

Design and Implementation of Computerized Inventory System for Efficient Stock Management and Real-Time Business Operations

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<https://doi.org/10.56201/ijcsmt.vol.12.no9.2026.pg42.56>

Abstract

This study focused on the development of an automated inventory-control system for Gamzaki Store to address limitations associated with the manual inventory-control process. The existing process involved repetitive record keeping, manual calculations, difficulty updating inventory information, and challenges in retrieving transaction records. A case-study approach was used to examine the existing inventory-control process and identify the functional requirements of the proposed system. The system was developed as a computerized inventory-control application incorporating user authentication, stock management, transaction processing, receipt generation, and transaction history management. The implemented system provides facilities for adding and updating stock information, processing customer transactions, generating receipts, and retrieving previously recorded sales information. The system was tested using varied inventory and transaction data to examine the operation of its implemented functions and the production of required outputs. The results demonstrate that the developed system provides a structured computerized approach to recording, processing, storing, and retrieving inventory and transaction information. The system therefore provides a practical alternative to the manual procedures previously used at Gamzaki Store. However, the study did not quantitatively measure improvements in efficiency, accuracy, processing time, or user satisfaction. Further evaluation using operational performance measures and user-based assessments is recommended to determine the extent of such improvements.

Keywords: Computerized Inventory, Stock Management, Real-time Business

Introduction

Inventory control is an important aspect of business operations because it involves managing inventory in order to meet customer demand while maintaining an appropriate level of investment and controlling the costs associated with holding stock. An effective inventory control system requires organizations to consider factors such as purchasing goods according to demand, seasonal variations, changing usage patterns and possible losses of inventory. The cost of managing inventory may also include storage expenses, inventory risks and the opportunity cost associated with capital tied up in stock. Inventory management also involves costs associated with storing and controlling stock, making effective inventory practices important to business operations (Koumanakos, 2008). Effective inventory management is

important because inaccurate inventory records can affect stock availability and inventory-related decision-making in retail operations (DeHoratius & Raman, 2008). The importance of inventory control is further related to the need to maintain an appropriate balance between product availability and the cost of holding stock. Organizations require sufficient inventory to satisfy customers and support continuous business operations, but maintaining excessive quantities can create additional financial and operational burdens. Graman and Magazine (2006) noted that the cost of holding inventory, product proliferation and the risk of obsolescence can make large inventories expensive, particularly when organizations maintain stock for items with low demand. Similarly, Sahari et al. (2012) observed that large buffer inventories consume valuable resources and generate hidden costs. Excessive inventory can occupy physical space, tie up financial resources and increase the possibility of damage, spoilage and loss (Nyabwanga & Ojera, 2012). Effective inventory management practices are particularly important for small and medium-sized enterprises because inventory management can influence their operational performance and use of available resources (Kareem, 2018). On the other hand, insufficient inventory can disrupt business operations and affect the availability of products required for sales (Koumanakos, 2008). These challenges demonstrate the need for inventory control practices that allow organizations to maintain adequate stock while avoiding unnecessary accumulation. Inventory control has also been associated with the efficiency and profitability of business operations. Lyson (1996) posited that inventory control can enhance profitability by reducing costs associated with the storage and handling of materials. Buffa and Sarin (1987) identified several reasons why organizations maintain inventory, while also noting that excessive stock can result in tied-up funds, increased holding costs, deterioration, obsolescence and theft. Conversely, shortages may interrupt the availability of products for sale and negatively affect customer relationships. Rajeev (2008) also emphasized the need for businesses to adopt effective inventory management practices as organizations seek to improve operational effectiveness and competitiveness. These observations indicate that inventory control is not limited to recording the quantity of goods available but also involves maintaining accurate information that can support purchasing, sales and other business decisions. Inaccurate inventory records can create difficulties in inventory planning and operational decision-making, particularly in retail environments where recorded stock levels may differ from physical stock levels (DeHoratius & Raman, 2008). Computerized systems provide useful tools for maintaining inventory records because businesses need timely information about purchases, sales and available stock. Small and medium-sized retailers can also experience inventory-control and information-visibility challenges involving stock location, purchasing, replenishment and point-of-sale processes, creating a need for appropriate information technologies to support inventory operations (Hamilton et al., 2010). In retail environments, increasing administrative and paper-based activities create a need for faster and more effective methods of managing inventory information. Computerization provides an approach for changing manual inventory procedures into a computerized process in which information can be entered, processed, stored and retrieved through a structured system. In the context of inventory control, such a system can be used to manage information relating to stock numbers, product names, quantities, cost prices and selling prices and to produce relevant inventory outputs. The use of computerized inventory control is particularly relevant where manual procedures require repeated recording, calculation and monitoring of stock. The proposed computerized system is intended to improve the speed and organization of inventory-related activities by supporting information entry, processing, storage, retrieval and report generation. A computerized system can also support the generation of reports and receipts and provide information about stock levels and transaction history. Recent literature on retail inventory management has highlighted the use of information systems, technologies and performance

indicators to support inventory management in retail organizations, including small and medium-sized enterprises (Muñoz Macas et al., 2021). The proposed approach is therefore based on replacing repetitive manual inventory procedures with a computerized process while retaining the fundamental inventory-control activities required by the business. At Gamzaki Store, the existing inventory-control process was identified as completely manual. The process requires sales personnel to monitor the stock level of individual items and take action when stock levels become too high or too low. Such actions may include recording stock-status information or generating purchase orders. The study identified several problems associated with this approach, including inaccuracy and inefficiency in record keeping, time consumption, difficulty calculating the total amount of items sold, excessive paperwork and difficulty updating records whenever changes occur. These problems create a need for an inventory-control approach that can handle stock information more efficiently and reduce the amount of repetitive manual work required by staff. The analysis of the existing system further showed that staff at Gamzaki Store manually record sales and maintain inventory information. The existing process involves recording information such as the stock number, product name, quantity in stock, cost price, selling price and reorder level. Staff are also required to calculate the items used over a period, determine future requirements and place orders with vendors when necessary. According to the study analysis, these activities require considerable time and human effort and are prone to human error. The manual approach can also require staff to perform several tasks simultaneously, particularly during sales activities, which may place additional pressure on the process of maintaining accurate records. The analysis therefore identified the existing system as inefficient and inflexible in handling inventory-related data, with specific problems including repetitive routines, difficulty updating records when new stock is added and incorrect calculations. In response to these problems, the study proposed and developed an automated inventory-control system for Gamzaki Store. The proposed system is designed to accept information relating to stock items, including stock number, product name, quantity, cost price and selling price, and to process and store the information. The system is also designed to produce outputs such as sales reports, stock reports, payment receipts and transaction-history reports. In addition, the study specifies login authentication as a security measure intended to restrict unauthorized access to the system. The system is intended to provide a computerized means of maintaining inventory information and processing transactions while reducing dependence on manual record keeping. The proposed computerized system was designed to maintain stock information, record transactions, generate relevant reports and produce transaction receipts. It also includes transaction-history records and stock-availability checking to support inventory and sales information management. These functions provide a structured alternative to the repetitive manual procedures identified in the existing system. Therefore, this study aimed to develop an automated inventory-control system for Gamzaki Store through the incorporation of computer technology into the existing manual inventory-control process. The study was intended to address problems associated with inventory calculations and management by providing a computerized approach to recording, processing, storing and retrieving inventory and transaction information.

Materials and Methods

Study Setting and System Investigation

The study focused on the inventory-control activities of Gamzaki Store, where the existing process was investigated as the basis for designing an automated inventory-control system. The investigation examined how stock information was recorded and monitored, how sales were tracked, how stock levels were assessed and how orders were generated when additional inventory was required. The analysis of the existing process was used to identify operational

difficulties and determine the requirements of the proposed system. A case-study approach was appropriate because the study focused on understanding the inventory-control process within the actual operating environment of the selected retail business (Ellram, 1996).

Data Collection

Information about the existing inventory-control process was obtained through interviews and observation. Oral interviews were conducted with relevant stakeholders at Gamzaki Store, including personnel involved in inventory-control activities, to obtain information about the operation of the existing system. Direct observation was also used to understand the procedures followed during inventory and sales activities. Online research and library research were additionally used to obtain supporting information on inventory management, inventory-control practices and computerized inventory systems.

Analysis of the Existing System

The existing inventory-control process was analysed to determine its procedures, inputs, outputs and limitations. Under the existing manual process, sales personnel monitored the stock level of individual items, recorded stock information and took action when stock levels required replenishment. Inventory information included stock number, product name, quantity, cost price, selling price and reorder level. Staff also recorded sales and calculated inventory requirements before placing orders with vendors when necessary. The analysis identified difficulties associated with manual record keeping, including repetitive procedures, time consumption, calculation errors, difficulty updating records and dependence on human effort.

System Requirements

The requirements of the proposed system were derived from the analysis of the existing inventory-control process. The functional requirements included user authentication, stock management, transaction processing, transaction-history management and generation of inventory-related outputs. Non-functional requirements relating to usability, security, reliability and performance were also considered during the design of the system.

System Design

The system was designed around the inventory and transaction activities identified during the analysis of the existing process, integrating inventory information, transaction processing, and information retrieval within a single computerized environment. Similar inventory information-system research has emphasized the use of computerized systems to provide more accurate stock information and support inventory-control decisions in retail settings (Hartini & Adi, 2013). The design included the system structure, use-case representation, database structure, input specifications, processing procedures, and output specifications. The database was designed to store the inventory and transaction information required by the system. The stock-management data structure included information such as product name, category, cost price, selling price, and minimum stock balance, while transaction records included transaction identification, product, quantity, selling price, total amount, and transaction date. The use of a computerized system is appropriate for retail inventory management because increasing product variety and transaction complexity can make inventory decisions more difficult to manage manually (Muñoz Macas et al., 2021).

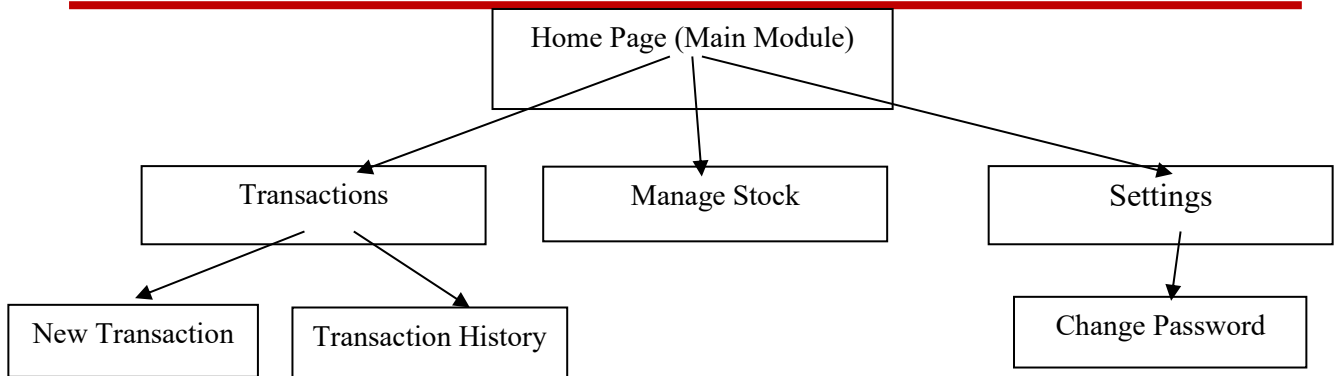


Figure 1. Structure Chart of the System Design

The proposed system was designed to support the interaction between sales personnel and the main inventory-control functions. After authentication, the sales personnel can access the transaction functions, including performing new transactions and viewing transaction history. The system also provides functions for managing stock information and changing the user password. During transaction processing, the system checks the availability of the requested stock and, after a successful transaction, generates the corresponding bill or receipt. These interactions provide the functional basis for the use-case representation of the system.

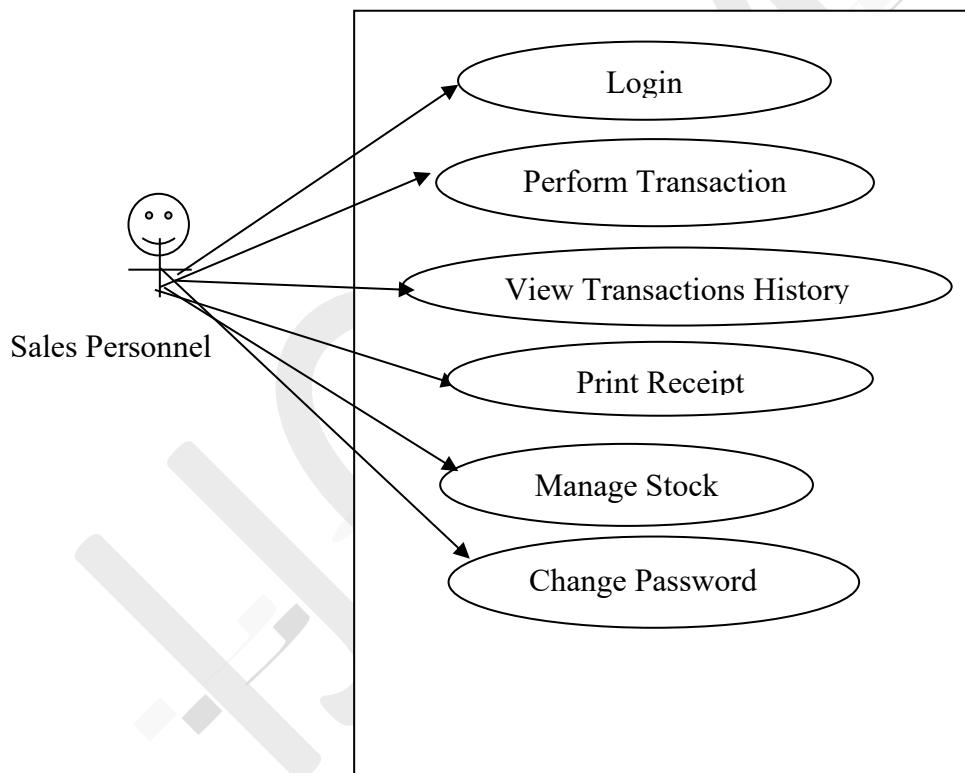


Figure 2. Diagram of the System Design

The database was designed to store and manage the information required for inventory control, transaction processing and user authentication. Microsoft Access was used as the database platform, with separate data structures provided for stock management, transaction history and login information. The stock-management structure contains information such as stock name, category, cost price, selling price and minimum stock balance. The transaction-history structure records information relating to transactions, including item category, price, quantity, total amount and purchase date. The login structure stores the information required for user authentication and password management. Field and table-level validation were considered in the database design to support the organization and management of the stored

information.

Table 1. Structure of the manage stock table

Description	Field Names	Data Types
Serial number	S/N	Number
Item name	StockName	Text
Item Category	Category	Text
Cost price	CostPrice	Number
Selling price	SellingPrice	Number
Minimum Balance	MinimumStockBal	Number

Table 2. Structure of the transaction history table

Description	Field Names	Data Types
Serial number	ID	Number
Item category	Category	Text
Selling price	Price	Number
Quantity	Qty	Number
Total amount	TotalAmount	Number
Purchase date	PurchaseDate	Number

Table 3. Structure of the Login Table

Description	Field Names	Data Types
Serial number	S/N	Number
Username	Username	Text
Old Password	Password	Text
New Password	Password	Text
Confirm Password	Password	Text

The system processes inventory transactions by receiving the item and quantity information entered by the sales personnel during a customer transaction. The system checks the available stock for the requested item before processing the order. Where the required stock is available, the transaction is processed and the corresponding transaction information is recorded. The system then calculates the transaction amount and generates the applicable bill or receipt for the customer. Transaction information is also retained in the transaction-history records to support subsequent retrieval and inventory monitoring.

System Development Environment

The computerized inventory-control system was developed using Visual Basic.NET as the programming environment and Microsoft Access as the database platform. Microsoft Excel

was identified as a supporting software tool, while the system was designed to operate within a Windows environment. The development environment was selected to support the implementation of the required inventory-management, transaction-processing and reporting functions.

System Implementation and Testing

Following the system design, the identified inventory-control functions were implemented and integrated with the database. The system incorporated user authentication, stock-management functions, transaction processing and transaction-history management. Testing was carried out using varied inventory and transaction data to examine the operation of the developed system and its ability to process information and produce the required outputs. The testing procedure provided the basis for evaluating the implemented system and identifying whether the designed functions operated as intended.

Results and Discussion

System Implementation

The automated inventory-control system was implemented by integrating the major components developed for the system, including the Login Form, Home Form, Transaction Form, Transaction History Form, Manage Stock Form and Change Password Form. The completed forms were integrated to constitute the complete inventory-control system. The implementation was developed to process inventory information entered by the user and provide the required transaction outputs. The implementation therefore translated the system design presented in the Materials and Methods section into an operational computerized inventory-control application. The main functions provided by the implemented system include user authentication, stock management, transaction processing, receipt generation and transaction-history management. These functions correspond to the major activities identified during the analysis of the existing manual inventory-control process.

Figure 3. Welcome form

The Home Form is displayed after the username and password have been supplied, allowing access to the features of the software. The implementation of this main interface provides access to the functions required for inventory and transaction management. The implemented system consequently provides a computerized alternative to the manual process previously used at Gamzaki Store. The original system analysis identified repetitive procedures, time



consumption, calculation errors, difficulty updating records and dependence on human effort as problems associated with the manual process. The implemented functions address these

activities by providing structured facilities for recording, processing, storing and retrieving inventory and transaction information.

User Authentication

The implemented system includes a Login Form through which the user provides a username and password before accessing the features of the software. The Login Form is the first form requiring user information for access to the system. After the credentials have been supplied, the Home Form is displayed and the system features become accessible.

Figure 4: login form

The login function provides the authentication mechanism specified in the system design.

The image shows a web-based login form. On the left, there is a dark blue vertical rectangle with the word "Login" in white text. To the right of this bar, on a light blue background, are two text input fields. The first field is labeled "Username" and the second is labeled "Password". Below these two fields are two buttons: "OK" and "Cancel".

The study identified login authentication as a security provision to restrict unauthorized access to the system. The error-handling requirements also specify that the system should report invalid login errors and violations of authorization rights. The implementation of authentication is relevant to inventory control because the system contains stock and transaction information. Restricting access through username and password provides a basic mechanism for controlling access to the computerized inventory records. However, the study does not provide a quantitative assessment of the security strength of the authentication mechanism; therefore, the result is limited to the implemented access-control function.

Change Password Form

The Change Password form allows the management or system administrator to securely update an existing account password. The user enters their username, old password, new password, and confirms the new password before selecting OK to save the changes. The Cancel and Exit buttons allow the user to cancel the operation or close the form.

Figure 5: Change password form

A screenshot of a Windows-style dialog box titled "Change Login Details". The dialog has a light blue header bar with standard minimize, maximize, and close buttons. The main area has a light blue background. It contains four text input fields: "Username", "Old Password", "New Password", and "Confirm New Password". Below these fields are three buttons: "OK", "Cancel", and "Exit".

Home Form

The Home Form is displayed after the user successfully provides a valid username and password. It serves as the main interface of the system, providing access to the software's available features. From this form, the user can access Transactions, Manage Stock, and Settings, while the Exit option allows the user to close the application.

A screenshot of a Windows-style application window titled "Home Frm". The window has a light blue header bar with standard minimize, maximize, and close buttons. Below the header is a menu bar with four items: "Transactions", "Manage Stock", "Settings", and "Exit". The main area of the window is a large, empty light blue rectangle. At the bottom of the window is a solid dark blue horizontal bar.

Figure 6. Home form

Stock Management

The Manage Stock Form provides the implemented system with a facility for maintaining stock information. The implementation of computerized stock and transaction records provides a structured basis for inventory monitoring and record retrieval. This is relevant to

the broader inventory-management literature, where inaccurate inventory records have been identified as a significant problem in retail operations and where inventory-management tools have been proposed to account for record inaccuracies (DeHoratius et al., 2008). According to the study, this interface allows the user to add new stock and update selected stock balances.

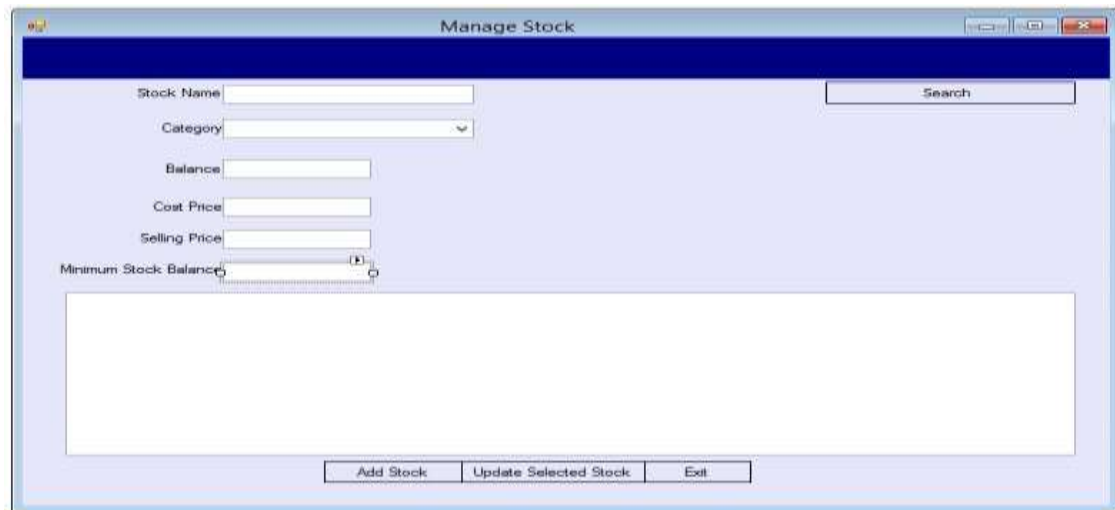


Figure 7: Manage Stock form

The implemented stock management function corresponds to the database structure designed for inventory information. The Manage Stock structure contains fields for stock name, category, cost price, selling price and minimum stock balance. The source implementation also shows that the system can search for a stock item by stock name, retrieve its category, stock balance, cost price, selling price and minimum stock balance, and add a new stock record to the ManageStock table. The stock-management function therefore provides a computerized means of maintaining inventory records rather than relying entirely on the manual recording procedures identified in the existing system. In the manual process, staff were required to record stock information, monitor stock levels and update records when new stock was added. The implemented Manage Stock Form provides specific functions for these activities and therefore addresses the difficulty of updating stock information identified during the system analysis. The study also identifies a minimum stock balance as part of the stock-management data structure. This provides a field for maintaining information about the minimum level of stock required for an item. However, the study does not provide a quantitative evaluation of the effectiveness of a low-stock alert; therefore, no numerical improvement in stock monitoring is claimed in this study.

Transaction Processing

The Transaction Form is one of the main operational components of the implemented system. The study describes the Transaction Form as the form used for selling items and issuing a receipt to the customer whenever an item is purchased.

Figure 8. Transaction form

The screenshot shows a software window titled "New Transaction". It features a dark blue header. Below the header, there are two input fields: "Item Name" and "Qty". To the right of these fields are three buttons: "Add", "Remove", and "Remove All". Below these buttons is a table with the following columns: "S/N", "Item Name", "Qty", "Price", and "Total". The table is currently empty. Below the table is a "Sub Total" input field. At the bottom of the window, there are three buttons: "Calculate Total", "Save", and "Exit", followed by a "Total" input field.

During operation, the system receives item and quantity information entered by the sales personnel during a customer transaction. The system checks the available stock for the requested item before processing the order. Where the required stock is available, the transaction is processed and the corresponding transaction information is recorded. The system then calculates the transaction amount and generates the applicable bill or receipt for the customer. The transaction process provides a computerized approach to activities that were previously carried out manually. Under the existing process, staff recorded sales and calculated inventory requirements before placing orders when necessary. The analysis of the manual system identified incorrect calculations, repetitive procedures and dependence on human effort among the problems requiring attention. The implemented transaction function addresses these activities by providing a structured sequence in which transaction information is entered, processed and recorded. The study specifies transaction output information including item name, quantity, price and total amount, which provides the information required for the transaction output.

Receipt Generation and Printing

The implemented system includes a Receipt Form for producing the receipt associated with a completed purchase. The study states that the Receipt Form enables the receipt associated with a completed purchase to be printed and issued to the customer.

The screenshot shows a web-based receipt form for 'Gamzaki Stores'. The form is titled 'Receipt' and contains a table with the following columns: 'Date', 'Label1', 'S/N', 'Item', 'Qty', 'Price', and 'Total'. Below the table, there is a 'Print' button and a label 'Total Amount Label1'. The form is displayed within a browser window with a dashed border.

Figure 9. Receipt form

The receipt function represents the output stage of the transaction process. The system processes the information entered during the transaction and produces the required transaction output. The study specifies that the output contains information relating to the stock item, including item name, quantity, price and total amount, and that the information is intended to be printed. The implementation of receipt generation provides a computerized alternative to manually preparing transaction records for customers. It also connects the transaction processing function with a physical transaction output. This is consistent with the system design, which specifies that after a successful transaction, the system generates the corresponding bill or receipt. The receipt functionality should therefore be interpreted as an implemented output feature rather than evidence of a measured improvement in transaction speed. Although the study identifies completion of transactions within seconds as a non-functional requirement, no measured processing time values are provided.

Transaction History and Report Generation

The Transaction History Form provides access to previously recorded sales. The study states that transaction history is used to show the list of all sales for reference purposes and that the form can be used for printing transaction records.



Figure 10. Transaction History form

The source implementation retrieves transaction information from the TransactionHistory table, including Item, Category, Price, Qty, TotalAmount and PurchaseDate, and displays the retrieved information in a data grid. The implementation also provides a print function through which the transaction data can be transferred to Microsoft Excel and exported as a transaction report. The transaction history function therefore provides a structured method of retaining and retrieving sales information. This corresponds to the database design, which includes a transaction history structure containing transaction identification, category, price, quantity, total amount and purchase date. The ability to retrieve transaction records provides a useful alternative to the manual process in which sales information was recorded and maintained manually. The study identified the difficulty of maintaining and updating records as one of the problems of the existing system. The transaction history function provides stored records that can subsequently be viewed and printed for reference. The implementation also demonstrates the relationship between the inventory system and Microsoft Excel for report output. The source implementation creates an Excel workbook, transfers the transaction history data into the workbook, automatically adjusts the columns and opens the generated file for viewing.

System Testing and Error Handling

The implemented system was tested using varied inventory and transaction data after the development and integration of the different forms. The study reports that the output was displayed on the monitor and could also be printed on paper. The testing was intended to examine the operation of the implemented system and its ability to produce the required outputs. The study also specifies error-handling requirements for data-type mismatches on form fields, violations of authorization rights and invalid login errors. These requirements correspond to the functional areas of data entry, user authentication and controlled access within the system. The development process documented in the study consisted of understanding the problem, problem analysis, program design, segmenting the program, desk checking and running the program. Program segmentation was intended to allow individual components to be tested and debugged, while desk checking was used to identify and correct syntax and logic errors.

Overall Discussion of the Implemented System

The results demonstrate that the proposed automated inventory-control system was implemented with the principal functions identified during the analysis of the existing manual process. These functions include user authentication, stock management, transaction processing, receipt generation and transaction history management. The implementation also integrated the individual forms into a complete system. The implemented functions correspond to the main problems identified in the existing system. Manual inventory control at Gamzaki Store involved recording stock information, monitoring stock levels, recording sales, calculating inventory requirements and updating records. The analysis identified repetitive procedures, time consumption, calculation errors, difficulty updating records and dependence on human effort as limitations of the manual process. The Manage Stock function provides a computerized means of adding and updating stock information, while the Transaction Form provides a structured process for recording sales. Receipt generation provides a transaction output for the customer, and the Transaction History Form provides access to previously recorded sales and supports printing of transaction records. Taken together, these functions provide a more structured computerized approach to recording, processing, storing and retrieving inventory and transaction information. The system therefore addresses the central aim of incorporating computer technology into the existing manual inventory-control process.

Conclusion

It can be observed that computer applications are very important in every field of human endeavour. With this new system, the difficulties encountered with the manual inventory control system of Gamzaki Store are overcome. The automated inventory control system reduces the workload of the staff, saves time and increases efficiency. The records of the company are safe and secure, distribution process is well managed, errors are minimized, and reports generated for management are accurate thereby increasing the profit margin. On a general note, this project covers necessary process involved in designing any inventory control in a retail shop. It is aimed at providing a means of helping staff of manage sales and inventory. The approach used involves the consultation of different individuals ranging from the owner and staff of Gamzaki Store. The method of implementation was with the use of visual studio 2010 (visual basic.net) as the programming language, SQL as the database engine. The basic user attention was given priority when designing the system. Therefore, this project if embraced would address the problems of sales and inventory management.

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