

MOBILE STORE MANAGEMENT SYSTEM

A Thesis

Presented to the

Faculty of

San Diego State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

in

Computer Science

by

Park B. Patel

Fall 2012

SAN DIEGO STATE UNIVERSITY

The Undersigned Faculty Committee Approves the

Thesis of Park B. Patel:

Mobile Store Management System

N. Marvac

Marovac Nenad, Chair
Department of Computer Science

Carl E. Eckberg

Carl Eckberg
Department of Computer Science

Joseph M. Mahaffy

Joseph Mahaffy
Department of Mathematics and Statistics

11 / 9 / 2012

Approval Date

Copyright © 2012

by

Park B. Patel

All Rights Reserved

DEDICATION

Dedicated to
My Mother Chetna Patel,
Father Bharat Patel,
Wife Komal Trivedi
And
Brother Jatan Patel

ABSTRACT OF THE THESIS

Mobile Store Management System
by
Park B. Patel
Master of Science in Computer Science
San Diego State University, 2012

The Mobile Store Management System is software which can become the backbone for a billing and inventory system for small organizations. This software provides an uncomplicated system to run mobile stores. This application could be very useful to small organizations. This application is inspired from current pen and paper based store management systems. It will provide an easy and attractive interface so that the user can easily manage and utilize the application. Various other approaches were considered for this application. This application is designed in a way that it will only require a minimum amount of information from the user. The goal was to look for the minimum amount of information that will meet needed requirements.

TABLE OF CONTENTS

	PAGE
ABSTRACT.....	v
LIST OF TABLES	ix
LIST OF FIGURES	x
ACKNOWLEDGEMENTS.....	xi
CHAPTER	
1 INTRODUCTION	1
2 BACKGROUND	3
2.1 Need for a Mobile Store Management System	3
2.2 Background and Motivation	3
2.3 Market.....	4
3 HISTORY, RELEVANT LITERATURE AND SURVEY.....	5
3.1 Transformation from Paper to Computer-based System	5
3.2 Point-of-Sale System: An Innovative Proposal	6
3.3 Why Computerization is Required?.....	7
3.4 Survey of Current Inventory Systems in Stores.....	8
3.5 Project Needs	12
4 REQUIREMENTS.....	13
4.1 Technological Requirements	13
4.2 User Interface Requirements.....	13
4.3 Functional Requirements	13
5 TECHNOLOGY	14
5.1 Visual Basic	14
5.2 SQL Server.....	15
5.2.1 What is SQL?	15
5.2.2 How is it Different from Other Languages?	15
5.2.3 SQL Server.....	16
6 DESIGN.....	17

6.1 High Level Design	17
6.2 System Architecture.....	18
6.2.1 Presentation Tier	18
6.2.2 Logic Tier.....	18
6.2.3 Data Tier	19
6.3 Use Case Diagram.....	19
6.4 E-R Diagram	19
6.5 Data Flow Diagram.....	22
7 FUNCTIONALITY AND USAGE	23
7.1 Login Page	23
7.2 User Control Panel.....	24
7.3 User Forms.....	26
7.3.1 Manage Supplier Information	26
7.3.2 Manage Product Information	27
7.3.3 Manage Customer Information	27
7.3.4 Manage Purchase Information	28
7.3.5 Manage Sales Information	29
7.4 Functionality	29
7.4.1 Add.....	29
7.4.2 Delete	30
7.4.3 Retrieve	32
7.4.4 Update	32
7.4.5 Clear	33
8 TEST PLAN FOR APPLICATION.....	34
8.1 Why is Testing Important?.....	34
8.2 Testing Methodology	34
8.2.1 White Box Testing	34
8.2.2 Black Box Testing.....	35
8.3 What Kind of Testing is Important?	35
9 FUTURE WORK AND LIMITATION	39
9.1 Limitation.....	39
9.2 Future Expansion	39

10 CONCLUSION.....	40
REFERENCES	41
APPENDIX	
SQL SCRIPT	43

LIST OF TABLES

	PAGE
Table 3.1. Customer Information, Supplier Information and Product Information Form Validation	9
Table 8.1. Database Connection Validation	36
Table 8.2. Login Page Validation	37
Table 8.3. Customer Information, Supplier Information and Product Information Form Validation	37
Table 8.4. Purchase Information Form Validation	38
Table 8.5. Sales Information Form Validation	38

LIST OF FIGURES

	PAGE
Figure 3.1. Remote server- Client POS system.	7
Figure 3.2. Survey of types of inventory system used by small businesses.	9
Figure 6.1. High level design.....	17
Figure 6.2. Three tier system architecture.	18
Figure 6.3. Use case diagram.	20
Figure 6.4. E-R diagram.....	21
Figure 6.5. Data flow diagram.	22
Figure 7.1. Login screen.	23
Figure 7.2. Software main screen.	24
Figure 7.3. Software main screen – Menu expanded.....	25
Figure 7.4. About page.....	25
Figure 7.5. Chula Vista supplier details page.	26
Figure 7.6. Chula Vista product details page.....	27
Figure 7.7. Chula Vista customer information page.....	28
Figure 7.8. Chula Vista purchase details page.....	29
Figure 7.9. Invoice print format.....	30
Figure 7.10. Chula Vista sales details page.	31
Figure 7.11. Print bill format.	32

ACKNOWLEDGEMENTS

I sincerely thank my thesis adviser, Dr. Nenad Marovac, for his guidance, unrelenting support, and assistance whenever I needed his help during my research work. Without his help it would have not been possible for me to accomplish this task. I also like to thank Professor Carl Eckberg and Professor Joseph Mahaffy for being the readers of this thesis and for giving their valuable suggestions.

CHAPTER 1

INTRODUCTION

The Mobile Store Management System is developed for desktop systems to facilitate mobile shop owners' management of customer details and inventory data, which will include mobile phones and accessories. It can be used efficiently for physically separated shops in different locations. This software will provide in a simple and easy to operate user interface, which can be managed by any user without having prior in-depth knowledge of the computer system. One can use this software to get a sales report. Administrators can pull data, from any location from the server. This software is a complete package for small organizations which will allow them to keep track of their sales and inventory, and provide a computerized billing system. There are various applications with more complex implementation and features available in the market, but they are generally very expensive. Therefore, creating an application with the basic requirement of low cost is essential for small organizations. This application will allow stores to manage customer details, keep inventory of all products and purchase information, in a very simple way, using a state-of the-art software application. It will automatically generate invoices and update inventory.

The rest of this document is organized into the following chapters:

- Chapter 2: Background. This chapter discusses the background of mobile store management system and targeted market.
- Chapter 3: History, Relevant Literature and Survey. This chapter discusses the history of mobile store management system. It also discusses different approaches for mobile store management. At the end of chapter Survey results are included for the possible use of the application by different businesses.
- Chapter 4: Requirements. This chapter describes different requirements for this application.
- Chapter 5: Technology. This chapter provides an overview of the software and tools used to develop this application.
- Chapter 6: Design & Implementation. This chapter discusses the design approach for the database and application. It also includes the implementation method for this application.

- Chapter 7: Functionality and Usage. This chapter provides information about details of different functions available for this application and their usage.
- Chapter 8: Test Plan for Application. This chapter describes different testing methodologies used for this application and their results.
- Chapter 9: Future Work and Limitations. This chapter includes limitations of the existing application and future scope.
- Chapter 10: Conclusion.

CHAPTER 2

BACKGROUND

2.1 NEED FOR A MOBILE STORE MANAGEMENT SYSTEM

In today's market, retailers and wholesale outlets should quickly adapt to the ever-changing technology to minimize overhead, lower cost of operation, and help to stay competitive. Everybody needs software, which can facilitate store operations and make their day-to-day lives much easier.

Mobile Store Management System is application software designed to take advantage of today's technology and reduce or avoid the burden of storing data on paper and in files. This facilitates moving purchase, sales, and customer information, as well as supplier and company data, from paper to digital media on a secured server. Sales and purchase bills can be generated as needed. Each store has an option to store their data on one remote central database server. This will also allow stores to access information from other partner stores. This would in turn lead to information sharing, so that all the stores are aware of each other's current inventory. It will be useful when ordering new purchases to avoid overstocking.

2.2 BACKGROUND AND MOTIVATION

The concept of the Mobile Store Management system has been around for a long time, but it is still in the phase of discussion and design. Initially, all inventory and billing reports were managed manually by shop owners/employers using ledger- based systems. This requires a significant amount of time due to repeated access of the data. There is a high risk of lost or stolen data in that system. Storing old data is also one big factor. Stores have to spare one separate room to store this information. Paper- based documents might lose their information with time, and after some years we can't really read them at all. So the Mobile Store Management System is designed to reduce paper- based data storage system and provide digital touch to billing and inventory system.

2.3 MARKET

This software application is targeted for small and medium retail stores who want to transform their paper- based inventory, sales, and procurement system to a computer- based system. This is an inexpensive and easy-to-use software application for easy transition to digital media. Also, this system is simple to install and maintain in PC/Laptops, thus avoiding huge investments on enterprise or other types of servers. Currently, there is only one user for this application, who will also be the administrator. The system administrator will have complete access to the system configuration and data. The system administrator will also have access to other partner stores. The benefits drawn from the system and low cost for installation and maintenance come as a huge advantage. The possible retail shops are cell phone shops, jewelry shops, small carts in malls, family owned departmental and grocery stores. The Mobile Store Management System requires working network to communicate with mobile location. This does add some cost to the application. To gain an advantage of managing inventory from a mobile location, the store would have the expense of an internet service cost, if they do not have already.

CHAPTER 3

HISTORY, RELEVANT LITERATURE AND SURVEY

3.1 TRANSFORMATION FROM PAPER TO COMPUTER-BASED SYSTEM

A modern digital inventory management system must have the ability to keep track of sales and inventory. It should also provide communication means to contact suppliers as needed. It should also allow the incorporating shop owner's ideas to be implemented into the system. Implementing the idea of the previous section is practical for an inventory system, and requires combining many technologies into one common approach. The time taken by a customer care representative of any mobile store to enter information in the computer represents a base of the modern Mobile Store Management System [1].

Merchants used to write down inventory and sales details. They had to search their paper records to estimate future needs and retrieve old sales information. They had to spend significant amount of time every day for such work.

After the Industrial Revolution, efficiency and accuracy became the major factors of business, along with significant change in positive customer care to increase sales. A team at Harvard University designed the first modern check-out system in the early 1930s [1]. That system needed punch cards associated with items details. A system would gather information from the punch card and send it to stored data. As the system that was used by that time was too expensive for general merchants, this was the first time a store management system was transformed to a computerized system. Although it was very expensive, as computer systems during that time were relatively new and too expensive, this new innovation opened new dimensions to a store management system. Yet, the shop owners knew that they would need a better management system, and then different ideas for management systems were introduced, such as bar code scanner, RFID- based scanning systems. Merchants knew they needed a better system, and researchers created the forerunner of the modern bar-coding system in the late 1940s and early 1950s [1]. Bar code Scanners used ultraviolet ink and a

reader to detect items at the time of sale. But this system also required a significant computer contribution, which was also expensive. The development of affordable laser technology in the 1960s revived the concept, and lasers allowed smaller, faster and cheaper readers, or scanners [1]. The modern bar code, or the Universal Product Code (UPC), was born and caught on just before the 1970s [1]. The computers became cheaper and more affordable to support UPC codes and manage inventory systems with a significant improvement.

During the mid to late 1990s, retailers began implementing modern inventory management systems, made possible in large part by advances in computer and software technology [1]. The proper inventory management system ensures that customers would get all their needs met, and merchants would get their profit at same time.

3.2 POINT-OF-SALE SYSTEM: AN INNOVATIVE PROPOSAL

During evolution from traditional management system, mechanical registers were also replaced by point-of-sale (POS) systems. POS systems helped to build capabilities and provide more important advantages. Historically, vendors of POS systems have focused their marketing efforts on large chain stores, but now they have turned their attention to small businesses because of their significant potential to grow and expand [2]. Therefore, small organizations are also encouraged to use more powerful computer systems and software with a more attractive user interface that uses POS system instead of an old fashioned mechanical register system. For small organizations, such as mobile shops, product suppliers, and restaurant owners keeping transactions and inventory records is very hard and takes a lot of effort. POS system can be very beneficial for small organizations by providing smooth processes and functions. Such POS systems can be designed as shown in Figure 3.1 [2].

As the local data cache is stored in a local drive and transfers to a remote sever, this POS system can provide significant benefits to the small organizations. This study proved that checkout processing time, which represents operational performance, was improved significantly both in the local and the remote server-client models, when an ADO data cache was embedded in the POS system [2]. The more clients the proposed system served simultaneously, the greater savings it delivered, especially when large numbers of items were purchased in a sales transaction [2].

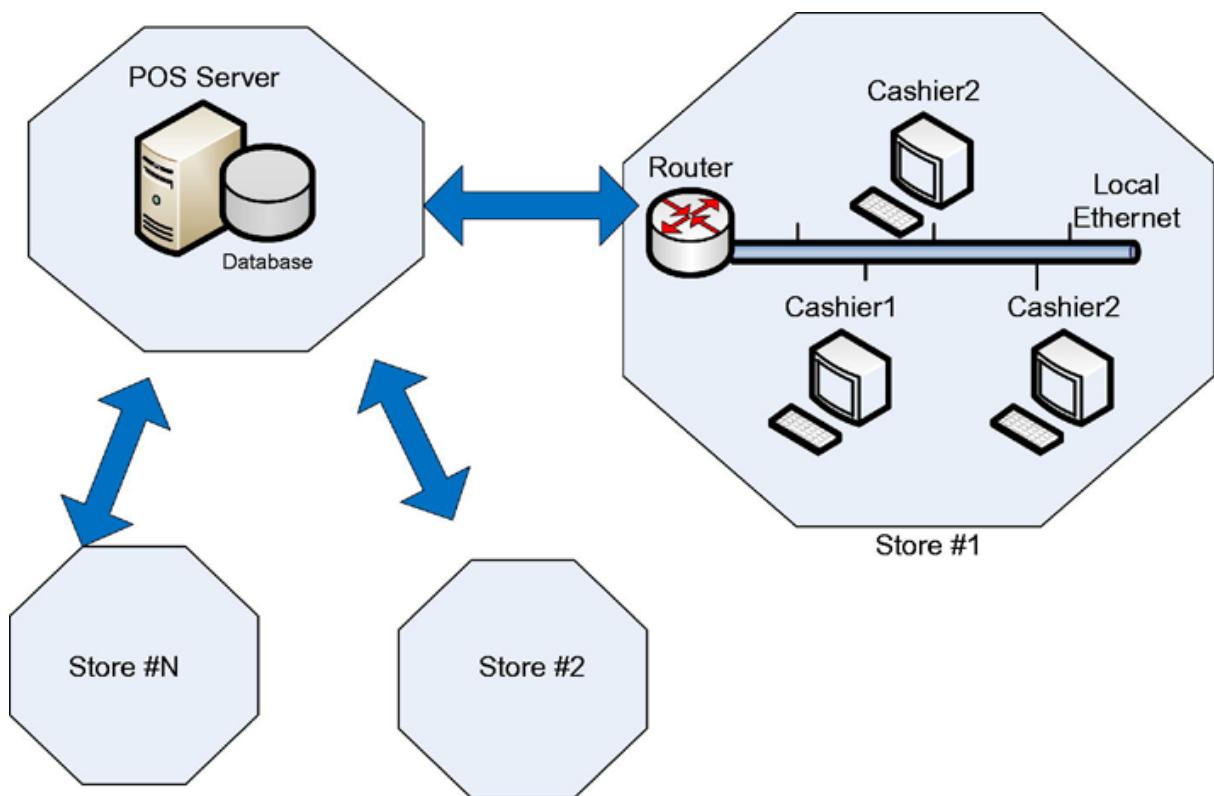


Figure 3.1. Remote server- Client POS system. Source: Y. KIM AND J. LIM, *A POS system based on the remote client-server model in the small business environment*, Management Res. Rev., 34 (2011), pp. 1334-1350.

Currently the Mobile Store Management System application is not supporting a full POS system. It only supports remote server-client environment, so the proposed POS system can be implemented in future.

3.3 WHY COMPUTERIZATION IS REQUIRED?

Accuracy and efficiency are very important to be competitive in this ever-changing market, given the advantages of technology. Computerization of any system will improve efficiency and reduce the cost of operation. For every business, effective management of inventory is one of the most important factors for success. Inventory management has significance for any enterprise in an industry because effective practices in inventory management will allow an enterprise to minimize inventory costs, and therefore avoid the dire consequences that come with a shortage of resources [3].

Manthro (1994) [4] classified inventory management into three broad areas:

1. Inventory record keeping: due to the availability of computers at a reasonable price, it is appropriate to automate inventory records through computerization [4].
2. Inventory decision-making: many models can be integrated into computer-based inventory systems [4].
3. Material requirement planning (MRP) system: MRP is an IM information system concerned with getting the right materials to the right place at the right time [4]. (This factor is not applicable for Mobile Store Management System).

The use of formal practices for managing inventories was also inadequate [3]. Poor inventory management practices are characterized by the lack of an integrated approach in the form of the absence of links between physical stock and accounting system [3]. Lack of appreciation for inventory management among the entrepreneurs and lack of qualified staff are the two major factors contributing to low inventory management practices [3].

Considering the above factors, we can conclude that formal practices for inventory management are not efficient and accurate. At same time, they consume a lot of time, which lowers the performance of store keepers. Use of a computerized inventory system will help small businesses to grow and make good benefits from their efforts.

3.4 SURVEY OF CURRENT INVENTORY SYSTEMS IN STORES

A survey was undertaken to find out the existing inventory systems used in the stores by the different merchants. Each of these stores is using different software based on their requirements. Although there are several benefits, many small businesses don't track their inventory using software. Some of the small businesses don't track their inventory manually at all. In a survey conducted by "WAPS Barcode" [5] company 23% of the customers had not used any kind of inventory tracking system. 30% turned to pen and paper based inventory tracking system and 32% are using excel or other general purpose database to track their inventory. The complete survey chart can be seen in Figure 3.2 [5] with different methods currently used by other small businesses. The above survey states that there are still around 53% of small businesses can be transformed to the digital inventory system.

Another survey conducted for different inventory management methods and software used by local stores in San Diego. Many advanced stores use the software, which are modified as per their requirements, but they still have not fully functional software as per

How Small Businesses Commonly Track Inventory

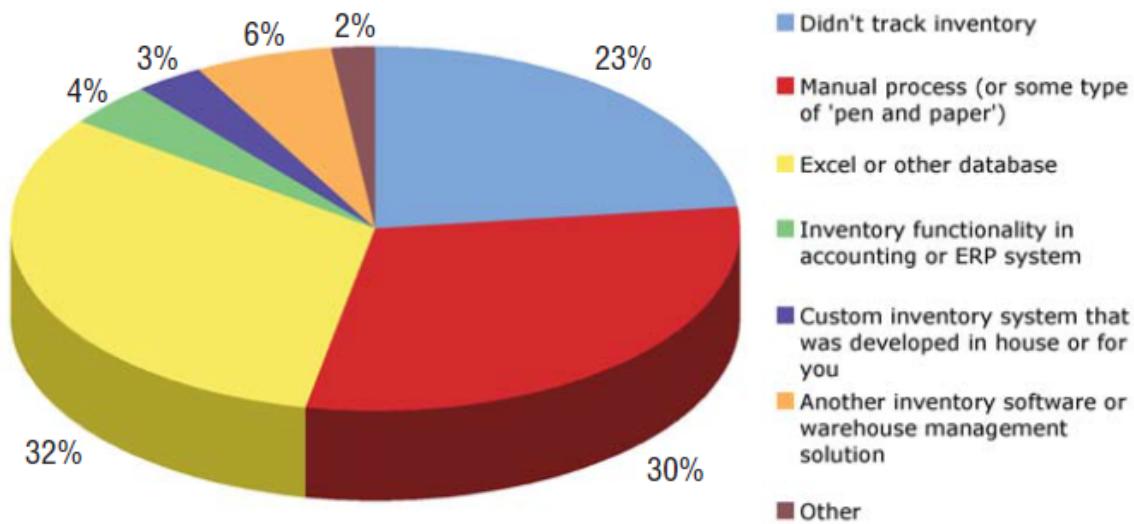


Figure 3.2. Survey of types of inventory system used by small businesses. Source: WASP BARCODE TECHNOLOGIES, *Taking stock of your inventory*. Wasp Barcode Technologies, http://www.waspbarcode.com/pdf/inventory_whitepaper.pdf, accessed October, 2012, August 2010.

their needs. Some of the stores are not using any kind of software and used to keep inventory manually, while some of the stores do not even track their inventory.

See Table 3.1 for survey of some of the stores using different inventory management systems.

Table 3.1. Customer Information, Supplier Information and Product Information Form Validation

Business Name	Business Type	How does your software provider charge you?	Do you have internet connection to run software?	Current System	Proposed New System using "Mobile Store Management System"
Surti Farsan Mart	Restaurant	One-time	Yes	Merits: • Organized by Category • View item sold history • Integrated credit card authorization system (3rd Party Software integration required) • Sales set by quantity	• Provide digital inventory management system • Provide digital purchase information • Provide digital supplier information •

(table continues)

Table 3.1. (continued)

Business Name	Business Type	How does your software provider charge you?	Do you have internet connection to run software?	Current System	Proposed New System using "Mobile Store Management System"
				<ul style="list-style-type: none"> • Remote location access Short coming: <ul style="list-style-type: none"> • Pen and paper based inventory system • No digital purchase information • No digital supplier information No weight machine integrated. Need to enter weight manually. 	<ul style="list-style-type: none"> • Barcode scan feature can be added using supported hardware Weight machine integration can be added using supported hardware
Bombay Bazaar	Grocery Store	Yearly	Yes	<p>Merits:</p> <ul style="list-style-type: none"> • Barcode Scan adding • View item sold history • Integrated credit card authorization system (3rd Party Software integration required) • Sales set by quantity • Weight machine integrated (3rd party hardware integration required) <p>Short coming:</p> <ul style="list-style-type: none"> • Pen and paper based inventory system • Not organized by category • No customer database • No remote location access 	<ul style="list-style-type: none"> • Provide inventory status check from remote location • Provide digital inventory system • Provide real-time inventory status • Provide information for future order • Provide digital purchase information • Provide digital supplier information • Support remote location access
Himalayan Cuisine	Restaurant and Grocery Store	Yearly	Yes	<p>Merits:</p> <ul style="list-style-type: none"> • Real-time inventory tracking for grocery store • View item sold history for grocery store • Weight machine, barcode scanner and credit card swipe system integrated (3rd party Hardware integration) <p>Short coming:</p>	<ul style="list-style-type: none"> • Provide connectivity for restaurant and grocery store inventory and sales management • Support digital inventory system for restaurant • Provide digital supplier information for restaurant and grocery store

(table continues)

Table 3.1. (continued)

Business Name	Business Type	How does your software provider charge you?	Do you have internet connection to run software?	Current System	Proposed New System using "Mobile Store Management System"
				<ul style="list-style-type: none"> • Pen and paper based inventory system for restaurant • No digital supplier information for both restaurant and grocery store • No digital purchase information for restaurant • No remote location access <p>No centralize data storage system</p>	<ul style="list-style-type: none"> • Provide digital sales record system for restaurant • Support customer database to provide better customer service for frequent customers. Support remote location access
Mission Valley Cart	Sunglasses Store	NA	No	<p>Short coming:</p> <ul style="list-style-type: none"> • Pen and paper based inventory system • No customer database • No supplier information • No digital purchase information 	<ul style="list-style-type: none"> • Provide inventory status check from remote location • Provide digital inventory system • Provide real-time inventory status • Provide information for future order • Provide digital purchase information • Provide digital supplier information • Support remote location access • Provide multiple store location inventory management and sales review
Mission Valley Cart	Cell phone accessories Store	NA	No	<p>Short coming:</p> <ul style="list-style-type: none"> • No inventory management. Use personal observation to track inventory. • No customer database • No supplier information • No digital purchase information 	<ul style="list-style-type: none"> • Provide inventory status check from remote location • Provide digital inventory system • Provide real-time inventory status • Provide information for future order • Provide digital purchase information

(table continues)

Table 3.1. (continued)

Business Name	Business Type	How does your software provider charge you?	Do you have internet connection to run software?	Current System	Proposed New System using "Mobile Store Management System"
					<ul style="list-style-type: none"> • Provide digital supplier information • Provide multiple store location inventory management and sales review

3.5 PROJECT NEEDS

The Mobile Store Management System is a software that can be integrated with multiple stores' requirements with some customizations as per store type and needs. We do not need to create new software for different businesses. Many stores surveyed either didn't have a proper inventory management or they do not track their inventory at all due to high cost of available software in market. The store would just need a decent internet connection to use this software. Each store can track their inventory status in real-time with the use of this software from remote location as well. The Mobile Store Management System is cost effective and very easy to implement on computer system.

CHAPTER 4

REQUIREMENTS

This project is targeted to help small companies to organize their inventory and billing system in digital form. There are several categories of requirements associated with this project.

4.1 TECHNOLOGICAL REQUIREMENTS

The technological requirements include the frontend programming tool and the backend database system. The application should be easy to use, and it should be easily managed by any person with little knowledge of computers. The database should be easy to install and configure. At the same time, it should be portable and independent so that we can use the database anywhere and install it on any laptop or PC. This application should be very easy to install on any machine. Finally, this application should not require higher configuration on any machine.

4.2 USER INTERFACE REQUIREMENTS

The application should be very simple and easy to use by any employee. Below are the basic requirements of general user interface:

- The application shall be easy to use.
- The application shall take few inputs from user.
- The understanding time of the application shall be very small.

4.3 FUNCTIONAL REQUIREMENTS

The functional requirements of the application are as follows:

- The application shall have all required functionality which is necessary for mobile store inventory and billing system management.
- The application shall have ability to print bills and invoices.
- The application shall have functionality to be used by different stores from one location.
- The application shall have user name and password protected security system.

CHAPTER 5

TECHNOLOGY

Selecting technologies to develop any application is the very first step in order to complete an application successfully. After considering various factors, I have decided to use Visual Basic and SQL Server to develop Mobile Store Management System. Many low cost projects employ Visual Basic to develop application and access database. However, SQL Server is chosen as the technology for this project because of the needs to centralize data storage when used by multiple stores. SQL Server Express is freely available from the Microsoft website.

5.1 VISUAL BASIC

VISUAL BASIC is a high level programming language evolved from the earlier DOS version called BASIC. BASIC stands for Beginners' All-purpose Symbolic Instruction Code. The program codes in Visual Basic resemble English language. VISUAL BASIC is a visual and events driven Programming Language. These are the main divergences from the old BASIC. In BASIC, programming is done in a text-based environment, and the Program is executed sequentially. In VISUAL BASIC, programming is done in a graphical Environment [6].

Visual Basic is sometimes called Rapid Application Development (RAD) system because it enables programmers to quickly build prototype applications [7].

Advantages of Visual Basic: The graphical user interface of the VB-IDE provides intuitively appealing views for the management of the program structure in the large scale and the various types of entities (classes, modules, procedures, forms) [8].

Powerful Front-End Tool: Event driven concept equipped with advanced features of object oriented programming along with user friendly IDE makes Visual Basic a powerful programming and front-end tool. Visual Basic can accomplish simple to complex business requirements in a very productive and efficient manner. It has wonderful chemistry with multiple databases, including DBMS (Database Management System), like Microsoft

Access, RDBMS (Relational Database Management System), like Microsoft SQL Server and Sybase, and ORDBMS (Object Relational Database Management System) like Oracle. It can also work with Flat Text file and Microsoft Excel data files [9].

Standalone and Distributed Applications: You can create standalone as well as distributed application with Visual Basic. Standalone refers to a program, which runs on your single desktop, and your machine acts as both server and client. In distributed types, you can install multiple copies of your program or work with single installation in COM+ environment on corporate network [9].

5.2 SQL SERVER

SQL Server provides database to store information on remote location. We will see introduction of SQL server before we start detail functionality of the SQL Server.

5.2.1 What is SQL?

SQL Server is a database management system. SQL is an acronym for “Structured Query Language” [10] and, as mentioned previously, SQL is a standard computer language for maintaining and utilizing data in relational databases [11]. SQL is a language that allows users to communicate with relational databases. The American National Standard Institute (ANSI) introduced its very first version of standards for the language in 1986 [11]. After that first release we have seen several revisions of the language.

It is also described that the SQL language has three major components [11]. The first component is DML (Data Manipulation Language), which allows you to add, delete, update, or retrieve data within a database. The second component is DDL (Data Definition Language), which allows you to create, delete, or modify the database. It also allows to provide update statement, which allows you to modify the tables in the database. The third component is DCL (Data Control Language), which maintains proper security for the database. It means it provides security feature to the database, which makes SQL so important [11].

5.2.2 How is it Different from Other Languages?

We have also seen discussion of this question, which gives a good overview of the differences between SQL and other languages [11]. Let's see a comparison with Visual Basic

or C++, which are much more familiar languages. These languages are procedural in nature. Procedural nature means that those languages allow users to specify particular procedures to achieve a desired goal. On the other hand, SQL is declarative in nature. SQL needs declaration with a single statement to achieve the desired goal. SQL has simple structure, as it is only concerned with relational databases rather than the entirety of computer systems [11].

5.2.3 SQL Server

Microsoft SQL Server is available in several versions and editions. Available editions run from a basic Express edition to a fully featured Enterprise edition. The Express edition is free but still has an abundance of features that allow you to get started with full-fledged database development. The Enterprise edition includes many sophisticated database management features, plus complex business intelligence components [11].

SQL Server is a more robust database management system. SQL Server was designed to have many hundreds, or even thousands of users accessing it at any point in time. Microsoft Access, on the other hand, doesn't handle this type of load very well [12].

SQL Server is a database application to look after the backend of a system (storing the data, controlling transactions, etc.). There are many options available, ranging from SQL Server Express Edition (formally MSDE) which supports 5-10 simultaneous users, to SQL Server Enterprise Edition [13].

Having a centralized place to store data is a great benefit to SQL Server users. Centralization is the primary SQL Server benefit that means that everyone is using the same data source. As a result, there is no need to merge information together in order to receive an accurate version of a record. With centralized data, every time that you retrieve a record, you will be confident that you have the latest information [14].

CHAPTER 6

DESIGN

In this chapter we will discuss a variety of different diagrams such as data flow diagram, activity diagram and entity-relationship diagram, which are relevant to the development phase of this application. These diagrams explain this application flow and its logical construction very well. These diagrams are part of background research during development phase. They helped to develop connection between different modules of the application, which is very helpful for any development.

6.1 HIGH LEVEL DESIGN

Figure 6.1 explains the communication process between multiple stores using a central server. Each store stores their information on central server and fetches needed information from same server. If any store needs to access a different store's information, they can access this information easily. Currently there is no separate security system implemented to access different stores. The central server is managing all the information for different stores. The central server has different partitions for each store.

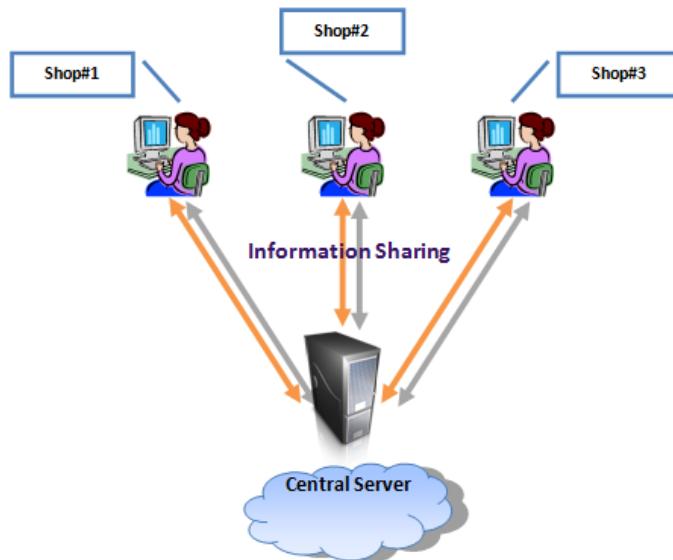


Figure 6.1. High level design.

6.2 SYSTEM ARCHITECTURE

This diagram describes architecture of the system, which represents information sharing within the system. Figure 6.2 shows the system architecture. It shows a three-tier architecture between users, server, and database.

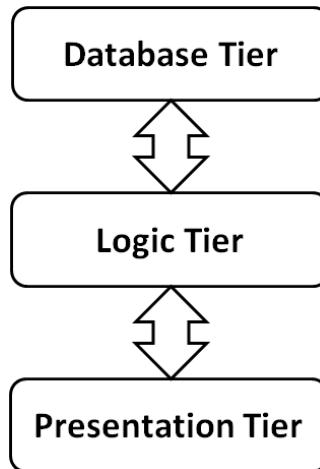


Figure 6.2. Three tier system architecture.

We will discuss each tier and its importance for the three tier architecture in the next section.

6.2.1 Presentation Tier

This part of architecture is responsible for communication between the end user and the application system. A user interacts with the application using this module of system. This is the topmost level of the application. The presentation tier displays information related to such services as browsing merchandise, purchasing, and shopping cart contents [15]. It communicates with other tiers by outputting results to the browser/client tier and all other tiers in the network [15]. The application like Mobile Store Management System uses Visual Studio or Java for user interface development. The Mobile Store Management System uses Visual Basic.

6.2.2 Logic Tier

This is a very important tier for any architecture. It is very essential at same time. This tier is responsible for the logical processes. This tier communicates with the database and application and at the same time provides other significant services such as calculations

and logical decisions. This tier is independent from the database and presentation tier. The logical part never changes with the change of the other tiers. This tier is responsible for creating and managing database. At same time it is also responsible for sending required data to the presentation tier.

6.2.3 Data Tier

This database tier is responsible for communicating with the database and the logical tier. This layer provides access to the database and manages a connection with the database. The Mobile Store Management System is using SQL server. MySQL, Access, and SQL Server are major database programs used for this tier.

6.3 USE CASE DIAGRAM

Modeling of the dynamic system in UML can represent using use case diagrams. This diagram explains the behavior of system. This diagram shows the relationships between use cases and users [16]. In Figure 6.3, the use Case Diagram for Mobile Store Management System application is shown. When a user from any store wants to access any information from the store he will get access using a proper user name and password combination. Once the user has access to system, the user can select the store from which he wants to get information. The user from one store can access all different stores' information.

6.4 E-R DIAGRAM

An Entity-Relationship Diagram (E-R Diagram) classically serves as the main deliverable for an intangible data model. An E-R Diagram is logical exemplification data, and consists of three chief components:

- Entity: It is a piece in the real world that is distinct from other objects.
- Attributes: It is an asset of an entity.
- Relationships: It is a linkage between two entities or attributes.

An E-R Diagram is important to demonstrate design of a database and used to plan database as well. Figure 6.4 illustrates one possible E-R Diagram for the database used for Mobile Store Management System.

As shown Figure 6.4, database for Mobile Store Management System has five entities, which are Supplier, Customer, Product, Purchase and Sales. Each entity has different

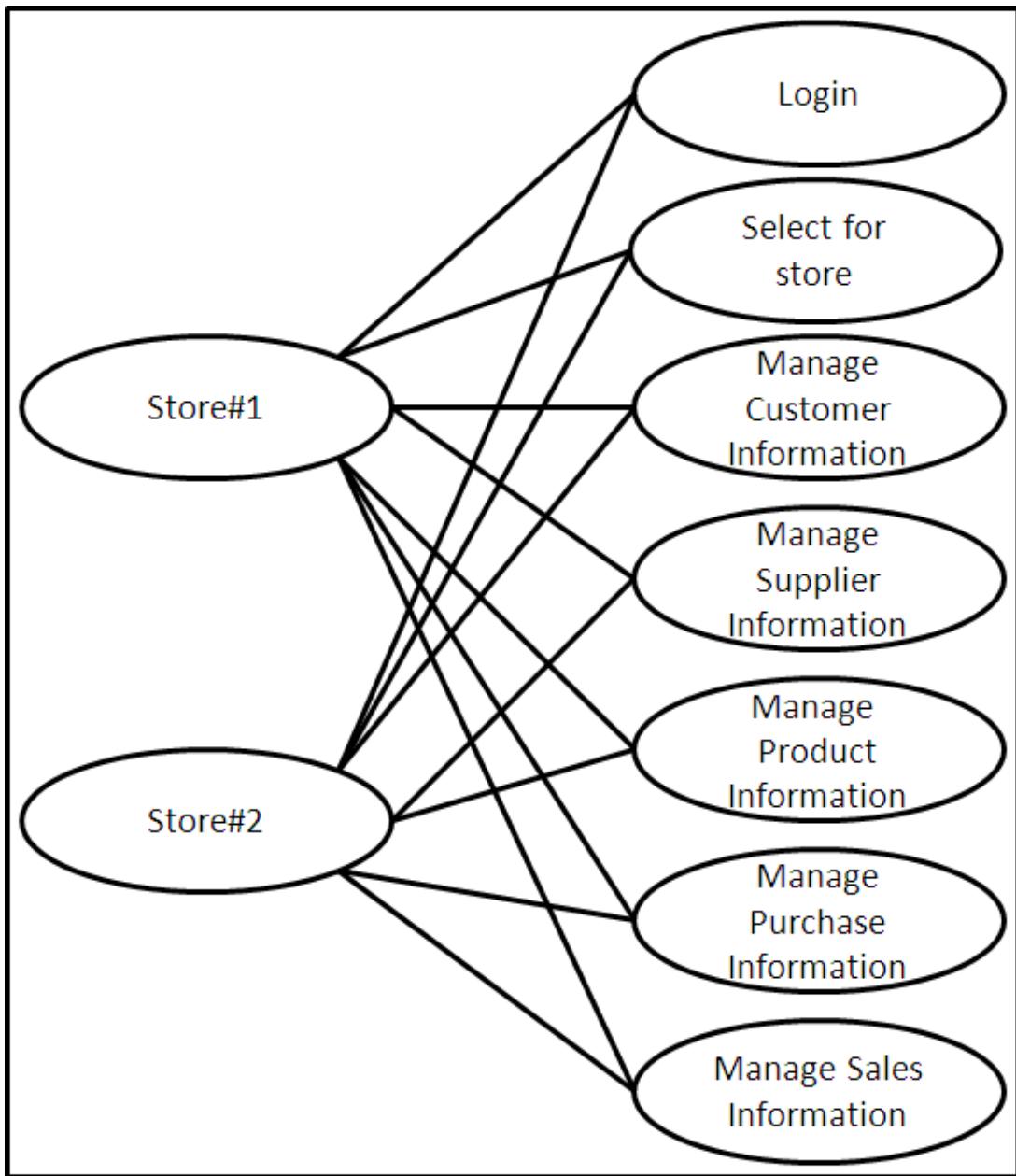


Figure 6.3. Use case diagram.

attributes based on its requirement. We can see individual attributes of each entity in Figure 6.4. In general, the entity can be described using a noun and the relationship can be described using a verb. As we can see in Figure 6.4 the entity is “supplier” which is a noun and relation between supplier, and the product can be describe as “supplied by”, which is a verb. The entity supplier has a supplier id, supplier name, supplier address, supplier cell number and

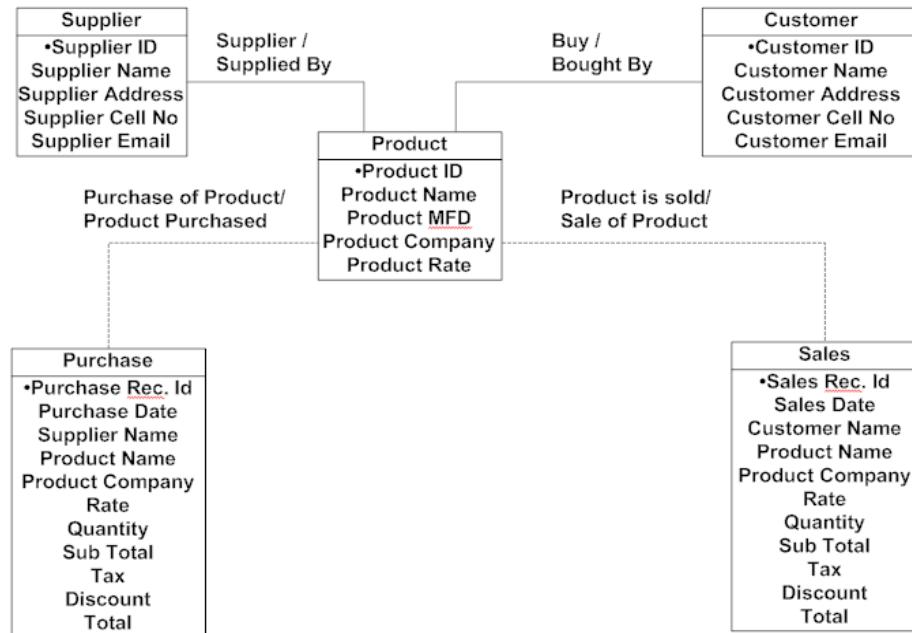


Figure 6.4. E-R diagram.

supplier email as attributes. The entity customer has a customer id, customer name, customer address, customer cell, and customer email as attributes. The entity product has a product id, product name, product MFD (manufacturing date), and product rate as attributes. The entity purchase has a purchase record id, purchase date, supplier name, product name, product company, rate, quantity, subtotal, tax, discount, and total as attributes. The entity sales has a sales record id, purchase date, customer name, product name, product company, rate, quantity, subtotal, tax, discount, and total as attributes.

As shown, the attribute **supplier name** in purchase entity is populated from the attribute supplier name of supplier entity.

In same way, the attributes **product name** and **product company** in purchase entity are populated from the product entity.

There are some relations between attributes of sales, product, and customer entities. Attributes **product name** and **product company** in the sales entity are populated from the product entity.

Attribute **customer name** in sales entity is populated from the attribute customer name from the customer entity.

We can perform above operation using SQL query statement as shown in the Appendix.

6.5 DATA FLOW DIAGRAM

We can represent a system with graphical symbols showing data flow, data process, database, and data sources in a Data Flow Diagram. Using this diagram, we can eliminate explaining this in words and explain it in a graphical form instead. As shown in Figure 6.5, we have to enter the entire Supplier, Product, and Customer Information. This information will be stored in a centralized database. As mentioned in the section above, certain information for the Sales and Purchase are populated from Supplier, Product, and Customer information stored earlier from the user input based on different relationship explained. We have to enter only partial information for Product and Sales data only. The sales and product table will combine both external and database information and record as new data set in database.

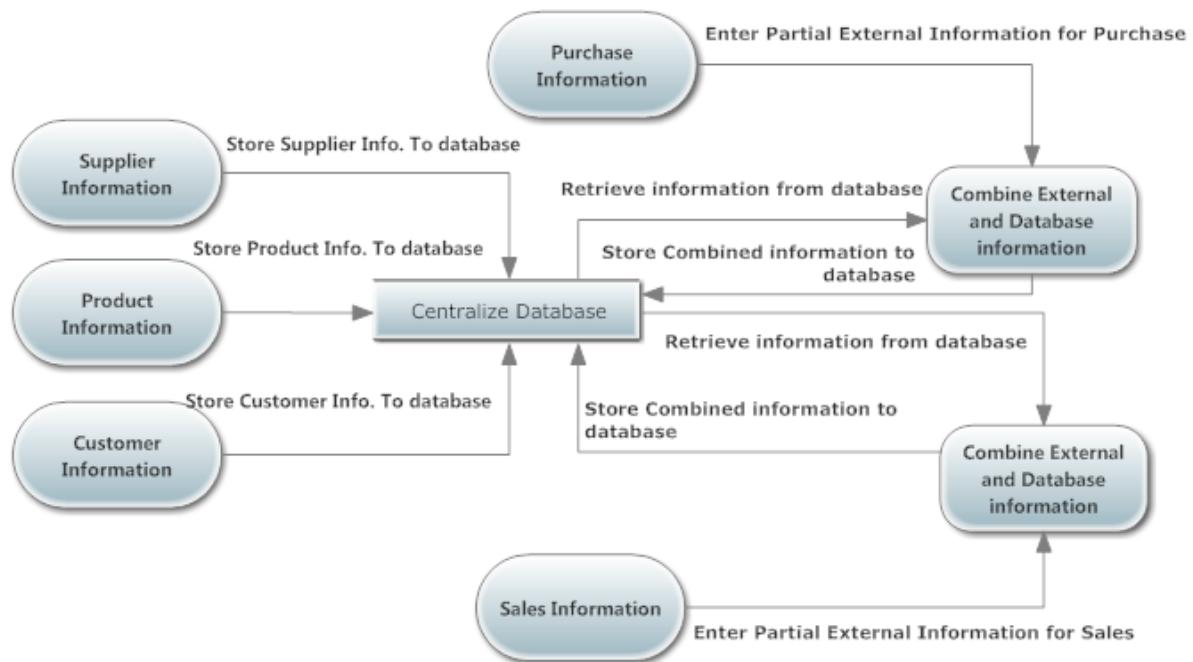


Figure 6.5. Data flow diagram.

CHAPTER 7

FUNCTIONALITY AND USAGE

We have discussed technologies, system design, requirements and architecture. Now we will discuss the different functionalities and use of the Mobile Store Management System application. This application is designed using VB for a frontend user interface.

7.1 LOGIN PAGE

The Mobile Store Management System is a secure application, and a user needs to enter the proper combination of Username and Password to access application. Currently this application has only one Username and one Password, but we can implement multiple users with user-wise limitation and access control. Figure 7.1 shows the login page of the application. If the user enters the wrong combination of username and password, the application will not allow the user to access the application.

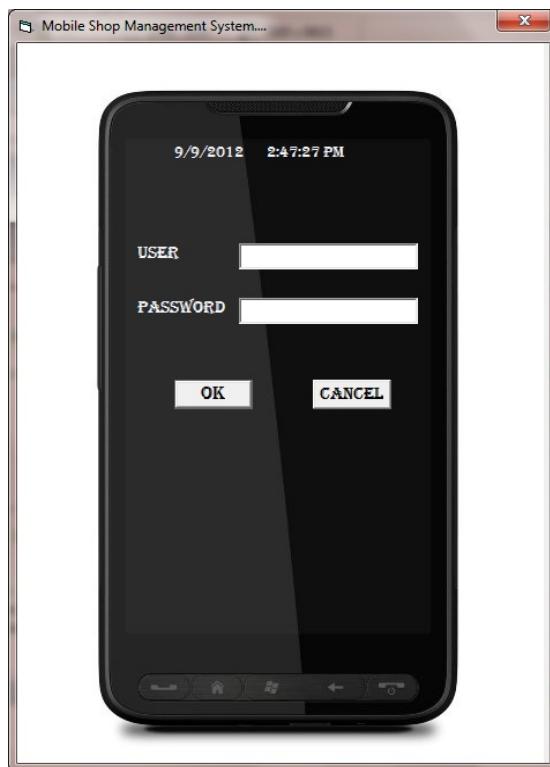


Figure 7.1. Login screen.

7.2 USER CONTROL PANEL

We have discussed earlier that this application is developed in Visual Basic. Visual Basic is commonly used for standalone applications. We can create a package, which can be installed on any system easily. Visual Basic provides a simple and attractive user interface to the user. Any user can easily manage the application using this interface. Figures 7.2 and 7.3 explain the basic main page of application and available menu options. The screen shown in Figure 7.2 will be available as a main screen for all stores. The user can select a store from this screen as shown in the second screen shot. The user can select a store and then an individual form for different purposes (see Figure 7.3). This control panel gives the functionality to select different stores and different information. There is an option to get the Mobile Store Management System's information as shown in Figure 7.4.

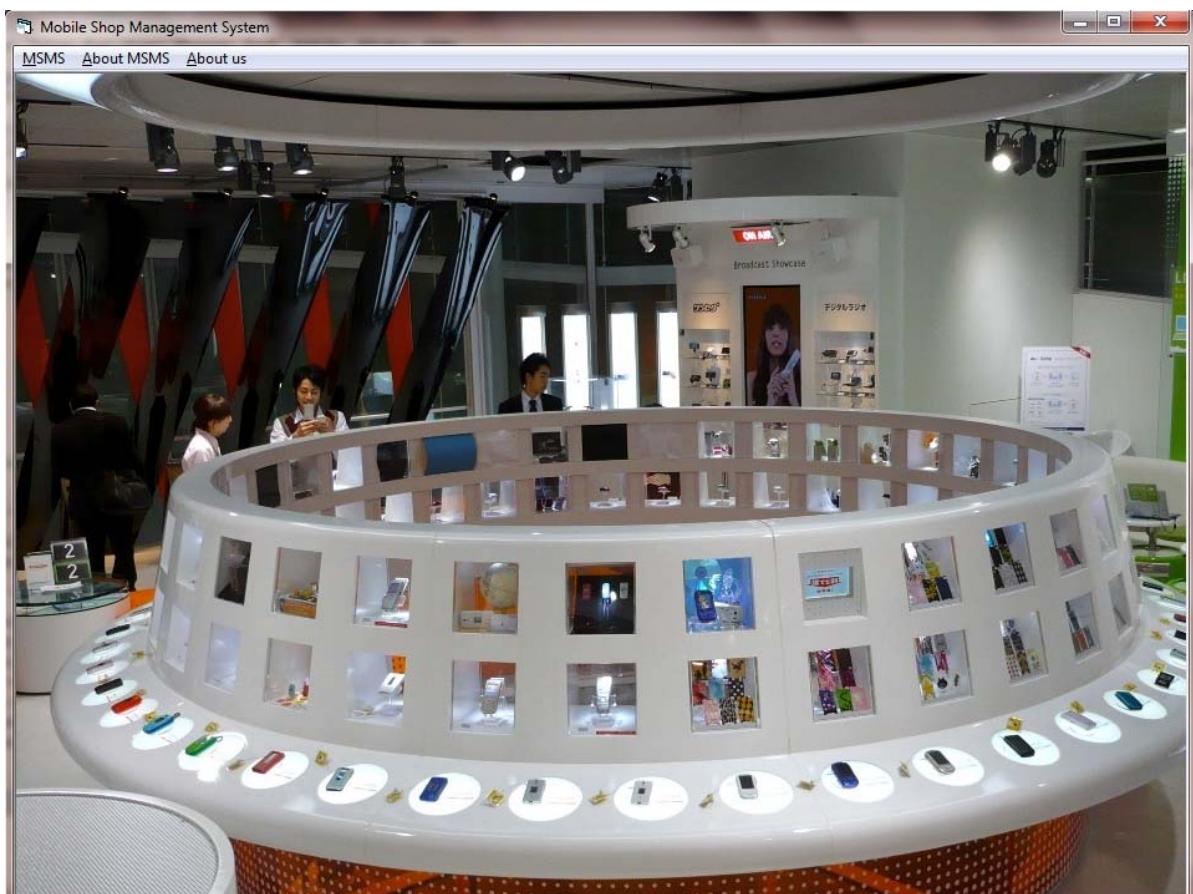


Figure 7.2. Software main screen.

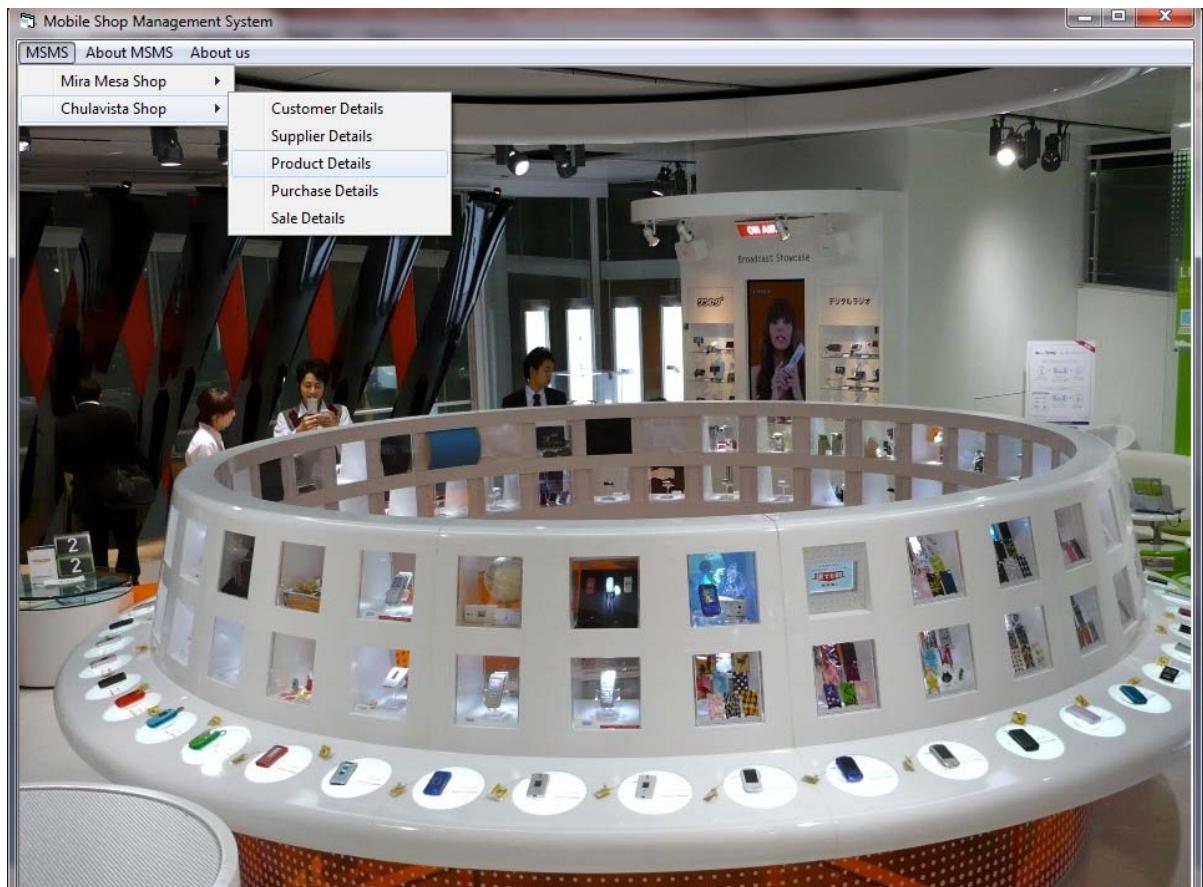


Figure 7.3. Software main screen – Menu expanded.



Figure 7.4. About page.

7.3 USER FORMS

These are the different pages, which are known as forms in Visual Basic. These forms will be majorly used by the user during daily work using this application. There are several forms available based on requirement of application. We will see different forms and their detail in next section.

7.3.1 Manage Supplier Information

The supplier Information form has information related to any supplier we have on record. This is basic information about the supplier in case we need to contact that supplier in the future for further purchases or inquiry about past purchases. Figure 7.5 shows a form available on Supplier Information page for Chula Vista store. This form has different data fields such as Supplier ID, name, address, phone number and email. The user can add new supplier information. The user has the facility to modify or search supplier information. Unwanted supplier information can be deleted using the delete function on the form. If the user need to erase all information available in the data fields, then the user can use the clear button to clear all fields rather than deleting each separate field manually.

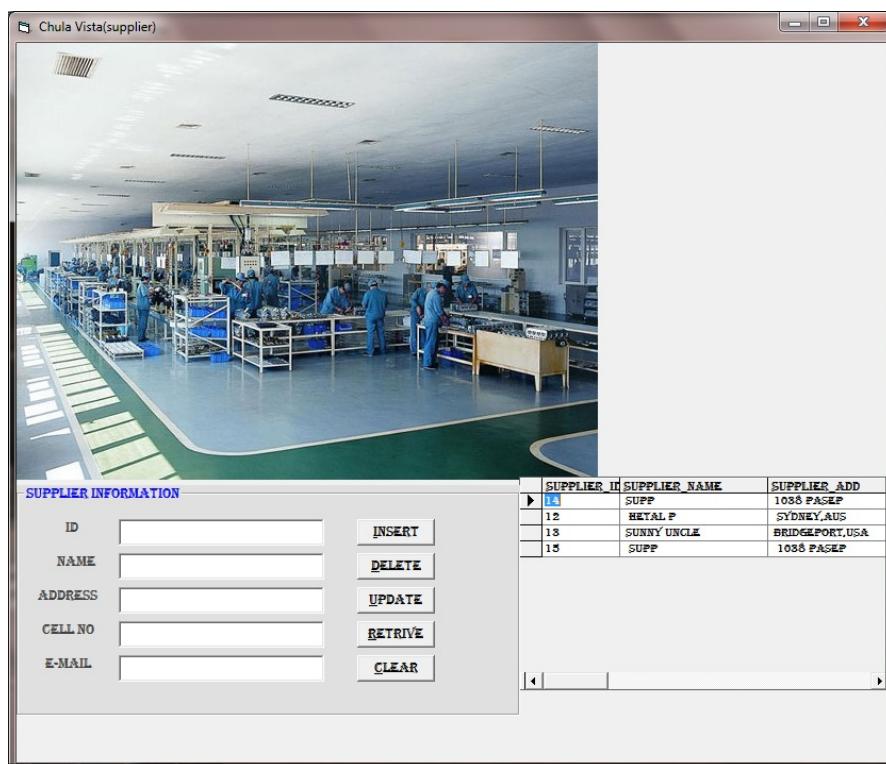


Figure 7.5. Chula Vista supplier details page.

7.3.2 Manage Product Information

Product information is very important for any store. We have to look at product details at any point of purchase or sales. We need to check its original purchase price or manufacturing/purchase date. We have all the basic details which are required for any product. This form has different data entry fields related to the product then supplier. The form has product ID, name, company, manufacturing date, and rate at which the products were purchased. Figure 7.6 shows Product details for Chula Vista store.

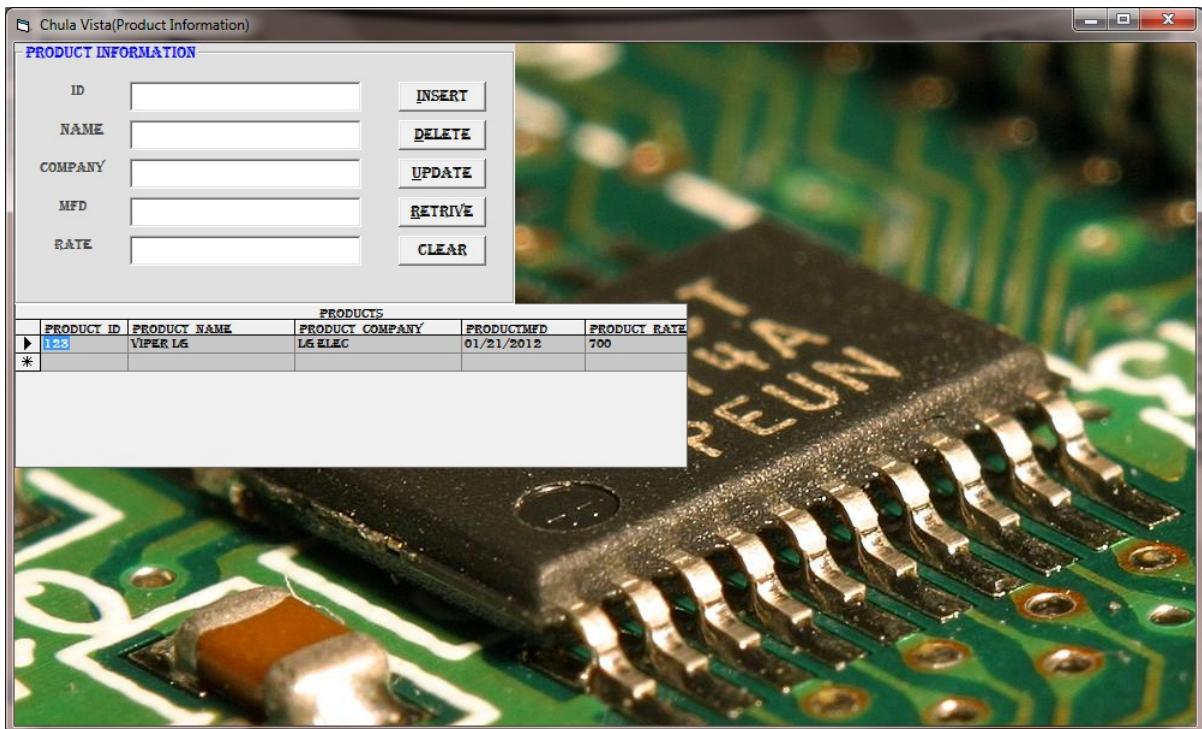


Figure 7.6. Chula Vista product details page.

7.3.3 Manage Customer Information

Customer Information is essential in order to provide enhanced customer care facility. We can call a customer after we sell any product to get there, or we can provide a discount if a customer is frequently purchasing from our shop. Figure 7.7 shows Customer Information Form for a Mira Mesa store. The user can enter customer information such as customer id, name, address, phone number, and email id. The user can add new information, update any existing information, search for any customer information using Customer ID or delete unwanted information from the database.

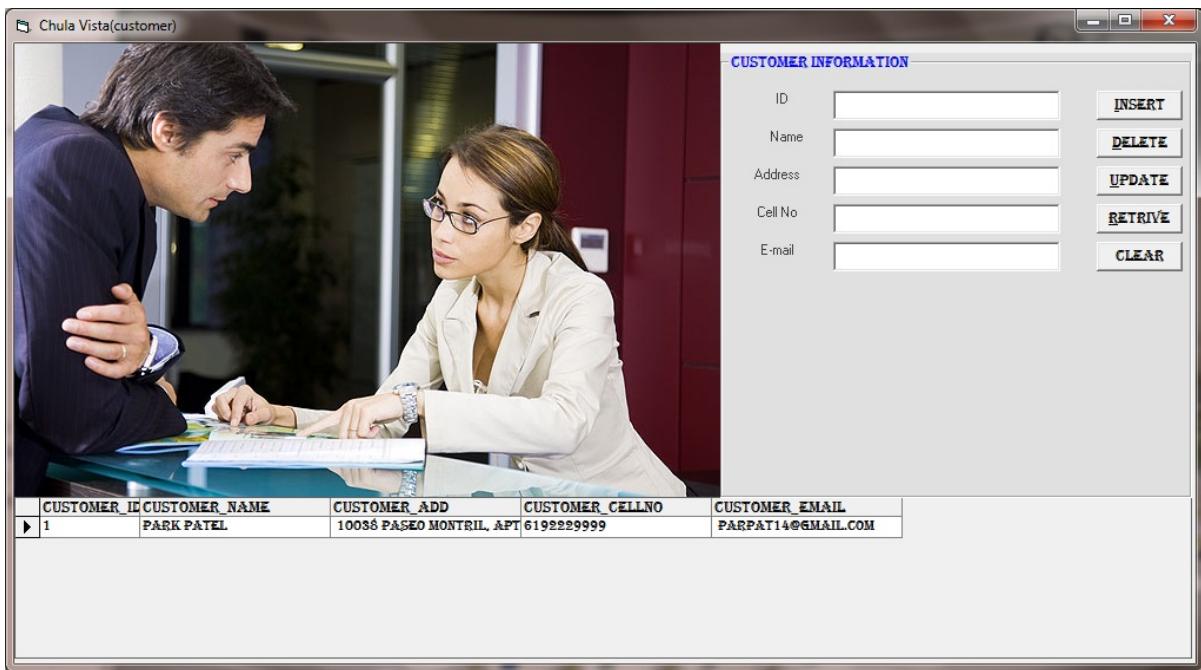


Figure 7.7. Chula Vista customer information page.

7.3.4 Manage Purchase Information

Purchase information is usually provided by Supplier, but it is not in the same format we need for our records. So we can enter product and supplier details, along with purchase details, and keep an invoice for our records. We can also print that invoice for any purpose. This form has more data fields than other previous forms. As we have discussed in previous chapter, the supplier name is being populating from the supplier information table, and the product name and company are being populating from the product table. The user needs to select this information from a drag down menu. The user can enter purchase ID, quantity of number of products purchased, rate at which it was purchased. A subtotal will be calculated automatically, and then the user can enter tax percentage applicable for the product and discounts in dollars received from the supplier. The final total will be automatically calculated using the subtotal, tax, and discount. As the information for purchases is large, we need to accommodate that information into another form. If you press the detail button, it will pop up another window and provide details of existing data in database. We can also print the invoice for any purchase made by pressing the Print button on the form. Figure 7.8 shows Purchase Information details page for the Chula Vista store. Figure 7.9 shows invoice print page format.

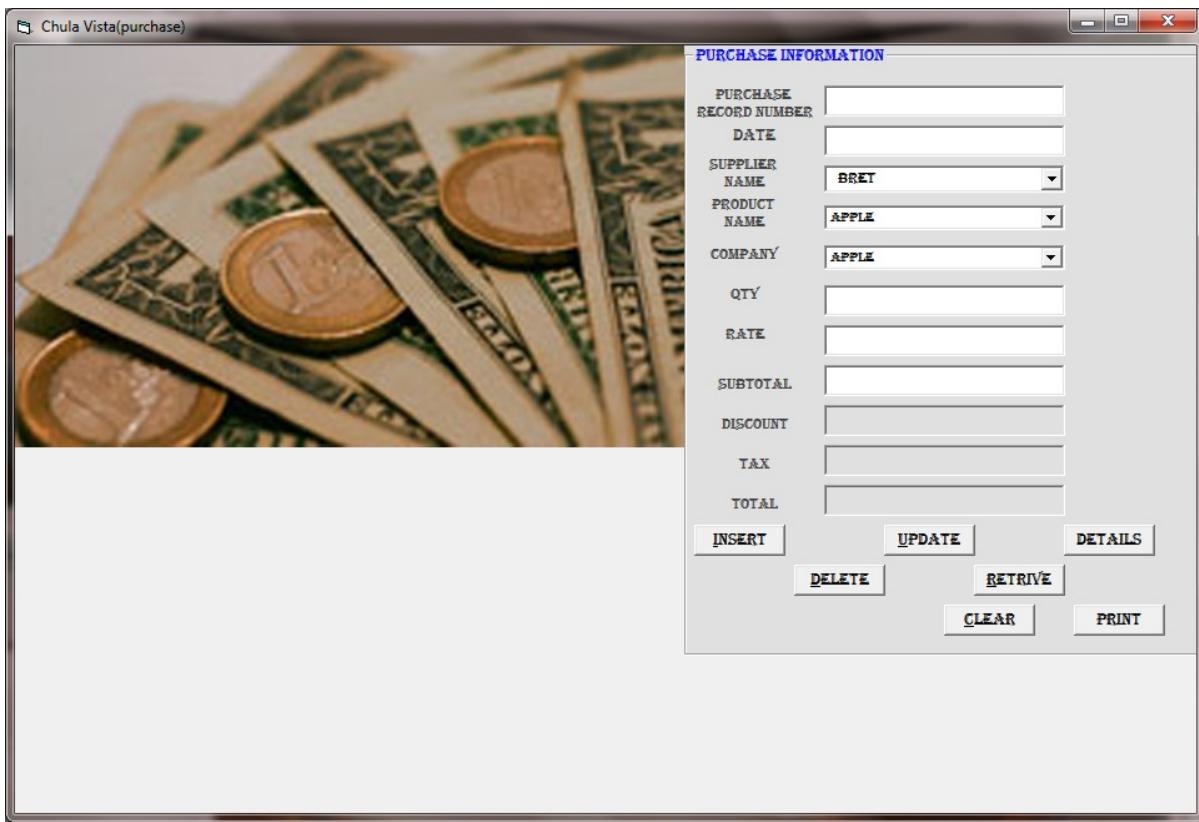


Figure 7.8. Chula Vista purchase details page.

7.3.5 Manage Sales Information

Sales information is the most important part for any store. They always need this information at any point in the future for different purposes. Transitioning to a computerized system will provide the most advantages to a billing system. We can keep our sales record for years without losing any data. We can also print a sales receipt. Figure 6.15 shows Sales Information form for Mira Mesa store, and Figure 7.10 shows the Sales Information page for a Chula Vista store. Figure 7.11 shows a bill print page format.

7.4 FUNCTIONALITY

Each user form contains some command buttons to perform targeted functions. Add, Delete, Update, Retrieve and Clear are those main functions.

7.4.1 Add

This command will add existing data into the database. It will add different fields to the appropriate table using a connection provided within that command.

The screenshot shows a Windows-style application window titled "Invoice". The main title bar says "Invoice". Below it, a section titled "INVOICE INFORMATION" is displayed. This section contains a grid of 12 rows, each with a label on the left and a corresponding input field on the right. The data entered into the fields is as follows:

SALE RECORD NUMBER	4
DATE	1/1/2012
COMPANY NAME	MINANG
PRODUCT NAME	MHL CABLE
COMPANY	HTC INC
QTY	3
RATE	400
SUBTOTAL	1200
DISCOUNT	100
TAX	3
TOTAL	1233
PRINT	

Figure 7.9. Invoice print format.

If a user forgets to enter any of the information for any form and tries to add that information, the application will notify the user to enter all information.

If a user is trying to enter information with the ID already present in the system, then it will notify the user that duplicated data is already available in the system.

7.4.2 Delete

This command will delete all records available with the given ID. This is required when we don't need any information for future reference and want to clean up our system. Our application does not support return inventory management, so we can delete that returned item sale from our system. We can manage multiple processes such as in this example. The application will confirm delete after pressing Delete command.

Chula Vista(sales)



SALES INFORMATION

SALE RECORD NUMBER	<input type="text"/>	INSERT
DATE	<input type="text"/>	DELETE
CUSTOMER NAME	<input type="text"/>	UPDATE
PRODUCT NAME	<input type="text"/> LG VIPER	RETRIVE
COMPANY	<input type="text"/>	DETAILS
QTY	<input type="text"/>	PRINT
RATE	<input type="text"/>	
SUBTOTAL	<input type="text"/>	
DISCOUNT	<input type="text"/>	
TAX	<input type="text"/>	
TOTAL	<input type="text"/>	

Figure 7.10. Chula Vista sales details page.

BILLING INFORMATION	
SALE RECORD NUMBER	4
DATE	1/1/2012
CUSTOMER NAME	PARK
PRODUCT NAME	HTC EVO 3D
COMPANY	HTC INC
QTY	2
RATE	600
SUBTOTAL	1200
DISCOUNT	10
TAX	
TOTAL	1200
PRINT	

Figure 7.11. Print bill format.

7.4.3 Retrieve

This is very important and the most advantageous function of this application. Entering any data or deleting any data is not too complicated and time consuming, but searching any data from existing information is time consuming and needs more expertise in a paper-based inventory and billing system. However, in this application we have implemented a search function in such a way that a user just needs to enter an ID and click on the Retrieve button. It will fetch all the information for the user.

If a user is trying to retrieve any information, which does not exist in the system, then the application will notify the user that this particular information is not available.

7.4.4 Update

This is also a very necessary function of this application. If any information for customer, produce, supplier, sales or purchase is changed after its original entry, we can

update that information very easily using this function. We just need to edit existing data and click on Update button.

7.4.5 Clear

This function is provided for comfortless of the user. There are many occasions that the user wants to erase all existing data available in different fields. The user can clear all information using this function so the user doesn't need to remove information individually from each data field.

CHAPTER 8

TEST PLAN FOR APPLICATION

8.1 WHY IS TESTING IMPORTANT?

This is the most important part of the software life cycle. It provides better quality of software to end users; therefore, those end users won't come across software issues. Testing of any software is very important for validating functionality of the software. Testing will provide the following information:

- It finds issues during early phases, which can be fixed before finalization.
- It assures stability and reliability of software in different conditions.
- It helps to provide issue-free software for delivery.

Any application must be tested with different methodologies. If the application is not tested properly, then some faulty application will be delivered to customers. Delivering such quality of application will reduce credibility, and the customers will be not delighted with application.

Testing is usually conducted by development and quality assurance teams. This testing validates the functionality of the application. There are different kinds of testing that are needed to perform to validate a specific module of application. A database is the main module of this application, so it will act as the main role in functionality of the application.

8.2 TESTING METHODOLOGY

There are mainly two different types of methodology used by quality assurance teams.

8.2.1 White Box Testing

White Box testing is the type of testing for which we need knowledge of internal implementation of the system. It is also called “open-box” [17] testing, as system implementation is open to the tester. For database testing we can consider functional tests, which will validate the working functionality from the white box test methodologies family.

8.2.2 Black Box Testing

Black box testing is the type of testing for which we don't need any knowledge of internal implementation of the system. We just need to know inputs and expected outputs. We can include unit tests, security tests, and basic performance tests [17] from the Black Box test methodologies family.

8.3 WHAT KIND OF TESTING IS IMPORTANT?

As the Mobile Store Management System is developed with a concentration on the data tier, there are various types of test methods we need to apply for the application test. In general practices there are two types of test methodologies that need to be used for database testing. They are the unit test and the functional test.

Unit tests: Unit testing is a black box test that verifies the contracts exposed by interfaces [17]. For a unit test there are certain inputs, and the procedure should return the correct outputs from the application. The pass or fail criteria need to be defined. For this the applicable procedure is not important. A unit test is defined as pass if output provides expected valid values in a correct format. Phrased another way, unit tests test the ability of interfaces to communicate with the outside world exactly as their contracts say they will [17].

Functional tests: It is a white box test that verifies the functionality of the application that is being tested [17]. A functional test covers all kinds of tests of the application and tests that different pieces of the application work correctly. In this type of test, procedure as well as output are considered for the pass or fail criteria. That means we need to consider procedure also for validating the application. The logic required for this kind of validation means that a functional test is a white box test in the database world, compared to the black box of unit testing [17].

From various types of testing, we need very few methods of testing for database validation. Those are listed below:

Interface consistency should be validated in order to guarantee that applications have a stable structure for data access [17]. This testing is required for the Mobile Store Management System application to ensure we have a properly constructed database and are connected properly.

Data availability and **authorization tests** are similar to interface consistency tests, but are more focused on who can get data from the database than how the data should be retrieved [17]. This testing is also required for the application in order to assure data connectivity.

Authentication tests verify whether valid users can log in, and whether invalid users are refused access. These kinds of tests are only important if the database is being used for authenticating users [17]. This testing is always necessary for any application which connects with secured database.

Performance tests are important for verifying that the user experience will be positive, and that users will not have to wait longer than necessary for the data [17]. Performance testing may involve **load tests**, which monitor the performance of the database under a given load; **saturation tests**, which attempt to overwhelm the system by constantly adding load and/or removing resources from it until it breaks; and **endurance tests**, which place a continuous demand on the database over a sustained period of time [17]. For this application a performance test is not necessary as it is not targeted for heavy usage simultaneously.

Regression testing covers every other type of tests, but generally focuses on uncovering issues that were previously fixed [17]. A regression test is a test that validates that a fix still works [17]. This is a very important testing methodology as there are very high chances to catch uncovered issues.

Tables 8.1 to 8.5 are the testing results of all forms on different scenarios.

Table 8.1. Database Connection Validation

Test Case No	User Action (Button)	Expected Result	Observed Output	Result
1	Add	The user can enter and store a new item.	When clicked on the Add button all the details “Record Inserted” pop up observed. Added record can be seen in database.	Pass
2	Add	The user can't enter and store a new item as database connection string is changed (wrong connection string).	When clicked on the Add button application give error message for connection.	Pass

Table 8.2. Login Page Validation

Test Case No	User Action (Button)	Expected Result	Observed Output	Result
1	Enter Correct Username and Password	Application should navigate to Main Menu of Application	When entered username and password main menu screen appears.	Pass
2	Enter Wrong Username and Password	The user can't access to application it should require user to enter username and password again	When entered username and password it asked again to enter username and password	Pass

Table 8.3. Customer Information, Supplier Information and Product Information Form Validation

Test Case No	User Action (Button)	Expected Result	Observed Output	Result
1	Add	The user can enter and store a new item.	When clicked on the Add button all the details "Record Inserted" pop up observed. Added record can be seen in database.	Pass
2	Delete	When clicked it should delete record data from given ID. It should ask for conformation. Press OK.	When clicked on Delete button it asked for delete. Press OK. Record Deleted observed.	Pass
3	Update	When click on this button it should update record in database.	When clicked on Update button "record updated" pop up observed. Record is updated in database.	Pass
4	Retrieve	When click it should search existing data from database using given ID.	When clicked all data retrieved for given ID.	Pass
5	Clear	When click it should clear all fields to allow new data to enter.	When clicked all fields were cleared.	Pass

Table 8.4. Purchase Information Form Validation

Test Case No	User Action	Expected Result	Observed Output	Result
1	Add	The user can enter and store a new item.	When clicked on the Add button all the details “Record Inserted” pop up observed.	Pass
2	Delete	When clicked it should delete record data from given ID. It should ask for conformation. Press OK.	When clicked on Delete button it asked for delete. Press OK. Record Deleted observed.	Pass
3	Update	When click on this button it should update record in database.	When clicked on Update button “record updated” pop up observed.	Pass
4	Retrieve	When click it should search existing data from database using given ID.	When clicked all data retrieved for given ID.	Pass
5	Clear	When click it should clear all fields to allow new data to enter.	When clicked all fields were cleared.	Pass
6	Invoice	When click it should open Printer option	It opens print option and prints successfully.	Pass
7	Details	When click it should open another window to show all records.	When clicked it opened another window which has all records.	Pass

Table 8.5. Sales Information Form Validation

Test Case No	User Action	Expected Result	Observed Output	Result
1	Add	The user can enter and store a new item.	When clicked on the Add button all the details “Record Inserted” pop up observed.	Pass
2	Delete	When clicked it should delete record data from given ID. It should ask for conformation. Press OK.	When clicked on Delete button it asked for delete. Press OK. Record Deleted observed.	Pass
3	Update	When click on this button it should update record in database.	When clicked on Update button “record updated” pop up observed.	Pass
4	Retrieve	When click it should search existing data from database using given ID.	When clicked all data retrieved for given ID.	Pass
5	Clear	When click it should clear all fields to allow new data to enter.	When clicked all fields were cleared.	Pass
6	Bill	When click it should open Printer option	It opens print option and prints successfully.	Pass
7	Details	When click it should open another window to show all records.	When clicked it opened another window which has all records.	Pass

CHAPTER 9

FUTURE WORK AND LIMITATION

9.1 LIMITATION

The Mobile Store Management System has some flows and limitation due to different requirements and time constrain. As this application will be used on the computers so the end user must have the basic knowledge of the computers. Currently only one item' information can be enter in the system at a time. The user has to enter information for different items. The system currently has only one combination of username and password credentials, every user has to share same credentials. The search function only supports search using ID number. The user has to get ID number of customer, sales, purchase, product, or supplier to search within the system.

9.2 FUTURE EXPANSION

We can add multiple usernames and passwords with user- wise separate access and authorities. We can implement search function using different information also. It is also possible to integrate an employee's time card and a payroll management system in this application. There is another idea to implement SIM card management system. Using bar code scanner and smart card reader, we can minimize manual data entry, which will potentially decrease the amount of time to enter data. But at the same time it will increase the cost of this application.

CHAPTER 10

CONCLUSION

In this dissertation we have studied different management systems used during evaluation and presented a low cost store management system application with the help of that study. A survey was also conducted to get current needs of small businesses which could be willing to migrate to the Mobile Store Management System application. The implementation of this system as a single solution for different businesses was challenging. I have learned a lot about document writing during this progression. The process of writing thesis document, which is a research paper, was not familiar to me, but of great benefit. The application Mobile Store Management System is created to help small businesses to transfer their records from paper-based system to computerized system, even with a low budget. At the same time, the requirements of a basic store have been taken care of, and a few features that can make the application easier to use and easy to understand to the user with beginner level knowledge of computers have been added. I hope that Mobile Store Management System fulfills all basic requirements for stores with intention of transferring to computerized billing and inventory system. The survey of real world small businesses helped me to understand current practice, and possible needs.

REFERENCES

- [1] T. CROSBY, *How inventory management systems works*. How Stuff Works, <http://money.howstuffworks.com>, accessed October 2012, n.d.
- [2] Y. KIM AND J. LIM, *A POS system based on the remote client-server model in the small business environment*, Management Res. Rev., 34 (2011), pp. 1334-1350.
- [3] N. RAJEEV, *Inventory management in small and medium enterprises: A study of machine tool enterprises in Bangalore*, Management Res. News, 31 (2008), pp. 659-669.
- [4] V. MANTHO, *Concepts and applications of inventory management in Northern Greece*, Int. J. Prod. Econ., 35 (1994), pp. 149-152.
- [5] WASP BARCODE TECHNOLOGIES, *Taking stock of your inventory*. Wasp Barcode Technologies, http://www.waspbarcode.com/pdf/inventory_whitepaper.pdf, accessed October, 2012, August 2010.
- [6] L. V. KIONG, *Visual Basic 6.0 made easy*. VB Tutor, http://vbtutor.net/vb6/vb6book/vb6_preview.pdf, accessed August 2012, December 2011.
- [7] WEBOPEDIA, *Visual Basic*. Webopedia, http://www.webopedia.com/TERM/V/Visual_Basic.html, accessed August 2012, n.d.
- [8] K10BLOGGER, *Advantages and disadvantages of Visual Basic*. Iiteeestudents, <http://iiteeestudents.wordpress.com/2011/08/28/advantages-and-disadvantages-of-visual-basic/>, accessed August 2012, August 2011.
- [9] R. KUMAR, *Advantages and disadvantages of Visual Basic languages*. Helium, <http://www.helium.com/items/1431314-advantages-and-disadvantages-of-visual-basic-language>, accessed August 2012, April 2009.
- [10] WIKIPEDIA, *Microsoft SQL server*. Wikipedia, http://en.wikipedia.org/wiki/Microsoft_SQL_Server, accessed October 2012, n.d.
- [11] L. ROCKOFF, *The Language of SQL*, Cengage, Boston, Massachusetts, 2010.
- [12] QUACKIT, *Microsoft Access versus SQL server*. Quackit, http://www.quackit.com/microsoft_access/tutorial/microsoft_access_versus_sql_server.cfm, accessed August 2012, n.d.
- [13] I. BANKS, *Microsoft .NET/SQL vs. Microsoft Access*. Hero Solutions, <http://www.hero-solutions.co.uk/articles/netsqlvsaccess.asp>, accessed August 2012, n.d.
- [14] SQL SERVER PROGRAMMERS, *Benefits of SQL server*. SQL Server Programmers, <http://www.sql-programmers.com/benefits-of-sql.aspx>, accessed August 2012, n.d.
- [15] WIKIPEDIA, *Multi-tier architecture*. Wikipedia, http://en.wikipedia.org/wiki/Multitier_architecture, accessed August 2012, n.d.

- [16] G. BOOCHE, J. RUMBAUGH, AND I. JACOBSON, *The unified modeling language user guide*, Addison-Wesley Longman, Inc., Reading, Massachusetts, 2005.
- [17] A. AITCHISON AND A. MACHANIC, *Expert SQL Server 2008 Development*, Springer, New York, New York, 2010.

APPENDIX**SQL SCRIPT**

Let's see some basic SQL script which will explain to a regular user how SQL queries work in database system. These queries are used for this application for different functions.

4. Q: Retrieve all the details of the customer who's id is 101, 105, 114.

```
select * from Chula Vista_customer where customer_id='101' or customer_id='105' or
customer_id='114';
```

5. Q: List all the customers whose address is 'National city, USA'

```
select * from Chula Vista_customer where customer_add='National city, USA';
```

6. Q: Count all the customers

```
select count(*) from Chula Vista_customer;
```

7. Q: Retrieve name, address and cell number for those who live in USA

```
select Customer_name, customer_add, customer_cellno from Chula Vista_customer
where customer_add like '%USA';
```

8. Q: Retrieve name, address and cell number who live in UK

```
select Customer_name, customer_add, customer_cellno from Chula Vista_customer
where customer_add like '%UK';
```

9. Q: Retrieve all the details of the supplier who's id is 1, 5, 10.

```
select * from Chula Vista_supplier where supplier_id='1' or supplier_id='5' or
supplier_id='10';
```

10. Q: Retrieve all the details of the supplier whose name is Bianca.

```
select * from Chula Vista_supplier where supplier_name='Bianca';
```

11. Q: Count all the Chula Vista suppliers

```
select count(*) from Chula Vista_supplier;
```

12. Q: List the name of supplier who sell product ipod

```
select * from Chula Vista_supplier where supplier_name in(select supplier_name
from product where product_name='ipod');
```

13. Q: List all the product which are sold my supplier

```
select product_name from Chula Vista_product;
```

14. Q: Retrieve productname and productcompany from the product which values greater than 500

```
select product_name, product_company from Chula Vista_product where
product_rate > 500;
```

15. Q: Retrieve product where supplier_address = San Diego, USA.

- select product_name from product where supplier_name in(select supplier_name from Chula Vista_supplier where supplier_add='San Diego, USA');
16. Q: Count all the product sold by Mobile shop whose rate is less than 1000
 select count(*) from Chula Vista_product where product_rate < 1000;
17. Q: Count total rate including tax and qty where sale_rec_nis 14;
 select (product_rate* product_qty)+(product_rate* product_qty* sale_tax)/100 as Product_total from Chula Vista_sale where sale_rec_no='14';
18. Q: Count total_rate including discount where sale_rec_nis 15
 select (product_rate* product_qty)-(product_rate* product_qty* sale_discount)/100 as Product_total from Chula Vista_sale where sale_rec_no='15';
19. Q: Retrieve all sale details of product whose name is 'Bluetooth'
 select * from ChulaVista_sale where product_name='Bluetooth';
20. Q: Count total rate including tax and qty where purchase_rec_nis 14
 select (product_rate* product_qty)+(product_rate* product_qty* purchase_tax)/100 as Product_total from Chula Vista_purchase where purchase_rec_no='14';
21. Q: Count total_rate including discount where purchase_rec_nis 15
 select (product_rate* product_qty)-(product_rate* product_qty* purchase_discount)/100 as Purchase_total from Chula Vista_purchase where purchase_rec_no='15';
22. Q: Retrieve all sale details of product whose name is 'Bluetooth'
 select * from Chula Vista_purchase where product_name='Bluetooth';
23. Q: Retrieve productid and sum of quantity for each product
 select product_id, sum(product_qty) from Chula Vista_sale group by product_id