Design and Development of a Sales Management System for SMEs in Northern Ghana

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Abstract—Sales management is a key function which helps small and medium size enterprises (SMEs) in monitoring and tracking stock and co-ordinating transaction processing. The efficiency of sales management depends on effective tools and facilities, especially modern information and communication technologies. Despite this, majority of businesses in developing countries, especially those in remote areas do not take full advantage of these technologies due to challenges related to the design of these technologies. This paper presents the design and development of a tailor-made computerized sales management system for SMEs in Northern Ghana. The object-oriented methodology is employed with UML, VB.NET and Microsoft Access Database for the design and development of the system which is flexible and tailor-made for SMEs in the region.

Index Terms—SME, ICT, Sales management system, Northern Ghana, Point of Sale.

1. INTRODUCTION

SMEs form a major part of the Ghanaian economy, covering a wide range of business circles. They include wholesalers, retailers, distributors and some serving as agents for bigger companies and organizations. Every economy puts limits to what size and scope of business can be described as a small or medium scale enterprise. The Ghana statistical services (GSS) defines a small scale enterprise as a business firm employing not more than nine (9) persons, while medium and large scale enterprises comprise firms employing ten (10) or more persons[1]. Another definition for a small scale enterprise is given by the National Board for Small Scale Industries as a firm employing not more than ten persons and the value of whose fixed assets are not more than ten million cedis[2]. In this paper, we consider an SME as a business entity employing not more than ten persons, whose scope does not go beyond a given locality (Town, village or region) and its data processing may not require more than four computer systems.

Majority of the SMEs in northern Ghana use the traditional daily sales books for their business transactions. Only a few of them have formalized sales tracking systems which are mostly accounting software or spreadsheet applications such as Microsoft excel, Microsoft Access or very uncommonly oracle and other proprietary software applications. While a few of the SMEs find the existing sales management systems (SMS) to be problem-free and a key to their continuous growth, most of them quit using these systems after a while for various reasons. The opinion of those who discontinued the computerized systems is either that, the systems were slowing down their daily sales or that they were too complex and expensive to use. The case is opposite for those who continue to use the systems. It is important that the wide spread of information and communication technologies (ICT) should enable every willing business to find an appropriate solution to its particular problems among the various solutions provided. However, it is not uncommon to overlook some of the challenges SMEs in developing countries still grapple with when it comes to sales management. While some businesses have had their problems solved by using computerized systems, others have to bear high cost if they wish to meet their sales target with the systems they wish to or are currently implementing. The common challenges faced by the SMEs include misrepresentation of sales, loss of goods and profit, high cost of sales tracking, customer dissatisfaction, difficulty implementing marketing strategies, and high cost of acquiring software licenses.

Though some of the challenges listed above have been tackled by various computer applications and sales management systems, many SMEs are still confronted with them. One for this problem is that most of the existing solutions have not been created to provide the information that most of the SMEs need to keep their businesses going. In summary, the challenges with the existing systems include high cost of acquiring full software packages, special hardware requirements of some functions, systems not satisfying unique goals of SMEs, requirement for understanding some accounting principles, and the cost of paying for extra functions that are not needed. he purpose of this work therefore was to design and develop a directed sales management system for SMEs in northern Ghana. The specific objectives of the work were to: design an easy to learn and use sales management system suitable for SMEs; build a prototype which can be used as a model for future projects; reduce cost of employing ICT in SMEs; expose SMEs to the usefulness of ICT to their business processes; make ICT more adaptable and appealing to entrepreneurs of SMEs within the region; help SMEs introduce more formalized sales transaction procedures into their businesses; and help SMEs maximize profits through a more effective sales and stock tracking system.
II. RELATED WORKS

As in common use, most business owners think of sales management as a purely accounting process. This conflicts with the definition of sales management as “the attainment of sales force goals in an effective and efficient manner through planning, staffing, training, leading and controlling organizational resources[3]. Sales management is also defined by the American Marketing Association (AMA) as “the planning, direction and control of personal selling, including recruiting, selecting, equipping, assigning, routing, supervising, paying and motivating as these tasks apply to the personnel sales force”[4]. Thus it is clear that sales management is not purely an accounting function. However, it links with accounting in the area of record keeping as accounting is employed to interpret data from sales operations.

A sales management system (SMS) can thus be thought of as the mechanism used by sales managers to make sales management easier and faster. It has been defined as an “Information System used by sales professionals or business entities for sales tracking which facilitates the sales management process”[5]. A working sales system comprises a point of sales system (POS) at the front end and a detailed implementation of various sales management and tracking functionalities at the back end. This structure directly mimics the sales process in a sales environment where the sales agents are at the front end interacting directly with customers whiles managers handle the reports from the transactions[6]. An example of SMS is Mr. John Beachy Asibu’s enterprise’s shop management application in Navrongo which provides a rich graphic user interface and basic functions such as generating invoices, tracking daily sales, generating reports and keeping track of stock. However, the system has no official documentation and provides no guarantee of satisfying the user’s needs. It is also designed using VBA, a dialect of Visual Basic for applications compiled into P-code and stored in a separate file on the host application and then interpreted by the virtual machine hosted by the host application. The P-code is commonly protected using a password set by the creator of the macro. Unlike other languages which generate binaries and provide more code encryption, the P-code is not encrypted and can easily be revealed with the appropriate password recovery tools and thus is not suitable for commercial use. Also Microsoft access runtime is not backward compatible which means that code written for the latest version of Microsoft access will not run correctly if at all on older versions.

Another set of systems common within the region are Intuit QuickBooks and TALLY, which are accounting software that have been converted and used as sales management systems. QuickBooks at a glance is a form of spreadsheet application, which is equipped with enormous accounting functions. The package allows its users to customize how entries are made into the system. This makes it easy to turn QuickBooks into a point of sale system to serve sales agents and also a faster way to get accounting done with a mouse click. TALLY is not much different. It however has no rich user interfaces as compared to QuickBooks and requires more keyboarding skills from the user. Since these systems were developed purposely for accounting personnel, they are difficult to use by people with very little accounting knowledge and expensive to implement due to training cost. Also the system supplies functions most SMEs will never use and paying for such functions is therefore seen as an unnecessary business expense. Some other well known systems globally include; Retailman, Hiopos and Shopkeep. Each of these systems is equipped with the basic functions any business will need to keep track of sales, implement and control marketing strategies. However, these functions come with their own challenges and even most of them are developed for more vibrant markets.

III. METHODOLOGY

The proposed system is designed and implemented using the object oriented development approach[7]. This approach makes it easy to identify system components, locate and fix bugs quickly with very little effect on other components and allows reusability of program codes. The user requirements were elicited through interviews with selected business owners. This helped to define the needs of the target users, which are SMEs within Northern Ghana. Selected SMEs in Tamale, Bolgatanga and Navrongo were used as case study since the most commercial and profitable SMEs are located in these towns. Also, to accommodate the ever growing nature of businesses, the project sought to create a solution which will be easy to upgrade through further developments to meet future needs of businesses.

In line with object oriented development, the Unified Modeling Language (UML) is used to design class models and use case diagrams for the main components to provide a blue print for implementation. The programming language for this project is VB.NET using Visual Studio 2008. This language is both object oriented and event driven and makes it easy to design interactive user interfaces. It is also proprietary to the windows platform which is the preferred choice of the target users. This guarantees that many of the libraries needed to run the system will be available on the user PC, making it cheaper to use the system. As an Information system, the sales management system runs with a Microsoft Access (2007) database at the back end to help collect, store, process and retrieve data for its users. As mentioned in the project aims, this system is not intended to be a final release. It serves as a prototype and a basis for further developments as the data needs of SMEs increase.

IV. REQUIREMENTS ANALYSIS AND SYSTEM DESIGN

The Requirements analysis was done to ascertain the type of sales management systems used by the SMEs and users experiences with the existing systems. This process led to the identification of two major types of systems namely; manual systems and computerized systems.
In response to questions about which of the two types of systems was preferred most of the businesses using the manual systems where daily sales books are maintained chose the computerized systems as most effective and convenient but cited factors such as difficulty of use, cost of acquiring full package and technical functions as reasons for not using them. It was also noted that some of the users of computerized systems also kept daily sales books, explaining that their sales persons needed a more formal training to be able to use the system effectively and for that matter it was convenient to keep a daily sales book to help identify error entries and sales misrepresentations. The more comfortable users of computerized systems were mostly users with a fair accounting knowledge. In some cases business owners left the entire system to the accountant who was more familiar with the system, a situation some said poses a business risk. Deductions from the requirements analysis show that ease of use and knowledge prerequisite are the main reasons why most SMEs are not able to adopt computerized systems fully for tracking and managing their sales processes. This situation makes them stick to old and sometimes wasteful methods of tracking sales. The effect of this is loss of profits due to poor record keeping. Hence we sought to build a sales management system with friendly and interactive user interfaces which is easy to learn and use. However, the design does not compromise the security or integrity of business processes, and is intended to streamline transactions to eliminate user level errors such as misrepresentation of sales, uncaptured transactions and error entries.

A. Main system components
The system is divided into three (3) main components (classes) each of which has its own sub components (subclasses) which carry out various functions. These components are the Entry component, Administrative component and Point of Sale (POS) component.

Component Diagram

![Component Diagram](image)

The system has a fourth component which provides a user manual and system documentation, which is meant to guide a user through some task and can also be used as a training manual. It is not treated as a main component of the system because its design and implementation is done independent of the project. The next section decomposes the main components and gives their detailed structure and designs.

A. System entry component
The system entry component is the first part of the system every user interacts with before undertaking or carrying out any other activities. It is composed of the main program background frame, the login frame and the system main menu. The background frame is the parent of all other frames within the system. It provides the initial controls needed to startup any other process within the system, this frame calls up the login frame which calls the main menu frame, which provides commands leading to the other components of the system.

Class Diagram

![Class Diagram](image)
The classes shown in Fig 2.1 above are implemented in a hierarchical manner. This hierarchy is illustrated in the next two figures which show the typical activities at the entry point of the system and also a simple sequence of events that directly involve this component.

Activity Diagram

![Activity Diagram]

**Fig 1.1.2 Activity diagram showing actions and responses at the entry component**

The activity diagram above shows in detail, how the user will execute commands at the entry level and the effect or functions that calls up the responses or events as a result of a given action.

The sequence diagram in Fig 3.4 below is used to show how the user interacts with the entry component.

Sequence Diagram

![Sequence Diagram]

**Fig 1.1.3 Sequence of events at the entry point**

B. Administrative component

The administrative component is also called settings in this project. It is the largest component within the system; it includes several functions for monitoring and controlling or defining which functions a user can call up at any point in the system.
Administrative Component

Each component in Fig 1.2 defines a set of functions which carries out the task related to the component. The administrative component illustrated above implements most functions related to the creation or assignment of resources defined by the system. Some of the functions include; creation and editing of user accounts and stock categories, adding inventory, defining charges and promotions and creating new units of measure. Fig 1.2.2 presents the class diagram of the administrative component which shows how the individual components are related and interconnected.

Administrative Component Class Diagram

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Fig 1.2.1 Administrative components

Fig 1.2.2 Administrative class diagram showing class relationships, attributes and operations
The operations and attributes shown in the class diagrams are generic in nature since an implementation may typically define many more operations to achieve the function defined by the operation in a given class.

C. Point of sale component (pos)

The POS system is the point where most of the data handled or processed by the sales management system are generated. It therefore includes a number of data input fields and data storage procedures to ensure effective tracking. The POS also includes some administrative features such as; the activation of charges and promotions and also their deactivation, viewing and printing reports and commission administration. The functions available to a user at the POS system are determined by the user group and rights; any user at the POS can conduct sales, however only administrators can access the administrative functions available. Below is a component diagram of the POS system.

**Components of the Point Of Sale (POS)**

The system links component represents functions that links or connects the POS system with the other components of the system i.e., this component allows a user at the POS system to switch to any other component. The payments components has a special relation with the POS system called a dependency, the relationship as shown on the diagram illustrates that the payments component is only triggered by the changes of events at POS system i.e. if no sales transaction occurs there is never going to be any instance of the payments component. Another special relationship can be seen at the POS administration component, this relationship shows that commission and the charges and promotions components are not an integral part of the POS administration and therefore can be implemented independently of it. Following is a class diagram to show in details the linkages and relations that exist between the components and also shows the features of each component.

**Class Diagram of the POS Component**

![Class Diagram of the Point of Sale System](image-url)
The system will also contain some other classes which define some functions to be used by the system components. Such classes define functions such as database connections and access. They also contain functions that are sheared between system components to avoid code repetitions. The class diagrams are shown below.

Connections class Diagram

<table>
<thead>
<tr>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>-sql: string</td>
</tr>
<tr>
<td>-table: string</td>
</tr>
<tr>
<td>+connectTODB():string</td>
</tr>
<tr>
<td>+FillDset(sql.table,con:string):Dataset</td>
</tr>
<tr>
<td>+UpdateData(Dset:Dataset,table,sq1)</td>
</tr>
<tr>
<td>+DeleteRecord(table,field:substring,cmpField:substring)</td>
</tr>
</tbody>
</table>

Fig 1.4.1. class defining functions for database connections and interactions

Verifications Class

<table>
<thead>
<tr>
<th>Verifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>-ErrCount:int</td>
</tr>
<tr>
<td>+Contact_Verification(test:string):int</td>
</tr>
<tr>
<td>+ID_Verifications(test:string):int</td>
</tr>
<tr>
<td>+Alphabet_Test(test:string):int</td>
</tr>
<tr>
<td>+Numeric_Test(Test:string):int</td>
</tr>
</tbody>
</table>

Fig 1.4.2. class defining functions for verifying contacts and ID card information

Objects of these classes are used as variables in some classes in order to make use of the functions they supply in the system.

V. SYSTEM IMPLEMENTATION

A. DESIGN IMPLEMENTATION

1. SYSTEM ENTRY COMPONENT

Entry Use case

Fig 2.1 System Entry request

The background frame sets up the environment for the given system. This includes loading business details and the custom background which identifies the business. A user at this point can make a login request by clicking ENTER or CANCEL to terminate the program. The login frame requires the user to supply data for identification and subsequent validation by calling validate_User () method which calls the Login () method when all conditions for a valid login are satisfied. Some conditions that may lead to a login fail include: database exceptions, concurrency, and invalid password.
When all the above conditions are satisfied, the user is presented with a menu, which allows him to access the various components of the system depending on the user group. The main menu provides the following options; Point of Sale (POS), ADMINISTRATION, HOW TO and CLOSE. The POS, HOW TO and CLOSE options are accessible to any valid user of the system, however only Users in the Administrative group can access the ADMINISTRATION option. The POS option calls up the POS component where sales are conducted, HOW TO option executes the user manual which provides some system tutorials, CLOSE option closes the main menu and ADMINISTRATION calls up the Administrative components. Below are screenshots of the components of the system entry:

![Login Interface](image)

Fig 2.2 the login interface

2. ADMINISTRATIVE COMPONENT

This component embodies six (6) other components for performing a number of administrative functions. They include: stock categories, inventory, user accounts, security, personalization and charges and promotions. The stock categories component allows the administrator to define inventory classes which make it easier to analyze and apply changes to inventory in the same class. The component also allows you to edit these classes.

The use case below illustrates the process of creating and editing a category:

![Use Case Diagram](image)

Fig 2.3. Creating and editing a category

A use case for the inventory component does not differ significantly from the one in fig 2.3. However adding inventory requires a little more data than the stock categories. This data includes the unit measure and price of the commodity. Also the ID generation and data validation methods are significantly different. The user accounts component allows the administrator to create and edit user accounts. A valid user account has a password, user group and a user name. A user name can contain any character but must not be an empty string and none numeric. The password however must be at least four (4) characters long and can contain...
numbers, alphabets and any of the following characters @,-,_ . All other characters are invalid. Security as used in this project refers to restrictions limiting the level of access to components of the system. They are implemented as a set of predefined rules. The restrictions include: Access to settings, Adding and editing accounts, valid payment modes and Returning sold items. The component is provided as a set of these rules for the administrator to select which ones to effect. The charges component gives the user the opportunity to define and apply charges on stock. A charge has a name and a value, an effect and items it affects. However a charge can be defined and implemented later. The effect of a charge can be one of the following; Additive, Subtractive, Multiplicative or Divisive, and its value; either of the following; Fraction, Percentage or part of cost, with respect to the items it affects. This component also has a reduction sale component, which is also called Promotions in this project. It allows you to create a function that gives bonuses to customers based on a defined procedure, like charges a promotion has a name and a value which can either be a fraction, percentage or unique with respect to the cost of the items it affects. Promotions also have targets which maybe; the quantity of the item being purchased or the total cost of the item being purchased. Personalization component allows the administrator to customize the application interface. This component allows you to specify what information to include in a sales receipt and also supply details of your business; this data is shown on any printout from the system. Business details required here include; Business name, Postal address, telephone number(s) and Email address. Below is a screen shot of the complete administrative component, each tab allows the administrator to perform the task it refers to.

![Fig2. 4. the complete interface for the administrative interface](image)

3. POINT OF SALE COMPONENT (POS)
At the POS a user is provided with various controls to effect and keep track of sales. Some of the controls include a sales counter to keep track of the day’s sales while business is going on and the shopping list which temporarily holds the list of items a customer wishes to purchase. The diagrams below show a use case of making a sale and restoring a sold item.

![Fig 2.5 Sales use case](image)
Sales can only be restored by the sales representative who made the sale and during his/her session on the day of sale if access is granted. Administrators can make such changes at anytime during their sales session. Items in the shopping list can be removed or their quantity changed. POS administration component provides some administrative functions which include commission, reports and charges and promotions. These functions are placed in the POS system for easy access and also as means of motivating sales personnel. The commissions component allows the administrator to create or add users to the commission list, this component is however not a core part of the POS system. It is therefore implemented as a separate component and then linked with the POS system. This is true also for the charges and promotions component. Commission is computed on a daily basis when the user logs off using the logoff menu option. The charges and promotion components allow the user to activate or apply charges or promotions which were created in the administrative component.

The system links component allows a user to access and interact with other system components. It is implemented as a set of menu options, which grants access to a given component based on the user group and access level, defined in the security component of the administrative component. Some links include; Main menu, search and view. Payments component provides options to allow the user view payment status and to clear payments made in other modes other than cash payments. Below is a screen shot of the complete POS.
Other classes defined within the project include connections, verifications, dataTables and Who_Is_Loged. The connections class defines functions for database connections and some interactions, the verifications class on the other hand is composed of functions for the verification of contacts and ID cards which includes; Social security number (SSNIT), Voter ID and National Identification Cards. It also has functions to check for alphabets or numbers in a string. The DataTables class provides an interface for the system and the database; it is composed of functions for getting fields and database tables from the database. Who_Is_Loged class provides functions for finding the current user and also for determining his access level for various components. The access database is composed of seventeen tables which are listed in Appendix B. Each table has a unique primary key whose field cannot be duplicated. The complete database file is password protected to ensure its integrity.

B. System requirements

The system is built for the windows environment and should therefore run flawlessly on any windows platform. However, as characteristic of .NET applications this program requires a .NET 3.5 runtime or (higher) to be installed on the client computer to have access to some required libraries. Also Microsoft access runtime is needed to guarantee support for the database file and connection. However, this should not pose a problem since this library is supplied by any standard Microsoft office 2007 installation or higher. The system requires no special hardware to function effectively, however special input devices can be used once the windows platform recognizes them for input fields. Printing is done using the default printer; the choice is then left for the user to select the appropriate printer for a print operation.

C. Limitations of the system

The system does not cover functionalities such as generation of financial statements or balance sheets, report on the salaries of sales agents, compatibility with E-commerce (online purchases and payments) and cross platform compatibility (it is windows based). The generation of financial statements or balance sheets is meant purposely to differentiate the sales system from the accounting system and remove the extra functionality which most SME’s hardly need or require. This applies also to the reports of sales agents salaries. E-commerce compatibility is also not handled because most of the SMEs are not yet into ecommerce. This feature can be included in later versions. Cross platform capability is also not supported because the entire target users are windows based.

D. Strengths of the system

Comparing this system with some existing systems, it is quite limited in functionality. This however makes it most suitable for the type of business entities it is meant for and also makes it adaptable to other businesses outside its scope. While most well known systems like QUICKBOOKS, TALLY and RETAILMAN will mostly require the user to be well informed in the area of accounting to be able to explore the full strength and benefits of the system, this will allow the hobbyist computer user and willing entrepreneurs, to transform their computer systems into very functional POS and sales management tools with ease and with no accounting pre-requisite. The main advantages of the system are that it is easy to learn and use with little training, well suited for small scale enterprises with little accounting operations, flexible and customizable, giving full control to the user, a directed solution that better addresses the challenges of its target users, a windows based system endowed with user friendly interfaces (GUIs) and support for most input devices and easy to generate reports. From the developers’ point of view, the system leaves a lot of room for future development and can therefore be upgraded as the business grows, making it an ongoing solution for the target firms that reflects the times.

VI. RECOMMENDATIONS

As SMEs continuously grow and change, it is recommended that the system should be periodically updated and upgraded to be able to cope with increasing data demands. System administrators should regularly create backups of the database to ensure business continuity in the event of system crashes. There is also the need for system users to adhere to use policies as provided in the user manual to effectively track changes in data which concerns them. For later upgrades the system should include network support, this will help speed up the sales process and also data analysis.

VII. CONCLUSION

The success of any system is dependent on its usage. It is therefore hoped that the system will be used under conditions that satisfy its requirements. Given the required maintenance, the system will help facilitate sales management by tracking and storing relevant data needed for effective sales management.
REFERENCES


