managing safety stock levels that uses minimum and maximum inventory policies. This method entails regulating minimum and maximum inventory thresholds by structuring stock ordering strategies to avert shortages (stockouts) or surplus inventory (overstock) (Hermawan et al., 2025).

D. QR Code

The Quick Response Code, or QR Code, is a two-dimensional barcode developed by the Japanese firm Denso Wave in 1994. This barcode type was originally used to track car spare parts inventory and has since been adopted across many business sectors for marketing and promotional purposes. The QR Code was originally designed to enable rapid content translation (Dharmakirti et al., 2024). A key feature of QR Codes is their ability to store information horizontally and vertically, enabling greater data storage than a one-dimensional barcode. Currently, QR Codes are widely used through applications like QR Code Readers and QR Code Generators, enabling users to easily generate QR Code content and retrieve the desired information by scanning it with their smartphone camera.

E. Microsoft Visual Basic .NET

Microsoft Visual Basic (VB) is a programming language that provides a visual Integrated Development Environment (IDE) for developing software applications on the Microsoft Windows operating system, utilizing the Component Object Model (COM) programming model. Certain scripting languages, such as Visual Basic for Applications (VBA) and Visual Basic Scripting Edition (VBScript), resemble Visual Basic but function distinctly. Developers can create apps with the components offered by Microsoft Visual Basic. VB programs can use the Windows API, but they require additional external function declarations (Mauidzoh et al., 2025).

F. Unified Modeling Language (UML)

UML was established by the Object Management Group in 1997 with version 1.0 and functions as a design instrument for object-oriented systems. The inception of UML is influenced by established notions, notably Object-Oriented (OO) modeling, which parallels systems with real-world situations characterized by objects. These objects are denoted by distinct symbols, rendering OO standards-compliant and autonomous [7]. The UML categories include the Use Case Diagram, which illustrates the behavior of the information system to be developed, facilitating the identification of available

functions and the permitted users of those functions (Lailiyah et al., 2025).

The Class Diagram delineates the system's architecture by specifying the classes that can be instantiated to construct the system. A class consists of attributes, which are its variables, and methods, which denote its functionality. The Activity Diagram illustrates the organized flow of data and operations within a system (Audina & Bakhtiar, 2021). The Sequence Diagram delineates the behavior of objects within a use case by illustrating their lifespans and the messages exchanged among them. To construct a sequence diagram, it is essential to identify the objects pertinent to a use case and the methods of the instantiated classes, with the quantity of sequence diagrams reflecting the established use cases and their message interactions (García-Chávez et al., 2022).

METHOD

The waterfall method is a structured, linear approach to software development. The process commences with the delineation of user needs. It advances through many planning phases, encompassing planning, modeling, and system construction, culminating in the delivery of the software to users and the requisite support. The initial phase, analysis, involves interviewing firm officials to collect data and pinpoint existing problems that necessitate research assistance. A literature survey identifies pertinent sources for review, while defining problem boundaries helps constrain the scope to the author's competencies. This step entails analyzing both hardware and software requirements for the application.

The design step, following the analysis, entails creating multiple UML diagrams, including use case, class, sequence, and activity diagrams, as well as an Entity-Relationship Diagram (ERD). The coding phase marks the apex of the development process, during which the application design is implemented in VB.NET. Upon completion of the analysis, design, and coding phases, the testing phase commences, considered the final step in system development. The author employs black-box testing to assess the program's performance. Subsequently, post-delivery, the program may be modified to accommodate new peripherals or operating systems, ensuring its continued efficacy in its environment.

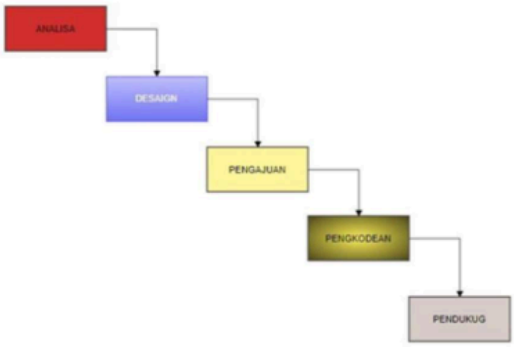

Figure 1. Waterfall Method

RESULT AND DISCUSSION

Developers might utilize the interview results as a reference to construct the sales system by

identifying the stakeholders. All actors' needs have been clearly delineated in the actor identification, as illustrated in the table below.

Table 1. Actor Identification

No	Actor	Information
1	Admin	This is an actor who manages applications, including suppliers, incoming goods, outgoing goods, order processing, creating invoices, delivery notes, shipping labels and reports.
2	Owner	This is an actor who can only see goods information, incoming and outgoing goods data, invoices and reports.
3	Warehouse	Is an actor who manages applications in the form of suppliers, incoming goods, outgoing goods and reports.

a. Design

A use case refers to a particular task, such as system login, data creation, or data deletion. In this sense, an actor is a human entity that engages with the system to do certain tasks. The use case diagram for the storage information system features three actors: Admin, Warehouse, and Owner. User data administration is handled by the administrator, who is responsible for adding, modifying, and removing users. The following is a detailed account of the business events and user interactions with the system.

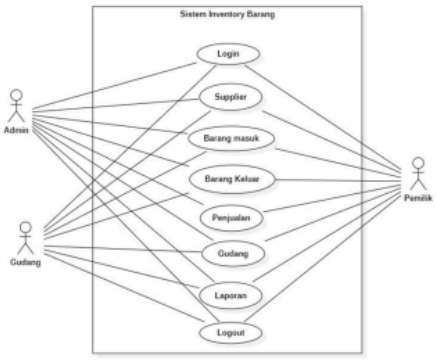

Figure 2. Use Case Diagram

Table 2. Login Use Case Narrative

Usecase	Login
Actor	Admin, Owner, Warehouse
Description	This use case describes the process of users (Admin, Owner, Warehouse) logging into the system to access the dashboard, and changing their account password if necessary.
Pre condition	The user is already registered in the system and has a valid username and password.
Main flow of event	

Action Actor	System Response
1. User opens login page	2. The system displays the login page.
3. The user enters the username and password.	
4. Click "Login"	5. The system validates the entered data
Alternate course	Alt 5.1 If the username or password is incorrect, the system will display an error message and ask the user to repeat the login process.
Post Condition	The user successfully logs into the system and is directed to the dashboard page or the system displays an error message if the login fails.

Table 3. Use Narrative Sales Admin

Use Narrative Sales Admin	
Objective	Sales Admin section can access the dashboard
Description	This system allows actors to process customer data, goods data, user data, sales orders, delivery orders, and invoices.
Actor	Admin
Initial Conditions	Actor opens dashboard
Actor	System Reaction
The actor selects the menu	The system will display the master data, sales transactions, and reports submenu.
The actor chooses to logout.	The system will display the process and exit from the activity.
Final Condition	If the command matches, the system will display what the actor selected.

Table 4. Narrative of Incoming Goods Use Case

Usecase	Incoming goods
Actor	Warehouse
Description	The warehouse can input data on newly incoming goods, change data if there is an error, delete invalid data, view a list of incoming goods, and print a report on the list of incoming goods.
Pre condition	The warehouse has been logged into the system
Main flow of event	
Action Actor	System Response
1. Warehouse opens incoming goods menu	2. The system displays the incoming goods page.
3. Warehouse selects goods input option	4. The system displays a form for adding new incoming goods data.
5. The warehouse fills in incoming goods data such as name of goods, quantity, qty, etc.	6. The system saves incoming goods data to the database.
7. Warehouse selects incoming goods list option	8. The system displays all stored incoming goods data.
Alternate course	Alt. 7.1 Warehouse can select the option to edit or delete incoming goods
	Alt 7.2 Warehouse can select the print incoming goods list option and the system will display a preview of the incoming goods list that will be printed.
Post Condition	Incoming goods data is successfully saved, updated, deleted, or printed according to the activities carried out.

b. Activity Diagram

The following activity diagram depicts the workflow of a menu system within the sales information system application:

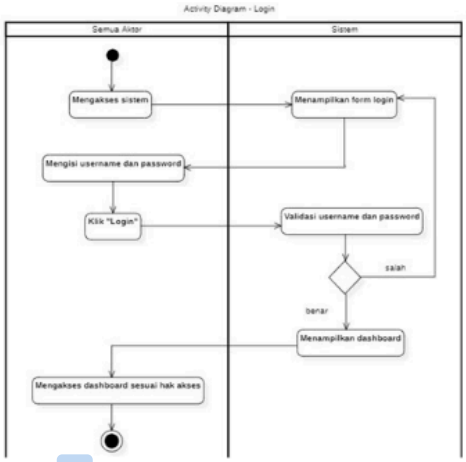

Figure 3. Login Activity Diagram

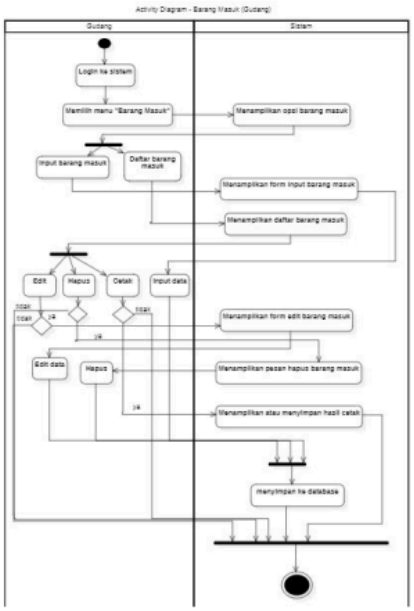

Figure 4. Activity Diagram for Incoming Goods

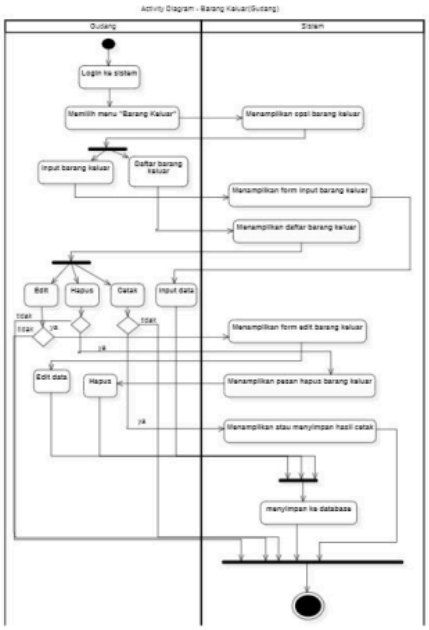

Figure 5. Activity Diagram for Outgoing Goods

c. Sequence Diagram

The Sequence Diagram illustrates the order of messages sent between objects at particular moments during system execution. Objects are depicted as boxes, lines with arrows represent messages, and the timeline is illustrated as a series of vertical processes. The following is the sequence diagram for the login procedure of the storage information system:

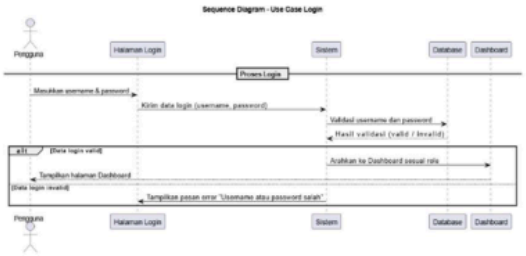

Figure 6. Login Sequence Diagram

d. Class Diagram

This class diagram delineates the objects that constitute a system and the interrelationships among the object classes within it.

Figure 7. Class Diagram

e. System Architecture

The system architecture comprises the interaction between users and the web server via the internet and web browsers on user devices. The web server functions with the XAMPP application and employs MySQL as the database server. The diagram of the system architecture has been generated below:

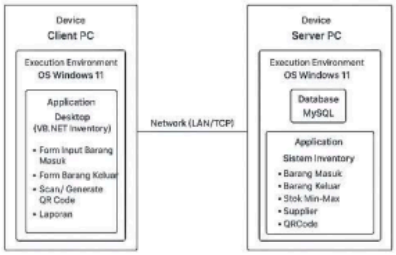

Figure 8. System Architecture

f. Database Implementation

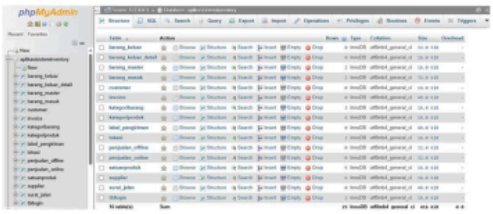

Figure 9. Database Table

g. Implementation of the Min Max Stock Method

The transaction data for arriving and leaving items employs the Min-Max Stock technique. This method aims to establish the minimum and maximum thresholds for stock storage using specified filters. The following are the commands from the Min-

Max Stock methodology on the incoming and outgoing items pages:

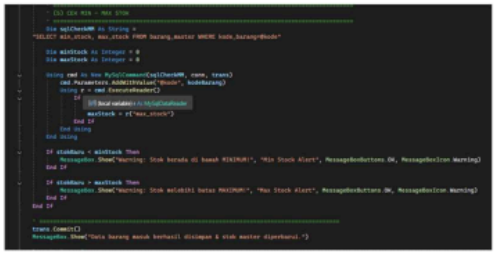

Figure 10. Check Min Max Stock of Incoming Goods

```
'Cek stok min-max
If Not CekStokValid(kode, qty) Then
    trans.Rollback()
    Exit Sub
End If
```

Figure 11. Check Min Max Stock of Outgoing Goods

h. Interface Implementation

During the implementation phase, the interface is developed according to the designs established in the preceding stage to enhance user comprehension of the system.

Figure 12. Login Page Implementation

Figure 13. Implementation of the Dashboard Page

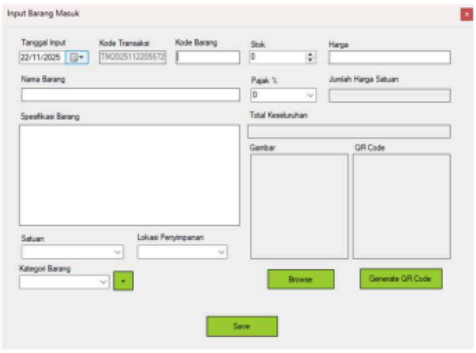

Figure 14. Implementation of the Incoming Goods Page

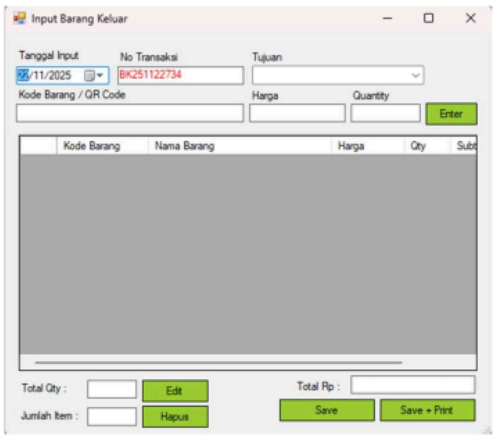

Figure 15. Implementation of the Outgoing Goods Page

i. Testing

This application testing emphasizes Black-Box Testing to assess the system's functionality and analyze program execution outcomes. It guarantees that designated inputs will activate the appropriate processes and yield outputs consistent with the design.

Table 5. Login Testing

No	Testing Scenario	Input	Expected Output	Results
1	Login with correct username and password	username: admin, password: correct	The system accepts login and enters the dashboard.	Succeed

2	Login with correct username, wrong password	username: admin, password: wrong	The system rejects and displays the message “Wrong password”	Succeed
3	Login with unregistered username	unknown username	The system displays the message “Username not found”	Succeed
4	Login without filling in any of the fields	empty username or empty password	The system rejects login and asks you to complete the data.	Succeed
5	Logout	Click the logout button	The system returns to the login page.	Succeed

Table 6. Testing of Incoming Goods

No	Testing Scenario	Input	Expected Output	Results
1	Adding new item data	Complete data (name, unit, initial stock, min–max)	Complete data (name, unit, initial stock, min–max)	Succeed
2	Adding item data without filling in any of the fields	Empty field	The system rejects and displays an error message.	Succeed
3	Changing item data	Change of name/stock/unit	Data changes according to input	Succeed
4	Delete item data	Select item → delete	Data deleted from the items table	Succeed

Table 7. QR Code Generation Testing

No	Testing Scenario	Input	Expected Output	Results
1	Generate QR Code	Valid Item ID	QR Code is formed and appears in PictureBox	Succeed

2	Generate QR Code with empty Item Id	Empty ID	The system rejects and displays an error message.	Succeed
3	Saving QR Code	Click the save button	Saved QR Code PNG file	Succeed

CONCLUSION

The established system, utilizing the Software Development Life Cycle (SDLC) Waterfall methodology, has been executed systematically from the analytical phase to testing. This method efficiently addresses problems that were hitherto managed manually. The system optimizes data recording, management, and presentation processes, making them swifter, more precise, and more efficient. Functions such as transaction documentation, item data administration, automated database storage, and report generation have demonstrated enhanced support for users in their daily operations. Test findings indicate that all functionalities perform well and meet user requirements, rendering the system suitable for routine operational tasks.

REFERENCES

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