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AdamAdelia's Inventory Management System

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Abstract

The AdamAdelia Inventory Management System is a tailored solution designed to optimize inventory management at AdamAdelia's Kids Clothes Shop. Addressing unique challenges in children's apparel, it provides real-time insights, automates restocking, and ensures timely product availability. This user-friendly system enhances efficiency by offering real-time stock tracking, automated restocking recommendations based on sales and consumer preferences, and robust data security. Tailored for AdamAdelia's shop but adaptable for similar businesses, it aims to increase profitability and streamline operations. Immediate deployment promises to integrate seamlessly into existing workflows. A feedback mechanism and thorough usability testing ensure it remains user-centric, minimizes errors, and boosts employee productivity. Overall, the AdamAdelia Inventory Management System is designed to drive efficiency, profitability, and success in the competitive retail landscape.

1. Introduction

AdamAdelia's Kids Shop is facing significant inventory management challenges impacting its growth and profitability, including stockouts, overstocking of items, and inefficient sales tracking. To address these challenges, the shop is developing a user-friendly Inventory Management System (IMS) to provide real-time stock tracking, automated restocking alerts, and comprehensive data integration. The IMS is expected to enhance operational efficiency, mitigate stock-related issues, elevate the customer shopping experience, and secure continued growth and competitiveness in the children's apparel market.

2. Literature Review

This section provides an overview of the related project study, the problem-solving method, and the necessary action to be taken. The elements that will be covered include the domain background, identification of the related technology, study of the existing application, and chapter summary. This study offers detailed information related to the developed system.

2.1 Inventory Management System: overview and theories

Inventory Management Systems (IMS) are advanced software applications that help businesses track and manage the flow of goods within their operations (Stadtler, 2013). These systems offer a wide range of functionalities, including real-time tracking of inventory levels across different locations, accurate demand forecasting to optimize inventory levels and prevent stockouts, creation, and management of purchase orders

from restocking inventory, and generation of comprehensive reports and analyses on inventory trends and performance. Businesses implementing IMS can enjoy numerous benefits, such as optimized inventory levels, which result in reduced carrying costs and minimized risk of obsolescence. Additionally, IMS helps businesses enhance customer satisfaction and loyalty by ensuring product availability. It also reduces manual processes and streamlines inventory management, increasing operational efficiency and productivity.

2.2 Study of AdamAdelia's current Inventory Management Process

The proposed Inventory Management System (IMS) has unique features and improvements compared to existing inventory management systems. In this section, we will conduct an in-depth analysis of the inventory management system currently in place at AdamAdelia. We aim to provide a comprehensive overview of the strengths and weaknesses of the system and identify areas that could benefit from improvement. By the end of this analysis, we hope to develop a clear understanding of the current inventory management system and provide actionable recommendations for enhancement.

2.2.1 Current Methods and Strengths:

AdamAdelia uses a compact point of sale (POS) system to manage customers' sales and cash receipts; therefore, it is an easy checkout process and insightful regarding sales information. The staff has a detailed inventory of customer needs, giving the operation a cohesive momentum. This increases sales and allows for customer behavior and preference analysis, thus ensuring satisfaction and loyalty.

2.2.2 Weakness and Areas for Improvement:

Managing online orders through a WhatsApp group manually is inefficient and challenging. This can make tracking orders and their statuses easier, leading to clarity and errors. Doing things manually takes a lot of time and effort, which can distract from other important business tasks. Finding better ways to manage online orders efficiently and reliably is essential. The issues with manual order management are:

- **Redundancies and Errors:**

Manual order entry and the packing process can result in occasional mistakes and redundancies. These errors can negatively impact on customer satisfaction and lead to inefficient resource use.

- **Limited Visibility and Data:**

  The current WhatsApp group setup lacks a centralized system for tracking and reporting. This deficiency hinders effective oversight of inventory and complicates data-driven decision-making. Implementing a robust tracking and reporting system would provide better insights into inventory management, improving overall decision-making and operational efficiency.

- **Out-of-Stock Challenges:**

  Managing inventory items that are out of stock can pose significant challenges without the support of automatic stock updates and efficient communication features. The manual process of informing customers about alternative options is time-consuming and can lead to confusion. Robust inventory management systems are crucial to ensure accurate stock updates. At the same time, effective communication channels are essential to address these challenges and provide customers with clear alternative options.

- **Scalability Concerns:**

  Using WhatsApp groups is not a scalable solution for anticipated business growth. As order volumes increase, the inefficiencies of this system will become more pronounced, necessitating the adoption of a more scalable and efficient order management system.

3. Methodology

The present software development project will rely on the Prototyping Model. This dynamic methodology enables the creation of a preliminary rendition of the system, thereby allowing for continuous feedback loops to refine requirements progressively. The choice of this methodology lies in its adaptability to the evolving needs of AdamAdelia's shop, ensuring the final product aligns seamlessly with its unique challenges. The Prototyping Model comprises five phases: Planning, Analysis, Design, Implementation, and Testing. Each stage plays a critical role in refining the system iteratively, responding to the dynamic nature of the project. A visual representation of this iterative flow is depicted in the figure below.

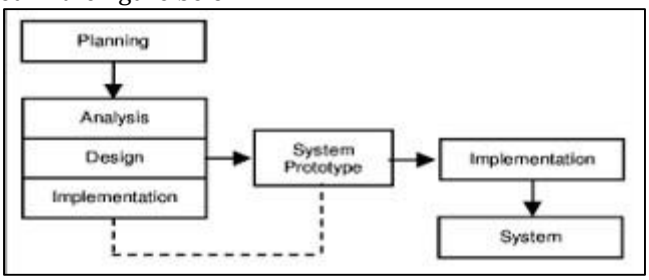

Figure 1 *Prototyping Model*

The subsequent sections will meticulously dissect each phase, elucidating the activities and tools used to navigate the Prototyping Model.

3.1 Planning Phase

During the planning phase of a project, the development team engages in an in-depth discussion to determine the project title and the type of system that will be developed. This phase involves creating and reviewing various planning documents, including a proposal, project Chapter 1 and Chapter 2. The team also conducts a comparative study of existing systems to identify areas of improvement in the proposed system. A work plan is generated that outlines a Gantt chart, a critical tool for project management. The Gantt chart provides a guide for performing the tasks scheduled to develop the system. The chart shows each task's start and end dates, dependencies, and the resources required. By conducting a comparative study of existing systems and generating a work plan with a Gantt chart, the team can ensure that the project is completed efficiently and effectively. The Gantt chart has been attached in Appendix A.

3.2 Analysis Phase

The first phase of a project is crucial as it sets the foundation for the entire project. A detailed interview is conducted with the business owner to gather information about the business and its operations. The workers are also observed during their regular work routine to identify areas of improvement. The software and hardware requirements are discussed to identify the resources needed for the project. The information gathered is analyzed to develop a comprehensive project plan that outlines the scope, timeline, budget, and resources required to deliver the project successfully. This phase is critical to the project's success as it ensures it is delivered within budget, on time, and meets the business objectives.

3.3 Design Phase

System requirements are gathered and analyzed to ensure optimal performance. Two approaches to software design are considered: visual design and architectural structure. The system is developed using a robust programming language, such as PHP. Comprehensive diagrams are presented to elucidate the system's dynamics. The user interface and database design are meticulously crafted using the Draw.io tool. An entity relationship diagram is produced to expound on the database design, which is crucial for optimal system performance and efficiency.

3.4 Implementation Phase

The Inventory Management System's deployment phase is a critical stage in its development cycle. It involves finalizing and assembling modules, integrating them with the SQL database, and implementing backup and recovery procedures. Version control systems like Git and database management tools can enhance collaboration and efficient database management. Completing this phase within the designated timeframe with the utmost attention to detail ensures a seamless experience for end-users.

3.5 Testing Phase

The Testing Phase is vital to ensure the IMS's flawless performance. It includes unit testing and system testing. The team scrutinizes each system component during unit testing to identify potential flaws. After unit testing, the team tests the entire system to ensure harmonious performance. They use various frameworks and tools to ensure the system's reliability, stability, and efficiency. Specific appendices may be referenced to optimize the system and eliminate potential errors.

3.6 System Requirement Analysis

Requirement analysis is a process to determine the needs or conditions to meet the new or altered product. It also determines user expectations of the outcome of the proposed application. There are functional requirements and non-functional requirements (Loucopoulos, 1995).

3.6.1 Functional and Non-Functional Requirements

a. Functional Requirements
Functional requirements define software's functions, including inputs, behaviour, and outputs.

Table 2 *Functional Requirement for the Proposed System*

No.	Modules	Functionalities
1.	User Management	Allow users to register for the system with appropriate credentials.
2.	Login/Logout	Enable users to access and exit the system securely.
3.	Product Management	• Add new products to the inventory system. Edit existing product information (name, description, price, size, color, etc.). • Delete products from the inventory. • View products in the catalog.
4.	Sales Management	• Process sales transactions and update inventory levels accordingly. • Generate sales and purchase reports.
5.	Order Management	• Add new orders to the inventory system. • Edit existing order information (customer details, items, and progress order) • Delete orders from the inventory.
6.	Media Management	• Add and apply the media in the inventory.

Applied Information Technology and Computer Science Vol. 6 No. 1 (2025) p. 267-283

b. Non-Functional Requirements

Non-functional requirements are vital for software development as they define quality attributes that enable the software to function efficiently. They represent a set of standards to judge the operation of a system, including performance, scalability, reliability, security, and maintainability. Developers can create high-quality systems that meet user needs by addressing these requirements.

Table 3 *Non-Functional Requirement for the Proposed System*

No.	Requirement	Description
1.	Performance	• The system should be responsive and provide real-time data access. • Loading times should be minimal for all functionalities. • The system should be able to handle a high volume of transactions without performance degradation.
2.	Operational	• The application should be easily updated and maintained. • The application should be user-friendly.
3.	Security	• User data and inventory information should be securely stored and encrypted. • The application should allow users to access their account with a user ID and password. • Access control should be implemented to restrict unauthorized access to sensitive data.

4. Implementation and Testing

This section discusses how to implement the designed system and check how well it works. First, we'll focus on turning the design specs into a working system. Then, we'll make sure the system works right and meets the requirements we want. This section will explain the methods, tools, and processes for putting the system into action and testing it. It will also cover the problems we faced and how we solved them. Thorough testing will help us find and fix issues for a solid and reliable final product.

4.1 Implementation

Six modules were built in AdamAdelia's inventory management system during the implementation. The most challenging stage was developing device encoding. The system was built according to the initial specifications, with some adjustments for enhanced functionality. The software for this system was written using PHP, JavaScript, and HTML via Visual Studio Code, and Xampp was used for the database.

4.1.1 Registration Module

This module is for new users to register and create an account. They need to enter their name, email, username, and password. Users can only use an already used email, and they'll see an error message if their password meets security requirements. Only staff with an account can access the application. Figure 2 shows what the registration page looks like.

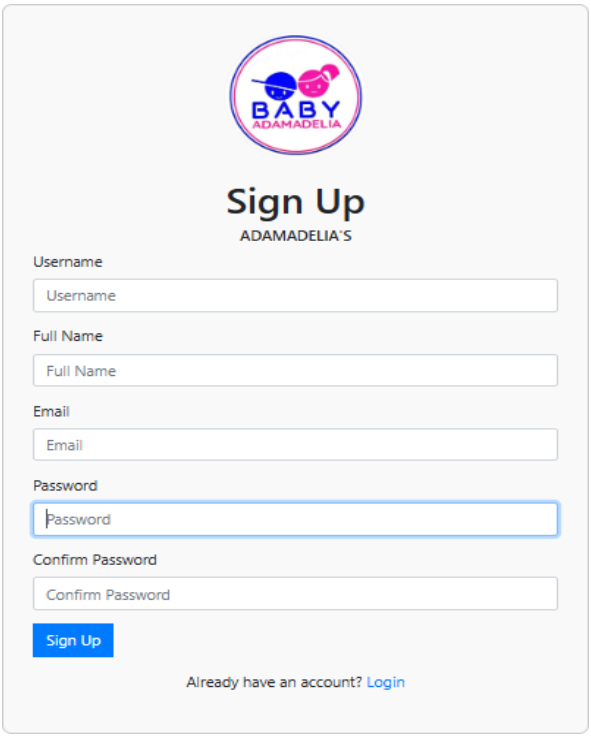

Figure 2 *Register Interface*

4.1.2 Interface and Implementation of Login Page

This module verifies registered users who want to access the system. Details of registered users are stored in a database. Only authorized users can log in. An error message appears for incorrect usernames or passwords or unregistered accounts. If authentication is successful, the user is redirected to the main page managing the inventory system. Figure 3 shows the login page interface.

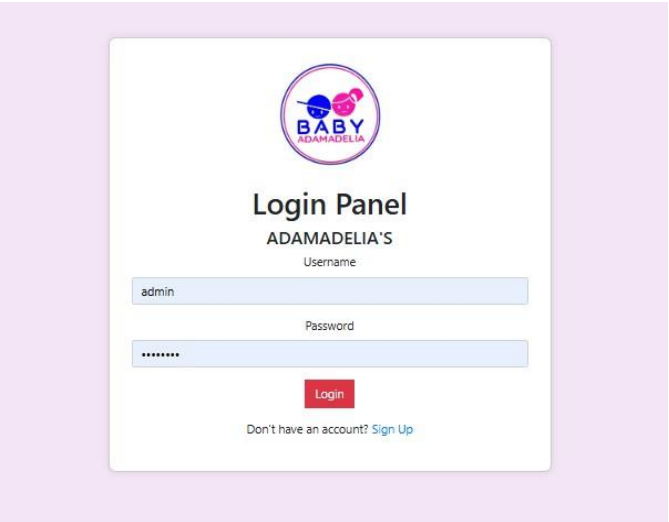

Figure 3 *Register Interface*

4.1.3 Product Management Inventory Module

In Figure 4, users can add, change, or remove products and check the latest stock levels. To add a new product, users click the "add new product" button, fill in the product name, photos, quantity, buying and selling prices, and then click "Add Product" to save it. To change product details, users

provide the product ID and updated information and click "Modify Product." Users can click the "Delete" button to remove a product from the inventory. The figure shows a user-friendly interface with forms for adding, changing, and removing products, which helps with efficient inventory management.

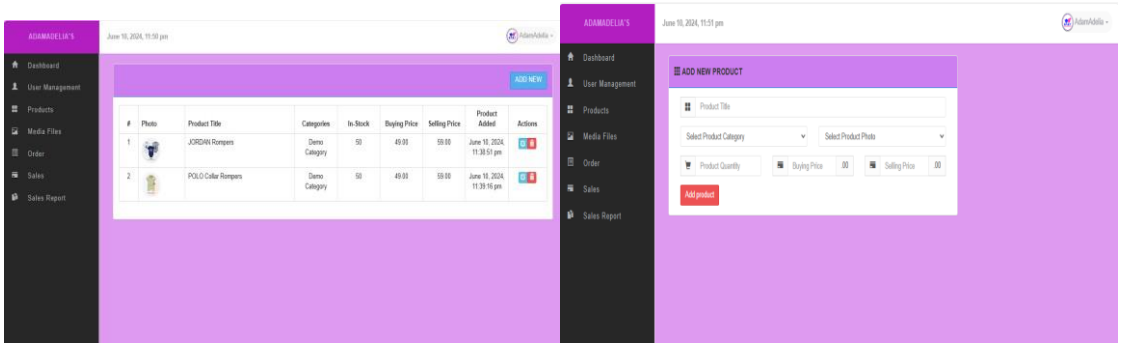

Figure 4 *Product Management and Add New Product Page Interface*

4.1.4 Sale Management Inventory Module

Figure 5 shows the interfaces for sales management. The sales management module handles sales transactions and updates the inventory in real time. It includes a main sales page where all sales are listed. Users can edit or delete existing sales from this page. Additionally, users can add a new sale to the system by pressing the "add sale" button.

Figure 5 *Product Management and Add New Product Page Interface*

4.1.5 Order Management Inventory Module

The order management system has interfaces for inventory, as shown in Figure 6. This module helps process customer orders. It allows adding, changing, or deleting order items and quantities and tracking order status. Users enter the customer ID, product ID, and quantity to make a new order and click "Add Order." Users choose the Order ID with new details to change existing orders and click "Edit Order." To delete orders, users click "Delete."

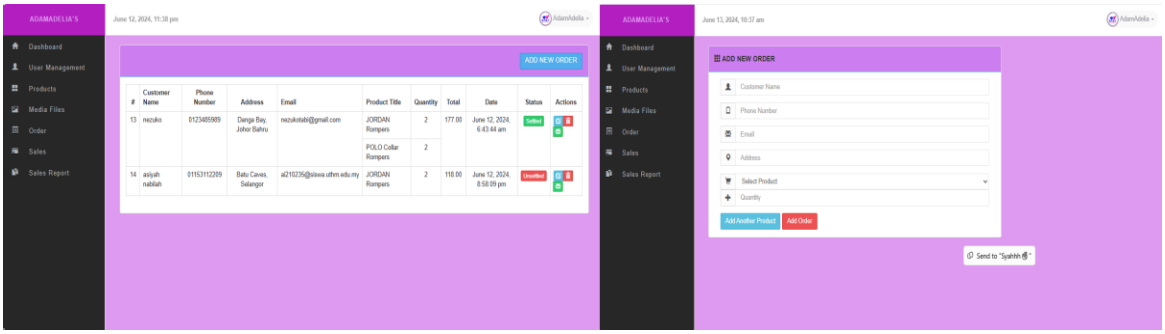

Figure 6 *Order and Add Order Management Inventory Interface*

4.1.6 Reporting and Analytic Inventory Module

The reporting and analytics system uses inventory interfaces, as shown in Figure 7. It creates reports using sales and order data, giving insights and analysis. Users choose the report date and click "Generate Report" to see the data. Users can also see daily and monthly sales options in the sales section. The interface allows users to generate sales reports, presenting data clearly to help make decisions, as the example shown in Figure 7.1.

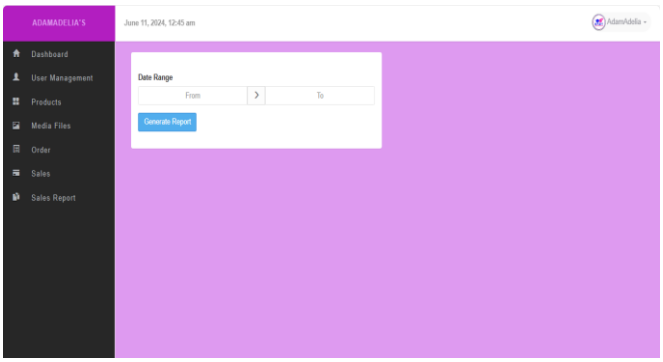

Figure 7 *Reporting and analytic inventory interfaces*

AdamAdelia's Inventory Management System - Sales Report

2023-12-19 TILL DATE 2024-06-12

Date	Product Title	Buying Price	Selling Price	Total Qty	TOTAL
2024-06-11	POLO Collar Rompers	49.00	59.00	3	177.00
2024-06-04	JORDAN Rompers	49.00	59.00	2	118.00
				GRAND TOTAL	RM 295.00
				PROFIT	RM50.00

Figure 7.1 *Report on sales*

4.2 System Testing

The testing phase takes place after the implementation is completed. It ensures that the system aligns with the system analysis and design from the previous chapter. System testing involves checking the system's functionality to ensure no anomalies or errors impact its operation.

4.2.1 Login and Registration Module Testing

Table 4 *Login and registration test cases*

Test Case	1
Test Case Name	Login and registration
User	Admin, user
Summary	Admin's registration and log-in authentication testing

Applied Information Technology and Computer Science Vol. 6 No. 1 (2025) p. 267-283

Table 4.1 *List of login and registration test cases*

No.	Test Cases	Description	Pass/Failed
TEST_100			
1.	TEST_100_001	Check user Login with valid Data	Pass
2.	TEST_100_002	Check user Login with invalid Data	Pass
3.	TEST_100_003	The registration page is visible	Pass
4.	TEST_100_004	The user creates a new account	Pass
5.	TEST_100_005	The system sends an error message for invalid login	Pass
6.	TEST_100_006	System details stored in the database	Pass

4.2.2 Product Management Module Testing

Table 5 *Product management test cases*

Test Case	2
Test Case Name	Product management
User	Admin, user
Summary	manage products by adding, modifying, and deleting them.

Table 5.1 *List of product management test cases*

No.	Test Cases	Description	Pass/Failed
TEST_200			
1.	TEST_200_001	Users can add the product name, image, quantity, buying and selling price.	Pass
2.	TEST_200_002	Users can edit the product by changing the product name and image and buying and selling prices.	Pass
3.	TEST_200_003	Users can delete a product, and a message of delete successful will be displayed.	Pass
4.	TEST_200_005	System details stored in the database	Pass
5.	TEST_200_006	The system shows a list of inventories stored	Pass

4.2.3 Order Management Module Testing

Table 6 *Order management test cases*

Test Case	3
Test Case Name	Order management
User	Admin, user
Summary	manage customer orders by adding, editing, or deleting items/quantities and keep track of their status.

Table 6.1 *List of order management test cases*

No.	Test Cases	Description	Pass/Failed
TEST_300			
1.	TEST_300_001	The order details will be shown with the customer's name, phone number, email, address, item, quantity, total, and status.	Pass
2.	TEST_300_002	Users can edit the orders by changing the customer's name, phone number, email, address, item, quantity, total, and status.	Pass
3.	TEST_300_003	Users can delete an order, and a message of delete successful will be displayed.	Pass
4.	TEST_300_005	System details stored in the database	Pass

4.2.4 Sales Management Module Testing

Table 7 *Sales management test cases*

Test Case	4
Test Case Name	Sales management
User	Admin, user
Summary	Sales record of inventory, which can generate a report for more accessible data analysis.

Table 7.1 *List of sales management test cases*

No.	Test Cases	Description	Pass/Failed
TEST_300			
5.	TEST_300_001	Users can view the list of product sales by comparing the quantity and total sales.	Pass
6.	TEST_300_002	Users can choose to see a reported sale daily or monthly or select a preferred date.	Pass

Applied Information Technology and Computer Science Vol. 6 No. 1 (2025) p. 267-283

4.3 User Interface Testing

After the software has been developed, a test is conducted to gather feedback from the target users. The users are asked to briefly explain how the program operates and how they interact with the interface. The questionnaires are designed to collect comments on issues related to the software interface, functionality, command structure, and data entry problems. Graphical data for both parts of the testing can be seen in Figures 8 and 9. The questionnaire is divided into parts A and B. Part A focuses on features, while part B examines the system's usability and design. In Part A, users answer with a simple yes or no, while in Part B, they indicate their level of satisfaction on a scale from 1 to 5, ranging from highly unsatisfied to highly satisfied.

- Questions asks to the user in part A are;
  - The user can see the home page after login/register?
  - The user can see the dashboard page on the system?
  - The user can access the product and add a new product page on the system?
  - The user can access the media and add new media page on the system?
  - The user can access the order and add new order page on the system?
  - The user can access the sales and add a new sales page on the system?
  - The user can access the generate report sales page on the system?
  - The user can see the profile page?
  - Can the user log out of the system?

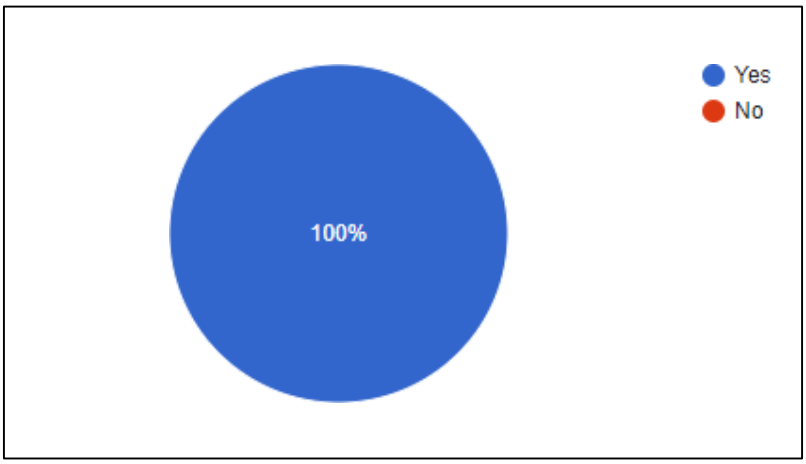

Figure 8 *Results of part A questionnaires.*

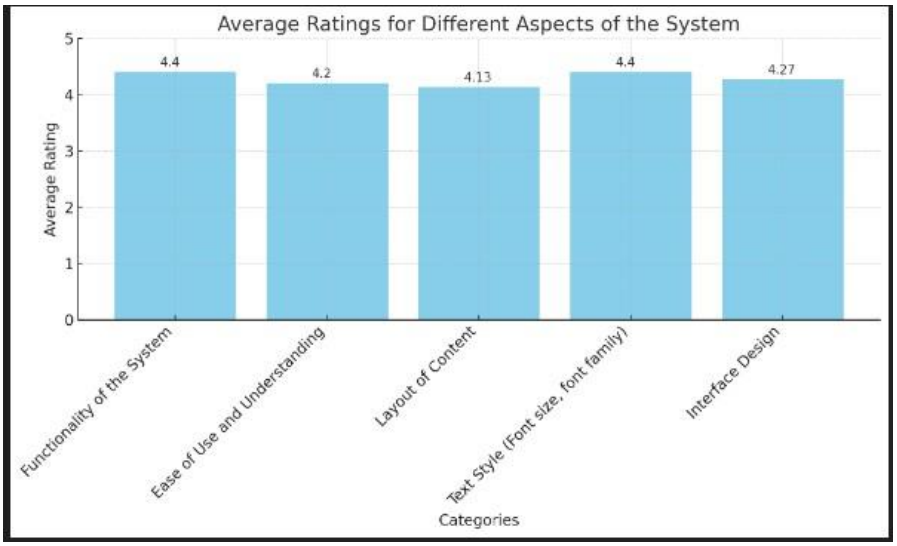

Figure 9 *Average ratings for Part B.*

5. Discussion and Conclusion

This section discusses the project's results following previous phases, based on research at the AdamAdelia shop. It reviews project objectives, technology benefits, and challenges faced. Proposed modifications aim to enhance the system and meet user requirements.

5.1 Achievement of the Overall Objectives

The Inventory Management System was specifically designed to meet the unique needs of AdamAdelia's Kids Clothes Shop. This retail store specializes in children's apparel. The tailored solution addresses the challenges of managing inventory in this niche market. An affordable approach was taken to fit the shop's financial constraints. Thorough testing ensured the system's functionality and reliability, providing seamless support for day-to-day operations. This project has successfully delivered a customized, cost-effective, and reliable inventory management system for AdamAdelia's Kids Clothes Shop. It is expected to streamline operations, improve inventory accuracy, and enhance overall business efficiency.

5.2 System Advantages

The system has these advantages:

1. It offers tailored inventory management solutions for AdamAdelia's Kids Clothes Shop:
The system can be customized to fit the shop's unique needs. It can handle the specific demands of managing children's clothing, such as sizes, styles, and seasonal variations.

2. It's cost-effective to implement:
A low-cost inventory management system helps AdamAdelia's shop minimize initial and ongoing costs, allowing for more effective resource allocation and improved inventory management capabilities.

3. It improves inventory accuracy and operational efficiency:
The system provides real-time updates and reduces stockout or overstock situations, benefiting operational efficiency by freeing up staff time for customer service and sales.

5.3 System Disadvantages

The system has some downsides:

1. Setting up and learning to use the new inventory management system may take time and effort for new users. They may initially find getting used to the system's interface and features challenging.

2. Users may need help finding specific products or orders in complex inventory systems due to the lack of an efficient search feature. As a result, they must spend much time manually searching through extensive inventories.

3. The inventory management system may need regular maintenance and updates to ensure it runs smoothly and securely. This could include updating software, fixing bugs, or adapting to changes in shop operations that could affect security.

5.4 Recommendations

Here are some suggestions for improving AdamAdelia's inventory system:

1. Enhanced reporting and analytics capabilities:
Develop advanced reporting and analytics features to provide comprehensive insights into inventory levels, sales trends, and performance metrics. This includes generating detailed reports on stock levels, identifying fast-moving items, analysing sales patterns, and evaluating profitability. These capabilities will help make data-driven decisions, allowing for proactive adjustments to inventory management strategies and identifying areas for improvement.

2. Search option for product and order list:
Implement a robust search function within the system to allow users to find specific products and orders quickly. This includes enabling search by product name, category, SKU (Stock Keeping Unit), or

order number. Additionally, a tracking number system should be integrated that automatically notifies users when their orders have been shipped, providing real-time updates on order status.

3. Point of sales:
Integrate barcode scanning capabilities into the POS system to streamline inventory updates. This feature will significantly reduce manual errors associated with inventory management by ensuring accurate stock counts and improving the efficiency of stock replenishment. Barcode scanning also speeds up transactions, improves accuracy in recording sales, and simplifies the management of product returns and exchanges.

Conclusion

AdamAdelia's Kids Clothes Shop has implemented the AdamAdelia Inventory Management System to optimize day-to-day operations, increase profitability, and enhance the retail experience through real-time inventory tracking, automated restocking, and user-friendly processes. The system was developed using a strategic Prototyping Model, which includes planning, analysis, design, implementation, and testing. Functional requirements include user and product management, sales and order processing, media handling, and reporting. Non-functional requirements cover performance, operational, and security aspects. The user interface design, facilitated by Figma and Mock Flow, ensures a seamless and user-friendly experience.

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Conflict of Interest

Authors declare no conflict of interest regarding the paper's publication.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Nur Asiyah Nabilah Binti Sabarudin;* ***data collection:*** *Dr. Firkhan Ali Bin Hamid Ali;* ***analysis and interpretation of results:*** *Nur Asiyah Nabilah Binti Sabarudin, Dr. Firkhan Ali Bin Hamid Ali;* ***draft manuscript preparation:*** *Nur Asiyah Nabilah Binti Sabarudin, Dr. Firkhan Ali bin Hamid Ali. All authors reviewed the results and approved the final version of the manuscript.*

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Appendix A: Related Diagram

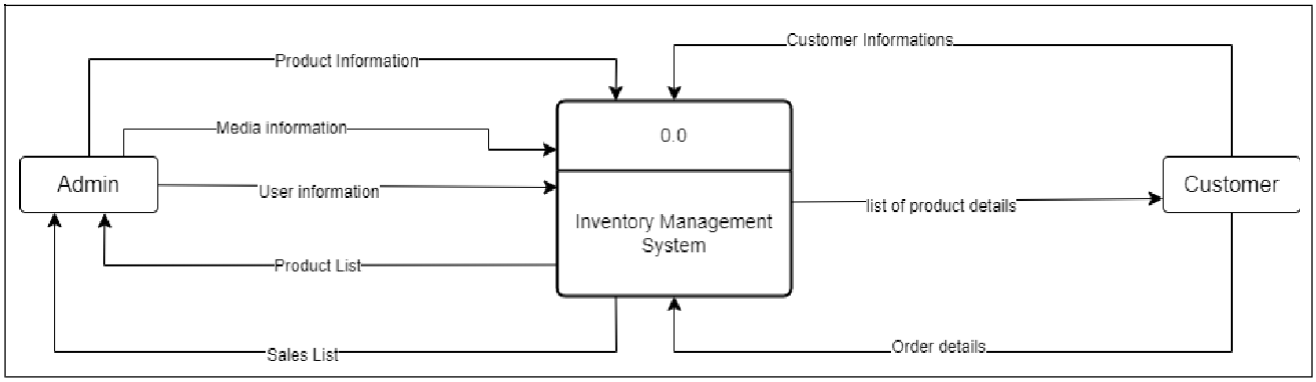

Figure 10 *Data Flow Diagram Context Diagram*

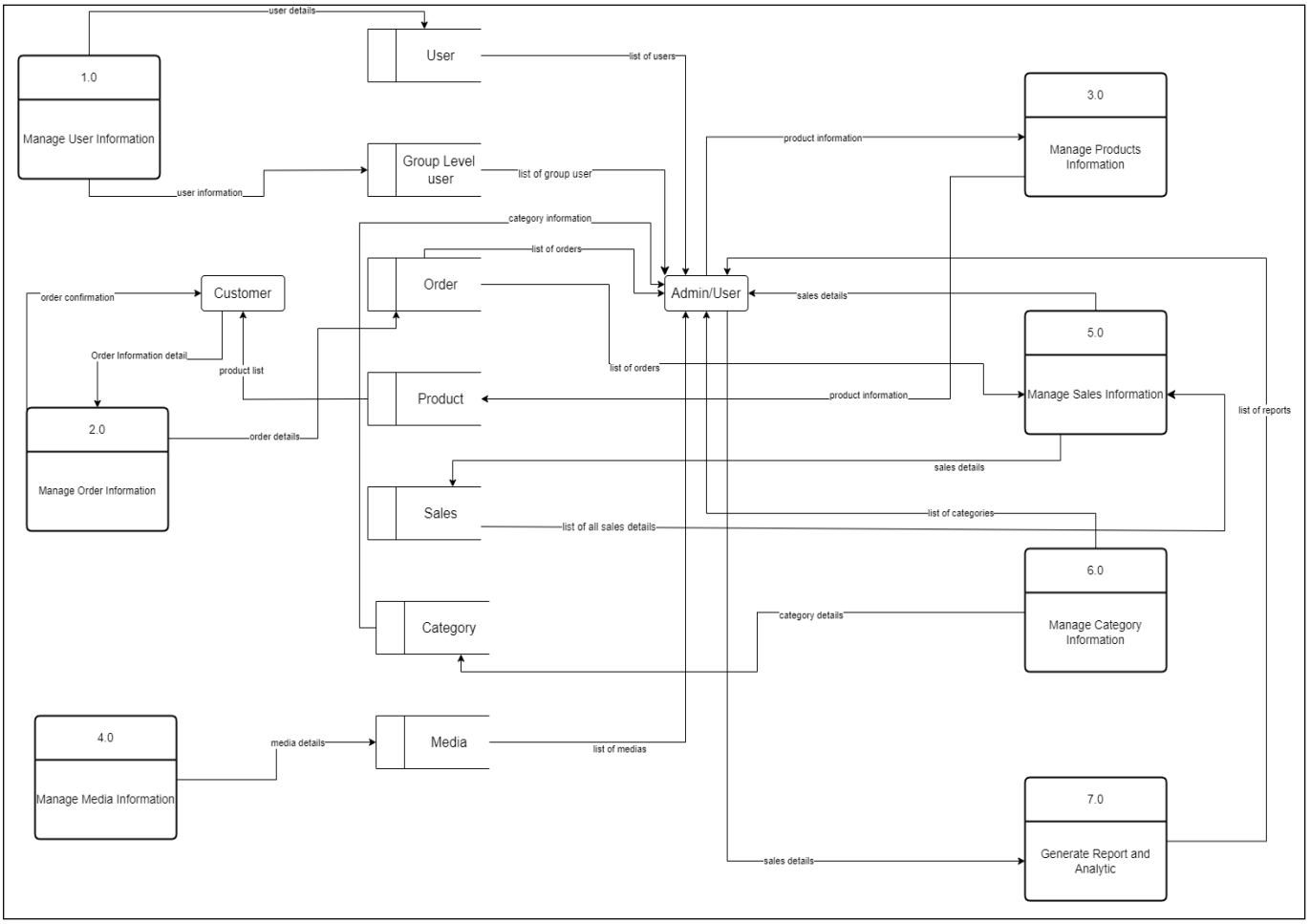

Figure 11 *Data Flow Diagram Level 0*

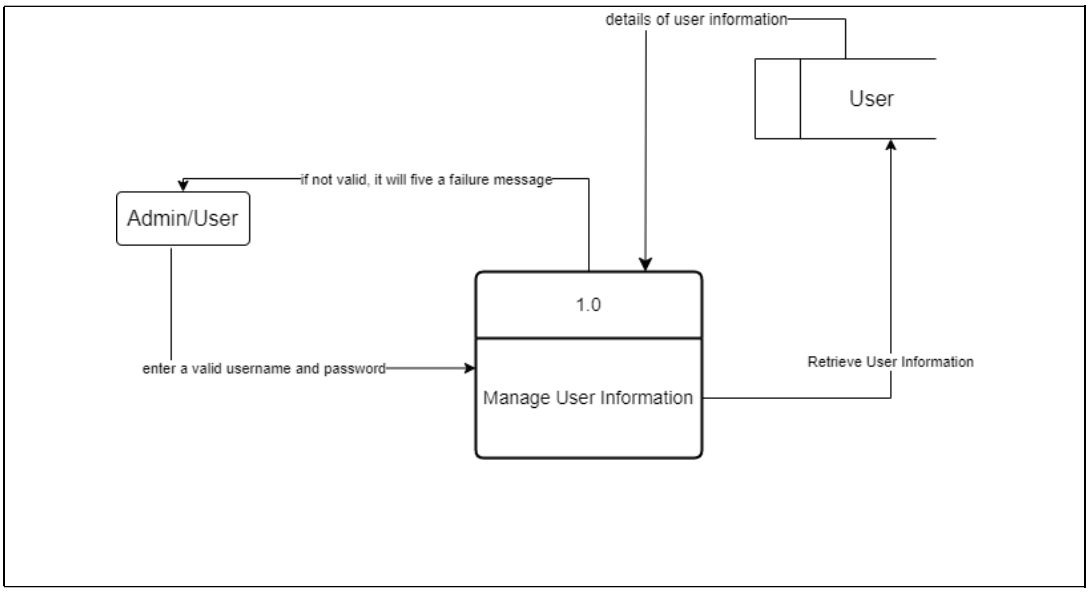

Figure 10 *User Information Management Data Flow Diagram*

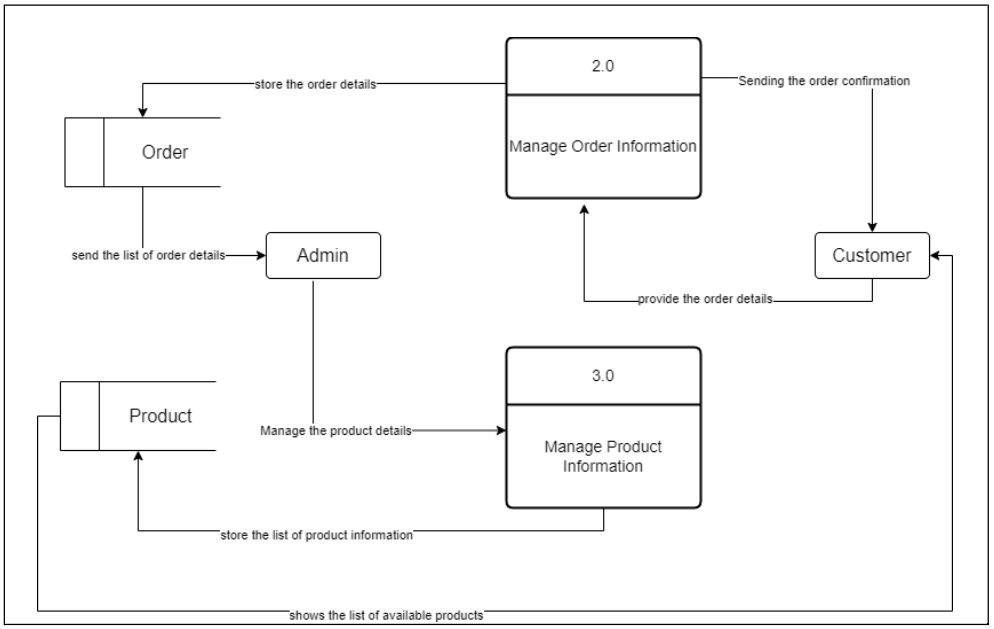

Figure 11 *Product Information Management Data Flow Diagram*

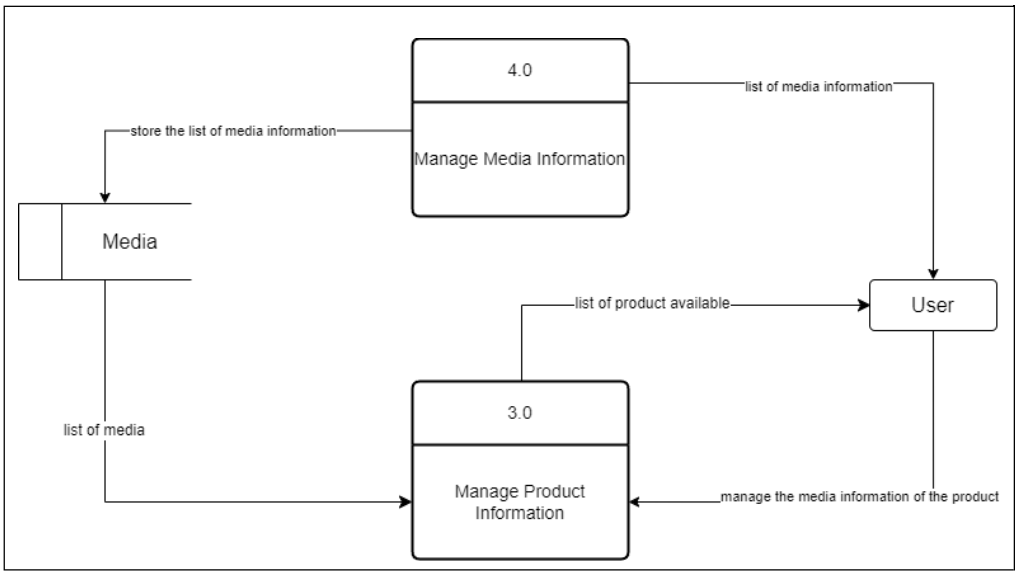

Figure 12 *Media Information Management Data Flow Diagram*

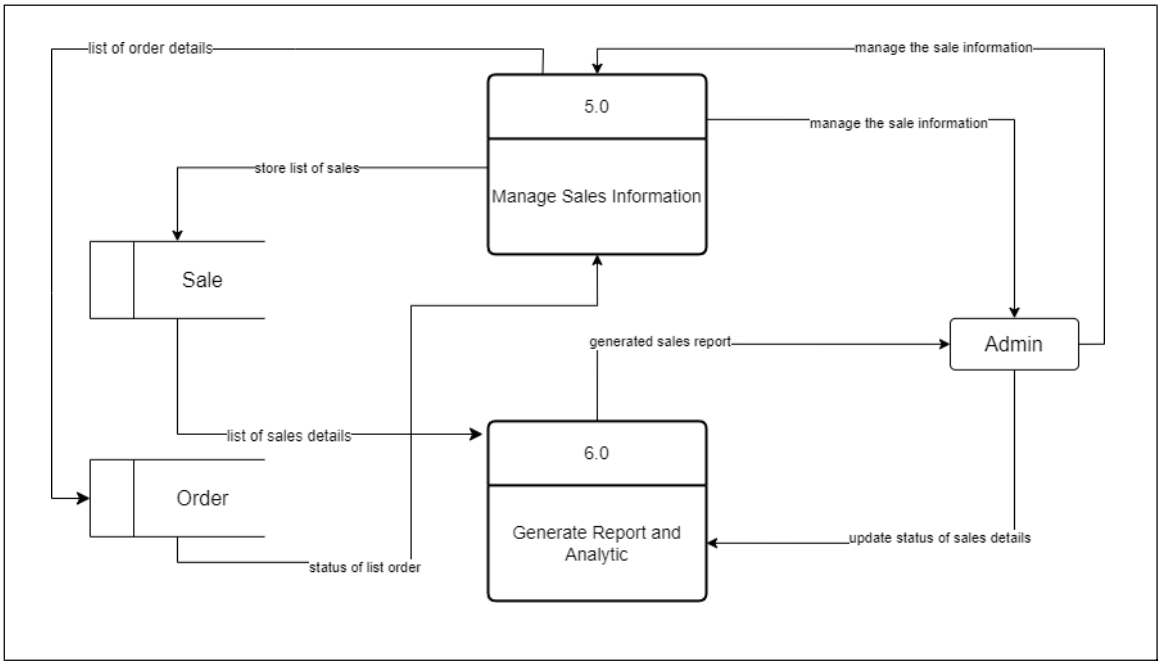

Figure 13 *Sale Information Management Data Flow Diagram*

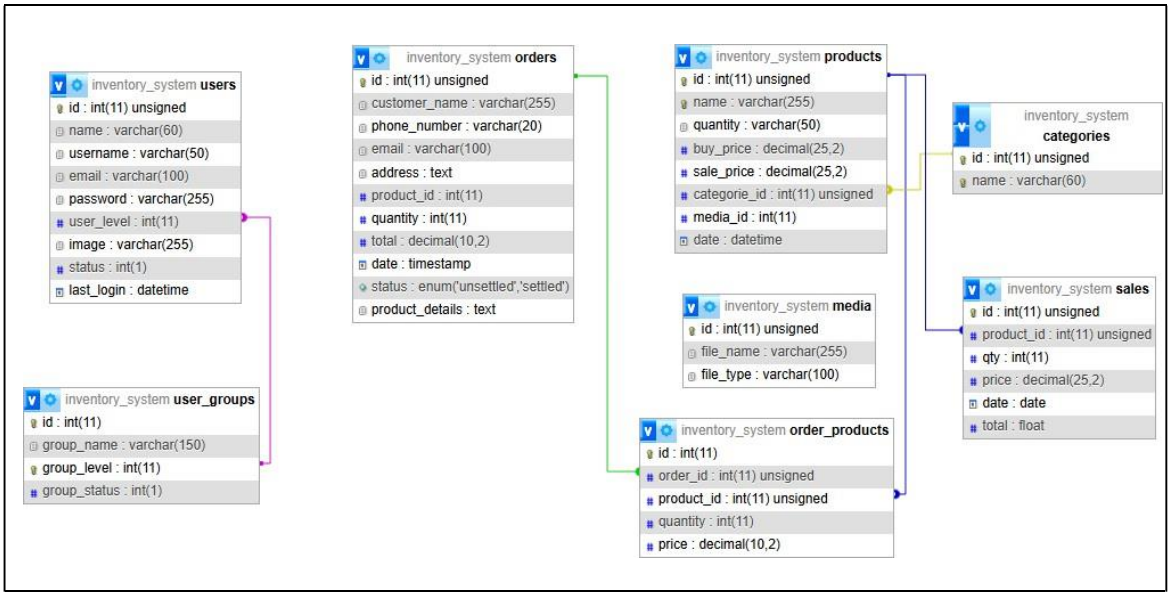

Figure 14 *The ERD for Inventory Management System*