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Web-Based Hotel Inventory Information System at Guna Wijaya Hotel Pati

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Abstract. Inventory management at Hotel Guna Wijaya currently relies on manual ledgers, leading to inaccurate real-time data and risks of record loss. Key challenges include difficult stock monitoring and delayed reporting due to manual recapitulation. This study develops a web-based inventory information system to enhance transparency, stock accuracy, and reporting efficiency using the Waterfall model: requirements analysis, system design, implementation, and testing. System design utilized Unified Modeling Language (UML), while testing employed Black Box and User Acceptance Testing (UAT) focusing on Role-Based Access Control (RBAC). Results demonstrate that the system successfully prevents data duplication through a Double-Check Validation feature on item names and locations. The digitalization significantly reduces report generation time from days to seconds using a Reporting Engine integrated with WhatsApp and Email. Furthermore, the Safety Stock Alert feature effectively provides early warnings to prevent shortages. Overall, the system improves monitoring, maintains data integrity, and supports efficient managerial decision-making at Hotel Guna Wijaya.

Keywords: Black Box Testing, Hotel Inventory, Stock Management, Waterfall Model, Web-Based System.

1 Introduction

waterstability within the hospitality industry. Among the various operational assets, inventory represents a critical component, including guest room amenities, housekeeping equipment, food and beverage supplies, office materials, and other supporting resources. Proper inventory management ensures the continuous availability of essential items, minimizes operational interruptions, and contributes to overall hotel performance [1]. In contrast, inadequate inventory control may lead to stock shortages, excessive inventory accumulation, increased operational costs, and a decline in service standards [2]. From an operations management perspective, inventory functions as a buffer mechanism that reduces uncertainty in supply and demand processes. Within hotel environments, insufficient inventory levels may directly disrupt room preparation, restaurant services, and maintenance activities. Therefore, inventory management should be viewed not only as an administrative recording process but also as a strategic factor influencing service reliability and organizational sustainability[3]. Despite rapid technological advancements, many small- and medium-sized hotels still rely on conventional inventory management practices such as handwritten logbooks and basic spreadsheet documentation. These manual approaches are highly susceptible to human error, duplicated records, delayed updates, and difficulties in generating accurate and timely reports [4]. Furthermore, the absence of real-time monitoring systems and automated control mechanisms restricts management's ability to make prompt and informed decisions, particularly during peak occupancy periods and increased operational demand [5].

Similar challenges are encountered at Guna Wijaya Hotel Pati, where inventory data are recorded manually by different departments. This fragmented approach increases the risk of inconsistencies and inaccurate stock balances[6]. The lack of an integrated inventory information system complicates stock supervision, monitoring of incoming and outgoing transactions, and identification of minimum stock thresholds [7]. As a result, replenishment decisions are often delayed, leading to operational inefficiencies that may negatively affect guest satisfaction [8]. Field observations and interviews with hotel personnel further revealed several operational gaps, including: (1) reliance on manual ledger-based recording, (2) absence of centralized and synchronized inventory data, (3) lack of automated minimum stock monitoring, and (4) time-consuming manual report recapitulation. These limitations highlight the necessity for an integrated and automated inventory management solution tailored to hotel operational characteristics. Previous research has shown that web-based inventory information systems can enhance data accuracy, streamline reporting processes, and strengthen inventory control mechanisms. These systems provide real-time data accessibility, enable automated report generation, and reduce redundancy in data entry[9]. Additionally, web-based platforms allow access from multiple devices and

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locations, thereby supporting more efficient supervision across departments. Nevertheless, many existing systems primarily focus on digitizing inventory records without incorporating advanced operational features such as real-time alert mechanisms, Safety Stock monitoring, automated cross-platform notifications, and structured user acceptance evaluation within hospitality contexts[10]. This condition indicates a research gap in integrating inventory control principles with responsive web-based systems specifically designed for hotel environments. The decision to adopt a web-based architecture in this study is supported by several practical considerations. Web-based systems facilitate centralized database management that can be accessed simultaneously by multiple departments without requiring local software installation [11]. Compared to mobile-only solutions, web platforms provide broader administrative functionality and are better suited for reporting and monitoring activities. Furthermore, enterprise-level cloud-native systems often demand higher investment costs and complex infrastructure, which may not be appropriate for small- and medium-sized hotels. Therefore, a web-based approach offers a cost-effective, scalable, and operationally suitable solution for Guna Wijaya Hotel.

The implementation of the Safety Stock feature in this research is grounded in inventory control theory, where safety stock serves as a reserve quantity maintained to prevent stockouts caused by demand variability or supply delays. By integrating predefined minimum thresholds into the system, automated notifications are triggered when stock levels fall below critical limits. This proactive mechanism enables management to take timely corrective actions and reduce the risk of operational disruption.

In response to the identified challenges, this study proposes the development of a web-based inventory information system tailored to the operational needs of Guna Wijaya Hotel Pati. The proposed system integrates real-time stock monitoring, Safety Stock Alert functionality, and automated notifications via WhatsApp and email to enhance inventory control and managerial responsiveness [12]. Through these integrated features, the system is expected to improve data reliability, support proactive decision-making, and increase operational efficiency in hotel inventory management[13]. Compared to prior studies that mainly emphasize digital transformation of inventory documentation, this research integrates real-time synchronization, automated validation mechanisms, Safety Stock alerts, WhatsApp-based notification integration, and structured User Acceptance Testing (UAT) within a hospitality operational framework. This integrated design contributes both practically to improving hotel management efficiency and theoretically to the advancement of web-based inventory systems in the hospitality sector.

2 Methods

This study adopts a Research and Development (R&D) approach to design and implement a web-based inventory information system for Guna Wijaya Hotel. The system development process follows the Waterfall model, which consists of five sequential phases: requirements analysis, system design, implementation, testing, and maintenance [14]. This structured approach ensures that each development stage is completed systematically before proceeding to the next phase. The Waterfall model was chosen because the operational procedures of the hotel were already clearly defined and stable. Since the system requirements were well-documented through interviews and observations, a linear development model was considered appropriate. The structured nature of Waterfall allows comprehensive documentation and minimizes requirement changes during development, making it suitable for organizational-based information systems. Data collection was conducted through interviews with hotel staff, direct field observations of inventory workflows, and literature review related to inventory management systems. These techniques were employed to identify both functional and non-functional requirements. Functional requirements identified include user authentication, role-based access control (Admin, Manager, and Housekeeping), master data management, stock-in and stock-out transaction processing, Safety Stock threshold configuration, automated notification features, and reporting modules. Non-functional requirements include system security, data integrity, real-time synchronization, usability, and performance efficiency. During the requirements analysis phase, operational challenges and system specifications were clearly defined. The design phase focused on developing system architecture, database schema modeling, and user interface structure using Unified Modeling Language (UML) diagrams [11]. The implementation phase translated the design into an operational web-based application. System testing was conducted to verify functionality and minimize potential errors, while the final phase ensured system deployment and ongoing maintenance to support long-term performance sustainability. In terms of technical architecture, the proposed system adopts a client–server model. The frontend interface is accessed through web browsers, while backend processing is implemented using the Flask framework. Data storage utilizes a MySQL relational database to ensure structured and reliable data management. Integration with external communication services, including WhatsApp notifications and email distribution, is facilitated through an API layer to enable automated alert delivery and real-time synchronization across departments. This development flow is depicted more clearly in Figure 1.

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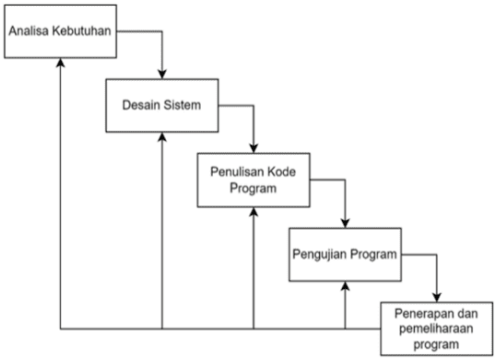

Figure 1. Stages of the Waterfall Method

3 Results and Discussion

3.1 Needs Analysis

The needs assessment phase involved direct observations and interviews with Guna Wijaya Hotel personnel. Findings indicated that the existing manual inventory processes, which rely on logbooks and spreadsheets, frequently lead to data discrepancies, clerical errors, and delayed stock synchronization. Personnel faced challenges in real-time monitoring, tracking transaction flows, and maintaining optimal stock levels. Consequently, this study identifies a critical need for an automated system featuring centralized data management, transactional logging, automated reporting, and alert mechanisms to enhance operational control.

3.2 System Design

In this phase, the findings from the requirements analysis are integrated into a comprehensive system design. This design process encompasses the development of the system architecture, database structure modeling, and user interface design to optimize inventory management [11]. System functionality and user interactions are modeled using UML diagrams, while the interface design prioritizes usability to facilitate hotel staff operations. The outcomes of this design stage will serve as the primary foundation for the software implementation process in the subsequent development stage.

3.2.1 Context Diagram

The context diagram of the Guna Wijaya Hotel Inventory System describes the flow of data between the system and three user roles: Admin, Manager, and Housekeeping. The Admin is responsible for managing master data, users, and reports. The Manager handles inventory-related activities and transaction monitoring without access to user data management, while Housekeeping performs operational data entry with limited access to reporting features.

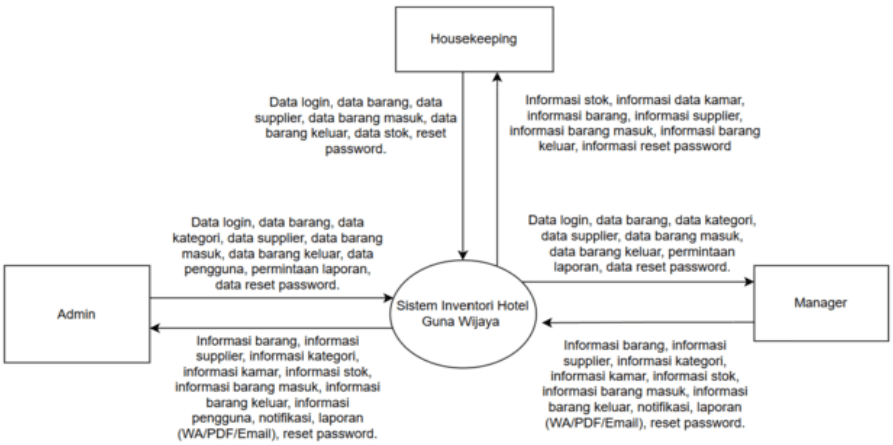

Figure 2 Context Diagram

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3.2.2 Use Case Diagram

The Use Case Diagram defines the interactions between three primary roles: Admin, Manager, and Housekeeping. It establishes a clear access control hierarchy, where the Admin possesses full administrative authority, the Manager oversees inventory reports, and Housekeeping manages operational stock transactions. Furthermore, the system incorporates essential security features, including authentication and self-service password recovery, to ensure data integrity across all user levels.

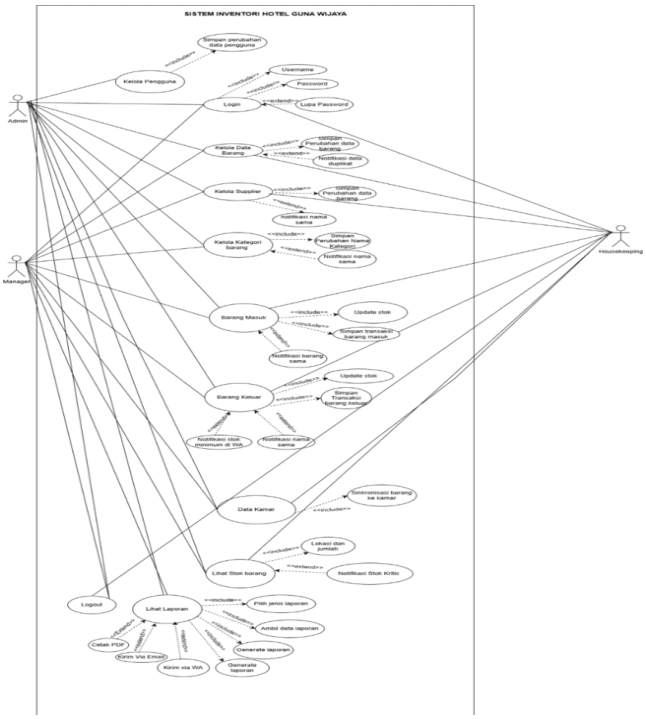

Figure 3. Use Case Diagram

3.2.3 Activiity Diagram

The operational mechanism for incoming goods is illustrated using three primary swimlanes: User, System, and Database. The workflow commences with user authentication, followed by the entry of incoming stock data. To ensure stock integrity, the system automatically performs validation to prevent data duplication. Once validated, the information is permanently stored in the database. Furthermore, the system supports update and delete functionalities with a feedback mechanism in the form of success notifications, ensuring that every modification is accurately recorded and synchronized within the latest inventory list. The Activity Diagram of the stock-in process is shown in Figure 3.

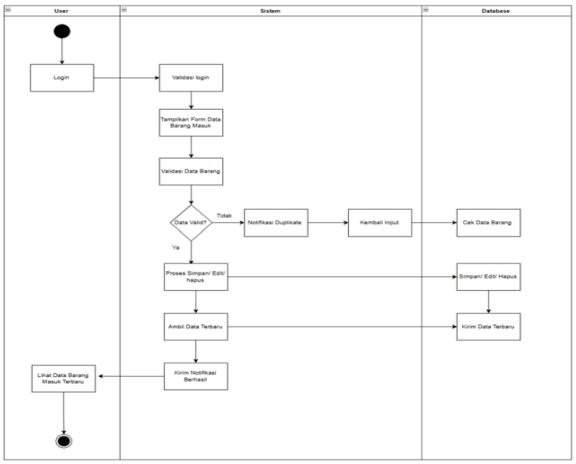

Figure 4. Activity Diagram of Stock-In Process

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The operational workflow for outgoing goods is mapped across three primary swimlanes: User, System, and Database. The process begins when the actor selects the stock-out feature to record a transaction. The system automatically performs a stock level validation to ensure that the requested quantity does not exceed current inventory levels. Upon successful validation, the system updates the stock balance and commits the transaction record to the database. Additionally, the system facilitates data modification and deletion, synchronized with the database to provide success confirmations. This integrated workflow ensures that every outgoing transaction is accurately documented and reflected in real-time within the inventory list. The Activity Diagram of the stock-out process is shown in Figure 4.

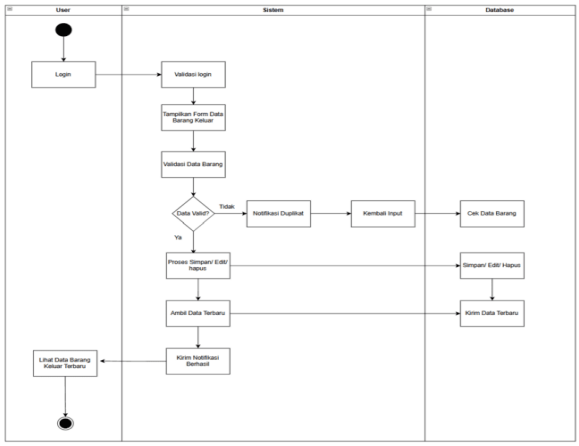

Figure 5. Activity Diagram of Stock-Out Process

3.2.4 Sequence Diagram of Inventory Transaction Process

The Sequence Diagrams for stock-in and stock-out transactions illustrate the dynamic interactions between the user, the transaction interface, the system logic, and the database in managing logistics at Guna Wijaya Hotel. The process initiates when the user inputs transaction data based on the item's name and location. The system then queries the database to verify the item's existence. If the item is found, the system triggers a confirmation notification: 'Item Already Exists, Continue to Save?'. The diagram utilizes operators to handle user decisions; if the user selects 'Yes, Continue to Save', the system executes the instruction to update the stock in the database until a 'Transaction Successful' message appears. Conversely, if the user selects 'Cancel', the system terminates the process and redirects to the main menu. This confirmation mechanism is designed to minimize input errors and maintain real-time accuracy of inventory data.

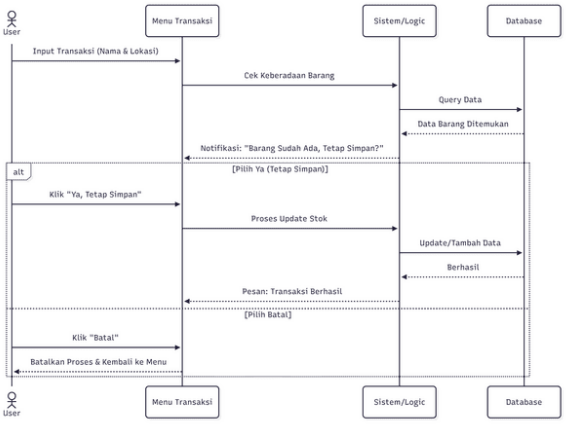

Figure 6. Sequence Diagram

3.3 Implementation

In this stage, the system design is translated into functional code using the Python programming language and the Flask framework. To ensure the reliability of the application, rigorous unit testing is performed on each component. This process identifies and resolves potential logic errors at the functional level before the system proceeds to full-scale integration.

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3.3.1 Login Interface Admin, Manager, Housekeeping

The login page serves as the system's primary gateway to implement user access control. This interface requires authentication via valid usernames and passwords to ensure the security of Guna Wijaya Hotel's inventory data. Although the system employs Role-Based Access Control (RBAC), the login interface is designed uniformly across all roles, including Admin, Manager, and Housekeeping. The visual representation of the login interface is presented in Figure 7.

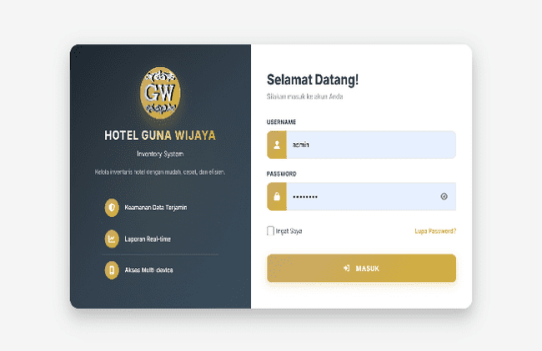

Figure 7. Login Interface

3.3.2 Dashboard Interface

The dashboard interface provides a comprehensive summary of inventory information, including total items, stock-in and stock-out volumes, minimum room stock availability, supplier data, and reporting modules. The dashboard design is identical for both Admin and Manager roles to ensure consistent monitoring of inventory status. This interface is illustrated in Figure 8.

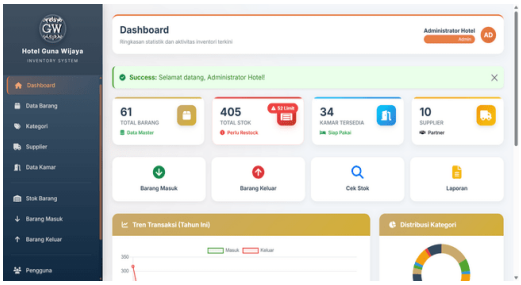

Figure 8. Dashboard Interface

3.3.3 Item Data Interface

This page facilitates the management of the hotel's inventory database, encompassing the addition, update, and deletion of item records. The information displayed includes the item name, category, stock levels, units, and action features. While the interface is designed uniformly for all roles, the system implements access restrictions where housekeeping users are not authorized to delete data records. The layout of the item data management page is illustrated in Figure 9.

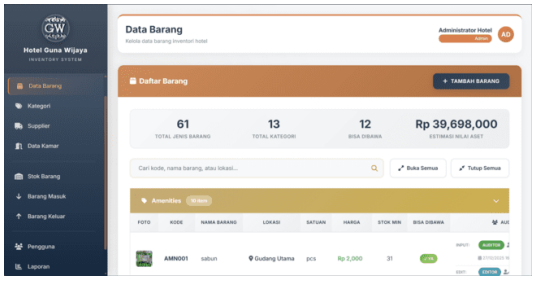

Figure 9. Item Data Interface

3.3.4 Stock-In Interface

The stock-in interface provides a detailed transaction record, encompassing transaction codes, item names, suppliers, quantities, purchase prices, total costs, item conditions, storage locations, input timestamps, and the designated operator. This interface is consistently presented across three user roles: Admin, Manager,

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and Housekeeping, to ensure transparency in logistics data. The visual representation of this stock-in interface is illustrated in Figure 10.

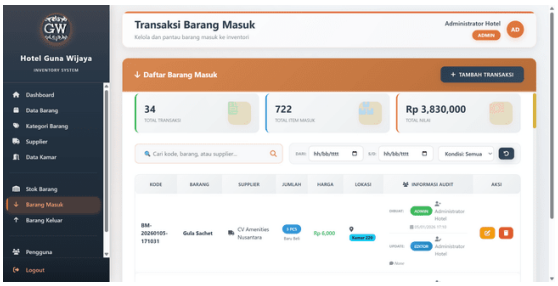

Figure 10. Stock-In Interface

3.3.5 Stock-Out Interface

The stock-out interface displays transaction data, including transaction codes, item names, quantities, transaction types, origin/destination locations, and user activity logs. This interface ensures accountability for goods circulation at Guna Wijaya Hotel, as illustrated in Figure 11.

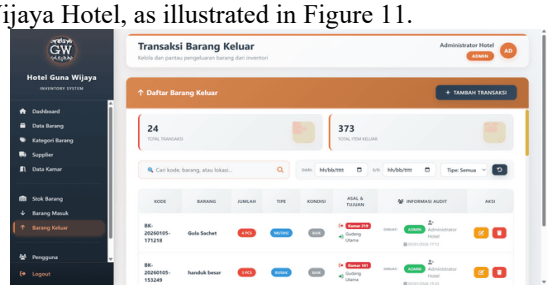

Figure 11. Stock-Out Interface

3.3.6 Low Stock Notification Interface

This feature provides automated low-stock notifications sent to the Manager's WhatsApp via the Foonte API. The alert is triggered whenever a stock-out transaction causes inventory to fall below the minimum threshold, ensuring prompt replenishment. The notification format is illustrated in Figure 12.

Figure 12. Low Stock Notification Interface

3.3.7 Reporting Interface

This interface displays the stock summary report, providing real-time data on current inventory balances. This feature enables management to monitor item availability accurately, supporting procurement efficiency. The stock report interface is illustrated in Figure 13.

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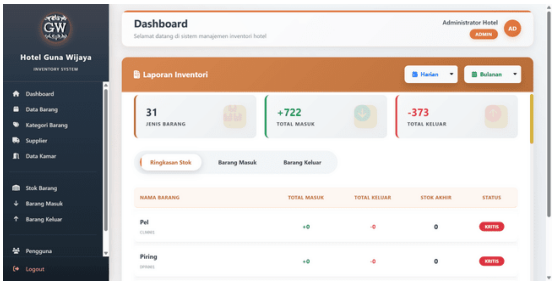

Figure 13. Reporting Interface

3.4 Testing

In this phase, the design is implemented into program units. Each unit undergoes rigorous testing to ensure the system is functional and ready for deployment. The testing and evaluation phase was conducted to ensure that the developed system operates in accordance with predefined specifications and effectively addresses the operational limitations identified during the needs analysis stage. The evaluation process consisted of functional validation using Black Box Testing and organizational assessment through User Acceptance Testing (UAT).

3.4.1 Blackbox Testing

System functionality is validated using Black Box Testing to ensure compliance with specifications. Black Box Testing was applied to verify that each functional module performs according to its intended operational requirements without examining the internal source code [15]. This method focuses on validating input-output behavior under realistic inventory management scenarios. The test cases were designed to directly reflect the previously identified weaknesses of the manual inventory system, including data inconsistency, delayed stock updates, transaction recording errors, and limited access control mechanisms. The test results are summarized in Table 1.

Table 1. Blackbox Testing Results

No	Testing Aspect	Test Scenario	Expected Result	Status
1	User Authentication	Login with valid/invalid credentials and password reset.	Access granted to correct roles; error for invalid data.	Success
2	Master Data Management	CRUD operations for Items, Categories, and Suppliers.	System processes addition, updates, and deletions correctly.	Success
3	Data Integrity	Input duplicate item names or categories.	System blocks duplicates and shows validation alerts.	Success
4	Stock-In Transactions	Recording incoming goods and supplier data.	Inventory levels increase and transaction history is recorded.	Success
5	Stock-Out Transactions	Recording outgoing goods and destination.	Inventory levels decrease and stock-out history is recorded.	Success
6	Safety Stock Alerts	Stock-out triggers minimum stock threshold.	Automated WhatsApp notifications sent via Foonte API.	Success
7	Validation Logic	Transaction volume exceeds available stock.	System blocks transaction and displays "Insufficient Stock".	Success
8	RBAC (Access Control)	Accessing restricted menus by different roles.	HK users cannot delete data; Manager/HK cannot access User Mgmt.	Success
9	Report Distribution	Generating and sending reports via Email/WA/PDF.	Reports generated accurately and delivered to intended users.	Success
10	Real-time Sync	Checking stock balance after transactions.	Stock figures update instantly following in/out movements.	Success

SAGA: Journal of Technology and Information Systems
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All ten testing scenarios produced successful outcomes, indicating that the system effectively performs authentication, role-based access control (RBAC), real-time synchronization, duplicate data validation, stock threshold monitoring, and automated notification delivery. The successful validation of Safety Stock alerts confirms that the system can automatically trigger WhatsApp notifications when inventory levels fall below predefined minimum thresholds, thereby reducing the risk of stock-out incidents. The 100% functional success rate demonstrates that the developed system technically resolves the operational gaps previously identified in the manual process.

3.4.2 User Acceptance Test (UAT)

User Acceptance Testing (UAT) was conducted to assess the system's usability, effectiveness, and organizational readiness for implementation within the operational environment of Guna Wijaya Hotel [16]. This evaluation involved 10 respondents from the Guna Wijaya Hotel staff, using a Likert scale (1-5) questionnaire. The satisfaction level was calculated using the percentage formula:

$$P = \frac{s}{skor}\ x\ 100\%$$

Where:

P : Percentage value.
S : Total respondent score.
Score : Maximum possible score (Highest scale $\times$ total samples).

The summary of the UAT results across 10 assessment indicators is presented in table 2.

Table 2. Summary of UAT Results

No	Assessment Indicator	Score (%)	Category
1	UI Aesthetics and Navigation Ease	84%	Very Satisfied
2	User Experience (User-Friendliness)	84%	Very Satisfied
3	Security Feature Functionality (Login)	80%	Very Satisfied
4	Notification Utility (WhatsApp & Email)	84%	Very Satisfied
5	Menu Accessibility and Functionality	88%	Very Satisfied
6	Data Completeness and Accuracy	86%	Very Satisfied
7	Contribution to Operational Efficiency	84%	Very Satisfied
8	Ease of Inventory Report Management	84%	Very Satisfied
9	System Alignment with User Requirements	86%	Very Satisfied
10	Long-term Implementation Feasibility	74%	Satisfied
Total Average Score	83.4%	Very Satisfied	

The UAT results yielded an overall average score of 83.4%, categorizing the system as "Very Satisfied." This outcome indicates strong user acceptance and confirms that the system substantially improves operational transparency, inventory accuracy, and managerial responsiveness compared to the previous manual approach. The high scores on efficiency (84%) and data accuracy (86%) suggest that the implementation of centralized data management and automated validation mechanisms significantly reduces clerical errors and reporting delays. The positive evaluation of the notification feature (84%) demonstrates that integrating Safety Stock monitoring with WhatsApp and email platforms enhances proactive decision-making and minimizes stock-out risks in hospitality operations. Although the long-term implementation feasibility indicator received a slightly lower score (74%), it remains within the "Satisfied" category, indicating that minimal user adaptation and training are required to ensure sustainable system utilization. Overall, these findings validate not only the technical reliability of the system but also its practical contribution to improving operational continuity in small-scale hotel inventory management.

4 Conclusion

This study demonstrates that the developed web-based inventory information system effectively enhances logistics management, data accuracy, and operational transparency at Guna Wijaya Hotel by replacing manual recording practices with centralized real-time monitoring. The integration of Safety Stock monitoring and automated WhatsApp and email notifications supports proactive decision-making and reduces stock-out risks.

The system achieved a 100% functional success rate in Black Box Testing and an overall UAT score of 83.4%, indicating strong technical reliability and user acceptance. These findings suggest that a cost-effective web-based architecture can provide a practical and scalable solution for supporting digital transformation in small- and medium-sized hospitality organizations.

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