DESIGN OF MANUFACTURING MANAGEMENT SYSTEM: PRODUCT SALES MANAGEMENT SYSTEM

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ABSTRACT

The advent of Industry 4.0 has fuelled the demand for Manufacturing Management Systems (MMS) in the manufacturing industry. This article presents the design and development of a comprehensive Product Sales Management System (PSMS) tailored for small and medium-sized manufacturing companies, focusing on the dairy product industry. Employing the Rapid Application Development (RAD) approach, the development process prioritised user-friendly interfaces and rapid prototyping. Through meticulous requirements gathering, key features were identified, including product information management, customer information management, sales order management, report generation, product advertisement management, and an analytic dashboard. Unified Modeling Language (UML) diagrams, such as use case, activity, and class diagrams, were utilised to visualise the system's functionalities and ensure alignment with requirements. Iterative development and user feedback enhanced the system's usability, resulting in a user-friendly interface for streamlined product sales handling. The proposed PSMS offers efficient management, enhanced communication, and revenue generation for manufacturing companies and tiny and medium-sized enterprises. Furthermore, the study contributes to an understanding of the system requirements and user interface of a PSMS, providing a valuable reference model for developers and researchers in the manufacturing industry. The proposed PSMS represents a significant step towards efficient product sales management, streamlining operations, and boosting manufacturers' profitability. In future work, the PSMS's user interface will be optimised for better mobile responsiveness, and its functionality will be extended to support collaborative sales management and provide manufacturers with advanced capabilities to enhance their sales processes and decision-making.

Keywords: Industry 4.0, Manufacturing Management System, Product Sales Management System, Rapid Application Development.

INTRODUCTION

A growing fusion of Industrial Production and Information and Communication Technologies (ICT) has resulted in Industry 4.0, which has gained popularity in the manufacturing industry due to globalisation and technology (Arnold et al., 2016). Manufacturing Management System (MMS) is increasingly in demand in the manufacturing industry due to the transformative impact of Industry 4.0 on traditional business models (Arnold et al., 2016). The key features associated with Industry 4.0, such as real-time capability, interoperability, and horizontal and vertical integration of production systems through ICT systems, guide the development of Manufacturing Management Systems, enhancing manufacturing management and meeting system requirements (Ibarra et al., 2018).

MMS primarily focuses on product sales management systems designed to manage product sales, product information, customer information, and related specifications for manufacturing companies (Paiola & Gebauer, 2020). This project targets small and medium-sized manufacturing companies without fully digitalising their business models and focuses on a dairy product manufacturing company (Paiola & Gebauer, 2020). Rapid Application Development (RAD) is implemented in this project to meet time and cost constraints, emphasising a fast-paced environment and user-friendly MMS User Interface (Paiola & Gebauer, 2020).

According to the research by Juvana and Lestariningsih (2022), a product sales management system is defined as software that automates and manages product sales processes, evolving from product sales management software to sales CRM software, including product sales and customer information. A Manufacturing Management System ensures the availability of consistent and accurate real-time data across all departments within an organisation, enabling better coordination of processes and procedures (Juvana & Lestariningsih, 2022). This system provides insight into manufacturing, quality control, inventory, cost of goods sold, and product sales, among other aspects, facilitating efficient and effective management across departments (Juvana & Lestariningsih, 2022).

The Manufacturing Management System's usability is crucial in providing a user-friendly interface and enhancing management efficiency (Derks & Weston, 2005). Complexity in system interfaces can impede management processes and affect efficiency. Therefore, in the prototype phase of this project, interface complexity and usability will be significant considerations, aligning with RAD principles (Derks & Weston, 2005).

To build a compelling product sales management system, attention should also be paid to sales management workflows (Fernández-Iglesias et al., 2005). An effective sales management workflow aligns strategies, training, and operations with M-level business objectives. This results in improved conversion rates, increased deal size, shorter sales cycles, and enhanced sales forecasting accuracy workflows (Fernández-Iglesias et al., 2005). Sales operations, strategy, and analysis are critical aspects of sales management workflows. Defining the sales process, maintaining an organised sales pipeline, and monitoring various sales activities contribute to effective sales management (Sarkar et al., 2020). The Product Sales Management System streamlines these workflows, ensuring efficient coordination and improved performance (Sarkar et al., 2020).

The objectives of this article are to analyse the requirements, design and develop a low-fidelity and M-fidelity prototype, and evaluate the usability of the Manufacturing Management System—product Sales

Management. The Product Sales Management System aims to analyse functional and non-functional requirements, increase the effectiveness of product sales handling, enhance information quality, reduce operational lead times, and strengthen communication between sales and manufacturing departments in small and medium-sized manufacturing companies, particularly in the dairy product industry.

There are six critical specifications for the MMS - Product Sales Management System, derived from the requirement planning stage using Rapid Application Development (RAD) principles. These specifications include managing product information, managing customer information, managing sales orders, generating reports, managing product advertisements, and providing an analytic dashboard. Managing product information is challenging due to intellectual property, security, and trust concerns, but it remains a critical feature in this project. Customer information management is also essential, although challenges may arise in maintaining Customer Information Management (CIM) and Customer Relationship Management (CRM) strategies, policies, and data protection requirements (Hernandez-de-Menendez et al., 2020). Sales order management aims to provide a more reliable solution than current workflow systems, addressing deficiencies identified in previous research based on manufacturing resource planning (Zhao & Tu, 2021). Generating reports is fundamental, with cost-effective approaches available for M-quality report development (Tandi & Jakobs, 2019). Managing product advertisements aims to increase revenue and brand popularity, allowing manufacturers to reach their sales targets in targeted time frames (Tandi & Jakobs, 2019). Lastly, the analytic dashboard provides an overview of product-sales-related information in a user-friendly interface, aiding decision-making processes (Eleken, 2023).

In conclusion, the Manufacturing Management System, PSMS, focuses on effectively managing product sales in manufacturing companies, particularly small and medium-sized ones. This project aims to enhance communication between sales and manufacturing departments, improve information quality, shorten operational lead times, and introduce product advertisement features to generate more revenue. Based on the prototype, the system's user-friendly interface provides convenience in managing product sales for manufacturers.

BACKGROUND AND RELATED WORK

The increasing variety of products offered by manufacturing companies poses challenges in effectively managing sales and manufacturing processes (Citadelle, 2021). There is a need to control and optimise sales and manufacturing activities to ensure efficient operations. However, the current Manufacturing Management System, particularly in the context of Product Sales Management, falls short of effectively managing product sales and generating revenue. Existing systems primarily focus on inventory management and recording sales transactions, neglecting the enhancement of product sales (Salesforce, 2024). Consequently, this problem disproportionately affects small and medium-sized manufacturing companies, which face difficulties managing product sales effectively.

In addition to the shortcomings in managing product sales, the User Interface (UI) of the Manufacturing Management System requires attention to improve user-friendliness and enhance management efficiency (Eitle & Buxmann, 2019). Existing interfaces are often non-intuitive, challenging for the management team to navigate, and overloaded with excessive tables and data, which hinders the effective handling of product sales through the system (Eitle & Buxmann, 2019). Moreover, the absence of product advertisement features limits their capabilities in the market. Developing a complete system with relevant features and a user-friendly interface incurs significant costs, making it unaffordable for small and medium-sized manufacturing companies.

Focusing on sales management workflows is essential to address these limitations and develop a better PSMS. An effective sales management workflow aligns strategies, training, and operations with M-level business objectives. This leads to improved conversion rates, increased deal size, accelerated sales cycles, and enhanced sales forecasting accuracy (Team Kissflow, 2024). Moreover, a well-implemented Product Sales Management System aids manufacturers in keeping track of the manufacturing process, allowing them to thrive in an increasingly competitive marketplace (Team Kissflow, 2024).

Sales operations, strategy, and analysis are pivotal in effective sales management workflows (Salesforce, 2024). Sales operations involve building a sales management team, the manufacturing company's backbone. Defining the sales process and establishing a sales pipeline are crucial components of sales strategy, as the pipeline visualises the necessary steps for each prospect, from the initial inquiry to the closing stage (Salesforce, 2024). Monitoring sales activities, such as lead generation, scoring, qualification, follow-up emails, social media messages, outreach activities, market research, and product knowledge, is essential for successful sales management (Eitle & Buxmann, 2019). Furthermore, reporting is a critical element of sales analysis, requiring the utilisation of sales metrics and quantifiable indicators to assess the performance of sales operations and goal attainment (Eitle & Buxmann, 2019). The Product Sales Management System streamlines sales management workflows by leveraging technology, facilitating more efficient and coordinated processes.

The existing challenges in managing product sales within manufacturing companies, particularly for small and medium-sized enterprises, the need for an improved Manufacturing Management System focused on Product Sales Management. Enhancing the user-friendliness of the system's UI and incorporating sales management workflows can improve sales performance, revenue generation, and overall efficiency in manufacturing operations.

METHODOLOGY OF THE STUDY

The study adopted the Rapid Application Development (RAD) methodology to develop the Manufacturing Management System - Product Sales Management System (Salesken AI Inc, 2023). RAD is an adaptive software development approach that streamlines the gathering of system requirements through prototyping. Despite the continuous transformation of software development methodologies, RAD remains relevant and widely used by software developers due to its effectiveness (Team Kissflow, 2024). It consists of four main phases, as illustrated in Figure 1.

Figure 1

The Phases of Rapid Application Development (RAD)
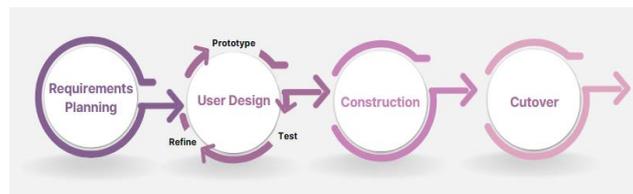
In contrast to traditional methodologies, the stages of requirements planning in RAD do not necessitate extensive stakeholder discussions to define a comprehensive set of specifications. Instead, they promote rapid development by finalising a broad set of requirements for the Manufacturing Management

System—Product Sales Management System early on. Ensuring alignment among stakeholders at this stage minimises the risk of costly reconstructions and prevents miscommunications.

During the prototype stage, the focus is prioritising prototypes for the Manufacturing Management System—Product Sales Management System and initiating actual development. Rapid prototypes with different specifications are designed to allow clients to assess various features quickly. This user involvement, testing, and feedback on a live system enable a more iterative development process. Moreover, prototyping aids developers in evaluating the feasibility of complex components, resulting in more robust and error-resistant software. Rapid construction involves coding, testing, and unit integration to transform prototypes into working models of the Manufacturing Management System—product Sales Management System. This phase demands continuous effort from developers, as most bugs, issues, and alterations are addressed through feedback and reviews.

The cutover phase marks the deployment of the Manufacturing Management System - Product Sales Management System into a real-world production environment. It encompasses extensive scale testing, technical documentation, issue tracking, final adjustments, and system simulation. The debugging process and final updates and maintenance activities are undertaken before confidently presenting the final product to the customer.

This study applied the RAD methodology to develop a quality Manufacturing Management System - Product Sales Management System. Each phase of RAD, namely requirements planning, prototype, construction, and cutover, was thoroughly implemented and discussed in the subsequent sections. The Design and Development of the Manufacturing Management System - Product Sales Management covered the requirements planning, user design, and construction phases. At the same time, the Evaluation of the system focused on the cutover phase.

DESIGN AND DEVELOPMENT OF PRODUCT SALES MANAGEMENT SYSTEM

The design and development of the Product Sales Management System (PSMS) involved a systematic process to gather and analyse requirements, followed by the creation of appropriate models to visualise the system's functionalities. The development process followed the Rapid Application Development (RAD) approach.

A broad requirement for the Manufacturing Management System - Product Sales Management System was finalised as an outcome of the requirements gathering phase in the RAD approach. The identified requirements gathered from the literature reviews were categorised based on priorities and functionalities, resulting in a comprehensive list of necessary features for the PSMS. The essential requirements were related to login account functionality, profile management, product information management, customer information management, sales order management, report generation, product advertisement management, analytic dashboard, and logout functionality. The gathered requirements illustrated in Table 1 were translated into the PSMS design and visualised using the Unified Modelling Language (UML). Several UML diagrams, including the use case, activity, and class diagram, were employed to represent the system's functionalities.

The use case diagram (Figure 2) illustrates the interactions between the users and the system, showcasing nine major use cases: Login, Manage Profile, Manage Product Information, Manage Customer Information, Manage Sales Order, Generate Report, Manage Product Advertisement, Analytic Dashboard, and Logout. Each use case contained sub-functions that allowed users to perform specific tasks within the system. The activity diagram (Figure 3) demonstrated the dynamic behaviour

of the PSMS, outlining the step-by-step operations involved in using the system for various tasks. The class diagram (Figure 4) represents the structural components of the PSMS. The interactions and associations between these classes were depicted in the diagram. Following the requirements gathering and design phases, the actual development of the PSMS commenced. Appropriate programming languages and technologies were utilised to implement the functionalities outlined in the UML diagrams. The system was developed step-by-step, ensuring that each feature was thoroughly tested and validated before proceeding to the next. The agile nature of RAD facilitated iterative development and allowed for rapid prototyping and testing. Overall, the design and development of the PSMS followed a systematic and comprehensive approach, ensuring that the system's functionalities aligned with the gathered requirements. The use of UML diagrams provided clear visualisations of the system's design.

Table 1

List of Requirements for Product Sales Management System

ID	Requirement Description	Priority
1	Login Account	
1.1	The user must enter a username and password to log into the system.	M
1.2	The system must verify the username and password of the user.	M
1.3	The system will show the notification message if the sales officer successfully logs into the system.	M
1.4	The system must display the home page after clicking on the notification message.	M
1.5	Forget Password	D
1.5.1	The Manager and Sales Officer Can Reset Their Password by Clicking "Forget Password" if they forget the password given by the company authority.	D

1.5.2	The system must provide a page for the manager and sales officer to reset their passwords by entering the details:
	    a. Username
	    b. New Password
	    c. Confirmation Password
		M

1.5.3	The system must save the new password for the manager and sales officer.	M
1.5.4	The manager and sales officer must log into the system using the new password, not the old password.	M
2	Manage Profile	
2.1	The system must access the user profile from the profile database.	M

2.2	The system must display a user profile page, which includes:
	    a. Staff ID
	    b. Username
		M

	c. Phone Number	
	d. Email	
	e. Department Role	
2.3	Update Profile Details	O
2.3.1	The system must display a page to allow the sales officer and manager to key in the profile information details such as: a. Phone Number b. Email	M
2.3.2	The sales officer and manager must click the save button to save the information that has been entered.	M
2.3.3	If any changes are made, the system must save the new, updated profile information details in the database.	M
3	Manage Product Information	
3.1	The system must access the product information from the product information database.	M
3.2	The system must display the page that shows the product list for manage and sales officer, which includes the following information: a. Product Name b. Product Id c. Universal Product Codes (UPCS) d. SKUS e. Product Categories f. Product Price g. Expiration Dates	M
3.3	The system must display a page that allows the sales officer to add, update, delete, and search for product information details.	D
3.4	Add Product Information Details	O
3.4.1	The system must auto-generate product id.	M
3.4.2	The system must display a page to allow the sales officer to add the product information details such as: a. Product Name b. Universal Product Codes (UPCS) c. SKUS d. Product Categories e. Product Price f. Expiration Dates	M
3.4.2	The sales officer must click the save button to save the entered information.	M
3.4.3	The system must save the newly added product information details and save them in the database if there are any changes made and have a prompt message "product details add successfully".	M
3.5	Update Product Information Details	O

| 3.5.1 | The sales officer and manager must key in the product id, which the system must verify, retrieve the product information from the database, and then display. | M |

| 3.5.2 | The system must display a page to allow the sales officer to update the product information details such as: | M |

<blockquote>
Product Name
SKUS
Product Categories
Product Price
Expiration Dates
</blockquote>

| 3.5.3 | The sales officer must click the save button to save the entered information. | M |

| 3.5.4 | The system must save the new updated product information details and save them in the database if there are any changes made and have a prompt message "product details update successfully". | M |

| 3.6 | Delete Product Information Details | O |

| 3.6.1 | The user can choose the delete button to delete the product details. | M |

| 3.6.2 | The sales officer and manager must key in the product ID; the system must verify it, retrieve the product information from the database, and then display it. | M |

| 3.6.3 | The system will delete the selected product details from the database. | M |

| 3.6.4 | The system must have a prompt message "product details delete successfully". | M |

| 3.7 | Search Product Information Details | O |

| 3.7.1 | The system must display a page to allow the sales officer to search the product information and input the product name to search. | M |

| 3.7.2 | The system must display the product information details based on the search field input, which is retrieved from the database. | M |

| 4 | Manage Customer Information | |

| 4.1 | The system must access the customer information from the customer information database. | M |

| 4.2 | The system must display the page that shows the customer list for manage and sales officer, which includes the following information: | M |

<blockquote>
a. Customer Id
b. Customer Name
c. Email
d. Phone Number
e. Address
</blockquote>

| 4.3 | The system must display a page that allows the sales officer to add, update, delete, and search for customer information details. | O |

| 4.4 | Add Customer Information Details | O |

4.4.1	The System Will Auto-Generate the Customer ID.	M
4.4.2	The system must display a page to allow the sales officer to key in the customer information details such as:	M

      a. Customer Name
      b. Email
      c. Phone Number
      d. Address

4.4.3	The Sales Officer Must Click the Save Button to Save The Entered Information.	M
4.4.4	The system must save the newly added customer information details and save them in the database if there are any changes made and have a prompt message "customer details add successfully".	M
4.5	**Update Customer Information Details**	O
4.5.1	The sales officer and manager must key in the customer id; the system must verify the customer id, retrieve the product information from the database, and then display it.	M
4.5.2	The system must display a page to allow the sales officer to key in the customer information details such as:	M

      a. Customer Name
      b. Email
      c. Phone Number
      d. Address

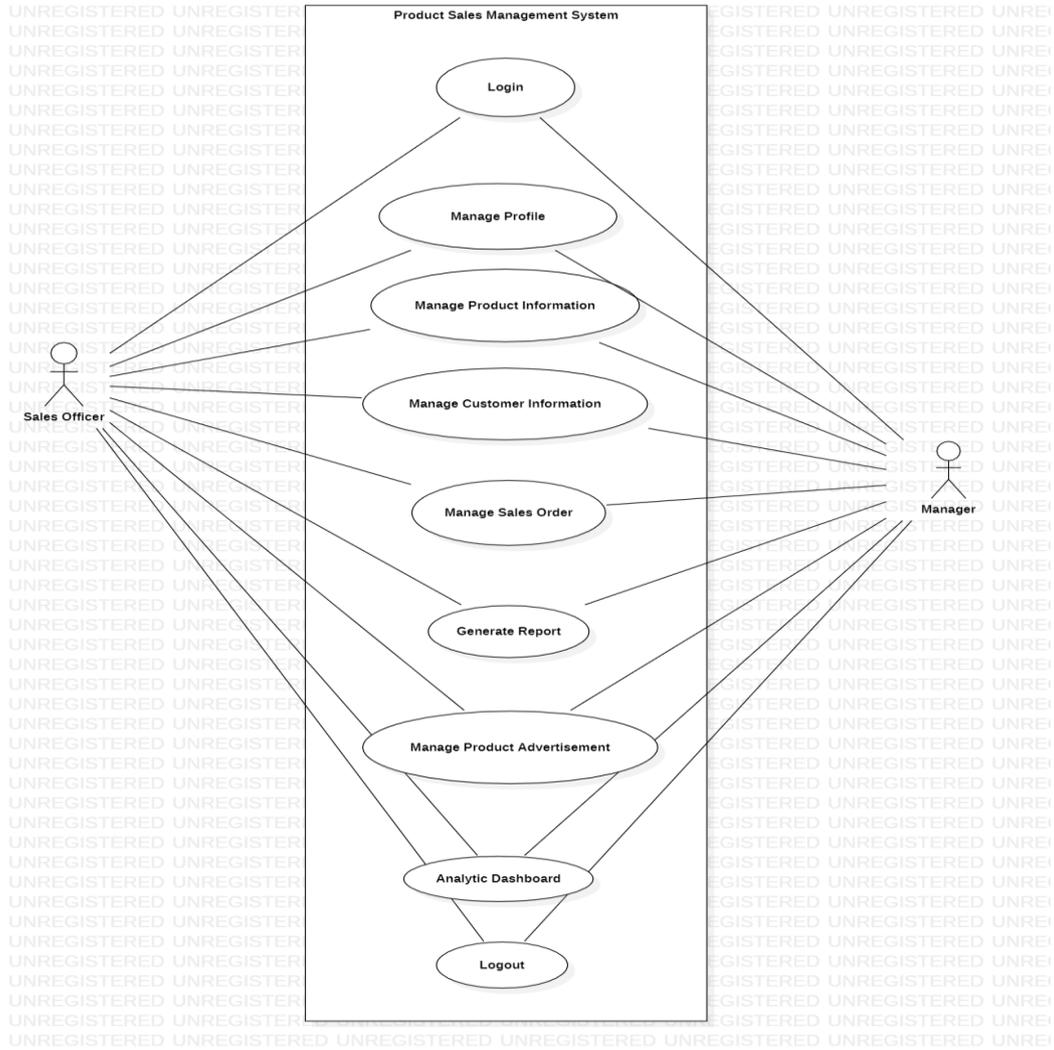|		
4.5.2	The sales officer must click the save button to save the entered information.	M
4.5.3	The system must save the new updated customer information details and save them in the database if there are any changes made and have a prompt message "customer details update successfully".	M
4.6	**Delete Customer Information Details**	O
4.6.1	The user can delete the customer details by clicking the delete button.	M
4.6.2	The sales officer and manager must key in the customer ID; the system must verify it, retrieve the product information from the database, and then display it.	M
4.6.3	If any changes are made, the system must save the relevant actions performed by the user based on the customer's information.	M
4.6.4	The system must have a prompt message "customer details delete successfully".	M
4.7	**Search Customer Information Details**	
4.7.1	The system must display a page to allow the sales officer to search the customer information and input the customer's name to search.	M
4.7.2	The system must display the customer information details based on the search field input retrieved from the database.	M

5	Manage Sales Order	
5.1	The System Must Access the Sales Order Information from The Sales Order Database.	M
5.2	The system must display the page that shows the sales order, which includes the following information:	M

    a.   Reference No
    b.   Customer Name
    c.   Order Date
    d.   Order Status
    e.   Order Amount

5.3	The system must display a page allowing the sales officer to add, update, delete, and search for the sales order details.	O
5.4	Add Sales Order Information Details	O
5.4.1	The system must auto-generate the sales order id.	M
5.4.2	The system must display a page to allow the sales officer to key in the sales order information details such as:	M

    a.   Customer Name
    b.   Order Date
    c.   Order Status
    d.   Order Amount

5.4.3	The sales officer must click the save button to save the entered information.	M
5.4.4	The system must save the newly added sales order information details and save them in the database if any changes are made. It must also have a prompt message: "Sales order information added successfully."	M
5.5	Update Sales Order Information Details	O
5.5.1	The sales officer and manager must key in the sales order id. The system must verify the sales order id, retrieve the product information from the database, and display it.	M
5.5.2	The system must display a page to allow the sales officer to key in the sales order information details such as:	M

    a.   Customer Name
    b.   Order Date
    c.   Order Status
    d.   Order Amount

5.5.3	The sales officer must click the save button to save the entered information.	M
5.5.4	The system must save the newly updated sales order information details and save them in the database if any changes are made. It must also have a prompt message: "Sales order information update successfully."	M
5.6	Delete Sales Order Information Details	O

5.6.1	The User Can Delete the Sales Order Details By Clicking The Delete Button.	M
5.6.2	The System Will Delete the Selected Sales Order Details From The Database.	M
5.6.3	The System Must Have a Prompt Message "Sales Order Details Delete Successfully".	M
5.7	Search Sales Order Information Details	O
5.7.1	The system must display a page to allow the sales officer to search the sales order information and input the order id to search.	M
5.7.2	The system must display the sales order details based on the search field input, which is retrieved from the database.	M
5.8	Edit Order Status	O
5.8.1	The system must display a page to allow the sales officer to assign the order status.	M

5.8.2	The sales officer can assign the order status to three statuses such as:
	
	    a. Invoiced
	    b. Packed
	    c. Shipped
		M

5.8.3	The system must save the order status if there are any changes in the order status.	M
5.8.4	The system must display the new order status of the manager or sales officer sets.	M
6	Generate Report	
6.1	The system must access product information, customer information and order sales from the database.	M
6.2	The system must be able to generate reports based on requests (dynamic reports).	M

6.3	The system must display a page to allow the sales officer to choose the format of the report to be generated:
	
	    a. PDF
	    b. XLS
	    c. DOC
		M

6.4	The system must display a page with a preview of the report, which needs to be generated, and a download button for the sales officer to access the report.	M
6.5	The system must display a page with a download button to allow the sales officer to download the report.	M
7	Manage Product Advertisment	

7.1	The system must access the advertisement information from the advertisement database.	M
7.2	The system must display a page to allow the sales officer to choose the relevant advertisement, such as:	M

    a. Google Advertisement
    b. Promotion
    c. Clearance

7.3	The system must access the product information from the product information database.	M
7.4	The system must display a page of product information that allows the sales officer to choose the advertisement method for the selected product.	M
7.5	The sales officer must click the save button to save the changes.	M
7.6	If the advertisement is changed, the system must save the changes and enter them into the database.	M
7.7	The system must display newly added advertisement methods on selected products.	M
8	Analytic Dashboard	
8.1	The system must access the product information, sales and customer information from the product information, order sales and customer database.	M
8.2	The system must display analytic data of the sales and customer on a page, including:	M

    a. Product Sales
    b. Top Product
    c. Sales Target
    d. Revenue
    e. Profit
    f. Sales Analytic
    g. Top Selling Categories
    h. Top Customer
    i. User Lead

| 8.3	The system must display a page for the manager to set the sales target.	M
8.4	The manager must click the save button to save the changes.	M
8.5	The system must save the data in the order sales database if any changes are made.	M
8.6	The system must display the new sales target that the manager has set.	M
9	Logout	
9.1	The system shall allow the sales officer and manager to exit the system.	O

Figure 2

The Use Case Diagram of the Product Sales Management System

The use case diagram is illustrated to show the dynamic behaviour of PSMS. The operations involved in the system are illustrated in an activity diagram in Figure 3, which is self-explanatory.

Figure 3

The Activity Diagram of the Product Sales Management System
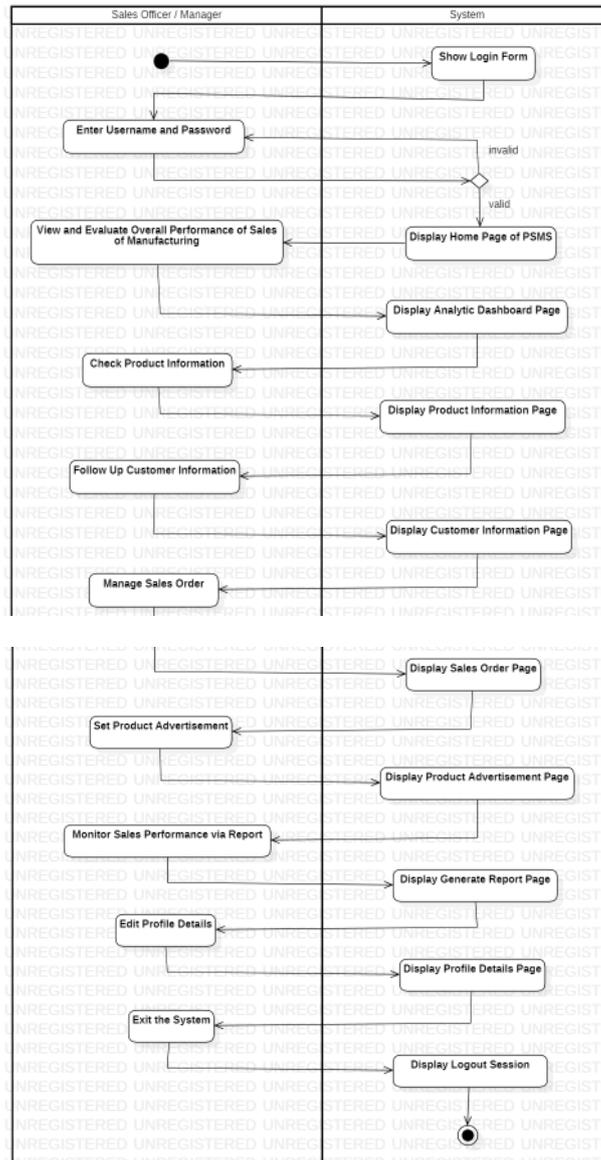
The structural components of the Product Sales Management System are represented in a class diagram, as illustrated in Figure 3. The class diagram in Figure 4 shows the system's attributes and operations. The work identified ten main classes: Staff, AccountInfo, AnalyticDashboard, CustomerInfo, OrderInfo, ProductInfo, AdvertisementInfo, Payment, Invoice, and GenerateReport. The diagram also clearly illustrates the interactions between the classes.

Figure 4

The Class Diagram of the Product Sales Management System
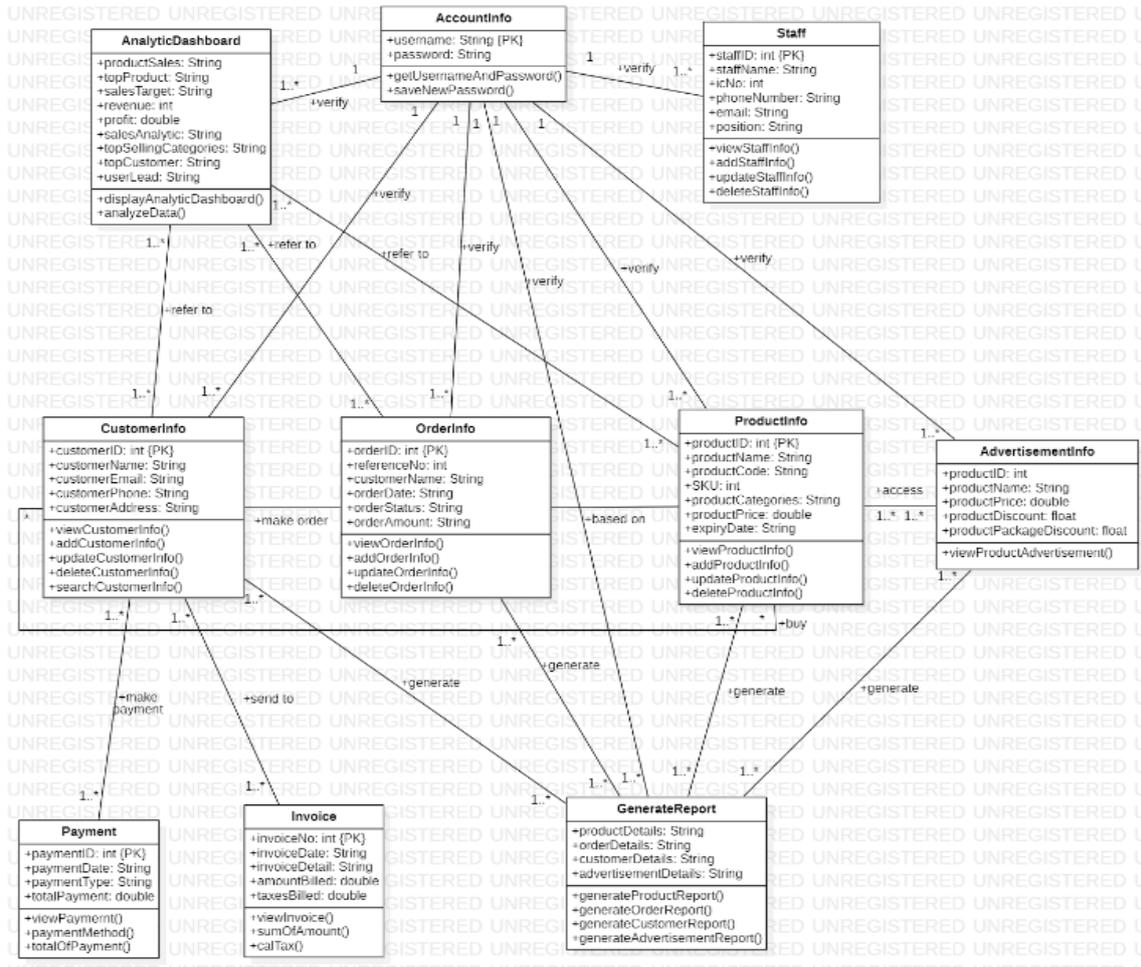
Utilising cPanel and MySQL, a user-friendly prototype of the Product Sales Management System (PSMS) was developed. cPanel, a web-based application, facilitated website hosting and provided essential programming tools for the PSMS prototype. The user interface was created using PHP, HTML, JavaScript, and Bootstrap, ensuring a responsive and intuitive design. MySQL, in conjunction with phpMyAdmin, handled the database for secure data storage. The PSMS prototype was crucial in gathering user feedback and refining system requirements. Employing the standard software prototyping approach, users interacted with the prototype, offering valuable comments and suggestions. This iterative process ensured that the PSMS would effectively meet user needs and expectations. Figures 5 to 13 present screenshots of the selected interfaces of the PSMS prototype to provide a comprehensive understanding of the system's design and functionalities.
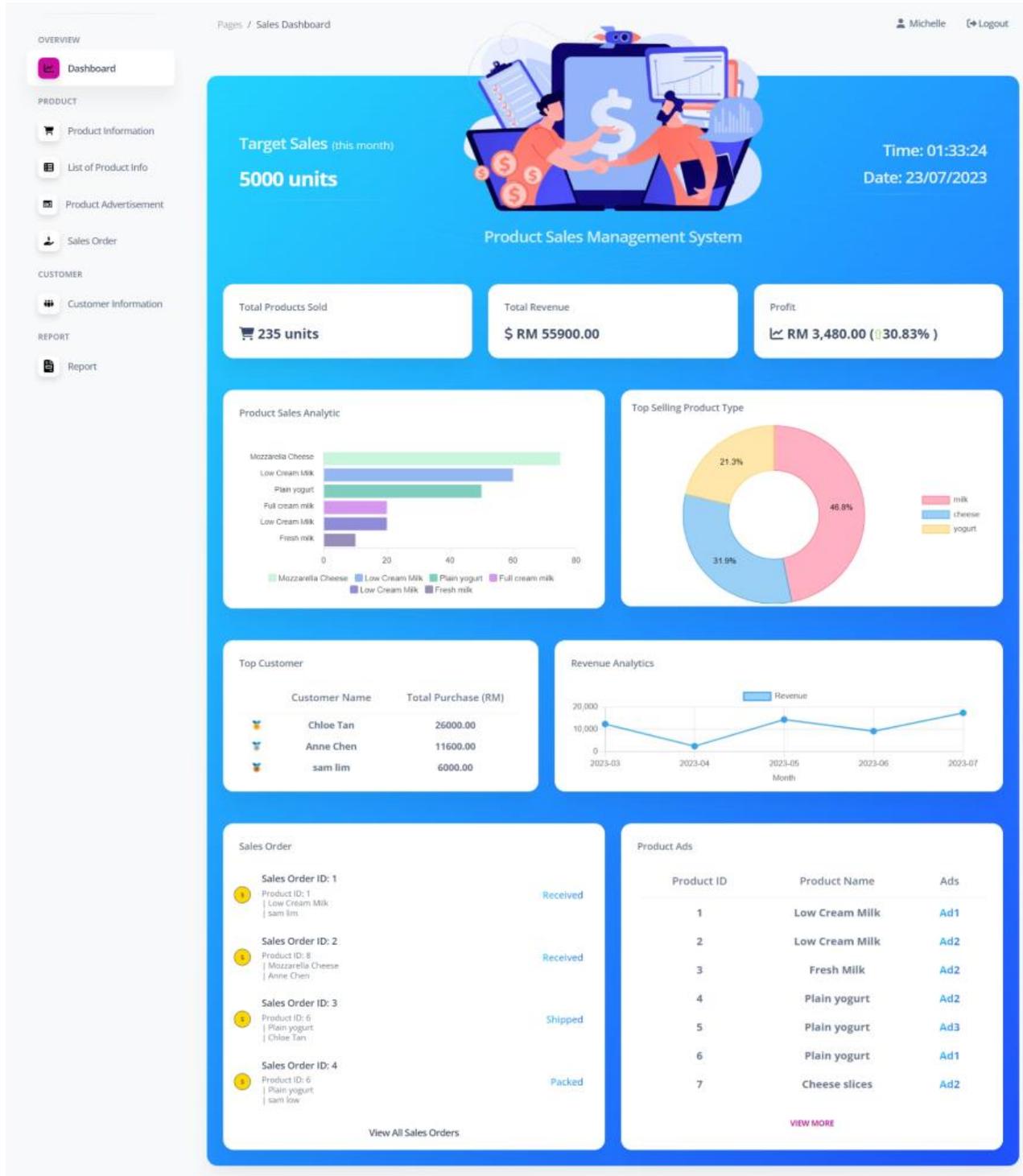
Figure 5

The Analytic Dashboard Interface of PSMS

Figure 6

The list of product information of PSMS

Figure 7

The Managed Sales Order PSMS

Figure 8

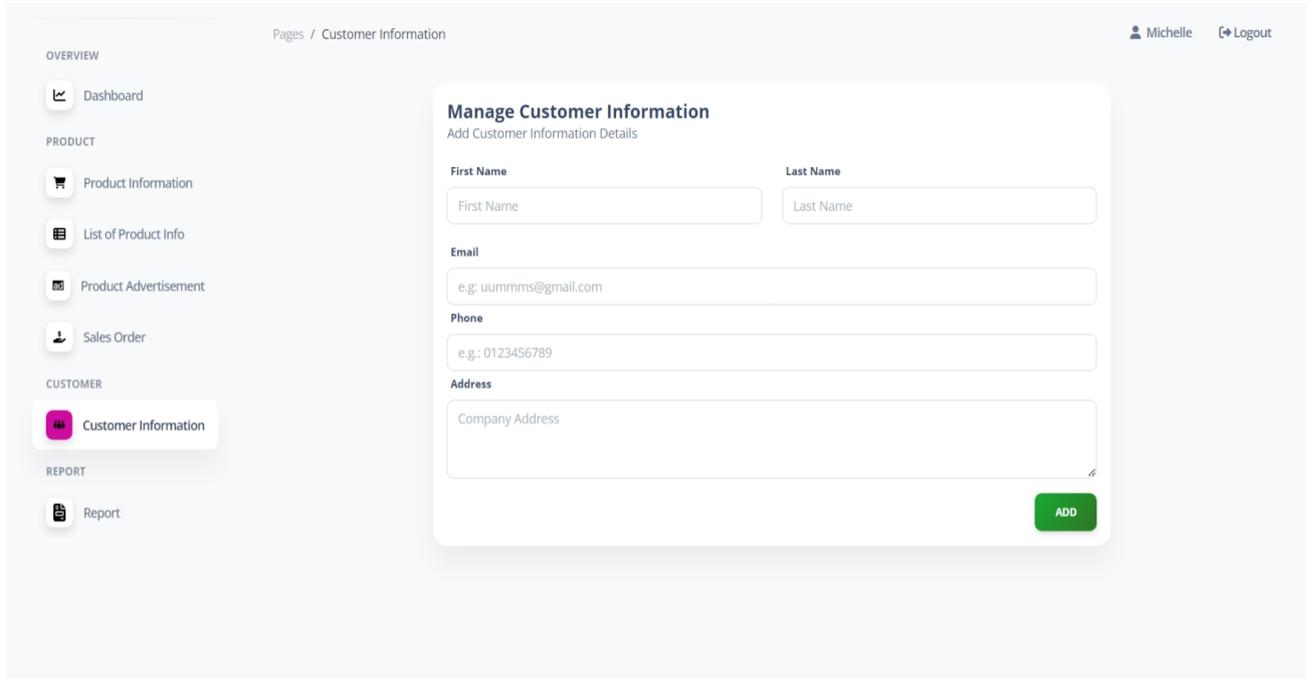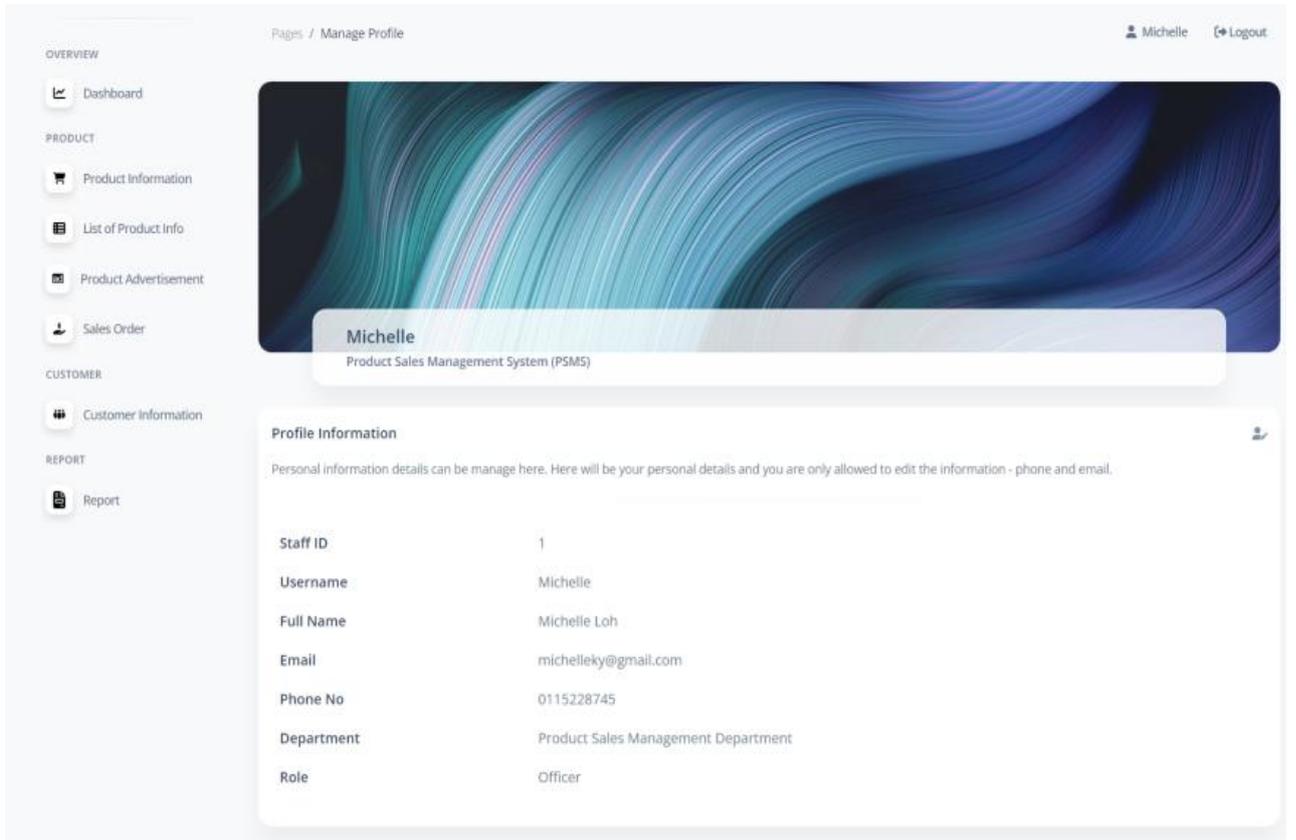*The Manage Customer Information Interface of PSMS*

Figure 9

The Product Sales Management System Main Functions

EVALUATION OF PRODUCT SALES MANAGEMENT SYSTEM

The Evaluation Setting

The evaluation of the Product Sales Management System (PSMS) involved 15 respondents who were selected as respondents. The respondents were chosen based on their experience in system development. They must have at least one year of experience in system development. The primary instrument for the evaluation was a Google Form questionnaire encompassing various sections, including demographic information, system functionality, usability, performance, reliability, and overall satisfaction. The questionnaire employed a Likert scale to measure respondents' agreement or disagreement with statements, facilitating quantitative data analysis. Additionally, the WAMMI (Website Analysis and Measurement Inventory) questionnaire was referenced to evaluate the system's usability, add depth to the evaluation process, and provide valuable insights for system improvements. The evaluation procedure involved accessing the PSMS through the provided link and using specific login credentials (Username: Michelle, Password: psms1234). Once logged in, the respondents were encouraged to explore and interact with the PSMS to gather firsthand experience and insights. The evaluation aimed to assess the PSMS comprehensively, considering various perspectives and respondents' feedback.

The Respondents' Demographic Information

The respondents' demographic information analysis indicated a diverse representation of age and gender. The majority of respondents, 80%, fell within the age range of 18 to 23, indicating a prominent presence of younger individuals experienced with contemporary web-based systems and technology. The remaining 20% of respondents were slightly older, aged between 24 and 29, ensuring comprehensive insights from different age groups. Regarding gender distribution, the respondents provided a reasonably equal representation, enabling a comprehensive assessment of the Product Sales Management System (PSMS) from various perspectives. This balanced gender distribution ensures that the evaluation encompasses feedback from individuals of all genders, fostering a comprehensive and equitable assessment.

Moreover, 100% of all respondents indicated they have relevant experience developing web-based systems. This strong background and expertise in the field make their feedback and insights particularly valuable for evaluating the PSMS. Their experience in web-based system development provides them with the necessary knowledge and perspective to assess the functionality, usability, accuracy, and performance of the PSMS in real-world conditions. The high percentage of respondents with development experience strengthens the validity and reliability of the evaluation results.

The Usability of Product Sales Management System

The Product Sales Management System (PSMS) evaluation based on the data provided in Tables 2 to 6 reveals promising results and positive feedback from the respondents across different aspects of the system. Looking at functionality (Table 2), the PSMS received high ratings, indicating that it effectively meets the users' needs. They found the system's features relevant and helpful in managing product information, especially sales order management and generating reports and analytics. Regarding usability (Table 3), the PSMS earned high praise for being user-friendly. Respondents reported that learning to operate the system was easy, and they appreciated the clear and helpful instructions and prompts provided by the system. Users encountered minimal difficulties during the initial learning

phase and felt controlled using the software. Regarding performance (Table 4), the PSMS demonstrated commendable results. Users were satisfied with its fast response time to inputs, and the system could handle simultaneous user activity without significant performance issues. Although a few respondents experienced unexpected system stoppages, the overall performance remained positive. Reliability (Table 5) was another vital aspect of the PSMS, with users finding it trustworthy and reliable. They reported minimal unexpected issues and highlighted the system's consistent data accuracy and integrity maintenance, contributing to their confidence in using it. Generally, the PSMS was well received by the respondents (Table 6). They provided positive feedback regarding the system. The screen's clarity and understandability enabled them to locate and understand the needed information. The post-task questionnaire demonstrates that the PSMS is highly effective and user-friendly. Its strong performance, reliability, and positive user feedback indicate that the PSMS holds great potential as a valuable tool for managing product sales and could significantly benefit small and medium-sized manufacturing companies seeking to enhance their sales and product management processes.

Table 2

The Respondents' Responses on the System Functionality

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
The system adequately meets my needs.	0	0	0	6 (40%)	9 (60%)	4.60
The features of the system are relevant and helpful in managing product information.	0	0	0	1 (6%)	14 (93%)	4.93
The sales order management feature of the system is efficient and effective.	0	0	0	2 (13%)	13 (86%)	4.87
The system's ability to generate reports and analytic dashboards is satisfactory.	0	0	0	5 (33%)	10 (67%)	4.67

Table 3

The Respondents' Responses on the Usability

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
Learning to operate the PSMS is easy.	0	0	0	3 (20%)	12 (80%)	4.80
The instructions and prompts provided by the system are helpful.	0	0	0	6 (40%)	9 (60%)	4.60
I do not encounter difficulties while initially learning to operate the system.	0	0	0	5 (33%)	10 (67%)	4.67

I feel in command of the software when using it.	0	0	0	6 (40%)	9 (60%)	4.60
The system might not disrupt my preferred way of arranging my work.	0	0	0	6 (40%)	9 (60%)	4.60

Table 4

The Respondents' Responses on the Performance

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
The system has a fast response time to inputs.	0	0	0	4 (27%)	11 (73.33)	4.73
I have experienced unexpected system stoppages.	11 (73%)	4 (26.70)	0	0	0	1.27
It is easy to restart the system if it stops.	0	0	0	6 (40%)	9 (60%)	4.60
The system handles simultaneous user activity without notable performance issues.	0	0	1 (7%)	5 (33%)	9 (60%)	4.53

Table 5

The Respondents' Responses on the Reliability

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
The system is reliable and rarely experiences unexpected issues.	0	0	0	6 (40%)	9 (60%)	4.60
The system consistently maintains data accuracy and consistency.	0	0	0	4 (27%)	11 (73%)	4.73
The system has proven to be dependable and trustworthy	0	0	0	5 (33%)	10 (67%)	4.67
The system has caused data loss or corruption issues.	9 (60%)	6 (40%)	0	0	0	1.40
The system	0	0	0	7	8 (53%)	4.53

| consistently maintains data integrity. | | | | (47%) | | |

Table 6

The Respondents' Responses on the Overall Satisfaction

The post-task questionnaire items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Average
I am satisfied with my sessions using the PSMS.	0	0	0	4 (26.70)	11 (73%)	3.93
The system provides a clear and understandable presentation of system information.	0	0	1 (7%)	3 (20%)	11 (73%)	4.67
I can find the necessary system information on the screen when needed.	0	0	0	3 (20%)	12 (80%)	4.80

CONCLUSION AND FUTURE WORKS

In this study, the Product Sales Management System (PSMS) design and development were presented using the Rapid Application Development (RAD) approach. The systematic process involved gathering and analysing requirements to create appropriate models for visualising the system's functionalities. The development phase followed an iterative and agile approach, allowing rapid prototyping, testing, and refinement. The requirements-gathering phase resulted in a comprehensive list of necessary features for the PSMS, categorised based on their priorities and functionalities. The key functionalities included login account management, profile management, product information management, customer information management, sales order management, report generation, product advertisement management, analytic dashboard, and logout functionality.

The Unified Modeling Language (UML) was utilised to visualise the system's design, and several UML diagrams were presented. The use case diagram depicted user and system interactions, showcasing nine major use cases and their sub-functions. The activity diagram demonstrated the dynamic behaviour of the PSMS, outlining step-by-step operations for various tasks. The class diagram represented the structural components of the system, illustrating the interactions and associations between classes. As a future work, one significant issue highlighted by the respondents pertains to the portrait view UI when accessing the PSMS on mobile phones. Users reported challenges in comprehensively viewing tables in the analytic dashboards from their mobile devices. Therefore, optimising the UI design for mobile responsiveness is imperative. By enhancing the system's adaptability to different screen sizes and orientations, users will seamlessly access and interact with all the device's features and functionalities.

This enhancement would significantly improve the overall user experience and bolster the system's usability on mobile platforms. Implementing Internet of Things (IoT) technology could further enhance the PSMS's capabilities. By embedding sensors in storage areas or shelves, the system could automatically detect when products are running low or out of stock and send notifications to sales officers or managers for restocking. In conclusion, the systematic design and development process created a robust and functional Product Sales Management System (PSMS). By addressing future work and optimising mobile responsiveness, the PSMS can further enhance its user accessibility and usability, making it a valuable tool for efficient product sales management in the manufacturing domain.

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