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Design of an Inventory Performance Tracking System

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ABSTRACT

Most existing stock management system has several drawbacks which includes technical issues and downtime, some systems need intensive training of employees in order to use the software effectively which takes time, some system rely on data storage and processing, raising concerns about data security and privacy. This study aims to address the limitations of existing inventory control systems, such as technical issues, downtime, extensive employee training, data security concerns, and lack of portability. The study applied the Rapid Application Development (RAD) software methodology. The proposed Inventory control system utilizes a client-server model and a connected database to efficiently track item sales, interpret data, and support multiple stores and warehouses. PHP was applied for the backend system development, while HTML and JavaScript for frontend system development. The system optimizes warehouse operations, including shipping, receiving, put away, and picking, leading to improved warehouse utilization. It also aids in determining economic order quantity and reorder points for products, enabling cost-cutting measures during economic downturns. The implemented web application facilitates warehouse management, product performance tracking, accurate reordering, forecasting, and demand analysis. These functionalities will enable decision makers to initiate accurate re-order and make forecast and demand of the product at any point in time and ensure a proper management of inventories.

1.0 INTRODUCTION

In the field of inventory management, manual systems have been plagued by challenges such as slow data handling, excessive paperwork, inaccuracy, and diminished efficiency. Through a meticulous exploration of these issues, our research aims to provide valuable insights into the specific improvements that can be realized through the adoption of computer-based systems, contributing to a more efficient and technologically advanced landscape in the field of inventory control. Inspired by prior research [1] and the comprehensive review [2], our focus lies in shedding light on the transformative potential of advanced technologies in inventory management. The adoption of a computer-based inventory management system holds promising prospects for businesses seeking to mitigate risks, enhance employee productivity, and improve supply chain visibility. This research will delve into the intricacies of this transition, shedding light on the specific benefits and challenges associated with automated processes. By staying attuned to the latest technological trends, businesses can tailor their inventory management solutions for optimal efficiency. As we embark on this exploration, it is crucial to acknowledge the potential of emerging technologies like blockchain and mobile applications in further augmenting these advantages. However, successful integration requires a vigilant approach, encompassing continuous improvement efforts and effective strategies to address potential challenges in the automated inventory control landscape.

2.0 RELATED WORKS

Srinivasa [3] conducted a study titled "Inventory Management in the Commercial Vehicle Industry in India." The research examined five sample firms and found a significant relationship between inventory and sales in the commercial vehicle industry. Effective inventory management was identified as crucial for organizational health and improvement, leading to enhanced profitability. The effect of inventory management on the profitability of cement manufacturing companies in Kenya was focused on in [4]. The research discovered a negative correlation between the gross profit margin and the inventory conversion period. The model resulted in an increase in sales, indicating larger firm size, was associated with higher inventory levels, resulting in improved profits. The study highlighted the importance of maintaining appropriate inventory levels to boost profitability y and reduce inventory costs.

In South Korea [5] conducted a study that surveyed customers of retail businesses in South Korea and found that customers were more satisfied when the business had accurate inventory levels, reduced waiting times, and improved product availability. They then proposed and

implemented an inventory control system that leads to increased customer satisfaction. In [6] a study was proposed and implemented on a computerized inventory control system that significantly improved the performance of retail businesses. The study sampled over 50 retail businesses in India and concluded that adopting an inventory control system increased sales, reduced stock levels, and improved cash flow.

To explore the potential benefits of using blockchain technology [7] developed an inventory control systems. The authors argue that blockchain can provide businesses with secure and transparent tracking of inventory levels, reduce fraud and errors, and improve supply chain visibility. They then, proposed a stock management software which uses blockchain technology that enable businesses to establish trust between different stakeholders in the supply chain. Focusing on medium-sized enterprises, [8] proposed an inventory control system that have significant impact on the performance of small and medium-sized enterprises (SMEs). In their study they analyzed several SMEs in Vietnam, and found that businesses that implemented the proposed inventory control systems were more likely to achieve their revenue and profit goals.

Artificial intelligence was integrated into an inventory control system that provided businesses with more accurate demand forecasting, automated replenishment, and predictive maintenance capabilities [9]. Their model helped businesses to identify patterns in customer behavior and optimize their inventory levels accordingly. Park et al. (2020) proposed a mobile stock inventory model and highlights the benefits of using mobile applications in inventory control systems. The authors argue that mobile applications can provide businesses with real-time inventory tracking, barcode scanning capabilities, and remote access to data. Additionally, mobile applications can enable employees to manage stock levels from anywhere, reducing the need for manual data entry.

An inventory control system was proposed by [10] that highlighted the benefits of an automation system. The authors argue that automation can help businesses to reduce manual errors, save time, and increase accuracy. Automation can also enable businesses to streamline their stock management processes and reduce costs associated with labor. A cloud-based inventory control system was suggested by [11] that provided businesses with real-time inventory tracking, remote access to data, and scalability. Additionally, the cloud-based system reduces hardware and maintenance costs associated with traditional on-premises systems. An inventory system was presented by [12]. They explored the relationship between inventory control systems and sustainability. The authors found that implementing an inventory control system help businesses reduce waste, minimize overproduction, and improve their environmental footprint. Additionally, businesses can use data analytics to identify areas where they can make sustainable improvements in their supply chain processes.

3.0 METHODOLOGY

The methodology employed in the development of the Inventory Control System with PHP is designed to align closely with the overarching goals and objectives of this research. This section outlines the systematic approach encompassing requirement gathering, system design, iterative development, and emphasizes the principles guiding the design procedure.

3.1 Design Principles Overlaying Research objectives

The following principles guide the development process:

1. Efficiency and Streamlined Functionality: The PHP web application is designed to prioritize clean code and streamlined functionality ensuring that the resulting Inventory Control System not only meets the specific research objectives but also operates efficiently in a real-world setting.
2. User-Centric Design: Throughout the development stages, user experience is a focal point. The system is designed with the end-user in mind, aiming to enhance usability and overall satisfaction.
3. Scalability and Flexibility: Recognizing the evolving nature of inventory management needs, the design principles emphasize scalability and flexibility. The PHP-based system is crafted to accommodate growth and adapt to changing business requirements.

3.2 Methodological Phases

The development process comprises several interconnected phases:

1. Requirement Gathering: The foundation of the Inventory Control System is laid through comprehensive requirement gathering. This phase ensures a clear understanding of the business needs and sets the stage for subsequent development steps.
2. System Design: Building on the gathered requirements, the system design phase transforms conceptual ideas into a structured blueprint. This blueprint guides the development team in creating a robust and efficient PHP web application.
3. Iterative Development: The development process is iterative, allowing for continuous refinement based on feedback. This iterative approach is crucial for aligning the evolving system with the research objectives and ensuring a responsive development cycle.
4. Integration, Testing, and Deployment: Rigorous testing follows the development phase, ensuring the system meets specified requirements. Integration with existing systems is seamless, and deployment is executed with precision.
5. User Training and Documentation: A comprehensive approach to user training and documentation ensures that end-users are equipped to make optimal use of the Inventory Control System.

3.3 Design

The UML Activity diagram illustrates the interactions among key components in the Inventory control system, including customers, bills, stocks, products, and stores. This visual representation showcases how these elements collaborate within the system. Specifically focusing on the Admin User's features, the diagram outlines activities like customer management, bill handling, and report generation. It details the steps involved in customer and bill management, emphasizing actions like addition, modification, and deletion. The interconnected relationships between objects such as Customer, Bill, and Store are highlighted. Furthermore, the diagram offers a comprehensive overview of activities related to Customer, Product, Store, Stock, and Bill within the system. Refer to Figure 1. for a visual representation of the major elements in the Inventory control system's activity diagram.

The UML Activity diagram depicting the login process for admin users in the Inventory control system underscores the importance of authentication and access control. Following a successful login, administrators gain access to functionality for managing Stock, Customer, Bill, Store,

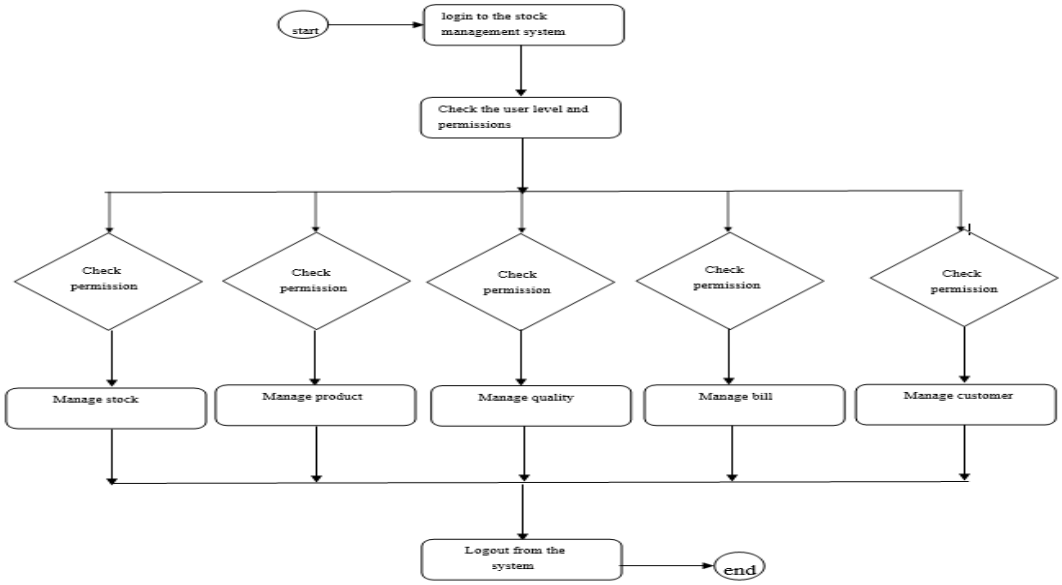

Figure 1: Activity Diagram for the Inventory Control System

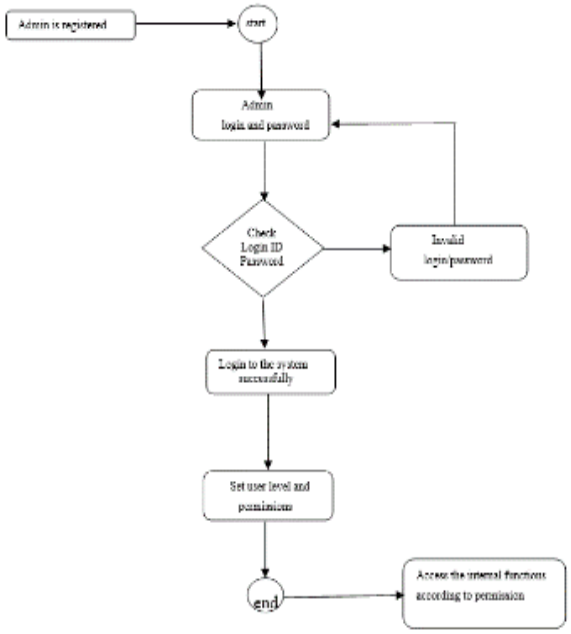

Figure 2: Login Activity Diagram

and Product operations. The diagram emphasizes the secure nature of authenticated pages, offering a clear visual representation of the login functionality's pivotal role in regulating system access. Figure 2. illustrates the key components of the login activity within the Inventory control system.

The Use Case Diagram for the Inventory control system depicts the interactions among actors and their respective use cases, highlighting key roles such as Super Admin, System User, Agents, and Customers. Use cases encompass

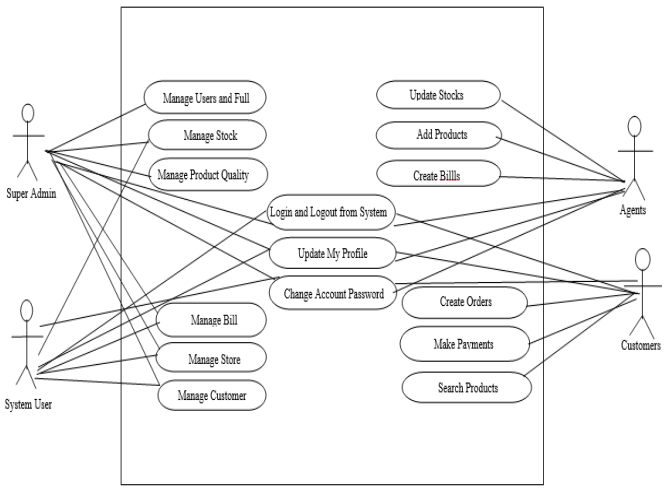

Figure 3: Use-case Diagram of the Stock Inventory System

Stock Management, Product Management, Bill Management, Customer Management, Store Management, and User Management. This diagram offers a concise representation of actor-use case relationships, facilitating system analysis and requirement identification within the context of inventory management. Figure 3 outlines the essential components of the UML use case diagram for the Inventory control system.The major elements of the class diagram of Inventory control system are shown in Figure 4. Below

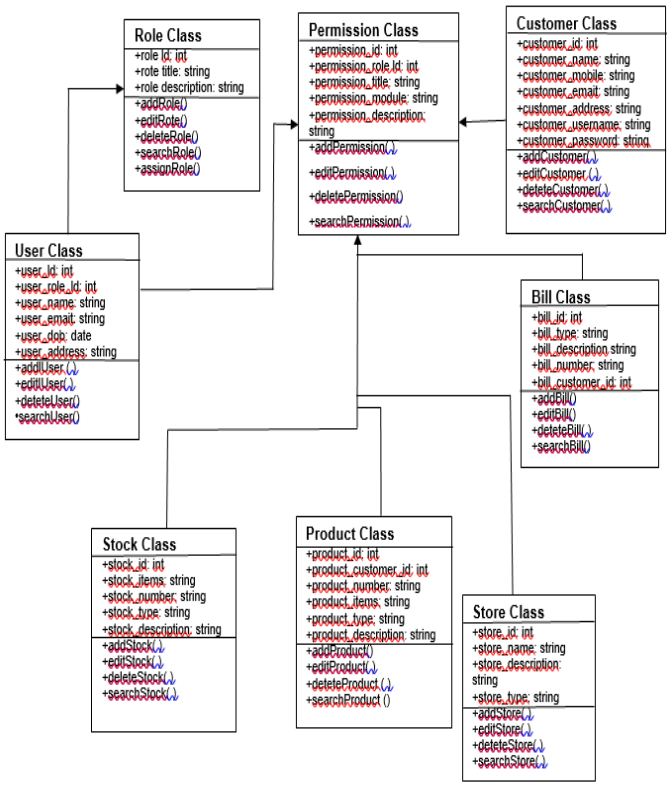

Figure 4: Class Diagram

The Component diagram represents the Inventory control system and its various components. These components include Store, Bill, Product, Stock, and Quality, each responsible for specific operations. The diagram provides an overview of the system's architecture and component interactions, aiding in understanding the system's physical components and their relationships. It also allows for modeling the database schema, executables, and source code of the Inventory control system. Major elements of the component diagram of Inventory control system are shown in Figure 5.

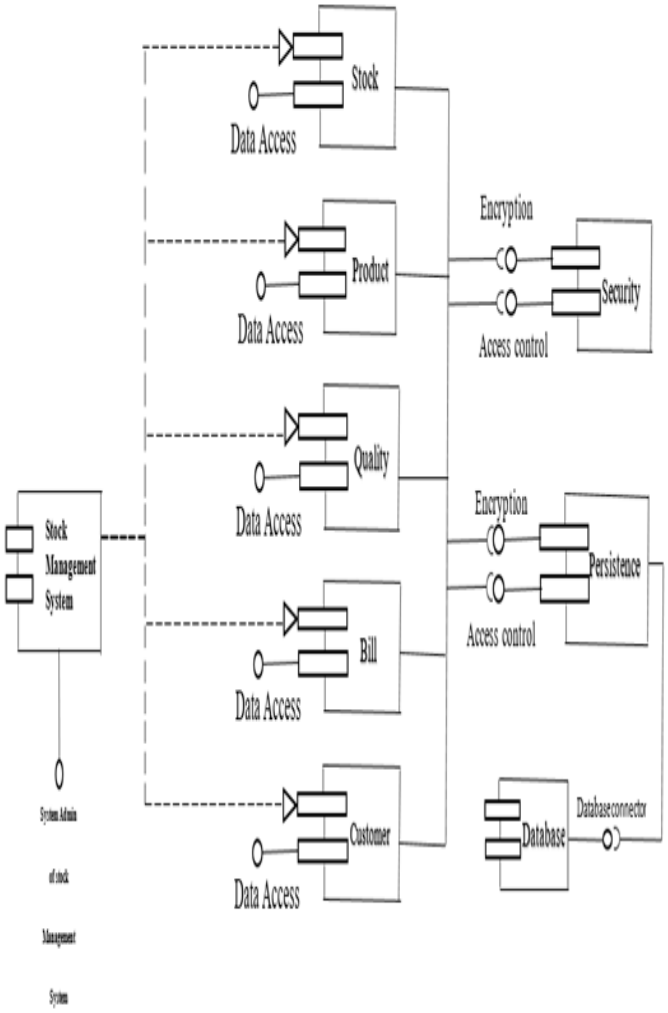

Figure 5: Component Diagram

4.0 IMPLEMENTATION

The proposed system necessitates both hardware and software components. For hardware, a processor with a clock speed of 1 GHz and multiple cores was utilized, along with a minimum of 2 GB RAM and sufficient disk space for storing PHP scripts, application files, and databases. The operating system should be compatible with the PHP version and other software dependencies, allowing for network connections with external systems.

In terms of software requirements, the system relies on the XAMPP/WAMPP server to create a local development environment for hosting PHP applications. A web browser is needed for accessing and testing these applications, and Visual Studio Code, a renowned text editor with features tailored for PHP development, is recommended. The PHP/HTML programming language is employed for front-end system design, while MySQL serves as the database.

4.1. Login Module:

Upon launching the program, users are presented with a login module to enter their credentials for authentication. Following successful authentication, the subsequent screen displayed is determined by the user's role and associated restrictions (see Figure 6 and 7).

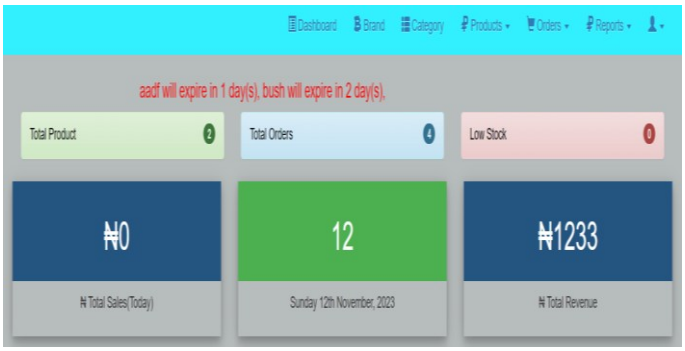

Figure 6: Login Module (for admin)

Figure 7: Login Module (for users)

The administrative dashboard screen showcases essential information, including the date and total revenue. It offers navigation options to various program aspects such as Products (for viewing stock and expiring products), Orders (for managing and placing orders), Brand (for adding new brands), Category (for adding new categories), and Me (providing options for adding users, accessing settings, and logging out). Users with limited access are directed to a distinct dashboard, ensuring a tailored experience within the inventory management system.

4.2 Add Users Module:

This screen is exclusive to only the admin. It's from here the admin adds new users to the database using a set of username and email address to identify each of them.

4.3 Order Report Module:

This screen is where reports of sales are generated. You can specify the duration by selecting the start and end date, this enables the program to automatically generate the report for the specified range. There's also an option to print the generated report also.

4.4 Settings Module:

The settings screen makes provision for the admin to change the password for security when necessary.

4.5 Manage Order Module:

This screen shows the orders already made and as seen in Figure 8, there's an "Action" button where the admin may decide to either delete, edit, or print a receipt for an order made.

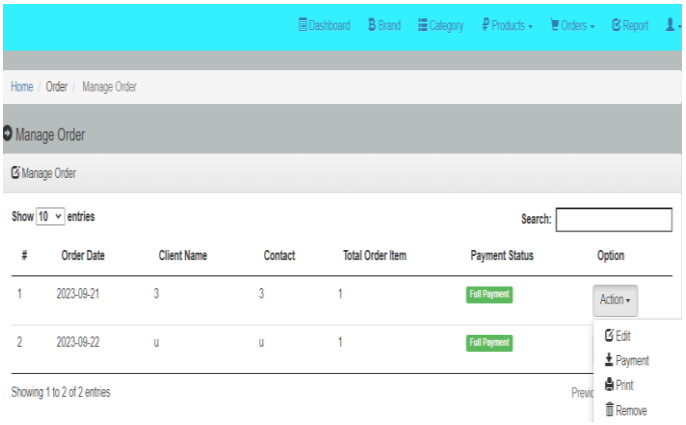

Figure 8: Manage Order Module

4.6 Add Order Module:

The "Add Order" screen is accessed from the "Orders" tab on the dashboard and is used for creating orders for clients. It provides fields for entering the client's name, date of transaction, contact details, amount, and other relevant information. After completing the order, the attendant can generate a printed receipt for the client (see Figure 9).

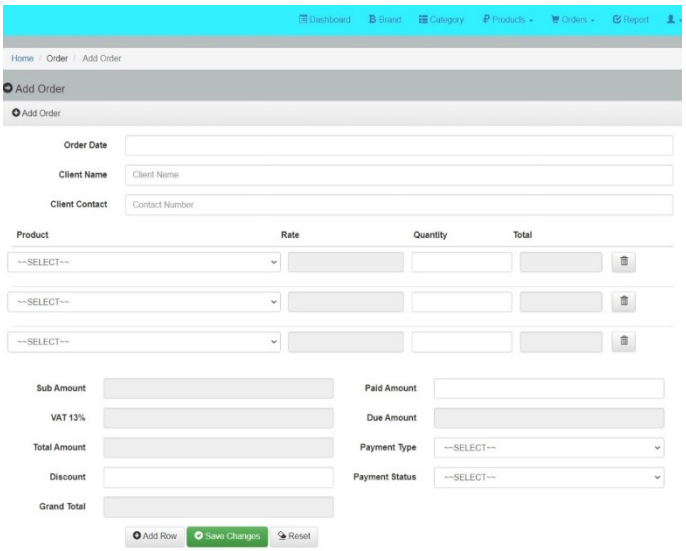

Figure 9: Add Order Module

4.7 Expiring Product Module:

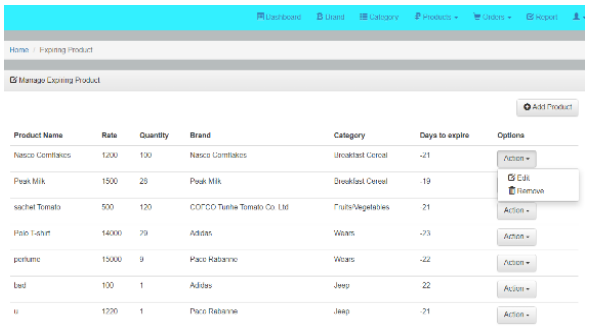

Figure 10: Expiring Product Module

As seen in Figure 10, the "manage expiring product module" screen displays all expiring products by displaying the product name, days to expire, etc. There's also an action button where an option to either edit or completely remove the expiring product. This option is exclusive to only the admin.

5. RESULTS AND DISCUSSION

Following the deployment phase, the results indicate a significant enhancement in inventory management efficiency, with notable improvements in data handling speed, accuracy, and overall system responsiveness. The system has undergone thorough testing and has proven to be reliable and user-friendly. The implemented system incorporates various features, such as real-time stock updates, expiry date tracking (shelf life management), etc., ensuring accuracy and minimizing manual errors. It also includes comprehensive reporting capabilities, providing valuable insights into stock levels, trends, and potential risks. By implementing this system, businesses can experience improved productivity, reduced costs, and enhanced customer satisfaction.

6. CONCLUSION

The project has successfully met its goals, delivering a resilient and user-friendly system for efficient stock inventory management. This system ensures precise tracking, streamlined reordering, and detailed reporting, with extensive testing confirming its reliable performance. The recommendation is to embrace this newly implemented inventory control system, particularly for businesses seeking to enhance their stock management processes. The system brings advantages such as minimized stockouts, effective shelf life management, reduced overstocking, and enhanced decision-making based on data-driven insights. In summary, the system promises improved inventory control, heightened efficiency, and overall business success.

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