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Design of an AppSheet Based Inventory Management Information System for Warehouses Using the Waterfall Method

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ABSTRACT

Accurate inventory recording is a crucial aspect of maintaining warehouse operational efficiency. XYZ Institution is a government agency that operates two distinct types of warehouses: the Central Supply Warehouse and the Environmental Chemical Warehouse. Historically, manual inventory recording in both warehouses has resulted in discrepancies between system data and actual field conditions, with an average data accuracy of only 67% in the Central Supply Warehouse and 44% in the Environmental Chemical Warehouse. This study aims to develop an inventory management application based on AppSheet using the Waterfall method, which includes the stages of design, implementation, and Black Box testing to verify the application's functionality. The application users consist of an admin, who acts as the warehouse supervisor, and end users, namely staff of the Central Supply Warehouse and the Environmental Chemical Warehouse, each with workflows tailored to their respective operational requirements. The test results indicate that the application successfully meets the designed system requirements and is ready for operational use. It is expected that the implementation of this application will serve as an initial step toward the broader digitalization of logistics systems within government institutions.

1. INTRODUCTION

Inventory recording is a crucial aspect of warehouse operations, particularly in managing the flow of incoming and outgoing goods and maintaining inventory data accuracy [1]. According to Ekoanindiyo and Wedana [7] A warehouse is a storage facility designed to accommodate various types of products, in both large and small quantities, over a specified period. Its primary functions include the storage of finished goods, the preservation of product quality, and the management of inventory. However, challenges in inventory recording often arise, especially when the required data is spread across multiple warehouses and not well integrated. This can lead to data discrepancies between warehouses, stock recording errors, and a lack of visibility regarding overall item availability [2]. Institution XYZ is a government agency responsible for analysis, implementation, and supervision functions, and it manages two warehouses with different purposes: the main inventory warehouse, which stores office supplies and cleaning equipment, and the environmental chemical warehouse, which is used to store chemical substances.

Based on observations at both warehouses of Institution XYZ, the inventory process is still carried out manually by recording item data on physical forms and referring to System X under the supervision of Ministry X. This often leads to errors, such as items not being recorded when entering or leaving the warehouse. As a result, during stock opname or routine inspections to match the data in System X with the physical condition in the field, discrepancies frequently occur between the actual number of items and the data recorded in System X across all warehouses. Stock opname is an activity of re-counting inventory to ensure that the physical quantity of items in the field matches the records in the system or bookkeeping documents [8]. The purpose of stock opname is to ensure that the actual quantity of items in the warehouse matches the records maintained in the company's system or logbook [9]. According to interviews with warehouse supervisors, the institution's policy mandates that the quantity of materials in the field must fully match the data in the system, with a target of 100%

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accuracy. To determine the level of recording accuracy, periodic stock opname is conducted at both warehouses, and the summarized results comparing physical and system data are presented in Table 1.

Table 1. Summary of Stock Opname Results in Institution XYZ Warehouses

Warehouse Category	Year	Period (Month)	Item Category	Actual Stock	System Stock	Difference	Accuracy Percentage	Description
Main Warehouse	2024	February	Office supplies	5162	3680	1482	71%	Inaccurate
			Testing Equipment	49	24	25	49%	Inaccurate
			Cleaning Tools	81	44	37	54%	Inaccurate
	2024	May	Office supplies	3390	2243	1147	66%	Inaccurate
			Testing Equipment	193	151	42	78%	Inaccurate
			Cleaning Tools	285	233	52	82%	Inaccurate
Environmental Chemical Warehouse	2024	February	Testing Chemical	18	8	10	44%	Inaccurate

Table 1 presents the recapitulation of stock opname results at Institution XYZ's warehouses. It shows that over two months, the average consistency between system-recorded data and physical stock in the field reached only around 67% for the main warehouse and 44% for the environmental testing warehouse, with the remainder being inconsistent. This issue is caused by the inefficiency of the inventory recording process, which is still conducted manually. Additionally, the lack of data integration between warehouses requires staff to perform direct monitoring at each location. This not only consumes time and effort but also increases the risk of data inaccuracy due to reliance on manual observation. The current method of inventory recording using physical forms is considered inefficient and suboptimal in supporting smooth warehouse operations.

A similar study was conducted by Yasmin and Nugraha [3] at the laboratory of PT Energi Agro Nusantara, which developed an inventory management system using the Google AppSheet application with a Waterfall methodology approach. The system was designed to facilitate the online recording and control of laboratory items, replacing the manual recording method that carries a high risk of human error. The test results demonstrated that the application significantly improved the efficiency of inventory management.

Firmansyah and Evanthi [4] at CV. Yummys Motherlacto Indonesia, which developed an inventory asset management system using the Google AppSheet application based on the Enterprise Asset Management (EAM) approach. The system was designed to replace manual record-keeping using Microsoft Excel and logbooks, which are prone to data redundancy and inefficiency. In its implementation, the application facilitates the digital and integrated management of asset recording, maintenance, transfers, and repairs. The results indicate that the application significantly enhanced the efficiency and effectiveness of inventory management and reduced the risk of asset loss due to disorganized recording procedures.

A study by Krisnawan and Kurniasih [5] at BSB House Rental in Kartasura, Central Java, developed an asset management system using the Google AppSheet platform with a prototyping approach. The system addressed challenges in manual inventory tracking and asset replacement, enabling digital data management, repair requests, and automated notifications. Blackbox testing confirmed its effectiveness in system functionality and user access. The implementation improved operational efficiency and reduced asset loss, enhancing both tenant satisfaction and business outcomes.

Previous research on inventory system development in the industrial sector has served as a foundation for this study, which focuses on designing an inventory management system for a government institution that operates two warehouses with distinct operational characteristics and

requirements. A Warehouse Management System (WMS) is an effective technological solution for managing warehouse operations. The shift from manual recording to software-based systems has become a significant trend in the industrial sector. This system assists warehouse staff in monitoring stock availability, tracking shipments, and organizing storage processes more efficiently through web-based applications or platforms [10]. The institution faces significant challenges related to discrepancies between physical inventory and system records. This study proposes an integrated information system tailored to the specific needs of the two warehouses namely the Core Supply Warehouse and the Environmental Chemical Warehouse to address these discrepancies effectively.

Based on these issues, an inventory recording system is needed that can integrate data between warehouses online and in real time, utilizing the AppSheet application. AppSheet is an online development platform that allows users to create mobile applications without using code, making it easier and more straightforward to use. It supports various data sources such as spreadsheets, Microsoft Excel, and cloud services like Google Drive and Dropbox [11]. It is the need for coding, making it easy and simple to use. This platform can be configured as an application containing an integrated database to record all warehouse data, accessible via mobile devices or browsers online, making it suitable for optimizing inventory recording and management at Institution XYZ's warehouses [6]. The use of AppSheet enables more effective inventory management by ensuring that every change, such as the entry and exit of goods, stock updates, and changes in storage status across all warehouses, can be monitored in real time. This helps minimize errors and improve operational efficiency.

2. METHOD

The information system design in this study uses the Waterfall method with a System Development Life Cycle (SDLC) approach. The Waterfall method is one of the classic approaches in software development, in which the process proceeds linearly from one stage to the next [12]. This method includes a series of stages that must be completed sequentially. The stages of the Waterfall method are illustrated in the following flow diagram:

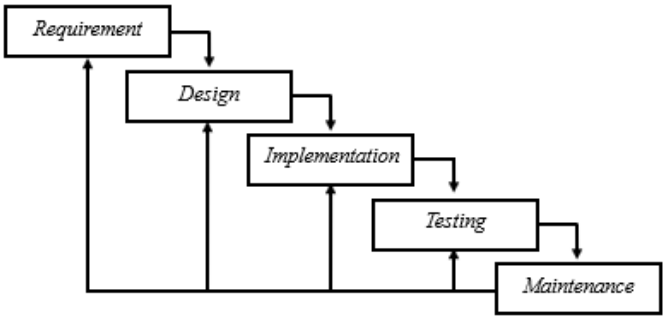

Figure. 1. Phases of the Waterfall Method [13]

1. Requirement

   The author conducted interviews and direct observations at the main warehouse and the environmental chemical warehouse of Institution XYZ to identify user needs and the objectives of the inventory management information system. This included gathering information on how items are currently managed, the challenges faced, and the desired features of the system.

2. Design

   The author designed the inventory information system using AppSheet as the development platform. Unified Modeling Language (UML), including Activity Diagrams and Use Case Diagrams, was used to map the process flow and user requirements within the application.

3. Implementation

   The system design was carried out by creating a database schema in Google Sheets containing item information and by designing the application interface using AppSheet's drag-and-drop

features. The application was then developed by connecting AppSheet to Google Sheets, followed by the implementation of business logic for automation, such as calculating total inventory.

4. Testing

   The application was tested using Black Box Testing to ensure that all features functioned properly and met the predefined requirements. Black Box Testing is a testing method that evaluates the functionality of an application based on inputs and outputs, without considering its internal structure. The focus is on testing all features and user interactions to ensure the application operates according to specifications.

5. Maintenance

   The maintenance stage was carried out by ensuring that all application documentation was available and well-organized to support long-term system upkeep. Maintenance also included updating the application as needed and conducting regular checks to ensure the system remains optimal in recording and managing warehouse inventory.

3. RESULTS AND DISCUSSIONS

The results of this study are presented based on the stages of system development that have been carried out, with the aim of providing a comprehensive overview of the design process through to the evaluation of the inventory management information system.

4.1. Requirement

At the requirements stage, the author identified the system needs based on observations at the XYZ Institution's warehouses, where inventory recording was still conducted manually and relied on System X. This resulted in significant discrepancies between physical data and system data, with the average accuracy reaching only 67% in the main warehouse and 44% in the environmental chemical warehouse. The main requirements identified included an inventory management system capable of integrating data between warehouses online and in real time, as well as features for managing incoming stock, outgoing stock, item inspection forms, and stock cards to reduce data inaccuracies. Based on this analysis, AppSheet was selected as the appropriate platform due to its ability to enable efficient inventory recording and monitoring via mobile devices.

4.2. Design

The design phase constitutes the planning and formulation process of the inventory information system to be developed for the warehouses of Institution XYZ. During this stage, the author constructed system models using use case diagrams and activity diagrams to map the process flow and user requirements within the AppSheet-based application.

4.2.1. Use Case Diagram

The use case diagram represents the interactions between actors and the system, where the actors in the inventory management application consist of warehouse staff who also serve as administrators, albeit with different roles and workflows. The following is the use case diagram of the AppSheet-based application for warehouse inventory management:

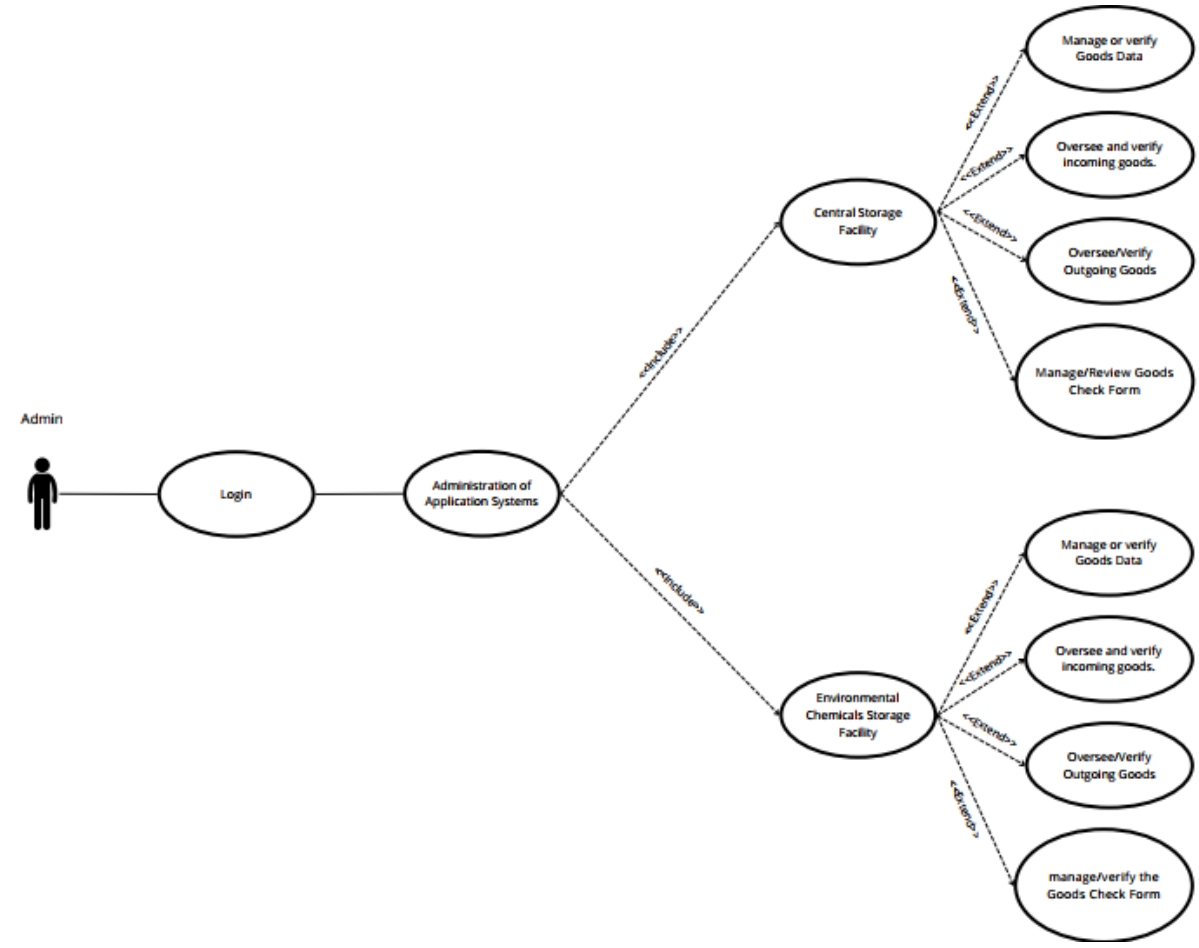

Figure. 2. Use Case Diagram for Administrator

Figure 2 illustrates the flow of activities that can be performed by the admin in the inventory management application developed using AppSheet. The admin has access to manage the application system, including the management of incoming and outgoing inventory data, as well as the verification of item inspection forms. In addition, the admin is also authorized to update and delete data stored in the database. Each of these activities represents a use case scenario designed to align with operational requirements. The application is considered successful if each function executed by the admin operates according to the defined use case scenarios without any errors.

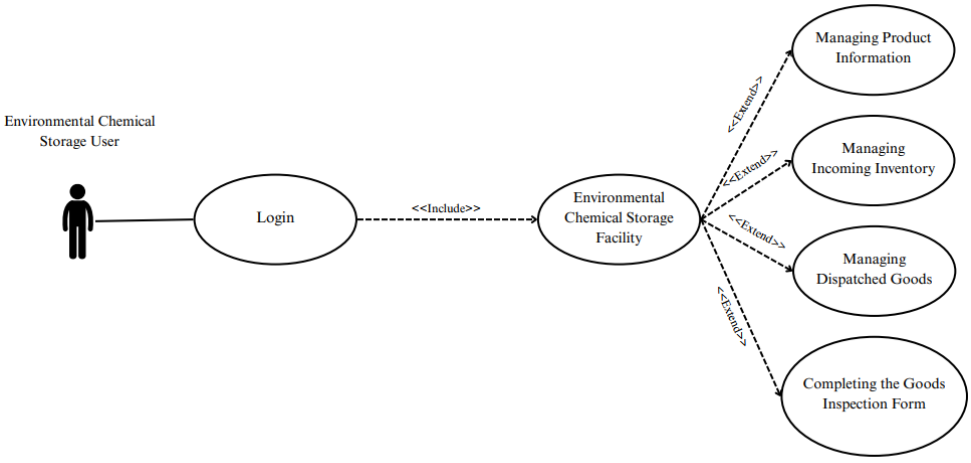

Figure. 3. Use Case Diagram for Environmental Chemical Warehouse Staff

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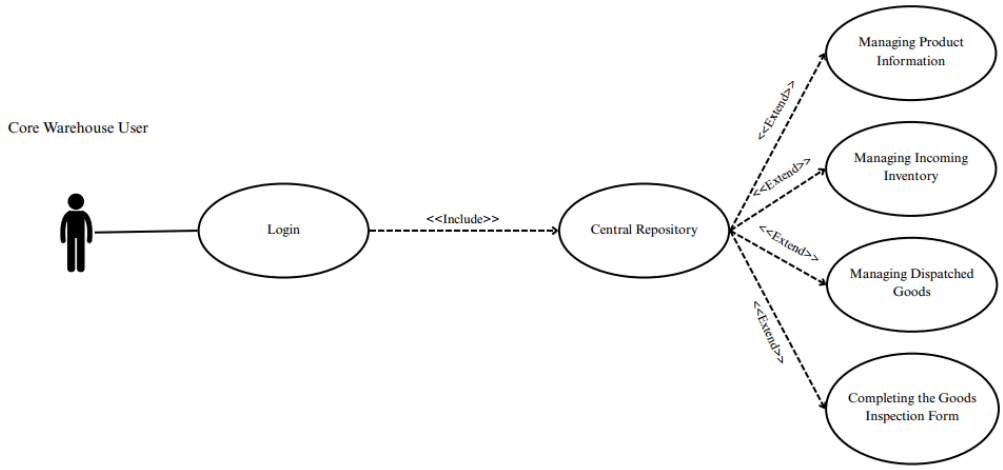

Figure. 4. Use Case Diagram for Main Warehouse Staff

Figures 3 and 4 illustrate the flow of activities carried out by warehouse staff within the inventory management application, specifically in managing incoming and outgoing goods. These activities include inputting data for newly received items, such as quantity and condition, as well as recording outgoing items to ensure inventory data accuracy. Additionally, warehouse staff are responsible for completing item inspection forms, which serve to verify the condition of goods either being received or dispatched, thereby ensuring that inventory data in the system remains up to date and reflects actual field conditions. The use case diagram represents application usage scenarios tailored to the operational needs of each user. The application is considered successful if every function can be executed by the user in accordance with the designated use case for each warehouse, and the process flows correctly without errors.

4.2.2. Activity Diagram

An activity diagram is used to illustrate the process flow within the system, including the interactions between actors and the system, as well as to map data processing and information flow [14]. The activity diagram for managing item data in the inventory management application of Institution XYZ's warehouse demonstrates that warehouse staff can add incoming item data, modify outgoing item data, view item details, and delete data when necessary (Figure 5). Each of these actions is performed to ensure that inventory information remains accurate and up-to-date in the system in accordance with the actual warehouse conditions.

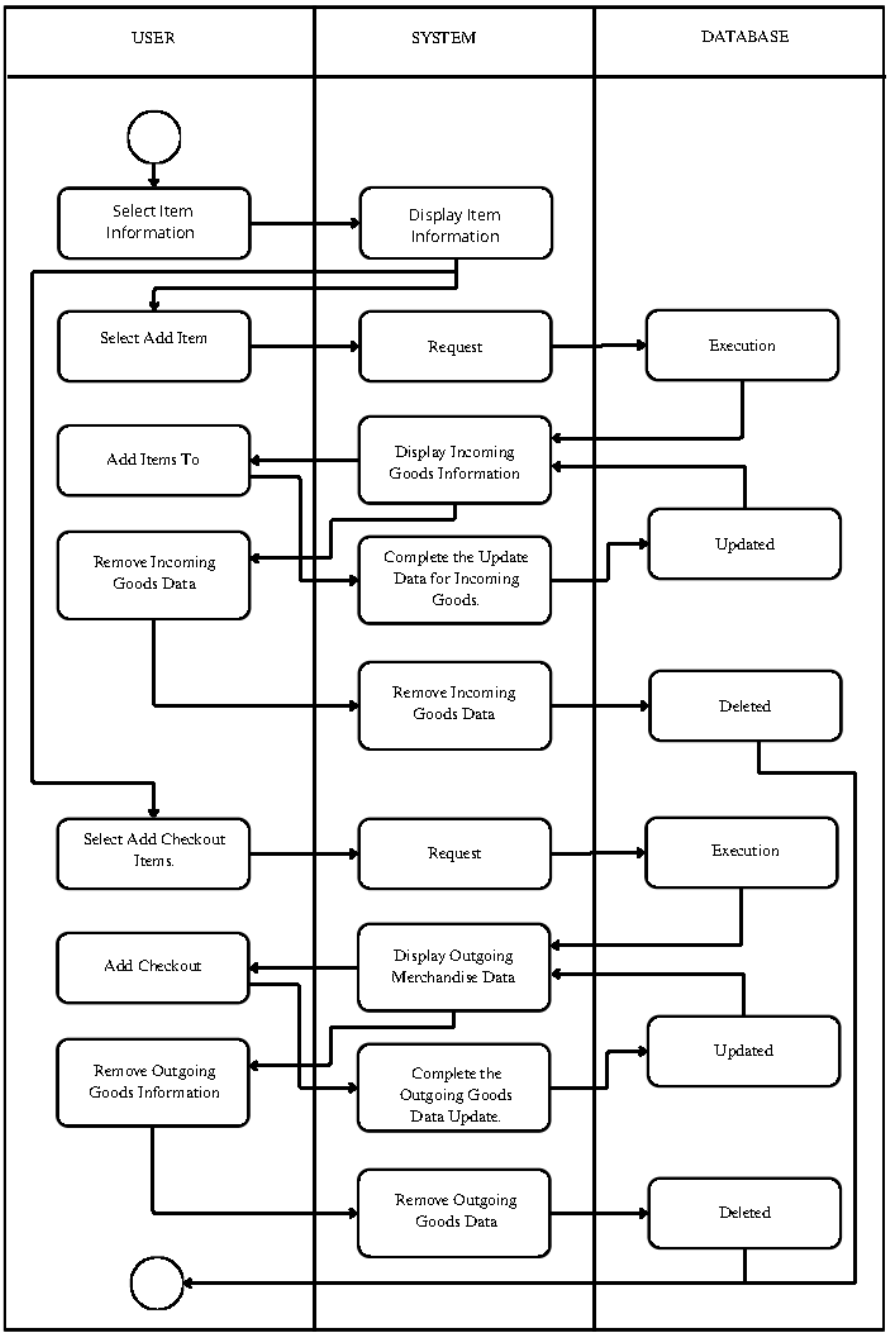

Figure. 5. Diagram Activity

4.3. Implementation

The result of the implementation stage is an AppSheet-based inventory management application designed to support inventory recording at the warehouses of Institution XYZ. The following section presents the user interface (UI) of the application.

1. Login page

   The login page appears when users first open the application. This page is intended exclusively for users who have been granted access rights, including both warehouse staff and administrators. On this page, users are required to enter their username and password as credentials to access their accounts.

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Figure. 6. Login Page Interface

2. Main Menu Page

   This page displays the main interface containing the available menus within the application. There are two accessible menus for users: the main inventory warehouse menu and the environmental chemical warehouse menu.

Figure. 7. Main Menu Page Interface

3. Main Inventory Warehouse Menu Page

   This page displays the menu accessible to users after selecting the Main Inventory Warehouse option on the main menu page. The menu includes item data, incoming goods recording, outgoing goods recording, and item inspection forms.

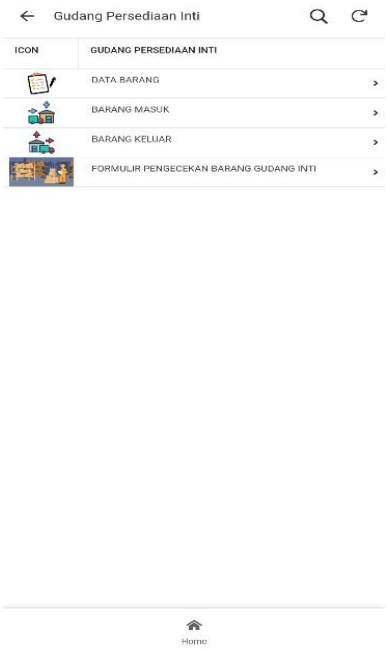

Figure. 8. Main Inventory Warehouse Menu Interface

4. Environmental Chemical Warehouse Menu Page

   This page displays the menu accessible to users after clicking the Environmental Chemical Warehouse option on the main menu page. The menu includes Environmental Chemical Data and Environmental Equipment Data.

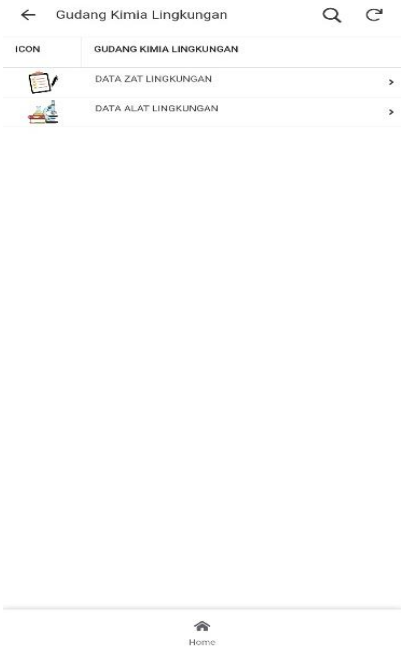

Figure. 9. Environmental Chemical Warehouse Menu Interface

4.4. Testing

The following is the result of Black Box Testing conducted on the inventory management application based on AppSheet for the warehouse of Institution XYZ, as shown in Table 2.

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Table 2. Application Black Box Testing Results

No	Tested Interface	Steps	Expected results	Actual results	Status
1.	Login Page	Enter username and password	Successfully navigated to the Main Menu page	Successfully navigated to the Main Menu page	Pass
2.	Main Inventory Warehouse Menu Page	1. Click the Main Inventory Warehouse option on the Main Menu page 2. Click the Goods Data menu 3. Click the Incoming Goods menu 4. Click the Outgoing Goods menu 5. Click the main Warehouse Inspection Form menu	1. Successfully accessed the Main Inventory Warehouse menu page 2. Successfully accessed all menu items	1. Successfully accessed the Main Inventory Warehouse menu page 2. Successfully accessed all menu items	Pass
3.	Environmental Chemical Warehouse Menu Page	1. Click the Environmental Chemical Warehouse option on the Main Menu page 2. Click the Environmental Substance Data menu 3. Click the Environmental Equipment Data menu	1. Successfully accessed the Environmental Chemical Warehouse menu page 2. Successfully accessed all available menus	1. Successfully accessed the Environmental Chemical Warehouse menu page 2. Successfully accessed all available menus	Pass

Based on the results presented in Table 2, all functionalities tested through Black Box Testing demonstrated outcomes consistent with the expected results. Each tested interface from the login mechanism to the management of inventory data in both the Central Supply Warehouse and the Environmental Chemical Warehouse performed as specified in the system requirements. The consistency between expected and actual outcomes confirms the reliability and correctness of the application's core features. Therefore, it can be concluded that the AppSheet-based inventory management application is functionally sound and ready to be deployed to support the operational activities of Institution XYZ's warehouses. The system offers an effective solution to improve inventory data accuracy, streamline warehouse processes, and ensure real-time integration across warehouse operations.

The inventory system testing using the black box method with state transition technique produced results that aligned with expectations, indicating the system is suitable for operational use. It is recommended that further testing using the white box method be conducted to assess the quality of individual units within the source code [15].

4.5. Maintenance

The maintenance phase aims to ensure that the AppSheet-based inventory management application at the XYZ Institution's warehouse continues to operate optimally after implementation. This process includes monitoring the application's performance, addressing any bugs that may arise, and updating features to meet the evolving operational needs of the warehouse. Additionally, the maintenance process involves routine data backup procedures to prevent the loss of important information and ensure that inventory data remains secure. Additional training and technical support for users, such as warehouse staff and administrators, are provided to help them operate the application effectively and address any minor issues that may occur.

4. CONCLUSION

This research successfully developed an AppSheet-based inventory management application to support inventory recording at the XYZ Institution's warehouse. The implementation of this system enables real-time recording of incoming and outgoing stock as well as data integration between warehouses. The results of the Black Box Testing indicate that the application's main features function according to the established requirements. The application's maintenance process includes performance monitoring and routine data backups, ensuring the system's sustainability. This application is expected to improve warehouse operational efficiency and minimize inventory data discrepancies that previously occurred frequently.

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REFERENCES

[1] E. Winata, A. Ayuningtyas, and I. G. N. A. W. Putra, "Pengembangan Aplikasi Manajemen Persediaan untuk Meningkatkan Efisiensi Operasional," *Jurnal Teknologi dan Informasi*, vol. 14, no. 1, pp. 36–49, Feb. 2024, doi: 10.34010/jati.v14i1.11412.

[2] D. G. Saputri and I. K. Sriwana, "Analisis Kebutuhan Sistem Monitoring untuk Perbaikan Proses Bisnis dengan Soft System Methodology (SSM) pada UMKM Ibunmanis Coklat," *Journal of Technology and System Information*, vol. 1, no. 3, p. 16, May 2024, doi: 10.47134/jtsi.v1i3.2578.

[3] A. V. M. Yasmin and I. Nugraha, "Perancangan Aplikasi Inventory Management Menggunakan Google Appsheet pada Laboratorium PT Energi Agro Nusantara," *Jurnal Teknologi dan Informasi*, vol. 14, no. 2, pp. 126–137, Sep. 2024, doi: 10.34010/jati.v14i2.11798.

[4] A. B. A. Firmansyah and A. Evanthi, "Pengaruh Prosedur Pendataan Barang Terhadap Efektifitas Pengelolaan Data Aset Inventaris Di CV. Yummys Motherlacto Indonesia," *MESTAKA: Jurnal Pengabdian Kepada Masyarakat*, vol. 3, no. 1, pp. 20–27, Feb. 2024, doi: 10.58184/mestaka.v3i1.233.

[5] A. B. Krisnawan and T. Kurniasih, "Optimalisasi Sistem Manajemen Barang dalam Bisnis Sewa Properti melalui Implementasi Appsheet (Studi Kasus: Sewa Rumah BSB)," *Jurnal Indonesia : Manajemen Informatika dan Komunikasi*, vol. 5, no. 2, pp. 1362–1372, May 2024, doi: 10.35870/jimik.v5i2.604.

[6] A. D. Y. Sari and S. Dewi, "Rancang Bangun Warehouse Management System (WMS) Berbasis Aplikasi Appsheet Pada PT ABC," *Jurnal Teknik Mesin, Industri, Elektro dan Informatika*, vol. 2, no. 4, pp. 250–263, Dec. 2023, doi: 10.55606/jtmei.v2i4.3051.

[7] F. A. Ekoanindiyo and Y. A. Wedana, "Perencanaan Tata Letak Gudang Menggunakan Metode Shared Storage Di Pabrik Plastik Kota Semarang," semarang, Jan. 2012. [Online]. Available: www.digilib.petra.ac.id

[8] M. Jims, "Analisis Dan Perancangan Sistem Stock Opname Berbasis Web Pada Pt Cakra Medika Utama," *Storage: Jurnal Ilmiah Teknik dan Ilmu Komputer*, vol. 2, no. 4, pp. 201–213, Nov. 2023, doi: 10.55123/storage.v2i4.2945.

[9] M. R. Nurmatama and T. Haryati, "Optimalisasi Prosedur Stock Opname Dalam Audit Persediaan pada KAP XYZ," *Sustainable Business Accounting and Management Review*, vol. 6, no. 3, pp. 1–14, Sep. 2024, doi: 10.61656/sbamr.v6i3.230.

[10] S. A. Azzahra and L. Fauziah, "Efektivitas Penerapan Warehouse Management System (Wms) Pada Gudang Pt Xyz," *Jurnal Bisnis, Logistik Dan Supply Chain (Blogchain)*, vol. 3, no. 2, pp. 79–82, Nov. 2023, doi: 10.55122/blogchain.v3i2.920.

[11] N. Petrovic, M. Radenkovic, and V. Nejkovic, "Data-Driven Mobile Applications Based on AppSheet as Support in COVID-19 Crisis," 2020.

[12] Deni Murdiani and Muhamad Sobirin, "Perbandingan Metodologi Waterfall Dan Rad (Rapid Application Development) Dalam Pengembangan Sistem Informasi," *Jurnal Informatika Teknologi dan Sains*, vol. 4, no. 4, pp. 302–306, Nov. 2022, doi: 10.51401/jinteks.v4i4.2008.

[13] V. Adi Kurniyanti and D. Murdiani, "Perbandingan Model Waterfall Dengan Prototype Pada Pengembangan System Informasi Berbasis Website," *Jurnal Syntax Fusion*, vol. 2, no. 08, pp. 669–675, Aug. 2022, doi: 10.54543/fusion.v2i08.210.

[14] H. Suhendi and F. U. Ali, "Sistem Informasi Geografis Berbasis Web Untuk Pemetaan Jalan Dan Jembatan Di Kota Cirebon," *Naratif : Jurnal Nasional Riset, Aplikasi dan Teknik Informatika*, vol. 2, no. 1, pp. 6–15, Jul. 2020, doi: 10.53580/naratif.v2i1.77.

[15] A. Setiawan *et al.*, "Black Box Testing Dengan Teknik State Transition Testing Pada Inventori Alat-Alat Medis," *Jurnal Sains dan Teknologi (JSIT)*, vol. 2, no. 2, pp. 151–158, Nov. 2022, doi: 10.47233/jsit.v2i3.218.