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Multifunctional Barcode Inventory System for Retailing. Are You Ready for It?

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***Abstract*—**This paper explains the development of Multifunctional Barcode Inventory Management System (MBIMS) to manage inventory and stock ordering. Today, most of the retailing market is still manually record their stocks and its effectiveness is quite low. By providing MBIMS, it will bring effectiveness to retailing market in inventory management. MBIMS will not only save time in recording input, output and refilling the inventory stock, but also in calculating remaining stock and provide auto-ordering function. This system is developed through System Development Life Cycle (SDLC) and the flow and structure of the system is fully built based on requirements of a retailing market. Furthermore, this system has been developed from methodical research and study where each part of the system is vigilantly designed. Thus, MBIMS will offer a good solution to the retailing market in achieving effectiveness and efficiency in inventory management.

***Keywords*—**Inventory, Retailing Market, Barcode, Automated Alerting and Ordering

I. INTRODUCTION

INVENTORY management is very important in every organization because a good inventory management can create optimal productivity and lowest waste. Basically, inventory management work is consists of input, output and refill. Input is a process of buying new products into the inventory and replacing the old products with the new ones. Meanwhile, output is a procedure of taking out the products from the inventory for sales or usage and refill is a process of increasing the number of existing products in the inventory in order to fulfill the insufficient products or escalating demands. Most of the retailing market is using traditional way in the inventory management system where a person is assigned to check and record the stock by hand using pen and paper. This technique is time-consuming and unavailable for 24/7 especially when the number of stock in the inventory is large and various in kinds. In addition, it is also a waste of money in hiring manpower to do stock checking and the risks caused by careless mistakes done by the staffs may occur. Furthermore, when the entire inventory ordering has to be made manually, it will consume time to contact suppliers and normally the process of ordering is only arranged after the stock is found out empty. Consequently, it will cause sluggish in stock refilling and bring negative effects towards productivity. Having a good inventory management system is never can't without the computer [2]. Therefore, our project goal is to develop a multifunctional system that will facilitate retail market in managing their inventory and stock ordering effectively and efficiency. The development of Multifunctional Barcode Inventory Management System (MBIMS) aims to increase the efficiency in stock data inputting by using barcode scanner, to provide comfort to staffs in monitoring the availability of inventory with auto-alerting function and to manage the inventory effectively by sending the order to supplier automatically when the stock is lacking. The case study is based on the development of Inventory Management System in School of Informatics Science, Universiti Malaysia Sabah.

The rest of this paper is organized as follows. In next section, the technology employed in MBIMS will be discussed. Section III depicts overview of our system design and followed by database design in section IV. Then, the implementation of MBIMS is explained in the following section. After that, testing and result are briefly presented in section VI. Finally, section VII concludes this proposed system and some future enhancement works will be mentioned.

II. TECHNOLOGY EMPLOYED

MBIMS is primarily developed using Microsoft Visual Web Developer 2008 and the core language of the system is ASP.net with Visual Basic. The database used for the system is Microsoft SQL server 2008 and it can be hosted on any Internet Information Server (IIS) that supports .NET framework 3.5 or any ASP.NET development server. The interface of the system is mainly built from Hypertext Markup Language (HTML) with Cascading Style Sheets (CSS) and some functions of the system are developed from Asynchronous JavaScript and XML (AJAX). The reporting function in this system is developed by using ASP.net report system. Besides that, this system can be deployed in any platform or operating system that only needs to have a web browser and do not need any installation or configuration required. It is also accessible from anywhere that has Internet access and will provide an effective method to improve

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coordination distribution, storage and access of project information and data of the production process. [1]

III. SYSTEM OVERVIEW

The MBIMS has three main modules, namely Staff Module, Management Module and Administrator Module. In the development of MBIMS, Data Flow Diagram (DFD) is used for process modeling where it illustrates the overall movement of data between entities, Staff, Management and Administrator and also the process and data stores within the system. Figure 1 and 2 show the context diagram and level-0 diagram of MBIMS.

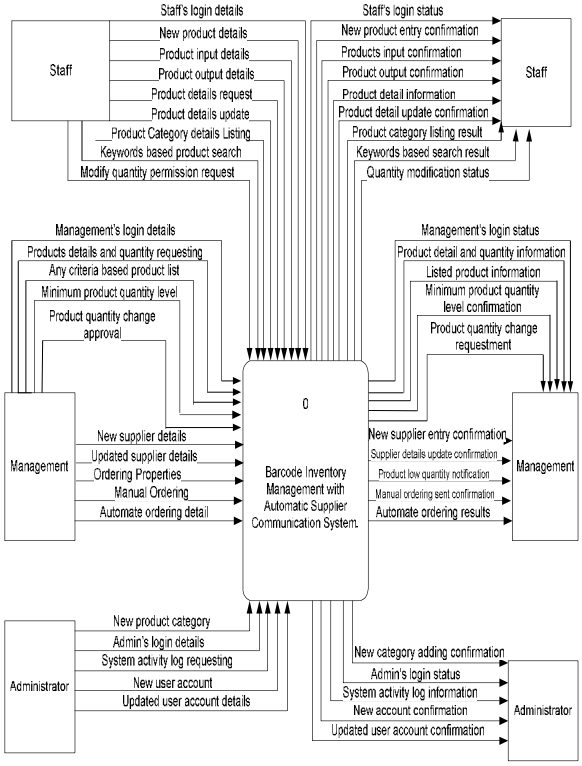

Fig. 1 Context diagram of MBIMS

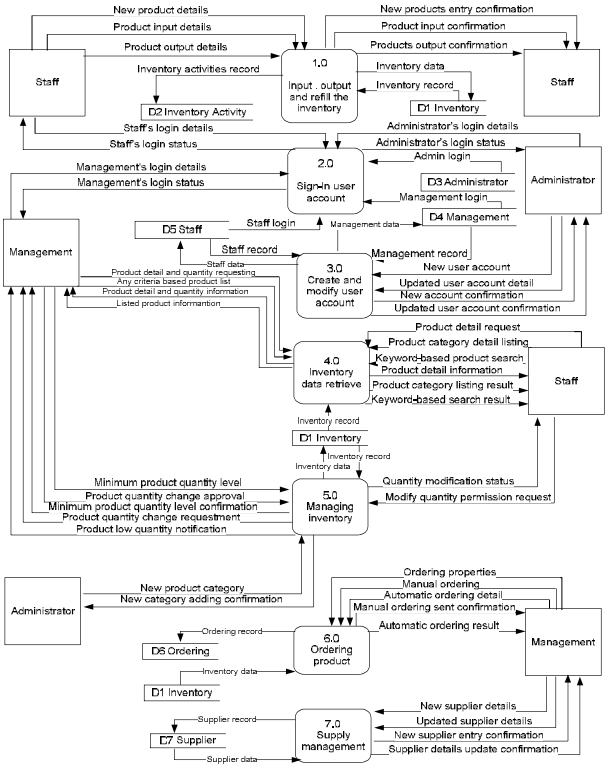

Fig. 2 Level-0 diagram of MBIMS

IV. DATABASE DESIGN

In conceptual data modeling, the attributes of these three entities and their relationships among other entities in MBIMS are graphically represented in Entity-Relationship Diagram (E-RD) as shown in Figure 3. In this E-RD has clearly shown that MBIMS consists of seven entities, which are Administrator, Staff, Management, Supplier, Inventory, Order and Inventory Activities.

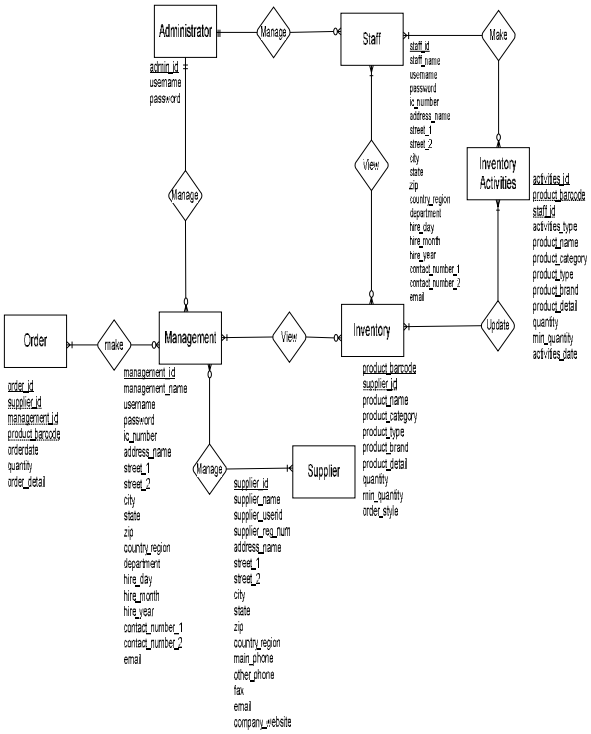

Fig. 3 E-R diagram of MBIMS

V. IMPLEMENTATION

Implementation stage is most time consuming phase of the entire System Development Life Cycle (SDLC). A fully proper functioning system should to be developed and tested in order to ensure the proposed system fulfill business and design requirements. There are several techniques of implementation such as pilots, gradual implementation, phased implementation, and parallel implementation. MBIMS is developed by employing gradual implementation techniques which involves programming languages and program documentation.

A. Programming Languages

Choosing the right programming language to develop a system is vital. The languages used to develop MBIMS are ASP.net 3.5, VB.net, AJAX, HTML, JavaScript and MSSQL. ASP.NET is employed as a web application framework because of its speed, compatibility and mostly reliability. For database management system (DBMS), Microsoft SQL Server (MSSQL) is utilized because it has good DBMS control features such as buffer management, logging and transaction and concurrency and locking where these features make the MSSQL very stable and widely used by most of the enterprises in the world. JavaScript is also been used to generate alert pop-ups and previous page linking functions. Furthermore, MBIMS has also been built up using Asynchronous JavaScript and XML (AJAX). With AJAX, web applications can retrieve data from the server asynchronously in the background without interfering with the display and behavior of the existing page. This function has been used when users retrieve product details from database by using barcode scanning.

B. Program Documentation

Program documentation in MBIMS can be divided based on its modules, Staff Module, Management Module and Administrator Module. The functionalities of the system are divided into 7 categories which are Inventory Operation, Inventory Data, User Management, Inventory Manage, Ordering Supply, Supplier and System Administrator. In inventory operation, there are basic inventory operations which include input, output and refill. Meanwhile, in inventory data, user can browse the inventory information in several ways like using barcode, keyword, category and status. Similarly in user management, staff users can view and change their profile, management can create new user of the system and admin can delete and manage the all user accounts. On the other hand, in inventory manage, there are additional functions such as change the inventory setting and information, track all the inventory activities and history, view the daily or monthly inventory report and also the whole inventory status. As in ordering supply, user can make ordering for any items record in the inventory, determine the ordering style of any items in the inventory which can be done automatically or manually, and also can track all the ordering history. Correspondingly in supplier part, user can register new supplier for ordering purpose and manage the supplier details. In system administrator, admin can view the user activities log, number and user that using the system right now and manage whole inventory database. The main page for Staff Module, Management Module and Administrator Module are shown in figure 4, 5 and 6.

Fig. 4 Main page for staff module

Fig. 5 Main page for management module

Fig. 6 Main page for administrator module

VI. TESTING AND RESULTS

MBIMS has been successfully developed and tested throughout an evaluation framework which consists of evaluation paradigms, evaluation techniques and evaluation of testing. In evaluation paradigms, usability testing is used to ensure the system accomplished the crucial user requirements. The participants of this testing include 15 staffs and 35 third year students from both School of Informatics Science and School of International Business and Finance. Observation is performed towards the participants, where user and system performance are recorded in term of duration time to complete a task, number of errors made and the navigation path through the system. For evaluation of testing, a unit testing is conducted which focus on the functionalities of each features of the system before proceed to navigation testing and lastly integration testing. As a result, the status of the usability testing and system testing that executed through unit testing, navigation testing and integration testing have successfully verified that the MBIMS is working properly and fully functioning as planned. Generally, MBIMS can be divided into 5 main functions as below:

A. Stock Data Inputting

The system has an inventory management system which covered input, output and refill that will work with barcode. All the barcode input and retrieval of the system is scanned using the barcode scanner.

B. Inventory Availability Checking

The system can show the user the in-house inventory and can check availability of stock at anytime. System will also be able to record down all the input, output and refill and calculate the stock availability accurately.

C. Stock Inventory Refilling and New Stock Ordering

The system has the ordering pages for the user to make order while observing the inventory. Two types of ordering forms have been prepared for refilling and new stock ordering. All the ordering is submitted to supplier by e-mail.

D. Automated Alerting and Ordering

The system will be able to alert the user when some stock is less than the pre-set level. The system also can make the ordering automatically when user set the system to do so.

E. Inventory Data Printing

User can print inventory data through the system as printing function will be included. Inventory data that can be printed based on items detail, inventory list, lacking stock, ordering data and date.

VII. CONCLUSION AND FUTURE WORKS

In conclusion, Multifunctional Barcode Inventory Management System (MBIMS) is a system that designed for providing efficiency and effectiveness for retailing market in their inventory management. The entire system is developed through System Development Life Cycle (SDLC), which initialized with planning, analysis, design and ended up with implementation and testing. Through this system, all the inventory activities like input, output, refill and browsing product can be done using barcode scanner. User only needs to scan the product barcode and the details of the product will be listed out for operation. Therefore, user can save time in keying product barcode or details and also prevent the mistake that may occur when key in the data. Besides that, all the functions' links are provided in the main page. User can directly access to the function they want right after log in to the system. In addition, user is able directly go to other function page by just clicking the main link at the header of the page which is available throughout all the function pages. The MBIMS has an ordering system where the user make the order easily especially in browsing the inventory data. This automated ordering function will send the order to supplier when the product quantity level is low. Furthermore, the inventory system also has strong security features. User is

required to log in before using this system. All the sensitive information like username and password will be encrypted to ensure they are not disclosed to unauthorized party. Moreover, all the user's activities in using the system will be kept in the log file as proof to provide non-repudiation purpose if any dispute occurred. Due to the time constraint, our work only serves to demonstrate of the some useful functions in retailing inventory management, but there are a number of areas that required more investigation for this development.

- Interactive ordering system should be built in MBIMS which enable user to know the status of sending the ordering email and also supplier can directly confirm the ordering through the system.
- Artificial intelligent report generating system should be embedded into MBIMS in order to track the inventory usage flow more clearly and precisely.

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