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DEVELOPING A STOCK MANAGEMENT SYSTEM WITH FIFO LOGIC FOR SME FERTILIZER WAREHOUSING

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ABSTRACT

Stock management is important for a business's performance and profitability. However, some companies manage their stock manually to update and check their stock. Manual stock management negatively impacts SMEs' performance through data inaccuracies and operational inefficiencies, leading to poor decision-making and lost revenue. The absence of systematic tracking mechanisms hinders optimal inventory control, resulting in overstocking or stockouts. Implementing robust inventory management systems is crucial for enhancing accuracy and efficiency in operations. This study focuses on the design and development of a Web-based Stock Management System for a fertiliser company to improve stock tracking and handling by implementing FIFO logic. The system is designed to meet the needs of SMEs which have poor stock management due to manual stock recording. The Rapid Application Development (RAD) methodology includes requirements planning, user design, construction, and cutover phases. Requirements were modelled using UML, followed by iterative user-involved design and development, and concluded with usability evaluation in the cutover phase. The prototype had been evaluated by five employees from the company on the aspects of usability, ease of use, and satisfaction. Results showed that the system was considered helpful in improving stock efficiency, easy to operate without written instructions, and overall satisfying to use. Future work will explore mobile integration and real-time alerts for further enhancement. This research contributes to the body of knowledge in web-based inventory systems by integrating system development methodology, usability evaluation, and operational efficiency outcomes within an SME context.

Keywords: Stock management system, inventory system, SMEs, warehouse management

INTRODUCTION

Stock management, or inventory management, is important for business performance and profitability. Stock control is an activity that maintains inventory levels at appropriate levels (Pandey & Raut, 2016). Managing stock levels effectively can increase operational efficiency and maximise financial strategy

(Mohamed, 2024). For small and medium enterprises (SMEs), poor stock management practices have a significant negative impact on business performance (Kittisak, 2023). One inventory management method widely used across industries is the First In, First Out (FIFO) system (Alamsyah & Putri, 2024). FIFO is a method in which the oldest stock or goods are sold or used first. Companies widely use the FIFO method because it is simple to calculate and execute, the final inventory value on the balance sheet is consistent with current prices, and it can prevent damage and obsolete inventory (Sembiring et al., 2019).

In some companies today and in the past, stock management is done manually using Excel or logs to update and check stock levels (Wei et al., 2023). Therefore, a stock management system is an important element in a company (Pandey & Raut, 2016). A stock management system for a company is crucial, as it allows it to track and manage its product inventory and revenue (Wei et al., 2023). Besides, many companies will be at risk if they lack an effective stock management system (Patil & Divekar, 2014).

Most companies manually record and maintain their inventory data in spreadsheets (Agboola et al., 2022). However, using a handwritten inventory system has several drawbacks, including frequent inventory-count errors, slow sales processing, and no way to monitor deals (Manga & Salikon, 2025). Therefore, a stock management system is needed to overcome this problem. A stock management system is a software application that assists companies in tracking and managing their stock (Agboola et al., 2022; Kumar et al., 2021).

This study focused on a fertiliser distribution company with two retail shops and a warehouse. The company's current stock management process relied on manual records maintained in spreadsheet tools. The stock record was always delayed, inconsistently formatted, and lacked critical batch information such as the arrival date. Hence, warehouse workers often deployed new stock because older batches of stock were not visible or difficult to access. This undermined first-in, first-out (FIFO) compliance and exacerbated inventory ageing issues, especially for products stored for long periods.

To address the problem introduced above, this study aims to design and develop a web-based stock management system suitable for the company in question. In fact, many web-based applications and stock management systems help companies manage their stock (Wei et al., 2023). However, many companies still manage their stock manually because they believe the system is expensive, uninteresting, inflexible, or unsuitable for their company (Wei et al., 2023). Thus, designing and developing a cost-effective and suitable stock management system will be the main objective of this study.

This paper is organised into six sections. The Introduction presents the background and research motivation, followed by the Related Studies section, which reviews prior work relevant to stock management systems. The Methodology of the Study outlines the RAD development process adopted. Subsequently, the Design and Development of the Stock Management System section details the system implementation, while the Evaluation of the Web-Based Stock Management System discusses the assessment and findings. Finally, the Conclusion summarises the key outcomes and offers recommendations for future research.

RELATED STUDIES

Stock management is important across all industries, whether service or product (Sembiring et al., 2019). For the retail store supply chain, stock management is one of the most important components (Wei et al., 2023). The objective of stock management is to generate stock ordering rules that ensure optimal inventory levels (Szentesi & Nagy, 2025).

Table 1

List of stock management systems found in academic databases

Related Studies	Description	Comment
IMS Mobile Application (Kumar et al., 2021)	This application is designed for small companies in India, as most of them lack access to computers. This application is a profile-based system, so a single user can manage multiple companies by creating multiple accounts. This application is also cloud-based, so that users can access the data wherever and whenever.	Since the IMS Mobile Application is a smartphone application, users can easily manage their business from anywhere. However, there are still some problems. One of the problems is data security. Another is that this application only supports Android phones, and iOS phones cannot use it.
Web-Based Inventory Management Platform (Agboola et al., 2022)	The purpose of this is to create a web-based platform to help SMEs automate stock management. This system is implemented by using a MySQL database. To enable the system to accommodate future changes, the authors have divided it into various modules.	This web-based system is suitable for SMEs because it is free to access, allowing companies to save on inventory management costs. However, this system lacks intelligence and is built as a standalone system.
Livestock Inventory Management System (LIMS) (Kanyip & Srivaramangai, 2023)	LIMS is implemented as an Android application. This application was developed using Android Studio, XML, Java, and SQLite. The main objective of LIMS is to help farmers record and manage their livestock.	LIMS is an Android application with a complete UI. The authors have also shown the minimum hardware requirements to run this application. The problem is that iOS users cannot use this application, and since it is not cloud-based, all data will be saved on users' phones.
AMUStock Inventory Management System (Manga & Salikon, 2025)	AMUStock Inventory Management System is developed to replace the manual inventory process at Amu Global Ventures. The AMUStock system is developed using PHP, MySQL, HTML, CSS, and JavaScript. This system is designed to provide automated inventory tracking, real-time updates, and secure transaction approvals.	AMUStock Inventory Management System contains a simple UI and various functions. However, AMUStock is a system specifically designed for Amu Global Ventures, so other companies cannot use this system for their inventory management.

Based on Table 1 above, we observe that different systems address stock problems in various ways. The IMS Mobile App (Kumar et al., 2021) was designed for small enterprises in India. It is useful because it is a mobile application that can be accessed anywhere with an internet connection. However, it is compatible only with Android phones and may pose data security issues. The Web-Based Inventory Management Platform (Agboola et al., 2022) is a more common solution. It operates through an online platform and helps SMEs manage their inventory using a MySQL database. It is free and broken into modules for future updates, but it lacks intelligent features such as automatic recommendations and notifications.

The Livestock Inventory Management System (LIMS) is designed for farmers. It allows users to monitor their livestock using an Android application (Kanyip & Srivaramangai, 2023). Although it has an attractive design and is simple to use, it stores all data on the phone and does not work on iOS, limiting its user base. Finally, the AMUStock Inventory Management System (Manga & Salikon, 2025) is designed for a single organisation and consists of real-time updates and secure authorisation features. However, since it is designed specifically for a company, it cannot be used by other organisations without any major modifications.

After reviewing all of these systems, some common issues were found. Some systems only work on Android, while others lack cloud storage, meaning that if the phone or computer fails, the data may be lost. Some systems are designed specifically for a particular company, so other businesses cannot use them directly. However, the system designed in this study aims to fill these gaps. The system should be easy to use and adaptable. It should run on both computers and mobile devices, and store data online for easy access anywhere, anytime. A new feature of first-in, first-out (FIFO) tracking would also be included in the system, which other systems do not seem to support. With its design, the system is believed to help fertiliser companies manage their inventory more effectively and prevent overstocking.

METHODOLOGY OF THE STUDY

The study used the Rapid Application Development (RAD) technique, which was established by Martin (1992). RAD is an agile software development technique that uses prototypes to gather system requirements. According to Anthony et al. (2018), RAD is still necessary and widely used by software engineers, despite frequent changes in software development techniques. RAD consists of four main phases: requirements planning, user design, construction, and cutover.

The requirements planning phase consists of collecting the requirements of a web-based stock management system. All the requirements are defined and visualised using the Unified Modelling Language (UML) diagrams, including use case, activity, and class diagrams. The user design and construction phases are carried out concurrently, during which the web-based system's user interface is designed. Users are involved in the design and construction phases, providing feedback to improve the user interface and information flow of the web-based stock management system. Lastly, during the cutover phase, an evaluation is conducted to assess the usability of the web-based system. The detailed implementation of the phases is explained in the following sections. The requirements planning, user design, and construction phases are covered in the Design and Development of Stock Management System section. In contrast, the cutover phase is described in the Evaluation of Stock Management System section.

DESIGN AND DEVELOPMENT OF STOCK MANAGEMENT SYSTEM

This section outlines the design and development of a stock management system throughout the first three phases of RAD. The section is divided into two subsections: the first contains the requirements for the web-

based stock management system, and the second presents the prototype development to illustrate the collected requirements.

The requirements of the Web-based Stock Management System

A requirements-gathering procedure was carried out using two methods: interviews and analysis of documents and apps related to stock or inventory management on the Internet. The interview was conducted informally with a retail manager at the company, who was asked a few questions about the stock management system's features. The opinions had been recorded, and the requirements were generated. For the secondary requirements-gathering process, the documents were searched using Google with the keywords “stock management”, “inventory management”, “inventory management system”, and “stock management system”. The documents were analysed to generate the requirements for the web-based stock management system; Table 2 lists seven functional requirements and their priorities, derived from the requirements-gathering process. The requirements include logging in to the system, managing stock, checking stock, placing orders, managing orders, checking orders, and viewing notifications to prevent overstocking.

Table 2

List of requirements for a web-based stock management system

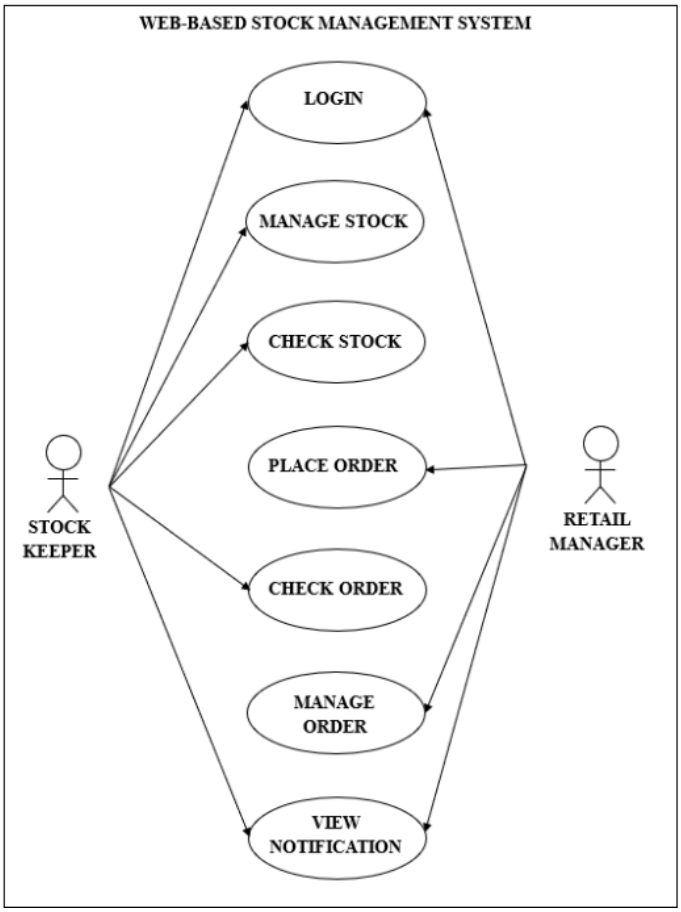
No.	Requirement ID	Description	Priority
	W-SMS_01	**LOGIN**	
1	W-SMS_01_1	Users can log in with a UserID and a password.	High
2	W-SMS_01_2	The system will display the Home Page if the UserID and password are correct.	High
3	W-SMS_01_3	The system will display an error message if the UserID and password are invalid.	High
4	W-SMS_01_4	Users can click the " forgot password link to get a new password.	Optional
5	W-SMS_01_5	New users can click the sign-up link to register by entering their UserID, password and confirm password.	Optional
	W-SMS_02	**MANAGE STOCK (STOCK KEEPER)**	
6	W-SMS_02_1	The user shall be able to click the “Manage Stock” button on the Home Page.	Medium
7	W-SMS_02_2	The user can click the "Add New Stock " button to add new stock information by entering StockID, PlaceID, Quantity, and Date.	High
8	W-SMS_02_3	The user can click the edit stock button to edit the stock information.	Optional
9	W-SMS_02_4	The user can click the delete stock button to delete unwanted stock information.	Optional
	W-SMS_03	**CHECK STOCK (STOCK KEEPER)**	
10	W-SMS_03_1	Users shall be able to click the “Check Stock” button on the Home Page.	Medium
11	W-SMS_03_2	Users can check the available stock by entering a StockID or a PlaceID.	High
12	W-SMS_03_3	The system will display StockID, PlaceID, Quantity and Date if the stock is available.	High

13	W-SMS_03_4	The system will display an error message if the StockID or PlaceID is invalid.	High
14	W-SMS_03_5	The system will display an information message if the stock is unavailable.	High
	W-SMS_04	**PLACE ORDER (RETAIL MANAGER)**	
15	W-SMS_04_1	Users shall be able to click the “Place Order” button on the Home Page.	Medium
16	W-SMS_04_2	Users enter the StockID and the quantity they want and enter their UserID before clicking the confirm button.	High
17	W-SMS_04_3	The system will display a successful message if the order is placed.	High
18	W-SMS_04_4	The system will display an error message if the StockID is invalid.	High
	W-SMS_06	**MANAGE ORDER (RETAIL MANAGER)**	
19	W-SMS_06_1	The user shall be able to click the “Manage Order” button on the Home Page.	Medium
20	W-SMS_06_2	The user can click the edit order button to change their order.	High
21	W-SMS_06_3	The user can click the " delete order button to cancel their order.	Optional
	W-SMS_07	**VIEW NOTIFICATION**	
22	W-SMS_07_1	Users shall be able to click the “Notification” button on the Home Page.	Medium
23	W-SMS_07_2	The system will display a message if the stock quantity is below the minimum limit.	High

The requirements described in Table 2 were transformed into the computer system functionality. The next process is to show and model the system's requirements using appropriate modelling methods and tools. In this work, the Unified Modelling Language (UML) was used to model and represent all requirements. The models used in this work are two behavioural diagrams, namely the use case diagram and the activity diagram, and a class diagram representing the system's structural components. The diagrams were drawn using draw.io, a free, open-source, and web-based diagramming application which allows users to create, edit, and collaborate on various types of diagrams. Figure 1 shows the use case diagram and the communications between the use cases and the actor for the web-based stock management system. Seven major use cases are login, manage stock, check stock, place order, manage order, check order, and view notification.

Figure 1

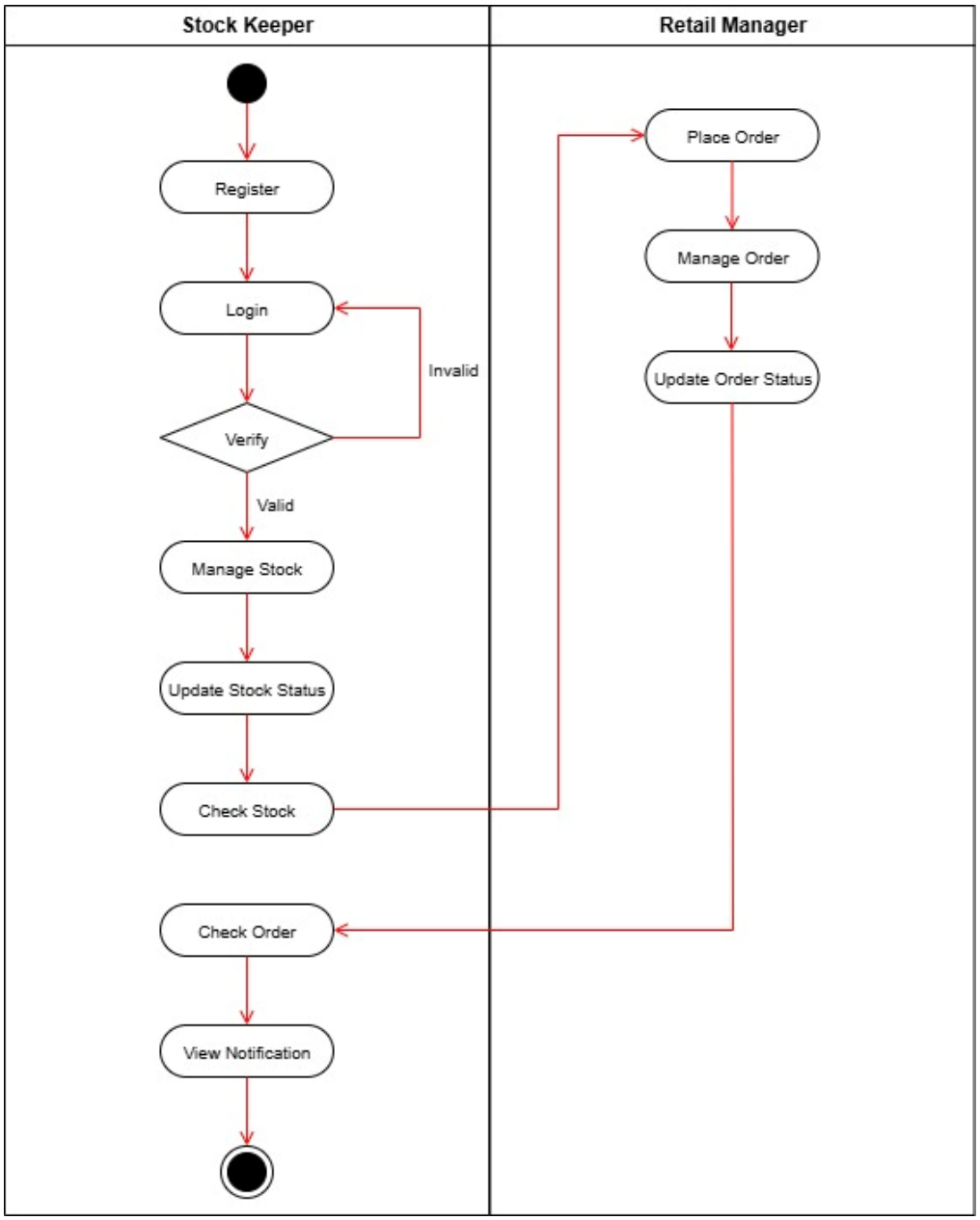
The use case diagram of a web-based stock management system



The use case diagram is presented to demonstrate the system's dynamic behaviour. Then, the actions involved in using the web-based stock management system are illustrated in the activity diagram in Figure 2, which is self-explanatory.

Figure 2

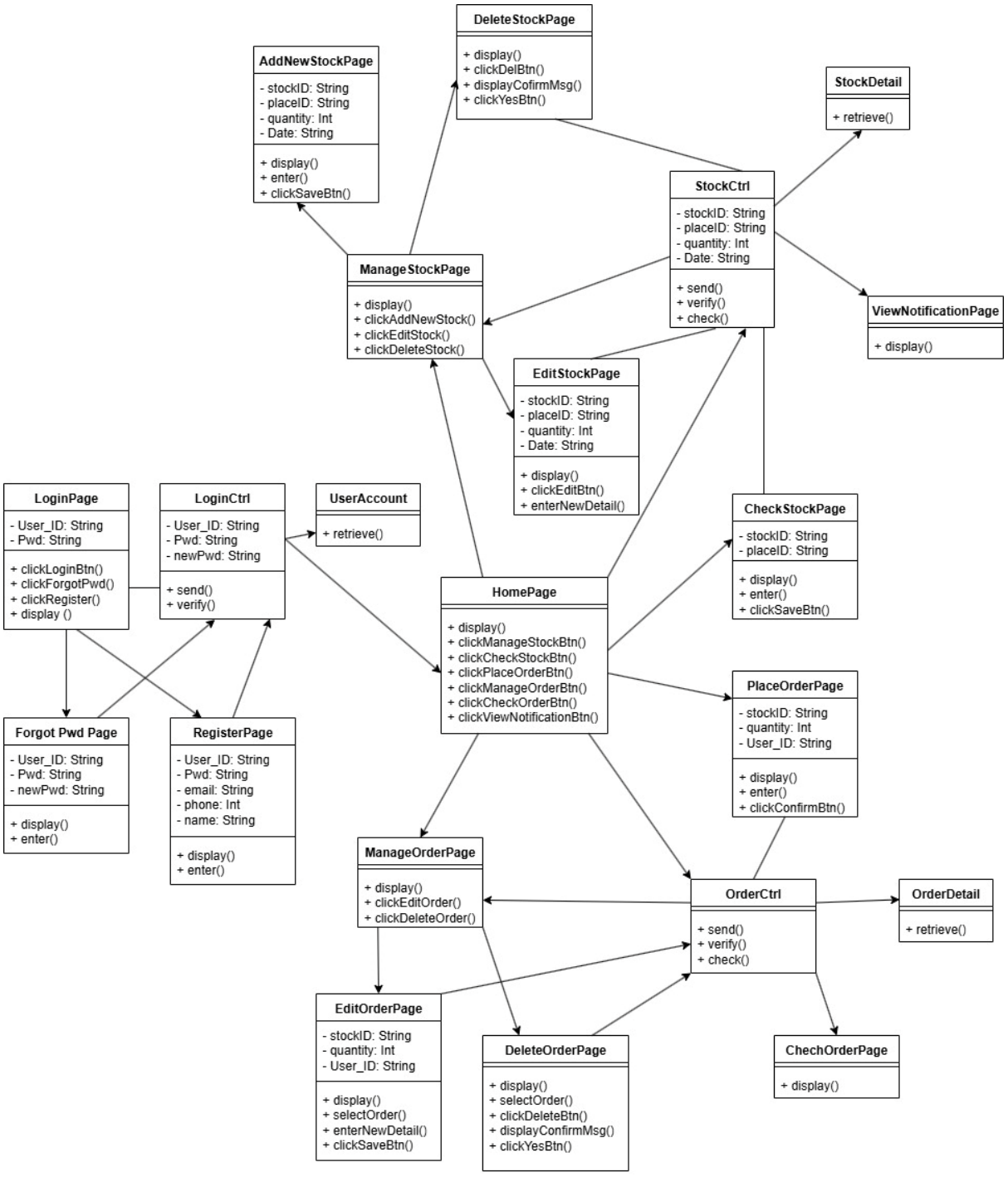
The activity diagram of the web-based stock management system



The structural components of the web-based stock management system are represented in a class diagram as illustrated in Figure 3. The class diagram in Figure 3 shows the app's attributes and operations. In this work, seven main classes were identified, namely login page, manage stock page, check stock page, place order page, manage order page, check order page, and view notification page. There are also many subclasses shown in the class diagram. The interactions between the classes are illustrated clearly in the diagram.

Figure 3

The class diagram of the web-based stock management system



A prototype of a web-based stock management system was developed. It shows all the requirements explained in the previous subsection. Software prototyping is a common method for demonstrating software requirements, enabling users to provide further feedback and recommendations based on their interactions with the prototype. Figma was used as the development tool to create the prototype of a web-based stock management system. The screenshots in Figures 4, 5 and 6 show the selected interfaces for the web-based stock management system.

Figure 4

The Interfaces for Login

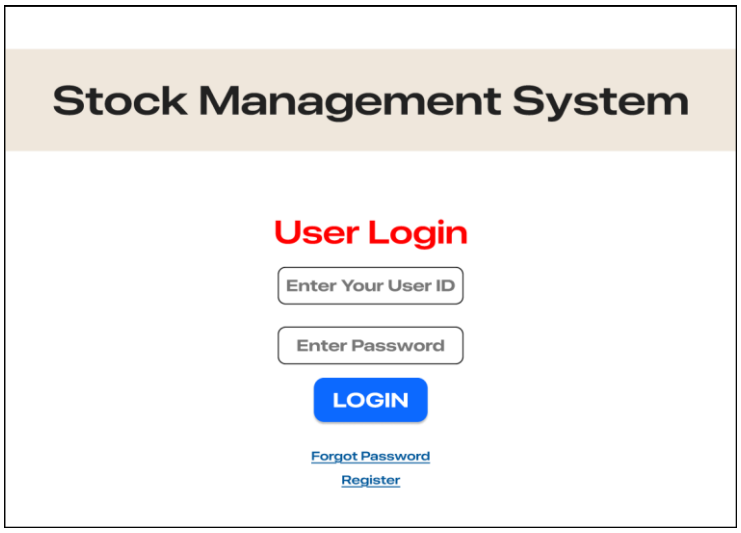


Figure 5

The Interfaces for the Home Page

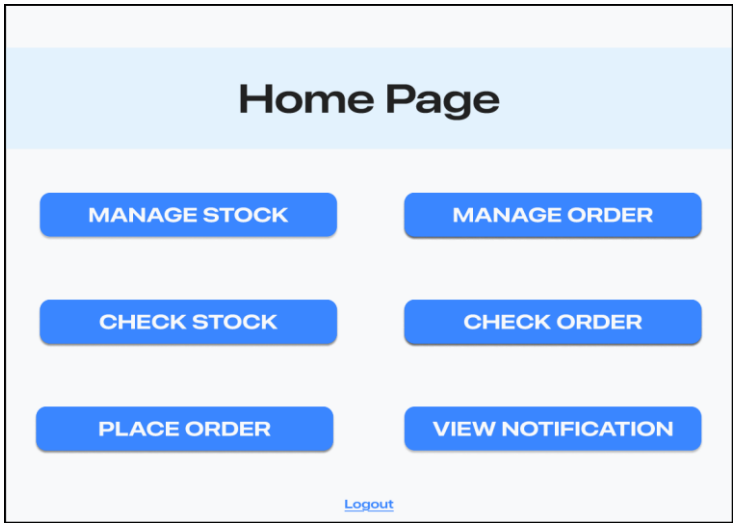
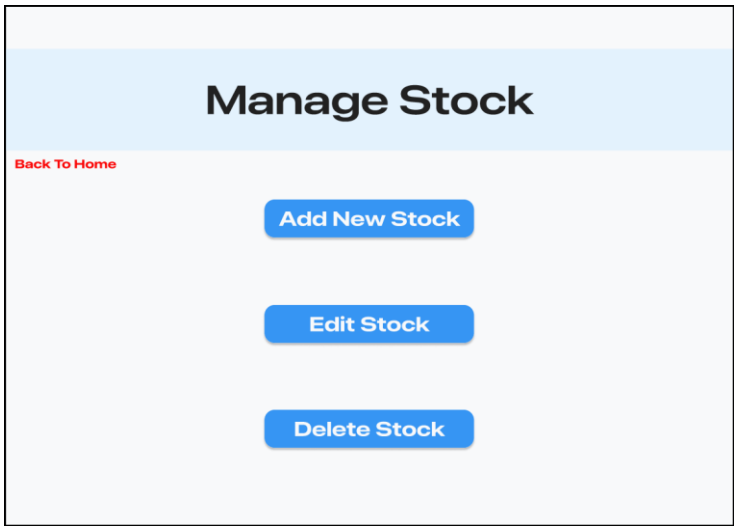


Figure 6

The Interfaces for the Manage Stock Page



EVALUATION OF WEB-BASED STOCK MANAGEMENT SYSTEM

A usability evaluation was conducted with 5 respondents from the company's workforce, who were stock keepers or retail managers. The prototype of a web-based stock management system and a questionnaire were used for the evaluation process. The questionnaire questions were adapted from the study by Katuk et al. (2019), which comprises 20 questions across 4 sections. Section A is about the respondents' demographic information, Section B asks about the usefulness of the system, Section C asks about the ease of use of the system, and Section D ask the respondents about their satisfaction with the system. The questionnaire was generated in Google Forms, and respondents need to answer all questions on a five-point Likert scale, where 1 represents strongly disagree, and 5 represents strongly agree.

This questionnaire has a total of five responses. In terms of gender distribution, most participants were male (4, 80%), with females just over 20% (1). In terms of age, many respondents (2, 40%) were between 35 and 44, with one respondent (20%) each in the 26-34, 45-54, and over-55 age groups.

The Usability of a Web-based Stock Management System

The usability analysis was conducted on the respondents' answers to Sections B, C, and D of the Google Form questionnaire. These 3 sections measure respondents' perceptions of the usefulness, ease of use, and satisfaction with a web-based stock management system. Tables 3, 4, and 5 show the frequencies and averages of the responses. Most respondents rated 4 or 5 on the questionnaire, and no respondent rated anything else.

Table 3

The respondents' responses on the Usefulness of the Web-based Stock Management System

Questionnaire questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
Web-based Stock Management System enhances my effectiveness in managing stock.	0 (0%)	0 (0%)	0 (0%)	4 (80%)	1 (20%)	4.20
It saves me time when I use this app to manage my stock.	0 (0%)	0 (0%)	0 (0%)	3 (60%)	2 (40%)	4.40
The web-based stock management system meets my needs.	0 (0%)	0 (0%)	0 (0%)	4 (80%)	1 (20%)	4.20
The Web-based Stock Management System does everything I expect it to.	0 (0%)	0 (0%)	0 (0%)	2 (40%)	3 (60%)	4.60
A web-based stock management system is useful overall.	0 (0%)	0 (0%)	0 (0%)	2 (40%)	3 (60%)	4.60

Table 4

The respondents' responses on the Ease of Use of the Web-based Stock Management System

Questionnaire questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
The Web-based Stock Management System is easy to use.	0 (0%)	0 (0%)	0 (0%)	4 (80%)	1 (20%)	4.20
The web-based Stock Management System is user-friendly.	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (100%)	5.00
The Web-based Stock Management System is flexible.	0 (0%)	0 (0%)	0 (0%)	3 (60%)	2 (40%)	4.40
The web-based Stock Management System is easy to learn.	0 (0%)	0 (0%)	0 (0%)	3 (60%)	2 (40%)	4.40
I can use the Web-based Stock Management System without written instructions.	0 (0%)	0 (0%)	0 (0%)	4 (80%)	1 (20%)	4.20
I can easily remember how to use the Web-based Stock Management System.	0 (0%)	0 (0%)	0 (0%)	2 (40%)	3 (60%)	4.60
My interaction with the system would be clear and understandable.	0 (0%)	0 (0%)	0 (0%)	2 (40%)	3 (60%)	4.60

I can use the Web-based Stock Management System successfully every time.	0 (0%)	0 (0%)	0 (0%)	3 (60%)	2 (40%)	4.40

Table 5

The respondents' responses on the satisfaction with the Web-based Stock Management System

Questionnaire questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Average
I am satisfied with the Web-based Stock Management System.	0 (0%)	0 (0%)	0 (0%)	3 (60%)	2 (40%)	4.40
I would recommend a Web-based Stock Management System.	0 (0%)	0 (0%)	0 (0%)	2 (40%)	3 (60%)	4.60
The Web-based Stock Management System works the way I want it to work.	0 (0%)	0 (0%)	0 (0%)	4 (80%)	1 (20%)	4.20
The Web-based Stock Management System is wonderful and pleasant to use.	0 (0%)	0 (0%)	0 (0%)	2 (40%)	3 (60%)	4.60

In terms of usefulness, all participants agreed that the system enhanced their stock management effectiveness, saved their time, and matched their needs. When it discusses ease of use, all users agreed or strongly agreed that the system was simple to use. For example, users stated that they could easily know how to use the system and that their interactions with it were simple and clear. Regarding satisfaction, all participants agreed or strongly agreed that they were satisfied with the system's functionality. The majority also believed that the system ran as expected. Hence, feedback shows that users considered the system intuitive, effective, and useful for stock management tasks. These results indicate that the system is well-suited for real-world deployment in retail or warehouse applications, fulfilling its basic standards of usability, usefulness, and satisfaction.

CONCLUSION

This project focuses on developing a Web-based Stock Management System suitable for a fertiliser company, with the main goal of enhancing storage management by implementing FIFO (First-In-First-Out) logic. The system was created to help small and medium-sized enterprises (SMEs) better manage their inventory, minimising issues such as ageing inventory and inefficient dispatch. In the future, the system might be improved by adding real-time stock notifications, mobile support for Android and iOS users, and even integration with barcode scanning technology to further speed inventory control. A larger-scale usability study with more participants and longer testing periods is also suggested to validate system performance and get larger insights. This study adds insight into web-based inventory systems by combining development methods, usability testing, and SME efficiency improvements. This study contributes to research by demonstrating how the integration of Rapid Application Development with usability evaluation can be applied in the context of SME inventory systems, thereby opening opportunities for future studies to explore similar hybrid approaches, additional usability factors, or extended system features such as real-time analytics. From a practical perspective, the study offers a useful reference for system developers and SMEs by outlining design considerations for web-based inventory systems, particularly in improving stock tracking efficiency through structured methods and user-centred interface design.

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