Quest Journals
Journal of Software Engineering and Simulation
Volume 8 ~ Issue 2 (2022) pp: 05-10
ISSN(Online) :2321-3795 ISSN (Print):2321-3809
www.questjournals.org

Research Paper

Development of Computerized Warehouse Management System

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Abstract: *A warehouse is a storage facility for products and commodities awaiting clearance. The manual clearance of these commodities is in used in most organizations. It involves physically transporting billing paperwork from one port to another, which delays the clearance of products. Furthermore, creating a reference to a specific transaction takes a lengthy time. In view of this, this paper developed a computerized warehouse management system to address these issues. It will electronically maintain records of Good Inwards (GI), check-in and check-out, as well as simplify warehouse operations by eliminating the rate of defects in the present manual method. For software implementation, observation and the internet will be employed as data collection techniques. As a result, the waterfall model is used to develop the new system. While PHP programming language is also used for the coding of the client-model application in order to achieve the aims and objectives of the system.*

Keywords: *(ABS): Warehouse; Check-in; Check-out; Database; Model; Export; Import; and Transaction;*

R*eceived 15 Feb, 2022;* ***R****evised 26 Feb, 2022;* ***A****ccepted 28 Feb, 2022 © The author(s) 2022.*
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I INTRODUCTION

A warehouse's primary function is to store things for future use and consumption. These warehouses are regarded as the most difficult and vital component, responsible for reducing costs while improving customer service. People are increasingly relying on information technology (IT) to provide speedier communication, data storage, and data processing. ITs are a key means of achieving these objectives, however depending on the activity in a firm, some are more suited to execute. Logistics operations, according to (Makaci, 2017), encompass the following activities: customer service, location, storage, transportation, distribution, and warehousing. Some aims in a warehouse clash, such as optimization of space use and reduction of average time of stay (Andiyappillai & Prakash, 2019). As a result, in order to fulfill its major goal, this element must be planned, managed, and controlled. As a result, warehouse data must be stored carefully and not at the mercy of any form of threat. Although some corporations have used the bookkeeping methodology, this method is inefficient since the records of such warehouses are paper-based in nature, and these papers are highly significant because they include crucial data of the many types of items that reside in the warehouse. However, the method of storing such records is insecure. Warehouse Management Systems (WMS) are a viable alternative for businesses of all sizes to address challenges in their warehouse operations (Shiau and Liao, 2013).

The fundamental purpose of a warehouse management system (WMS) is to electronically manage the movement and storage of items inside a warehouse as well as the associated transactions in a critical component of the supply chain. WMS also keeps track of stock based on real-time data on product status and storage locations.

WMS is undeniably important for the majority of enterprises. WMS is an efficient, productive, and accurate approach to manage a warehouse. It can be a standalone system or a module of an Enterprise Resource Planning (ERP) system or a supply chain execution suite.

1.1 Statement of the Problem

The manual approach of processing billing sheets for warehouse clearance of items may result in the omission of critical data that should be preserved and stored securely. Billing documents are currently carried

from one post to another while waiting to meet the person in charge at each post, causing delays in the supply of products and services.

Another issue is that it takes time to make a reference to a specific transaction. As a result, the present system's efficiency and dependability are hampered by these flaws. The current approach is seen to be time demanding, as well as wasteful and unreliable in terms of data handling. In this context, a Warehouse Management System provides a long-term solution for increased efficiency.

II. LITERATURE SURVEY

Reaidy et al. (2015) developed an IoT infrastructure for collaborative warehouse order fulfillment based on RFID and a negotiation protocol that takes advantage of the ideas of competition and cooperation amongst agents. An example of a collaborative warehouse was built to evaluate the proposed system and examine its influence on demand responsiveness while minimizing fuel and labor expenses. This platform may increase warehouse visibility, traceability, and transparency for decentralized warehouse management systems (WMS), hence improving the overall performance of distribution processes.

Yan et al. (2016) developed an IoT-based solution that used RFID to solve the issue of inaccurate information interchange in the management of goods and resources in a warehouse. They also created two ways of information inquiry for static and dynamic data. These techniques make it possible for operators to quickly track, trace, and inspect commodities at any time and at any stage, which improves product authenticity and quality and, as a result, increases supply chain efficiency in warehouse management.

Li and Li (2017) developed a framework to demonstrate how IoT cloud could improve supply chain and warehouse management performance, particularly supply chain innovation (SCI), by providing integrated data on activities, resources, and processes, thereby improving the overall performance of all supply chain partners.

Tejesh and Roy (2017) created an inventory management system based on IoT and open source hardware that can be used to monitor and track all product information, such as an item's position in the stockroom.

Qin et al. (2017) provided an evaluation model that demonstrated the impact of deploying RFID on the problem of erroneous inventory caused by the bullwhip effect caused by information distortion across the supply chain. This decrease in inventory leads to a rise in scarcity and holding expenses. The authors suggested that employing RFID in the downstream phases is more efficient than using it in the upstream stages.

Trappey et al. (2017) explained that warehouse improvement may be judged by the speed and precision with which requests are met, effective management, and a reduction in nonvalue-added operations. Another issue to consider is information integration, which includes crucial functions for inventory status updates, product tracking, and order administration.

III. METHODOLOGY

System design is the solution to the creation of a new system. We chose the waterfall development method as the preferred software development model to make this research fruitful. During the implementation, the major and most important properties of a warehouse management system were taken into account. This phase is composed of several systems. This phase focuses on the detailed implementation of the feasible system. It emphasizes on translating design specifications. System design has two phases of development:

i. Logical design
ii. Physical design

During the logical design phase, we were able to describe the inputs (sources), output (destination), database (data source) and procedures (data flows) all in a format, that meets user's requirements. We also specified the user's need at a level that virtually determines the information flow into and out of the system and the data resources. The logical design was done through data flow diagrams and database design. The physical design was followed by physical coding. Physical coding produces the working system by defining the design specifications, which tells the programmers exactly what the system users will do. The necessary programs were written to accept input from the user, perform necessary processing on accepted data through call made by the system users.

3.1.1 Design and Framework

The system design and framework is done using a Three Tier Architecture, having applied the waterfall model.

Description: The Three Tier Architecture consist of the Presentation, Logic and Data Tier layer

a) **Presentation Tier:** This layer presents data to the user and optionally permits data manipulation and data entry.

b) **Logic Tier:** Also referred to as the business logic tier. It controls the systems functionality, by performing detailed processing. Vote tallying and checking whether one has voted, is done in this layer and the business functionalities are achieved at this point.

c) **Data Tier:** This layer consists of the database server. The systems details are stored and retrieved on request at this layer.

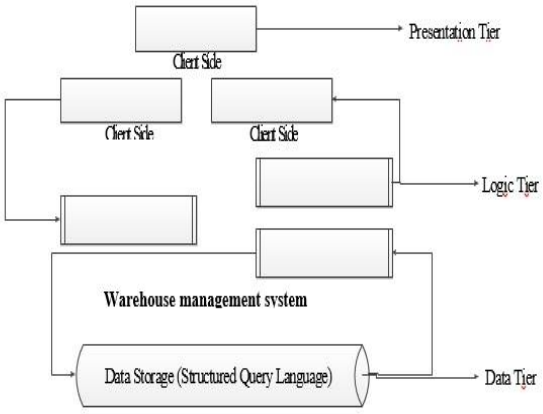

Figure 3.1: Three Tier Architecture of the System

3.1.2 Database Design

This section shows the database structures of the portal. These structures show how data and information about an entity of the system are stored. These data and information are stored in a form of a table which are logically connected to each other to share information amongst themselves within the database. This system made use of three (3) tables. These tables are Users Table, Import Table, and Export Table.

Table 3.1: Users Database Structures

Field_Name	Field__Type	Field_Size	Comment
User_ID	NUMERIC	50	Numbers
Name	VARCHAR	100	Variable Character
Email	VARCHAR	50	Variable Character
Password	VARCHAR	100	Variable Character
Gender	Char	10	Characters
Age	Numeric	50	Numbers
Dept	Text	50	Text only

The Table 3.1 depicts the database structure of users in the Warehouse Management System. The fields in the table are Name, Email, Password, Gender, Age and Department.

The import database structure keeps data and information on goods imported into the warehouse. It has the following fields: Goods Id, Model No, Description, Price, is_cleared and date as shown in Table 3.2.

Table 3.2: Import Database Structure

Field_Name	Field__Type	Field_Size	Comment
Goods_ID	NUMERIC	50	Numbers
Model_no	Numeric	100	Variable Character
Description	VARCHAR	100	Variable Character
Price	Numeric	100	Variable Character
Is_cleared	Boolean	True/False	True/False
Date	Date	10	Date

The export database structure depicts the database structure of exported goods out of the warehouse. The fields in the table are Goods Id, Model no Description, Price and date.

Table 3.3: Export Database Structure

Field_Name	Field__Type	Field_Size	Comment
Goods_ID	NUMERIC	50	Numbers
Model_no	Numeric	100	Variable Character
Description	VARCHAR	100	Variable Character
Quantity	INT	50	INTEGER
Price	Numeric	100	Variable Character
Date	Date	10	Date

3.1.3 Functional Requirement

The proposed system is a system which requires or depends on certain factors for reliability, efficiency and effectiveness. The factors are listed below;

i. Security of the system is ensured with the use of username and password, denying access to unauthorized users.

ii. The system also incorporates data integrity measures for total elimination of data duplication and redundancy, time and cost saving.

iii. The proposed speed of an operation is very high

iv. The transaction process is made easy when using the system

3.1.4 Non Functional Requirements

A non-functional requirement is that specified criteria that can be used to judge the operation of a system, rather than specific behaviors. It defines how the system is supposed to be. Outlined below are some of the expectations of the system when implemented.

a) Security

The system shall implement strategies to counter hacking and access by unauthorized persons.

b) Scalability

The system will be able to expand, in other to be able to meet the organizations future need and still be able to serve the purpose for which it is built.

c) Usability

The system provides an easy to use user interface, so that the user does not strain to interact with the system.

IV. RESULTS AND DISCUSSIONS

The system is separated into three interfaces: the import interface, which handles records of items entering the warehouse; the export interface, which handles operations of goods leaving the warehouse; and the third interface, which keeps records of the warehouse's financial activities.

4.1.1 Import Department Interface

Upon logging successfully, the system directs the user to the page shown in Figure 4.1. On this page, records of goods residing in the warehouse are shown each followed with dates and time of entry.

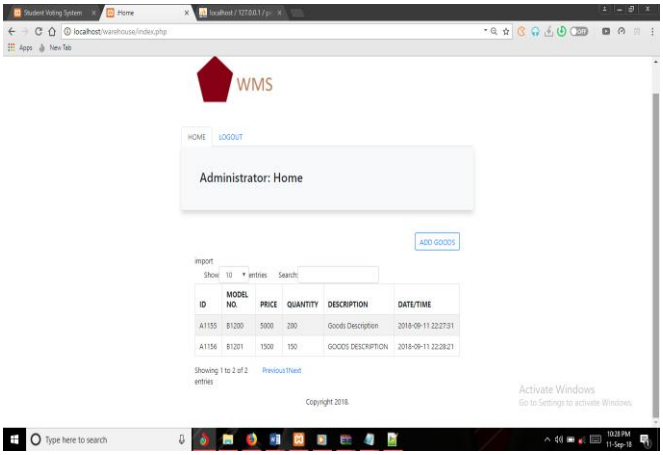

Figure 4.1: Import Department Interface

As shown in Figure 4.1, records of goods residing in the warehouse are added using the ADD GOODS button located at the right-hand corner of the page. The required inputs for goods to be added are Goods ID, Model ID, Price, Quantity, Description and Date/Time. Figure 4.2 below depicts ADD GOODS Page.

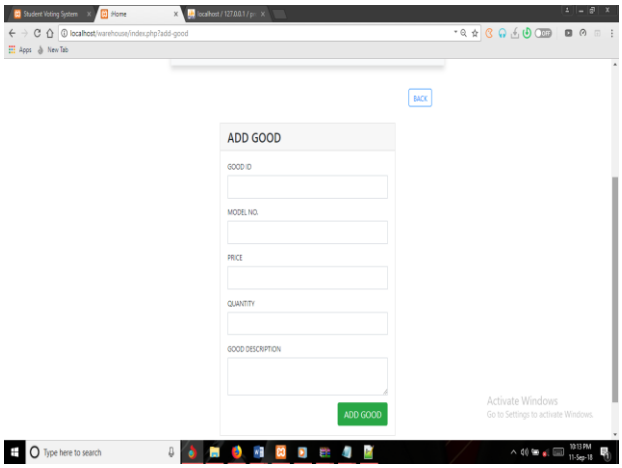

Figure 4.2: Add Goods Page

4.1.2 Finance Department Interface

This department handles the financial activities of the warehouse. They are responsible for clearing goods moving in and out of the warehouse. They also prepare a list of goods sent out of the warehouse for dispatch. Figure 4.3 below depicts the finance department interface.

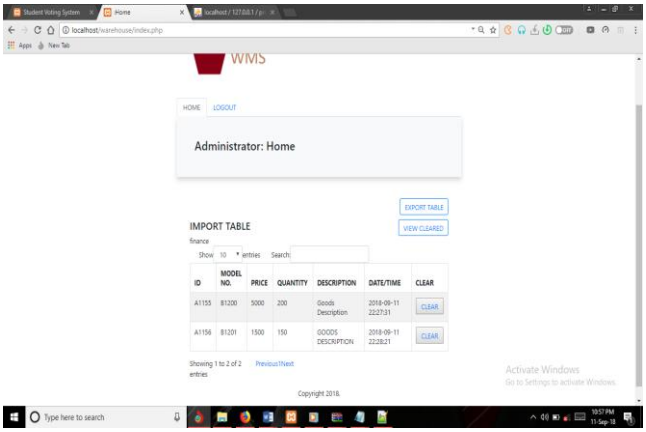

Figure 4. 1: Finance Department Interface

On this page, goods are cleared by clicking on the button "CLEAR" at the end of each record the list of goods cleared can be viewed with the VIEW CLEARED button located at the top right corner of the above figure 4.3.

4.1.3 Export Department Interface

This section handles record of goods moving out of the warehouse. The records of such goods are kept based on the following parameters: Goods ID, Model ID, Price, Quantity, Description and Date/Time. Figure 4.4 depicts Export Department Interface.

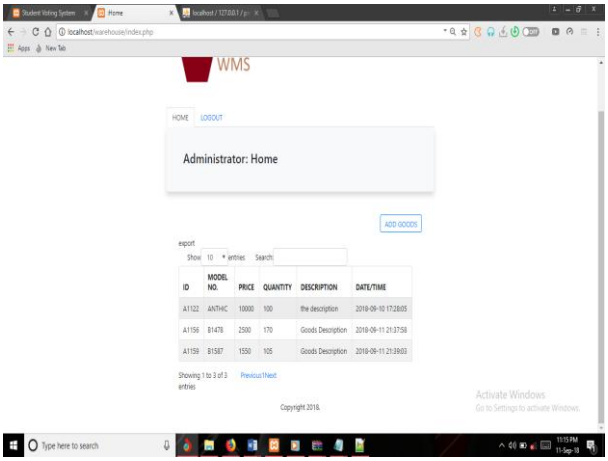

Figure 4.4 depicts Export Department Interface.

V. CONCLUSION

This paper investigated how warehouse recording is managed and concluded that it is obvious that businesses want to implement Warehouse Management Systems (WMS) to optimize their potential growth and stay ahead of the competition by delivering excellent distribution services to their customers. At the same time, WMS implementation should be in sync with the latest technical improvements in order to support the most recent technologies. Hence, the need to develop a WMS is crucial as it is expected to provide a reliable and efficient solution to curtail the problems associated with the traditional system- the use of paper and pens.

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