



ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY
SCHOOL OF ELECTRICAL ENGINEERING AND COMPUTING
DEPARTMENT OF COMPUTING

A MASTER'S PROJECT

ON

SUPERMARKET MANAGEMENT SYSTEM
USING BARCODE TECHNOLOGY
FOR STAR SUPERMARKET IN ADAMA CITY

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF
THE DEGREE OF
M.SC. IN TECHNICAL TEACHERS EDUCATION IN
INFORMATION TECHNOLOGY MANAGEMENT

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ABSTRACT

Supermarket management system using barcode technology is a web based system that automates the supermarket's sales activity. It enables for managing the stock details, maintaining the records of the sales done for a specific period of time and monitoring the expiry status of the items time to time.

This system is developed to replace the existing standalone system in the supermarket by increasing efficiency and effectiveness, making more interactive, speedy and user friendly.

The existing stand-alone system has problems in centralizing data base for the branches, in advertising and promoting products and reports are not accessible online.

The system is developed using an object oriented methodology with programming languages and soft wares Net beans IDE 8.0.2, Java Development Kit 1.4.0(JDK1.4.0), HTML, Java Server Pages (JSP) for front end Glassfish Server 4.1 as Web server and MYSQL server 5.6.21 for backend. The system uses android mobile phone with Zxing android barcode scanner application, gate blue android application installed on it and Bluetooth device to scan barcodes on the item.

At the end of the project, a web based supermarket management system is developed. The system generates bill, sales report, stock report, and print bill. It also checks the expiry date of each item.

Key words: *supermarket sales activity, generate bill, managing stock reports and checks item expiry date.*

TABLE OF CONTENTS

CONTENTS	PAGES
ACKNOWLEDGMENT.....	II
ABSTRACT.....	III
LIST OF TABLES.....	VIII
LIST OF FIGURES	IX
LIST OF ABBREVIATIONS.....	XI
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background the organization	1
1.2 Statement of the problem	1
1.3 Objective of the Project	2
1.3.1 General objective	2
1.3.2 Specific Objectives	2
1.4 Scope and Limitations of the Project	2
1.4.1 Scope of the Project	2
1.4.2 Limitation of the project	3
1.5 Significance of the Project	3
1.6 Methodology	3
1.6.1 Data Collection Method	3
1.6.2 System Analysis & Design Methodology	4
1.6.3 System Development Tools	4
1.7 Feasibility Study	6
1.7.1 Technical Feasibility	6
1.7.2 Operational Feasibility	6
1.7.3 Economic Feasibility	6
CHAPTER TWO	7
REVIEW OF RELATED LITERATURE	7
2.1 Theoretical background	7
2.1.1 What is barcode.....	7
2.1.2 Advantages of Barcodes	8

2.1.3	Types of Barcode	9
2.1.4	Zxing android barcode scanner application	10
2.2	Responsive web design	12
2.2.1	What is Responsive Web Design?	13
2.2.2	Advantages of Responsive Design.....	13
2.3	RELATED STUDIES	13
2.3.1	Study on Inventory Management System for Supermarkets	13
2.3.2	Web based Supermarket automation	14
CHAPTER THREE		15
REQUIREMENT ANALYSIS		15
3.1	Description of the Existing System.....	15
3.2	The Proposed System	15
3.2.1	Overview of the proposed system.....	15
3.2.2	Functional requirements.....	16
3.2.3	Nonfunctional requirements.....	17
3.3	Hardware and Software Requirements.....	17
3.4	Software Engineering Methods and Techniques.....	18
3.5	Analysis Activities	19
3.5.1	Use case diagrams.....	19
3.5.2	Use case Description.....	21
3.5.3	Class Diagram	27
3.5.4	Sequence diagrams.....	28
3.5.5	State chart diagrams.....	36
3.5.6	Activity diagrams.....	37
CHAPTER FOUR.....		42
SYSTEM DESIGN		42
4.1	INTRODUCTION.....	42
4.1.1	Design goals.....	42
4.2	Proposed software architecture	43
4.2.1	Overview	43
4.2.2	Subsystem decomposition.....	44

4.2.3 Persistent data management	45
4.2.4 Component diagram	47
4.2.5 Deployment diagram	48
4.3 Access control and security	53
4.4 Global software control	55
4.5 Boundary conditions	56
CHAPTER FIVE	58
IMPLEMENTATION AND RESULT	58
5.1 Selection of programming language and platform	58
5.2 Algorithms used	58
5.3 Methods Used	62
5.4 Security and Privacy	63
5.5 System Functionality	64
5.6 Sample Input/ Output Screens	72
5.7 Results	75
CHAPTER SIX	77
TESTING	77
6.1 System Testing	77
6.2 Test Plan Overview	77
6.3 Features to be tested/not to be tested	78
6.4 Approach	78
6.4.1 Software Module Testing	78
6.5 System Integration Testing	81
6.5.1 Testing materials (Hardware/Software requirements)	82
6.5.2 Test Case Specification	82
6.6 User Acceptance Testing	85
CHAPTER SEVEN	86
CONCLUSION AND RECOMMENDATION	86
7.1 Conclusion	86
7.2 Recommendation	87
7.3 Result achieved	87

7.4 Limitation of the project.....	87
7.5 Future Work	88
APPENDIX – A.....	89
User Manual	89
APPENDIX – B	96
User Acceptance Testing.....	96
System Performance Testing.....	96
BIBLIOGRAPHY	97

LIST OF TABLES

TABLES	PAGES
Table 2.1.Types of Barcode	10
Table 3.1.Use case Description for system administrator.....	21
Table 3.2.Use case Description for Data encoder	23
Table 3.3.Use case Description for Salesmen.....	25
Table 3.4.Use case Description for supermarket Manager	25
Table 4.1.Item table	49
Table 4.2.Employee table	50
Table 4.3.Bill table.....	50
Table 4.4.Bill detail.....	51
Table 4.5.item_subcategory	51
Table 4.6.Item_category	51
Table 4.7.Users table.....	52
Table 4.8.User type table	52
Table 4.9.Customer table	52
Table 4.10.Feedback Table	53
Table 4.11.Branch.....	53
Table 4.12.Access-control matrix	54
Table 6.1.System Login testing table.....	79
Table 6.2.Test Item Table	80
Table 6.3.Login test case	82
Table 6.4.Create user account test case	83
Table 6.5.item management test case	83
Table 6.6.Sales report test case	84
Table 6.7.Check stock level test case.....	84
Table 6.8.Check item expiry date	85

LIST OF FIGURES

FIGURES	PAGES
Figure 2.1.Barcode scanning using android mobile phone	11
Figure 3.1.Iterative Incremental Model	18
Figure 3.2.Use-Case Diagram.....	20
Figure 3.3.Class diagram	28
Figure 3.4.create user account Sequence Diagram	29
Figure 3.5.Add item Data encoder Sequence Diagram.....	30
Figure 3.6.Add employee Data encoder Sequence Diagram	31
Figure 3.7.Generate bill Sequence Diagram	32
Figure 3.8.Supermarket Manager Sequence Diagram for sales report	33
Figure 3.9.Supermarket Manager Sequence Diagram for stock report	34
Figure 3.10.Supermarket Manager Sequence Diagram for customer feedback	35
Figure 3.11.state chart diagram.....	36
Figure 3.12.Create user account Activity Diagram	37
Figure 3.13.Log on to system Activity Diagram	38
Figure 3.14.Data encoder Add item Activity Diagram.....	39
Figure 3.15.Salesmen generating bill Activity Diagram	40
Figure 4.1.System architecture layer logical View	43
Figure 4.2.System Decomposition.....	44
Figure 4.3.Persistent data management diagram	46
Figure 4.4.Component Diagram	47
Figure 4.5.The system deployment diagram.....	48
Figure 4.6.Control flow of the system	55
Figure 4.7.Use case for boundary conditions.....	56
Figure 5.1.Login page	63
Figure 5.2.Change of Password	64
Figure 5.3.Edit/delete item.....	65
Figure 5.4.edit item record.....	66
Figure 5.5.Adding items Record.....	67

Figure 5.6.search items	68
Figure 5.7.Checking Stock Level.....	69
Figure 5.8.Checking item expire date	70
Figure 5.9.sales report.....	71
Figure 5.10.username and password input,.....	72
Figure 5.11.Administrator page	73
Figure 5.12.Home page.....	74
Figure 5.13.Sales men login.....	75
Figure 5.14.Bill Detail	75
Figure 5.15.Bill Generation	76
Figure 5.16.Printed bill	76
Figure 6.1.Testing process	78

LIST OF ABBREVIATIONS

- CBD: component Based Development
- CSS: Cascade Style Sheet
- DFD: Data Flow Diagram
- EJB: Enterprise Java Beans
- GUI: Graphical user Interface
- Java EE: Java Enterprise Edition
- JDBC: Java Data base Connection
- JDK: Java development kit
- JSP: Java Server Page
- MYSQL: My Structured Query Language
- OCR: Optical Character Reader
- OMT: Object Modeling Technique
- OOA: Object Oriented Approach
- QR: Quick Response
- RWD: Responsive Web Design
- SOA: Server Oriented Architecture
- UI: User interface
- UML: Unified Modeling Language

CHAPTER ONE

INTRODUCTION

In today's business environment automation has become an important component which allows firms to collect, store and analyze vast amounts of information which is used in decision – making. Automation to a greater extent can reduce pressure of a supermarket workload. It also eliminates work stress and fatigue. Supermarket management system using barcode technology plays a very important role on managing the supermarket. This web based system improves the efficiency and effectiveness of supermarket management, and enhance its competitiveness in the global market. It ensures a proficient inventory control and rigorous sales analysis facility. This web based system also provides authorized users to perform sales analysis of various products and will prove to be extremely useful to adjust the purchase and sales strategies leading to an increase in profit. In general supermarket management system provides a cost effective system using barcode technology to meet needs of the supermarket.

1.1 Background the organization

Star supermarket is established in 2001 E.C. currently it has two branches in adama city. It offers a wide array of grocery items and non-grocery items. It stores and sells various products which include packed foodstuffs and drinks, milk products, decorative items, cosmetics and many other products of day to day use like washing powders, cleaning equipment, gaskets etc.

Star Supermarket is a small business enterprise with a work force of fifteen (15) employees; including four (4) automation machine operators, one (1) accountant, seven (7) shop labours, two (2) supervisors and one (1) manager. The type of automation they use is a stand -alone system for sales purpose.

1.2 Statement of the problem

Currently in the supermarkets, they use standalone application systems that worked well in the previous 10 years ago and are no longer robust enough to meet today's business needs. This standalone system is installed on a single computer on each branch of the supermarket.

The supermarket has no centralized data base for its branches. The system is difficult for the Owners/supermarket managers of the supermarket to control every activities of their

business in a remotely through internet. They cannot access the inventory reports, sales reports and the stock level through internet from the system remotely. Supermarkets have also problems in scanning the barcodes of bulky or heavy items. Gun type barcode scanner cannot work in wireless communication to scan item barcodes.

The customers are dissatisfied with the system because they have no interaction with the system and cannot see which item is available and in which branch is found before coming to the supermarket. Standalone system is not accessible through internet. Customers lose their time, energy and transportation cost in searching the item information. Supermarkets have also a challenge in advertising and promoting their products and service with the standalone system.

1.3 Objective of the Project

1.3.1 General objective

The objective of this project is to design and implement web based supermarket sales transaction management system for star supermarket in Adama city.

1.3.2 Specific Objectives

- ❖ To centralize the data base system for star supermarket branches in Adama.
- ❖ To design a more interactive, speedy and user friendly system.
- ❖ To upgrade the existing back end/database which supports online storage and retrieval that will store sales transaction.
- ❖ To design and implement a system that shows reports online.
- ❖ To design and implement a system that can be accessed by customers online to get full item information.

1.4 Scope and Limitations of the Project

1.4.1 Scope of the Project

The scope of this project covers supermarket stock management and sales system for the organization. It includes sales activity record keeping, inventory detail, bill generation and monitoring stock.

1.4.2 Limitation of the project

While we develop this project we faced some difficulties. Such as: Resource constraints, time constraints and budget constraints.

- ❖ Resource constraints: we couldn't get the resources which are necessary to develop the project in time. For example; barcode reader
- ❖ Time constraints: there was shortage of time in designing and implementing this project.
- ❖ Budget constraints: there was no enough budgets allotted for the project development.

1.5 Significance of the Project

This project will enhance the information management of supermarkets and it will provide insights helpful to the workers of the supermarket who operate the system. Managers and members of the supermarket will enjoy quick and good online service and will have a friendly and efficient system. The project is developed to reduce the time taken for maintaining different tasks on the supermarket and provide quality of services to customers.

1.6 Methodology

For the successful accomplishment of supermarket management system we the developers followed the following methodologies.

1.6.1 Data Collection Method

We collected the following required information by using the following fact finding techniques:

Interviews

We interviewed the persons directly dealing with the existing system i.e. with salespersons and the manager of supermarket. We asked how they perform their duties, what are the difficulties being faced by them in using the existing system and what they need to be included further.

Record Review

We also reviewed the complete record so as to come to know about the detail procedure of the supermarket that how they handle the complete process from the incoming of the client till the delivery of their products using the stand alone system.

Observation

Observation helps analysts to gain information which one can't obtain by any fact-finding method. We observed the functioning of supermarket and got firsthand information about how the activities are carried out in supermarket.

Discussion

Another way to finding the facts and data for the design of the system is discussion. Discussion is the best method to solve sort of critical and abstract problems that cannot be solved concretely by just observing and record reviewing etc...

1.6.2 System Analysis & Design Methodology

In Design of this project we follow an object oriented model. Using Object Oriented methods used to develop real-time systems has the potential to produce safer, more reliable and maintainable code. Instead of using functional decomposition of the system, the OOA approach focuses on identifying objects and their activities. Using the object -oriented approach, system analysts model information systems by identifying a set of objects, along with their attributes and operations that manipulate the object data.

1.6.3 System Development Tools

As software developers we require a best tool to develop supermarket management system.

Frontend

The front-end is responsible for collecting input in various forms from the user and processing it to conform to a specification the back-end can use. The front-end is a kind of interface between the user and the back-end. The programming Language used for implementation of this project is Java.

JAVA

JAVA is a portable, platform-independent language that could be used to produce code that would run on a variety of CPU's under differing environments. Java is still one of the most

powerful and popular languages for web and application development used today. Java can be used for responsive web design, for the development of standalone applications.

JSP (Java Server Pages)

JSP technology is created to support authoring of HTML and XML pages. It makes it easier to combine fixed or static template data with dynamic content.

JQuery

JQuery is a cross-platform JavaScript library designed to simplify the client-side scripting of HTML. It is a fast and concise JavaScript library created by John Resig in 2006. It is also simplifies HTML document traversing, event handling, animating, and Ajax interactions for Rapid Web Development.

Bootstrap

Bootstrap is the most popular front end frameworks currently. It is a sleek, intuitive, and powerful mobile first front-end framework for faster and easier web development. It uses HTML, CSS and Java script.

Glass Fish Application Server

Glass Fish is an open-source application server project started by Sun Microsystems for the Java EE platform. This allows developers to create enterprise applications that are portable and scalable, and that integrate with legacy technologies. It is a Java EE compatible application server that supports Java Server Pages (JSP), Java Servlet, and Enterprise JavaBeans (EJB) component-based applications.

Back End

In a web application it would be the server-side code that runs on the web server to pass the application's logic such as storing data to a database, verifying user registration info, and database. The database used for data storage in this project is MySQL.

MySQL

MySQL is open source database management software that helps users store, organize, and retrieve data. It is a very powerful program with a lot of flexibility. It is a very popular and very fast performance. It handles very large databases.

1.7 Feasibility Study

This supermarket management system/project is evaluated by its technical feasibility, operational feasibility and economic feasibility. These are considered because they are the most popular and efficient to measure the feasibility study of most projects.

1.7.1 Technical Feasibility

A study of resources availability that may affect the ability to achieve an acceptable system this evaluation determines whether the technology needed for the proposed system is available or not. This system can be made in any language that support good user interface and easy database handling.

1.7.2 Operational Feasibility

In this feasibility we consider the following points:

1. What changes will be brought with the system.
2. What new skills will be required? Do the existing staff members have these skills?

If not, can they be trained in due course of time?

In the new system we made some major changes for the staff members so that they have to be trained to use the newly added facilities. These major changes are possible and give a new era in the Supermarket in production and sales management.

1.7.3 Economic Feasibility

In this we consider the following costs:

1. The cost to conduct a full system investigation.
2. The cost of hardware and software for class of application being considered.
3. The benefit in the form of the reduced cost.

Our system has a lot of features at a minimum cost so it is feasible to implement and it will be very much beneficial to the sellers in a reduced cost. It's software and hardware cost is also low.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Theoretical background

2.1.1 What is barcode

A bar code is a series of black and white stripes of varying widths stamped onto an item or imprinted on a label. Each bar code has a start bar and a stop bar to tell a reader which way the code is being scanned. The stripes in between the start and stop represent numbers that in America most commonly use a pattern called Universal Product Code A. (Bytescout 2014). Barcode technology works off a principle called symbology. Symbology at its basic form is what defines the barcode; it determines the mapping and interpretation of the encoded information or data. This encoding allows the scanning device to know when a digit or character starts and when it stops, similar to a binary representation. We recognize barcodes as an array of parallel lines alternating between white and black lines. Barcode technology provides a simple and inexpensive method of recording data or information in a number of applications.

The symbologies of the barcode technology can be arranged or mapped in a variety of ways. A continuous symbology is marked by the characters beginning with a black line and ending with a white line or space, while discrete symbologies have characters encoded as a black line a space and then another black line. This takes care of the characters and how each individual number or letter is read. The lines of a barcode also have variances in encoding the widths of the lines. Some barcode technology systems use two separate widths to determine the character while others use multiple width lines. The use of any of these encoding styles depends, of course, on the application for which the barcode technology is being used.

The line or linear barcode technology is sometimes referred to as 1D encoding. While we are most familiar with these barcodes, there are more complex codes that employ the use of dot matrixes to achieve a more complex encoding process that can store and identify far more information. These are referred to as 2D or, in some cases data glyphs. They are comprised of miniature dots, like the old dot matrix printers, which create patterns that are

read in the scanning process. They are not limited to this format and can be comprised of circular patterns or a collection of shapes and modules inserted into a specified image for a user.

In order to read the data of barcode technology it needs to be scanned by a laser and then interpreted. The scanners, or lasers, used to read the barcodes measures the light reflected from the linear barcode technology and can distinguish between the white and black lines. Calibration of the laser and system needs to be done to ensure the proper interpretation of the code itself. This has to do with whether it is a continuous or discrete symbology, 1D or 2D images, and whether it uses two width or multiple width lines. The most common lasers used are helium neon lasers due to their low energy consumption and efficiency.

The complex or 2D barcode can not be read by a simple laser as the linear barcode technology can. The barcode needs an all encompassing reader as the full image needs to be read. Linear barcode technology only needs to be swept across to read it as the lines are the same regardless of the position of the laser. 2D codes must be read or scanned by an image based scanner, similar to the scanners used at home or in offices to scan documents and images. They are more costly but supply more information and data. These are used in encoding URLs for cellular phone use and higher end applications. (Favreau, Annie. "Symbology Based Bar Code Decoding Algorithms". Regents of the University of Minnesota. Retrieved 10/11/2011.)

2.1.2 Advantages of Barcodes

Barcode systems provide an array of benefits, including operational efficiency, better customer service, and improved visibility of key business information to management.

Speed

A bar code label of twelve characters can be read in approximately the time it takes a keyboard operator to make two keystrokes.

Accuracy

For every 1,000 characters typed by a keyboard operator, there are an average of ten keying errors. For an Optical Character Reader (OCR), there is one error in every 10,000 reads. With wands, barcode systems approach one error in every 3,000,000 characters, and with laser technology, they approach one error in 70 million entries.

Data Integrity

Probable number of substitution errors per 3,400,000 characters

Data Entry Method	Errors
Keyboard Entry	10,000
OCR Scanning	300
Barcode scanning (Code 39)	1

Ease of Implementation

Operators of bar code scanners can learn to use the equipment effectively in less than 15 minutes. System costs are lower than other means of data entry because of the existence of interfacing hardware and software. Barcode labels can cost less than a penny apiece, are easily read by thousands of commonly available devices, and can be printed universally.

Cost Effectiveness

Barcode systems have a demonstrated payback period of six to eighteen months, and they provide the highest level of reliability in a wide variety of data collection applications. Barcode systems create value not only by saving time, but also by preventing costly errors.

2.1.3 Types of Barcode

There are different types of barcode that used for different application, the table below shows the some types of barcode

Table 2.1.Types of Barcode

Type	Name	Symbol	Application areas
Numeric only barcode	CODABAR	 123456789012	• Library • blood bank
	EAN-13	 0 0 1 2 3 4 5 6 7 8 9 0 5	• world-wide for marking retail goods
Alphanumeric Barcode	CODE 128	 ABCxyz#\$%15z	• Automate Identification system
	CODE 39	 12345ABCDE	• Industries • Governmental barcode specification

2.1.4 Zxing android barcode scanner application

ZXing or Zebra crossing is a barcode image processing open-source library implemented in Java which enables multi-format, 1D & 2D barcode processing. The library also provides additional support with ports (to other languages). It could scan and parse both QR codes and barcodes. It uses the built-in camera on mobile phones to scan and decode barcodes on the device.

ZXing library supports formats such as QR Code, UPC-A & UPC-E, Data Matrix, EAN-8 and EAN-13, Codabar, Code 39, Code 93, Code 128, most variants of RSS Expanded, ITF,

all variants of RSS-14, PDF 417 ('alpha' quality) and Aztec ('beta' quality). Along with the support to decode barcodes, it also supports barcode generation.

In Mobile application perspective, ZXing support is available for both Android and iPhone application development and the library offers better recognition accuracy in reading images.

ZXing uses phone or tablet camera to scan barcodes, QR codes or multi-format 1D/2D barcodes. So the scan result highly depends on the camera quality and resolution.

ZXing has relatively fast processing speed. With a Zebra scanner in hand, workers of the supermarket can capture the data that matters most as fast and as accurately as possible.

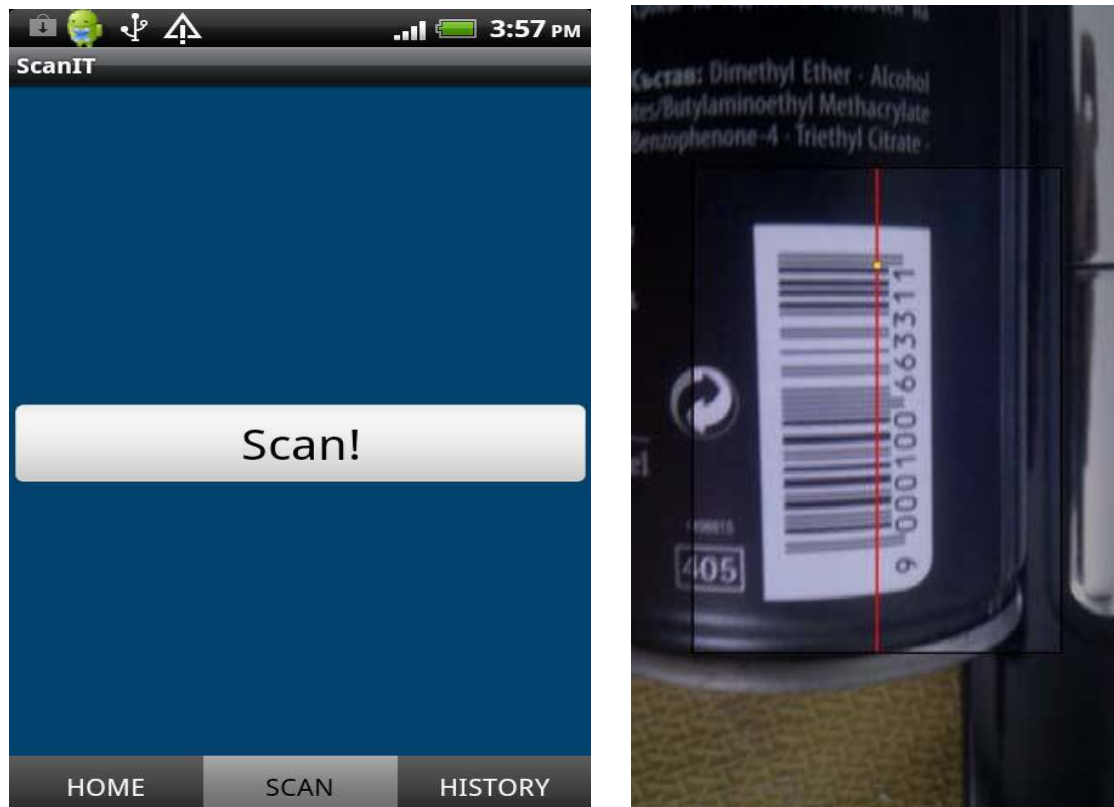


Figure 2.1. Barcode scanning using android mobile phone

Advantages of Zxing android barcode scanner application

Cost-effective and reliable

ZXing Barcodes are often overlooked as a method for cutting costs and saving time. A valuable and viable choice for businesses looking to improve efficiency and reduce overhead. It takes only seconds to use the hand-held scanner for reading barcodes.

Eliminate the possibility of error

The occurrence of errors for manually entered data is significantly much higher than that of barcodes. A barcode scan is fast and reliable, and takes infinitely less time than entering data by hand.

Reduces employee's time to enter data

It takes only seconds for reading barcodes. This also makes employee training less expensive and thus use the resources better.

Data obtained through ZXing barcodes is available rapidly

Since the information is scanned directly into the central computer, it is ready almost instantly. This quick turnaround ensures that time will not be wasted on data entry or retrieval. Interfaces for getting these data displayed. (Zebra. <http://zebra.sourceforge.net/>)

Bluetooth

Bluetooth is a wireless technology standard for exchanging data over short distances. It is a standard used in links of radio of short scope, destined to replace wired connections between electronic devices like cellular telephones, Personal Digital Assistants (PDA), computers, and many other devices.

Bluetooth technology can be used at home, in the office, in the car, etc. This technology allows to the users instantaneous connections of voice and information between several devices in real time. The way of transmission used assures protection against interferences and safety in the sending of information.

2.2 Responsive web design

A responsive website design is a must for all types of websites. Whether you are selling products online, promoting your services or running ads a responsive design can help you increase your traffic, make more conversion or earn more from your ads.

2.2.1 What is Responsive Web Design?

Responsive Web Design (RWD) is an approach of laying-out and coding a website such that the website provides an optimal viewing experience — ease of reading and navigation with a minimum of resizing, panning, and scrolling — across a wide range of devices (from desktop computer monitors to mobile phones).

2.2.2 Advantages of Responsive Design

Super Flexible

Responsive web design sites are fluid, meaning the content moves freely across all screen resolutions and all devices. Both the grids and the images are fluid. Just as a liquid spreads out or draws in to allow its content to fill an allotted space and retain its appearance, responsive web design's fluidity achieves the same result with website content on a device screen.

Excellent User Experience

Responsive web design is about providing the optimal user experience irrespective of whether they use a desktop computer, a smartphone, a tablet or a smart-TV. No scrolling or resizing is needed for any visitor to access your website from their favorite device.

Wide Audience

Users access the website using different mediums. With responsive web design, it attracts a wider audience. No matter what screen the visitor uses, it will look professional. This keeps customers coming back. (Author: Steve Hamm, Digital Marketing Solutions)

2.3 RELATED STUDIES

2.3.1 Study on Inventory Management System for Supermarkets

This study is a standalone inventory management system for supermarkets and infers solutions to the current challenges by designing a computerized inventory management system to order and update the stocks. Based on the findings this study highlights the possible solutions to the problems the supermarkets faced. The system has been developed using visual basic programming for front end, RDBMS backend- SQL server 7.0. (Abisoye Opeyemi, Boboye Fatoba, Abisoye Blessing, 2002).

In the above findings users of the system are beneficiaries that can easily communicate with the standalone system but it has many limitations like it is not include all sales management.

The system is not web based system. It is difficult to access stock reports online. The database is not centralized. This system is not supported using the barcode technology to implement the inventory management.

2.3.2 Web based Supermarket automation

This work presents procedures for automating the Super Market. It is an online shopping that maintains all the details related to the various customers and vendors involved in the transaction of the supermarket. It handles all the proceedings of payments made by the different customers of the supermarket. It makes the regular entry of the issues and receipts of the products indulged in the transaction of the super market. This web based system also generates various types of reports in order to keep all the activities under proper control.

Programming language- PHP, RDBMS backend- MYSQL server, Internet Technology- HTML, java script and wamp as Web server are used to develop the software package. (Irene Yousept, Feng Li, (2004): Online Supermarkets).

In the above findings users of the system are beneficiaries that can easily communicate on line but it has limitation in data entry and sales. It is not supported by barcode technology.

Our system is a web based system that is better to manage the stock and sales management using barcode technology by improving data handling of the supermarket and centralizing the database for all branches and managers can get and provide information on line. Customer has also access to the system to browse and search item information before visiting the supermarket.

CHAPTER THREE

REQUIREMENT ANALYSIS

3.1 Description of the Existing System

Many Supermarkets use the stand alone system to facilitate the activities of supermarket automation. The salespersons have been recording the items information in the present through this system. Salespersons receive the items at the end of the belt and slide the items across an in-counter gun type barcode scanner in a seated or standing position. Almost all items are moved across the scanner.

3.2 The Proposed System

3.2.1 Overview of the proposed system

AS stated above, in Star supermarket there are different problems. To solve this problem, we will develop a web based supermarket management system that will centralize the data base of all branches of star supermarket. The system will maintain the stock details, the records of the sales done for a fixed period of time. It will also generate bill, sales and stock report periodically.

This web based supermarket management system will have features that aid customers. It will provide for customers to browse and search item information and availability before visiting the supermarket. This will help them to perform price comparison of items of the same category and from different manufacturers and save their time, energy and transportation cost. Customers will also register in the system and leave comments on products and services of the supermarket.

The system will use android mobile phone with Zxing android barcode scanner application, Gate blue android application installed on it and the built-in camera on mobile phone to scan the barcodes embedded on the item. Bluetooth device will also use to establish the wireless communication between the server and the android mobile phone to exchange data. This type of barcode scanner will help to scan the barcodes of bulky or heavy items easily without moving across to salespersons seat.

So this web based supermarket management system will serve to solve the functions that cannot be achieved by the previous system.

3.2.2 Functional requirements

The functional requirements of this proposed system are listed below.

System administrator

System administrator is a site administrator and responsible for site maintenance. He/she can view all the status of the system and change it. He /she can also view the whole system and the details of the users. System administrator has authority to create, edit, block and delete client/user login details.

Sales Men

Should be able to

- Search for a particular item information by scanning the item barcode or by manually entering the item barcode.
- Enter the items purchased quantity by a customer and produce a bill
- Inform the supermarket manager about any exceptions
- Print receipt to the customers

Supermarket manager

The supermarket manager will be able to monitor stock levels, sales activity, expiry date of items and manage advertisement of products and services of the supermarket.

- Check the status of the inventory
- Validate the inventory against the sales done in the previous day
- Generate inventory reports of the items category-wise, price-wise
- Print sales report
- responsible for user feedback and queries

Data encoder:

- Who will enter the items/categories to the database
- Add new items /categories to the database
- Edit/update item/categories detail
- Delete item/categories from the database
- Can register employees to the database
- Can manage barcode generation for items that do not have embedded barcode.

3.2.3 Nonfunctional requirements

Nonfunctional requirements describe user-visible aspects of the system that are not directly related to the functional behavior of the system. Nonfunctional requirements span a number of issues, from user interface look and feel to response time requirements to security issues.

- **Performance characteristics.** The system validates all user inputs within the client's browser to reduce error. The system keeps response times to user interaction to a minimum. It retrieves items status by reading the item barcode with a mobile based portable barcode scanner better than the existing system.
- **Quality issues.** The system provide correct information to the user, it retrieves correct status of the supermarket.
- **Security issues.** Only the system administrator, data encoder, sales men and supermarket manager can log in to the system by using their own user name and password. They can access their own allowed interfaces necessary to carryover smooth operations.
- **Usability.** The system able to operate on any platform Such as Microsoft Window Operating systems.
- **Efficiency:** The system has efficiency in terms of time and space and it has capability of storing accurate data in centralized database.
- **User interface.** The system provides an easy and familiar user interface that can be learned in a short period of time by the user.
- **Hardware considerations.** The system is designed to interact with android mobile that has zxing android barcode scanner application in order to perform the desired functions.

3.3 Hardware and Software Requirements

Software requirement

- ❖ Net Beans IDE 8.0.2
- ❖ Glass Fish server 4.1
- ❖ Java development kit(JDK) 8
- ❖ MYSQL Server
- ❖ TWedge 3.1 interface software
- ❖ Microsoft office Visio 2007

- ❖ Web browsers (Internet Explorer 8, 9, Firefox 4+ or Chrome 12+)
- ❖ Microsoft windows operating system

Hardware requirement

- Personal Computer/ Laptop/
- Android mobile with Zxing barcode scanner and Gate blue android installed on it.
- Bluetooth device.

3.4 Software Engineering Methods and Techniques

The development model used for Supermarket Management System using barcode technology is an Incremental development methodology. The Incremental methodology is an evolution of the Waterfall model, where the Waterfall model is incrementally applied using the iterative philosophy of prototyping. With Incremental development the project is designed, implemented and tested incrementally with a little more is added each time until the product is finished. It involves both development and maintenance. The model is shown below,

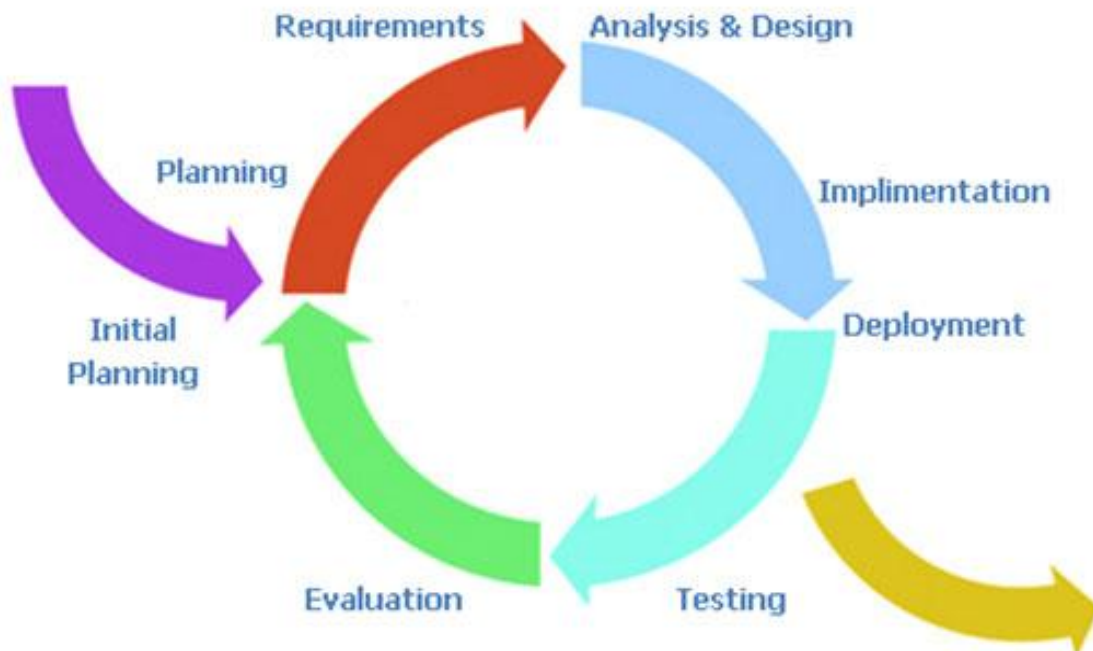


Figure 3.1.Iterative Incremental Model

3.5 Analysis Activities

UML Diagrams

UML is a notation that resulted from the unification of OMT (Object Modeling Technique, UML has also been influenced by other object-oriented notations. UML has been designed for a broad range of applications.

- **The functional model**, represented in UML with use case diagrams, describes the functionality of the system from the user's point of view.
- **The object model**, represented in UML with class diagrams, describes the structure of a system in terms of objects, attributes, associations, and operations.
- **The dynamic model**, represented in UML with sequence diagrams, state chart diagrams, and activity diagrams, describes the internal behavior of the system.

3.5.1 Use case diagrams

Use cases are used during requirements elicitation and analysis to represent the functionality of the system. Use cases focus on the behavior of the system from an external point of view. A use case describes a function provided by the system that yields a visible result for an actor. An actor describes any entity that interacts with the system (e.g., a user, another system, the system's physical environment). The identification of actors and use cases results in the definition of the boundary of the system that is, in differentiating the tasks accomplished by the system and the tasks accomplished by its environment. The actors are outside the boundary of the system, whereas the use cases are inside the boundary of the system.

Use case Model

A use-case model a model of how users interact with the system to solve a problem, and it describes the goal of the user, the interaction between user and the system and the required behavior of the system in satisfying the goal. A use case model consists of a number of model elements, the most important model elements are use-case, actors and relationship between them.

Actor Specification

An actor represents anything that needs to interact with the system to exchange information. An actor is a user, a role, which could be an external system as well as a person. An actor

initiates the system activity, a use case, for the purpose of completing the some business task. The use-case actors are listed below,

- ☞ Data encoder
- ☞ Salesmen
- ☞ Supermarket Manager
- ☞ System Administrator

Use-case diagram used to describe a set of actions on the system and show us the interaction between external users and internal of the system their privilege is varies.

Use case diagram

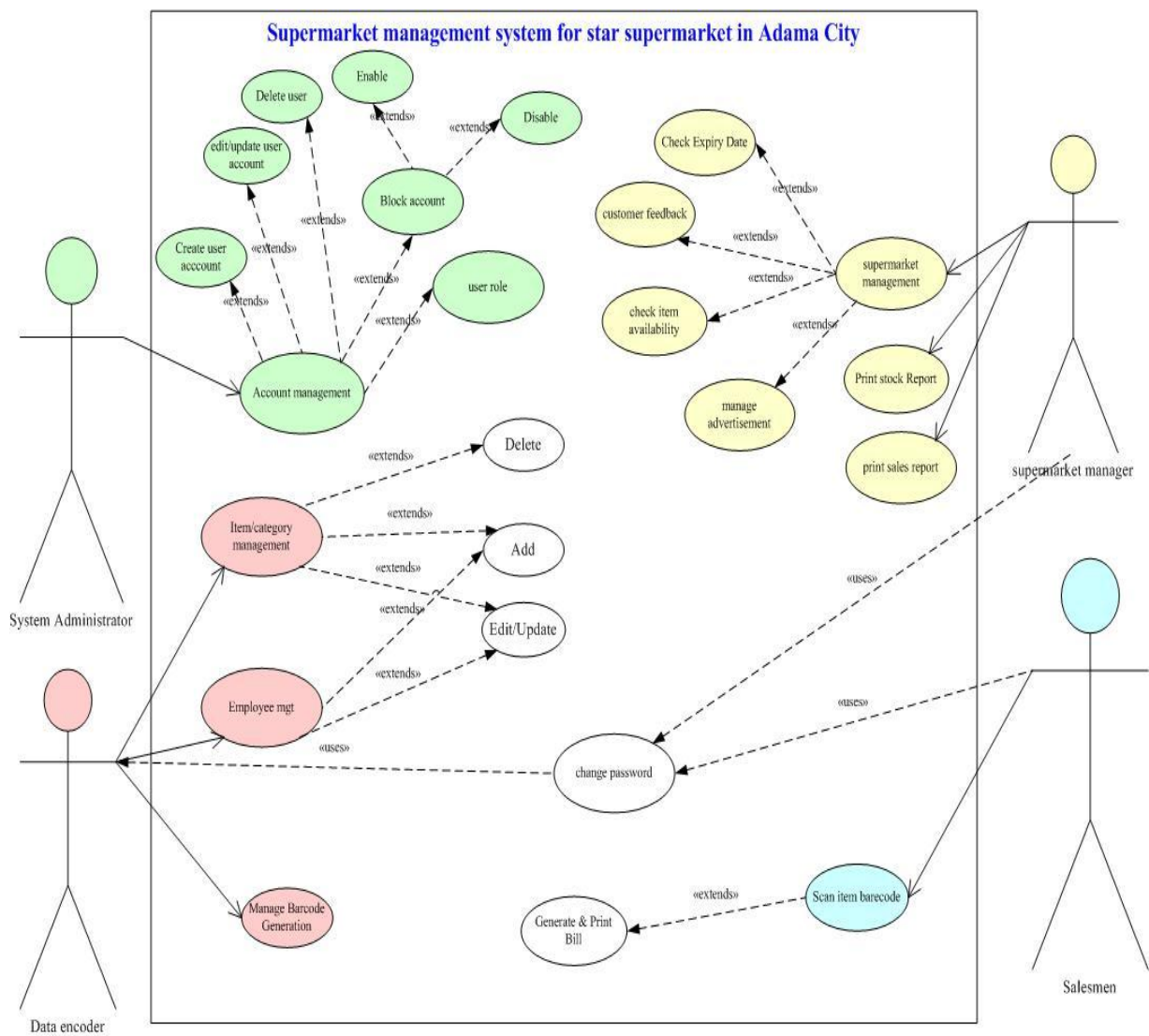


Figure 3.2.Use-Case Diagram

3.5.2 Use case Description

Table 3.1. Use case Description for system administrator

Use case 1: Log on to system

Use case	User Log in
Actors	System administrator, Data encoder, salesmen, supermarket manager
Preconditions	The Users are not logged on to the system.
Primary scenario	1. The use case begins when the Users select “Log in”. 2. The system asks the User for their user name and password. 3. The User enters their user name and password. 4. The user name and password are correct. 5. The system authenticates the User.
Post conditions	The User is logged on.
Secondary scenario	User Authentication Fails: 1. The system asks the User for their user name and password. 2. The User enters their user name and password. 3. The user name and/or password is wrong.
Post conditions	The User is not logged on

Use case 2: Create new user

Use case	Create new user
Actors	System administrator
Preconditions	The System administrator is logged on to the system
Flow of events	1. The use case begins when the System Administrator clicks on “New User”. 2. The system asks the System Administrator to input the following information: username, password, name of user, user role 3. The system creates a new user account.
Post conditions	A new user account has been created.

Use case 3: Edit/update user account

Use case	Edit/update user account
Actors	System administrator
Preconditions	The System administrator is logged on to the system
Flow of events	1. The use case begins when the System Administrator clicks on “Edit/update”. 2. The system asks for a user username, password, user role and name of user. 3. The system updates user account.
Post conditions	A user account has been updated

Use case 4: Delete user

Use case	Delete user
Actors	System administrator
Preconditions	The System administrator is logged on to the system
Flow of events	1. The use case begins when the System Administrator clicks on “Delete” 2. The system displays confirmation to delete. 3. The administrator confirms to delete. 4. The system displays successful message.
Post conditions	A user’s account has been deleted.

Use case 5: Block user account

Use case	Block user
Actors	System administrator
Preconditions	The System administrator is logged on to the system
Flow of events	1. The system Administrator use case begins to selects enable or disable 2. The system disables or enables for the user’s account.
Post conditions	A user’s account has been disabled or enabled.

Table 3.2. Use case Description for Data encoder

Use case 1: Add item/categories

Use case	Add item/categories
Actors	Data encoder
Preconditions	The Data encoder is logged on to the system
Flow of events	1. The use case begins when the Data encoder clicks on “Add New item” 2. The system asks the Data encoder to enter the item/categories information. 3. The Data encoder enters the requested information. 4. The Data encoder clicks on save to save in to the database. 5. The system confirms successful message items as saved.
Post conditions	Anew item/categories have been added to the database.

Use case 2: Delete item/categories From Database

Use case	Delete item/categories From Database
Actors	Data encoder
Preconditions	The Data encoder is logged on to the system
Flow of events	1. The use case begins when the Data encoder clicks on “Delete”. 2. The system displays delete confirmation. 3. The Data encoder confirms the deletion. 4. The system deletes the item from the database.
Post conditions	An item has been deleted from the database.

Use case 3: Edit/update item

Use case	edit/update item
Actors	Data encoder
Preconditions	The Data encoder is logged on to the system
Flow of events	1. The use case begins when the Data encoder clicks on “edit/update”. 2. The system displays item form to edit 3. The Data encoder changes item detail 4. The data encoder clicks on update button 5. The system changes item detail in the database 6. The system displays successful updated item detail
Post conditions	An item detail has been updated in the database.

Use case 4: Add employee information to database

Use case	Add employee To Database
Actors	Data encoder
Preconditions	The Data encoder is logged on to the system
Flow of events	1. The use case begins when the Data encoder clicks “Add new employee” 2. The system asks the Data encoder to enter the employee information. 3. The Data encoder enters the requested information and clicks save. 4. The system confirms that the new employee saved to the database.
Post conditions	A new employee has been added to the database.

Use case 5: Edit/update employee in the database

Use case	Edit/update employee
Actors	Data encoder
Preconditions	The Data encoder is logged on to the system
Flow of events	1. The use case begins when the Data encoder clicks “Edit”. 2. The system displays employee information to edit 3. The Data encoder changes the employee information and clicks save. 4. The system displays successful updated message for employee detail.
Post conditions	An employee detail has been updated in the database.

Table 3.3.Use case Description for Salesmen

Use case 1: Scan item barcode

Use Case	Scan item barcode
Primary Actor	Sales men
Goal in context	To display and identify the item information.
Precondition	You have a barcode scanner.
Trigger	There should have at least one item to be scan.
Flow of events	1. Get the item and scan using barcode scanner. 2. The system displays item information. 3. The salesmen generate and print bill.
Exception	The username and password cannot be verified.

Table 3.4.Use case Description for supermarket Manager

Use case 1: Print stock report

Use Case :	Print stock report
Primary Actor:	Supermarket manger
Goal in context:	To track stock detail of the business in daily basis
Precondition:	The supermarket manager has valid username and password
Scenario:	1. The supermarket manager log on to the system. 2. The supermarket manager selects the availability of item options. 3. The system displays an alert red color when items become run out item and green when items become available and yellow when items become low quantity. 4. The supermarket manager prints the stock report.
Exception	Username and password incorrect.

Use case 2: Print sales report

Use Case:	Print sales report
Primary Actor	supermarket manager
Goal in context	To track sales state of the business in daily bases
Precondition	The supermarket manager has valid username and password
Scenario	1. The supermarket manager log on to the system 2. The supermarket manager need to select specific date 3. The system will display sales report for the specified date. 4. The supermarket manager prints the sales report.
Exception	Username and password incorrect.

Use case 3: Manage advertisement

Use Case :	Manage advertisement
Primary Actor:	supermarket manager
Goal in on text:	To advertise supermarket items on the website
Precondition:	The supermarket manager has valid username and password
Trigger:	The supermarket manager wants to advertise new items, discounts on the website.
Scenario:	1. The supermarket manager log on to the system 2. The manager will add/edit/update/delete information on the websites page 3. The system displays on the website home page
Exception	Username and password incorrect.

Use case 4: check expiry date

Use Case	check expiry date
Primary Actor	supermarket manager
Goal	To check items expiry date
Precondition:	The supermarket manager has valid username and password
Scenario:	1. The supermarket manager log on to the system 2. The supermarket manager selects items expiry date options 3. The system searches for the items from data base 4. The system displays item information as red for expired, yellow for warning and green for good condition
Exception	Username and password incorrect.

Use case 5: customer feedback

Use Case :	customer feedback
Primary Actor:	supermarket manager
Precondition:	The supermarket manager has valid username and password
Scenario:	1. The supermarket manager log on to the system 2. The supermarket manager check feedbacks from customers
Exception	Username and password incorrect.

3.5.3 Class Diagram

We use class diagrams to describe the structure of the system. Classes are abstractions that specify the common structure and behavior of a set of objects. Objects are instances of classes that are created, modified, and destroyed during the execution of the system. Objects have state that includes the values of its attributes and its relationships with other objects. Class diagrams describe the system in terms of objects, classes, attributes, operations, and their associations.

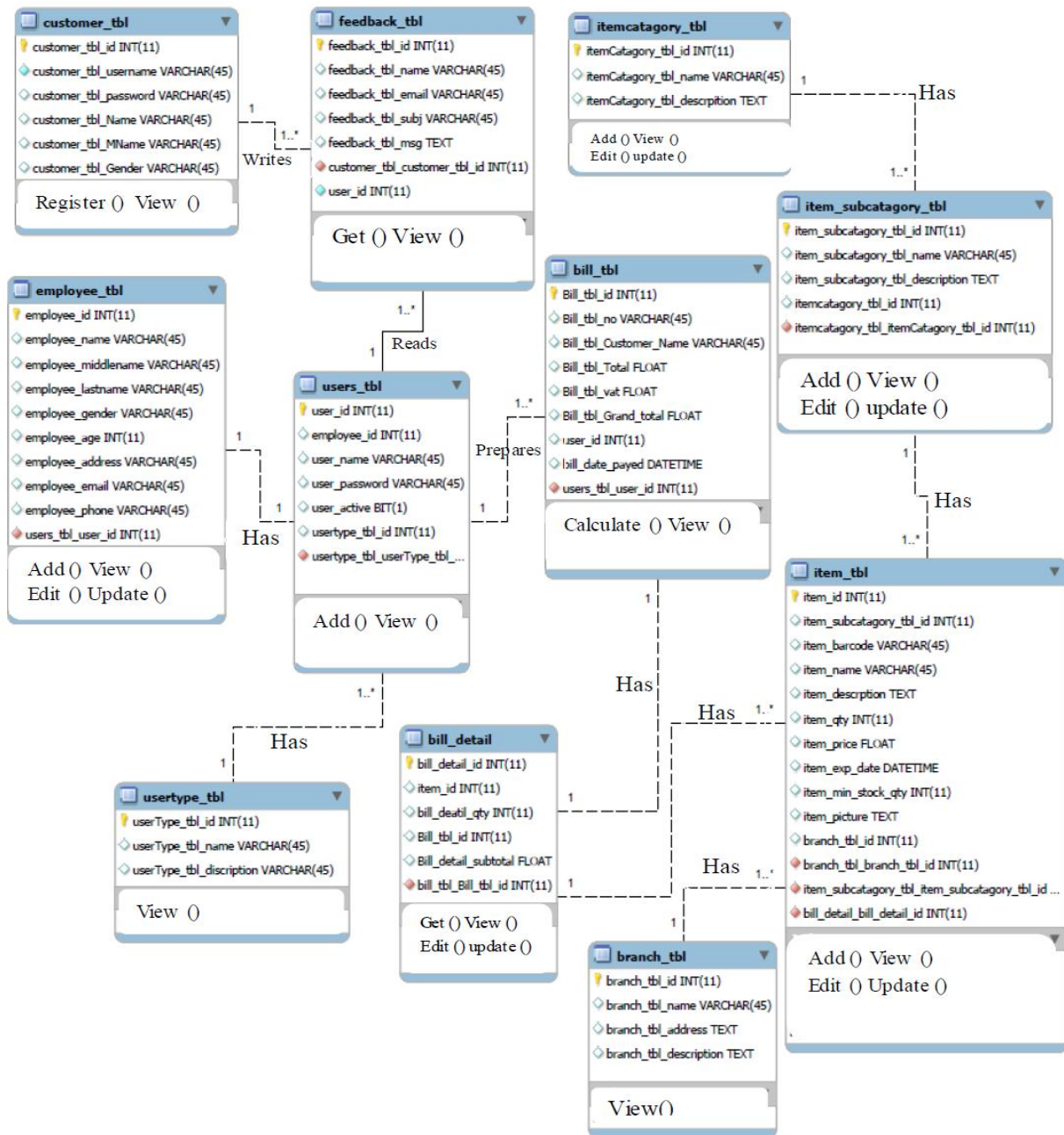


Figure 3.3.Class diagram

3.5.4 Sequence diagrams

Sequence diagrams are used to formalize the behavior of the system and to visualize the communication among objects. They are useful for identifying additional objects that participate in the use cases. We call objects involved in a use case participating objects. A sequence diagram represents the interactions that take place among these objects.

The sequence diagram of the system listed below.

System Administrator Sequence Diagram

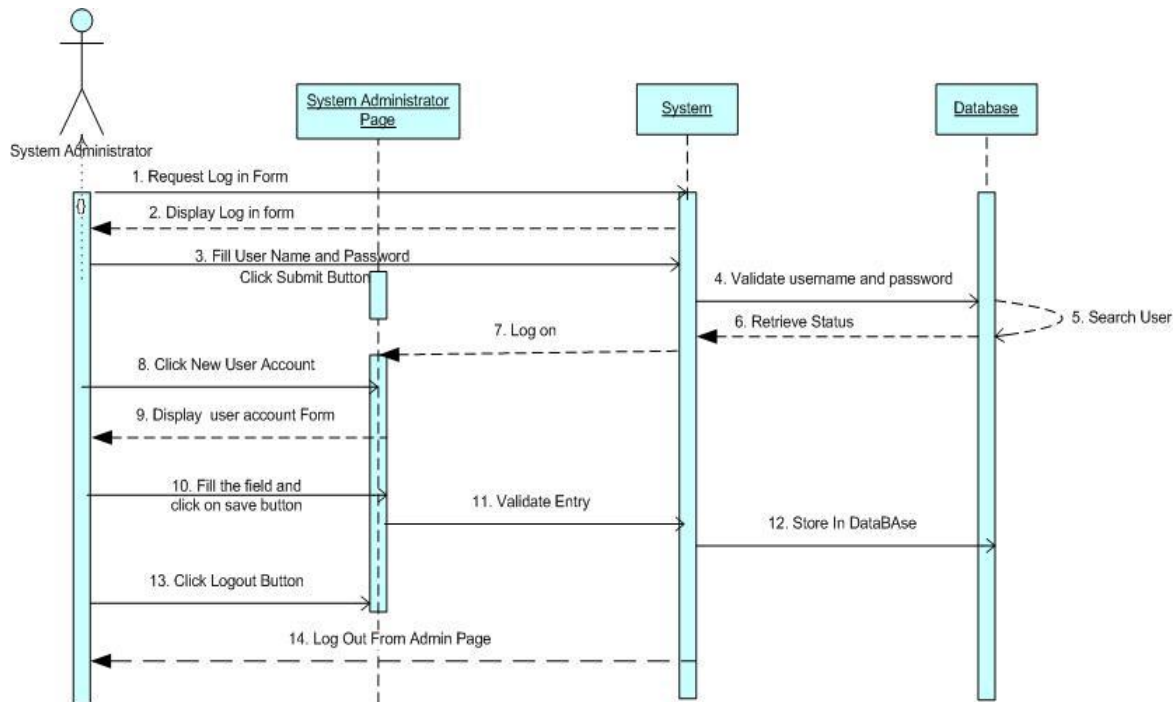


Figure 3.4.create user account Sequence Diagram

This sequence diagram shows the sequence events that the system administrator creates an account of users. The sequences of the events are

- ❖ First the administrator sends a log in request to the system.
- ❖ The system displays the login form
- ❖ The administrator fills the username and password and click submit button.
- ❖ The system validate the username and password of the user in Database
- ❖ In database search the user name and the password
- ❖ Retrieve the status of the user
- ❖ If the user is authorized then administrator logon onto admin page
- ❖ To create users account the administrator click new user button
- ❖ Display the add new user form
- ❖ Fill the user account field and click save button
- ❖ The system validate the fields and store in database
- ❖ The administrator clicks logout button
- ❖ And the system logout the administrator from admin page

Data encoder Sequence Diagram

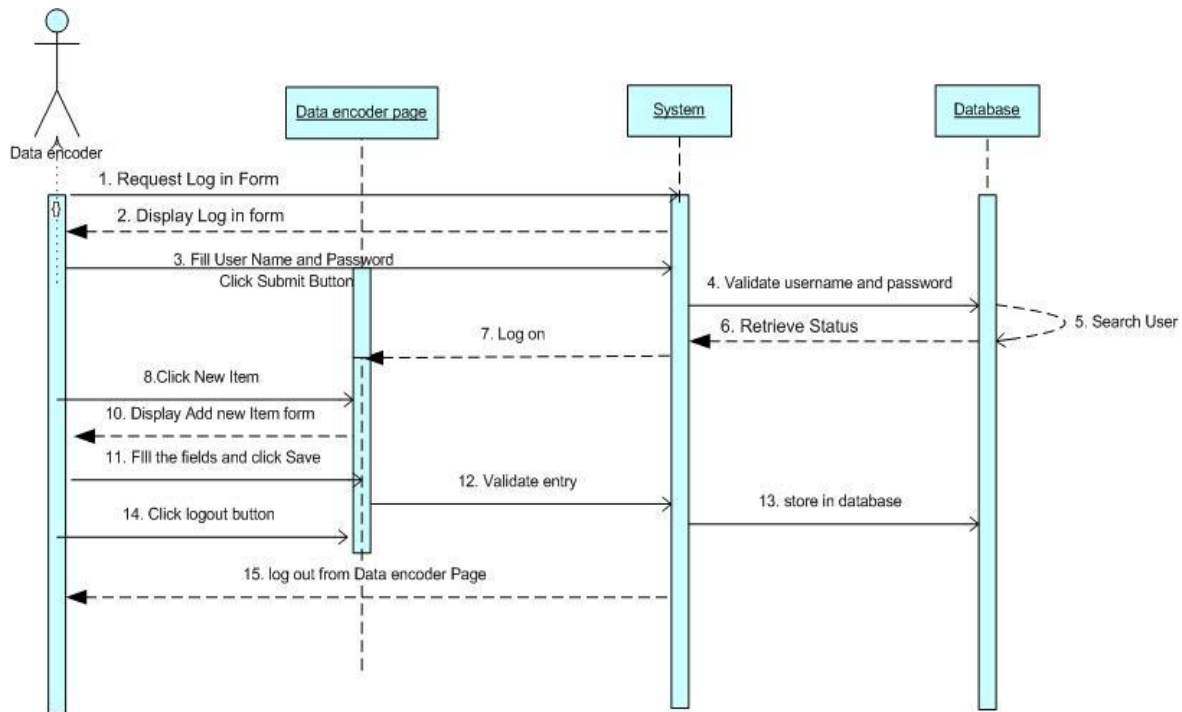


Figure 3.5.Add item Data encoder Sequence Diagram

This sequence diagram shows the sequence events of the Data encoder. The sequences of the events are

- First the Data encoder sends a log in request to the system.
- The system displays the login form
- The Data encoder fills the username and password and click submit button.
- The system validates the username and password of the user in database
- In database search the user name and the password
- Retrieve the status of the user
- If the user is authorized then log on to Data encoder page
- To add new items to the database click new item button.
- The system displays Add new item form
- Fill the field and click save button
- The system validates the field and store in the database
- The data encoder click the log out button
- And the system log out the data encoder form the data encoder page

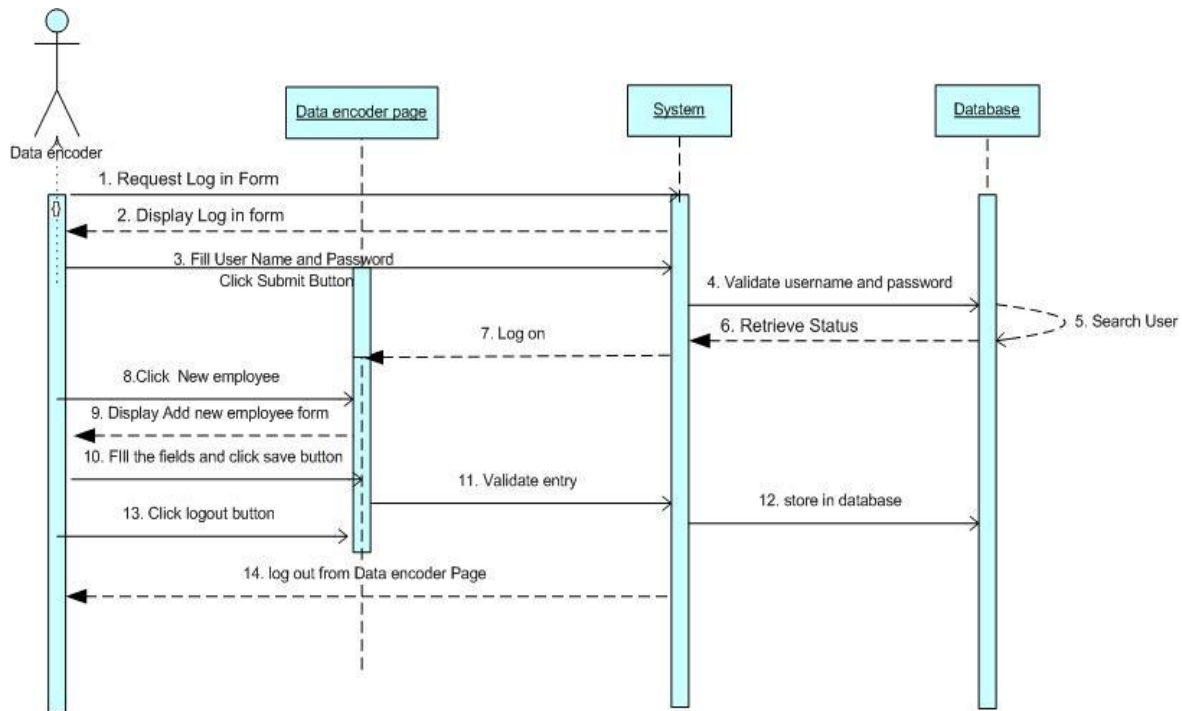


Figure 3.6.Add employee Data encoder Sequence Diagram

This sequence diagram shows the sequence events of the Data encoder. The sequences of the events are

- First the Data encoder sends a log in request to the system.
- The system displays the login form
- The Data encoder fills the username and password and click submit button.
- The system validates the username and password of the user in Database
- In database search the user name and the password
- Retrieve the status of the user
- If the user is authorized then log on to Data encoder page
- To add new employee to the database click new employee button.
- The system displays Add new employee form
- Fill the field and click save button
- The system validates the field and store in the database
- The data encoder click the log out button
- And the system log out the data encoder form the data encoder page

Salesmen Sequence Diagram

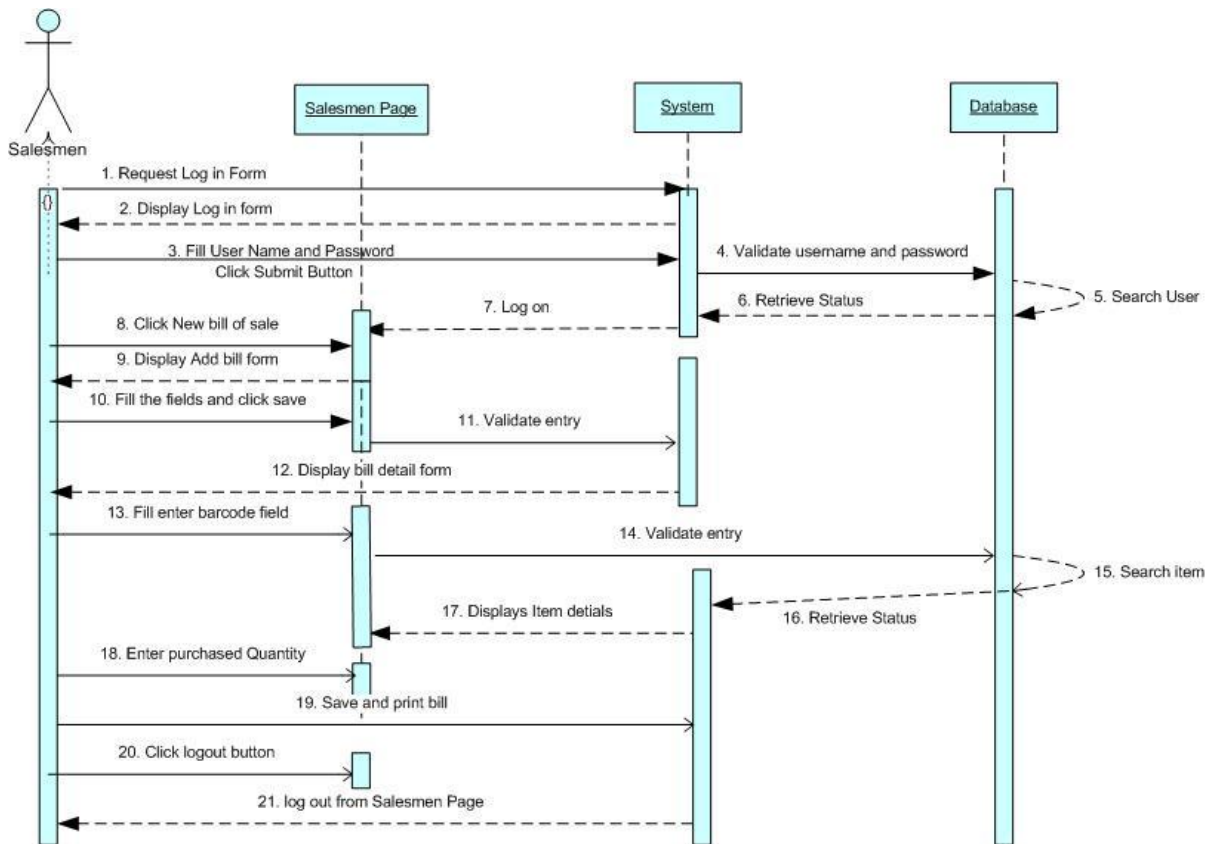


Figure 3.7. Generate bill Sequence Diagram

This sequence diagram shows the sequence events of the Salesmen.

The sequences of the events are

- First the Salesmen send a log in request to the system.
- The system displays the login form
- The Salesmen fills the username and password and click submit button.
- The system validates the username and password of the user in database
- In database search the user name and the password
- Retrieve the status of the user
- If the user is authorized then log on to Salesmen page
- Click on new bill of sale
- The system displays add bill form
- The salesmen fills the fields

- The system validates the entry
- The system displays bill detail form
- The salesmen enter the item barcode
- The system validates for the entry
- The database retrieves for the entry status
- The system displays item details
- The salesmen enters the purchased item quantity then save and print
- The salesmen click the log out button
- And the system log out the salesmen form the salesmen page

Supermarket Manager Sequence Diagram

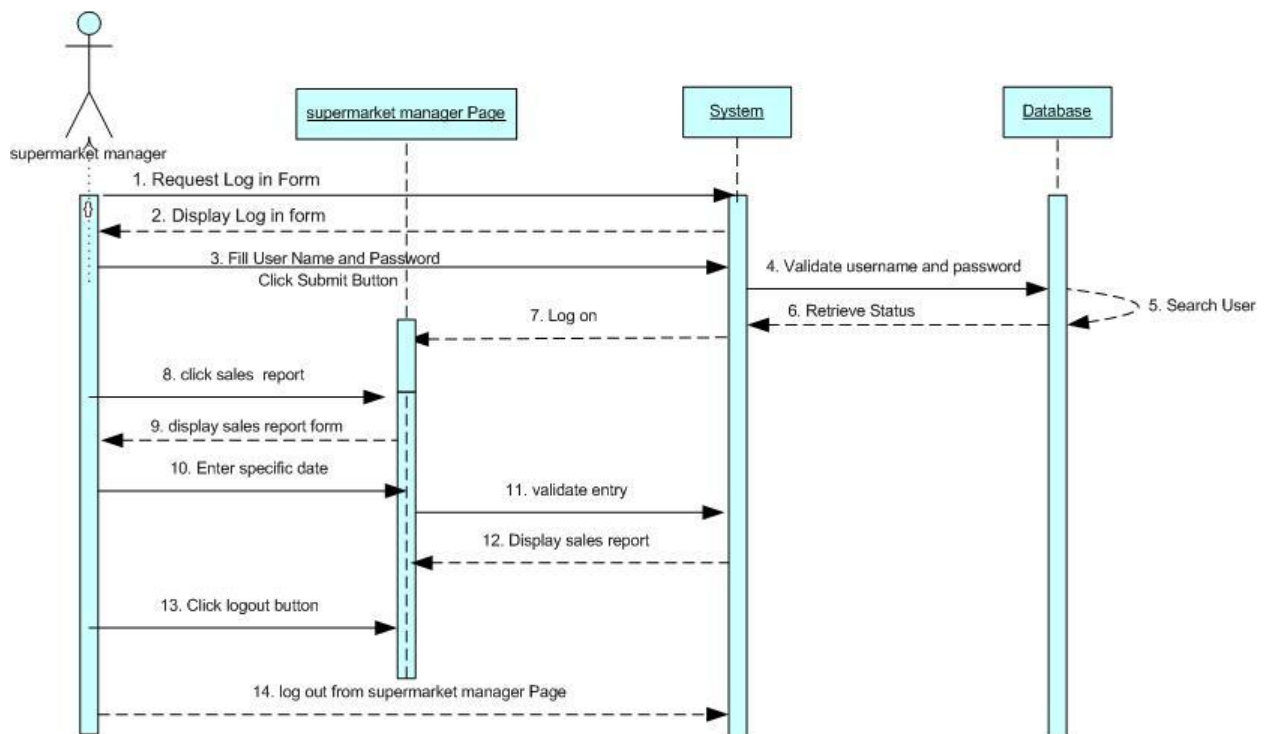


Figure 3.8. Supermarket Manager Sequence Diagram for sales report

This sequence diagram shows the sequence events of the Supermarket Manager for sales report. The sequences of the events are

- First the supermarket Manager sends a log in request to the system.
- The system displays the login form

- The supermarket Manager fills the username and password and submits the form and click confirm.
- The system validates the username and password of the user in database
- In database search the user name and the password
- Retrieve the status of the user
- If the user is authorized the log on to supermarket Manager page
- The supermarket manager clicks on sales report
- Enter specific Date
- The system validates entry
- The system displays sales report
- The supermarket Manager click the log out button
- And the system log out the supermarket Manager form the supermarket Manager page

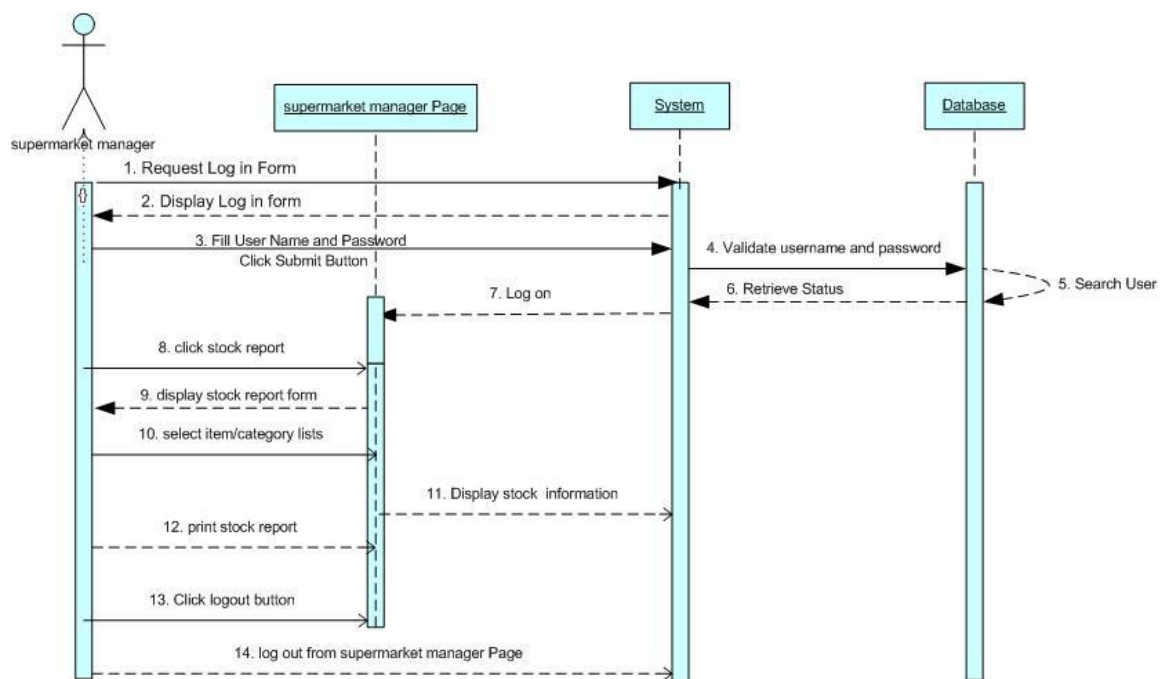


Figure 3.9. Supermarket Manager Sequence Diagram for stock report

This sequence diagram shows the sequence events of the Supermarket Manager for stock report. The sequences of the events are

- First the supermarket Manager sends a log in request to the system.
- The system displays the login form

- The supermarket Manager fills the username and password and submits the form and click confirm.
- The system validates the username and password of the user in Database
- In database search the user name and the password
- Retrieve the status of the user
- If the user is authorized the log on to supermarket Manager page
- The supermarket Manager clicks on stock report
- Select item/category list
- The system displays stock information
- The supermarket Manager prints stock report
- The supermarket Manager click the log out button
- And the system log out the supermarket Manager form the supermarket Manager page

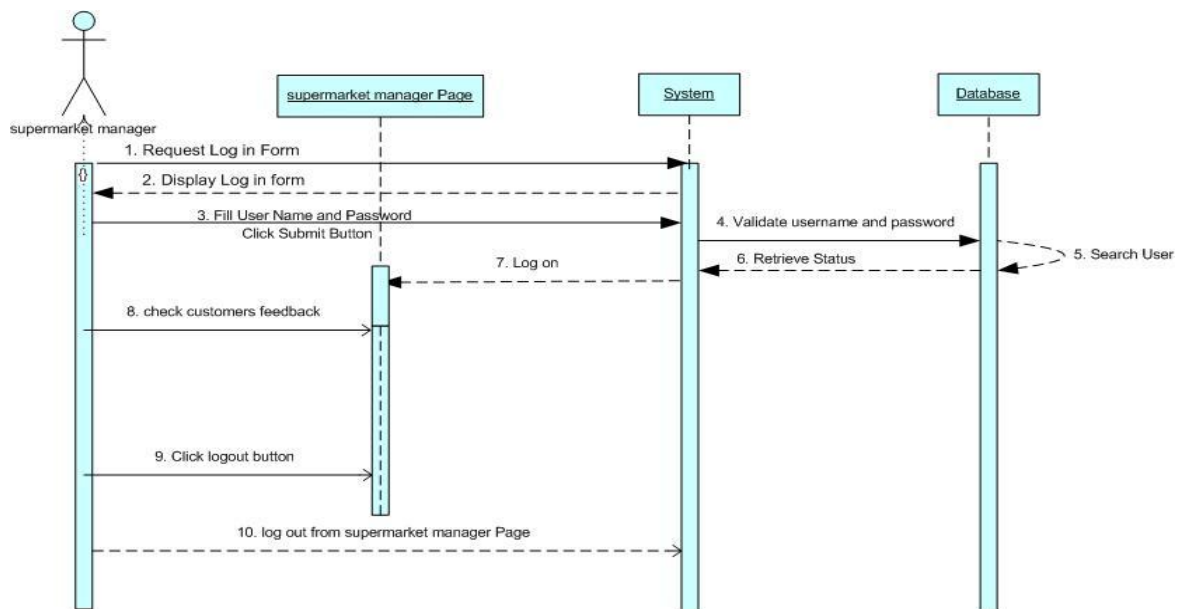


Figure 3.10. Supermarket Manager Sequence Diagram for customer feedback

This sequence diagram shows the sequence events of the Supermarket Manager for checking customer feedback. The sequences of the events are

- First the supermarket Manager sends a log in request to the system.
- The system displays the login form

- The supermarket Manager fills the username and password and submits the form and click confirm.
- The system validates the username and password of the user in Database
- In database search the user name and the password
- Retrieve the status of the user
- If the user is authorized the log on to supermarket Manager page
- The supermarket Manager check customer feedback
- The supermarket Manager click the log out button
- And the system log out the supermarket Manager form the supermarket Manager page

3.5.5 State chart diagrams

State chart diagrams describe the behavior of an individual object as a number of states and transitions between these states. A state represents a particular set of values for an object.

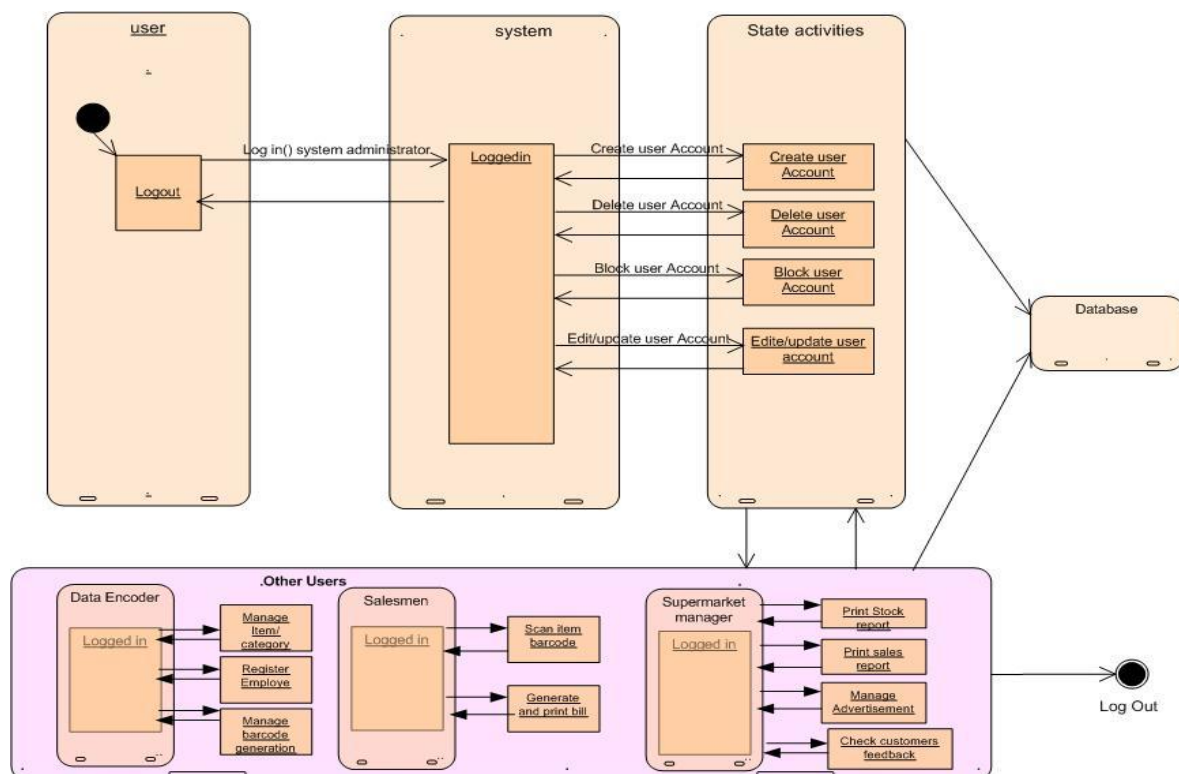


Figure 3.11.state chart diagram

The above state chart diagram describes states of the system. The users are logged in to the system and give their services.

3.5.6 Activity diagrams

An activity diagram describes a system in terms of activities. Activities are states that represent the execution of a set of operations. The completion of these operations triggers a transition to another activity.

The activity diagram of the system listed below,

1. Create user account activity Diagram for system Administrator

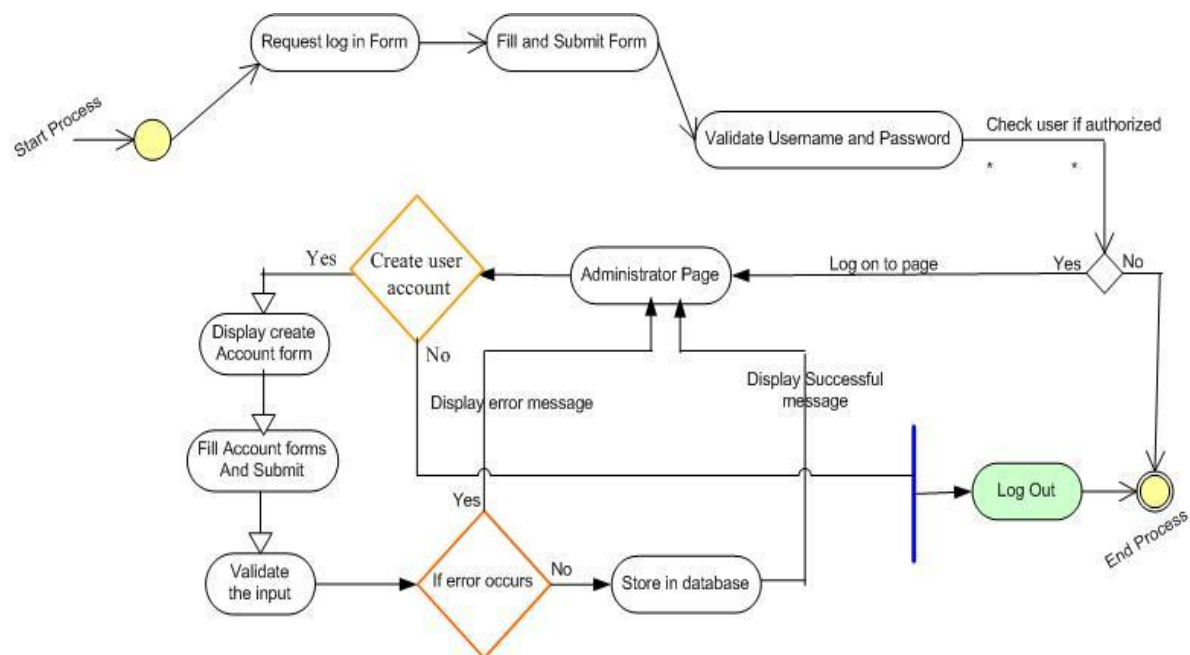


Figure 3.12.Create user account Activity Diagram

Creating account of users is performed by system administrator of supermarket management system. First the administrator logs in to the system then click on the button of create account. Then the system administrator fills all necessary attributes username and password, user role, employee name and click on submit button. If the inputs for attributes are correct it stores to the database and displays a successful creating user account message else it displays an error message then the administrator logout from administrator page.

Users Log on to system Activity Diagram

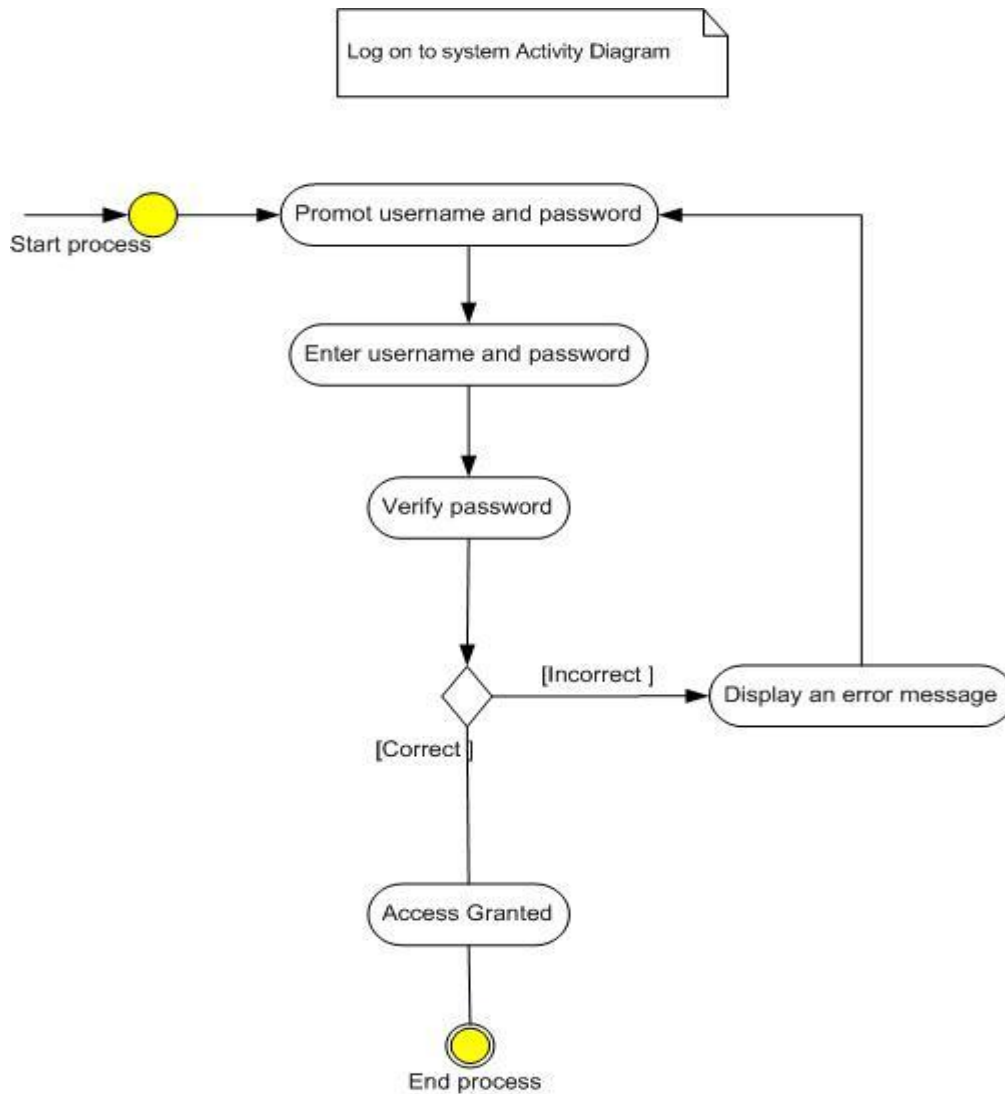


Figure 3.13.Log on to system Activity Diagram

The above figure shows the steps taken as a user logs on the system. Access is only granted if correct username and password is entered. If user enters incorrect username/password combination the system displays error message. Once access is granted the user can use the system.

Data encoder Activity Diagram

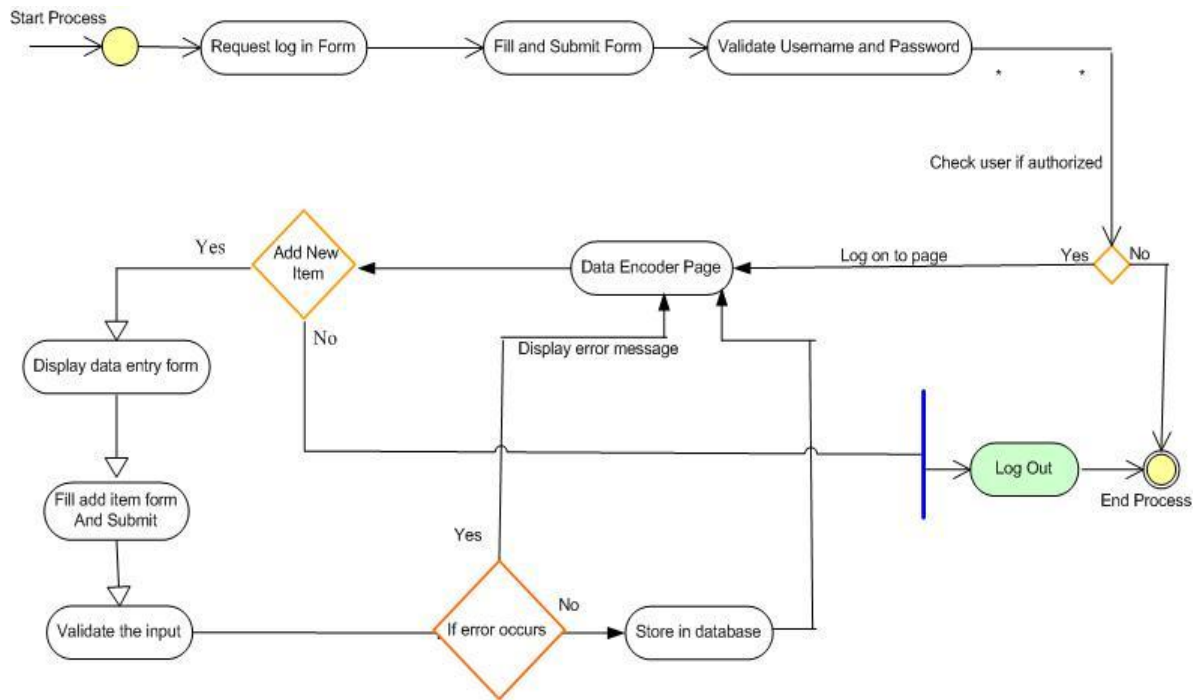


Figure 3.14.Data encoder Add item Activity Diagram

Data encoder performs different activities in the supermarket management system. One of the responsibilities of data encoder is to add new items to the database. The data encoder follows the following activity events to add items to the database. First the Data encoder log in to the system then clicks on the button of new item. Then the Data encoder fills all necessary item details and Click save button. If the inputs for the attributes are correct it stores to the database and displays a successful add item message else it displays error message then the data encoder logout from data encoder page.

Salesmen activity diagram

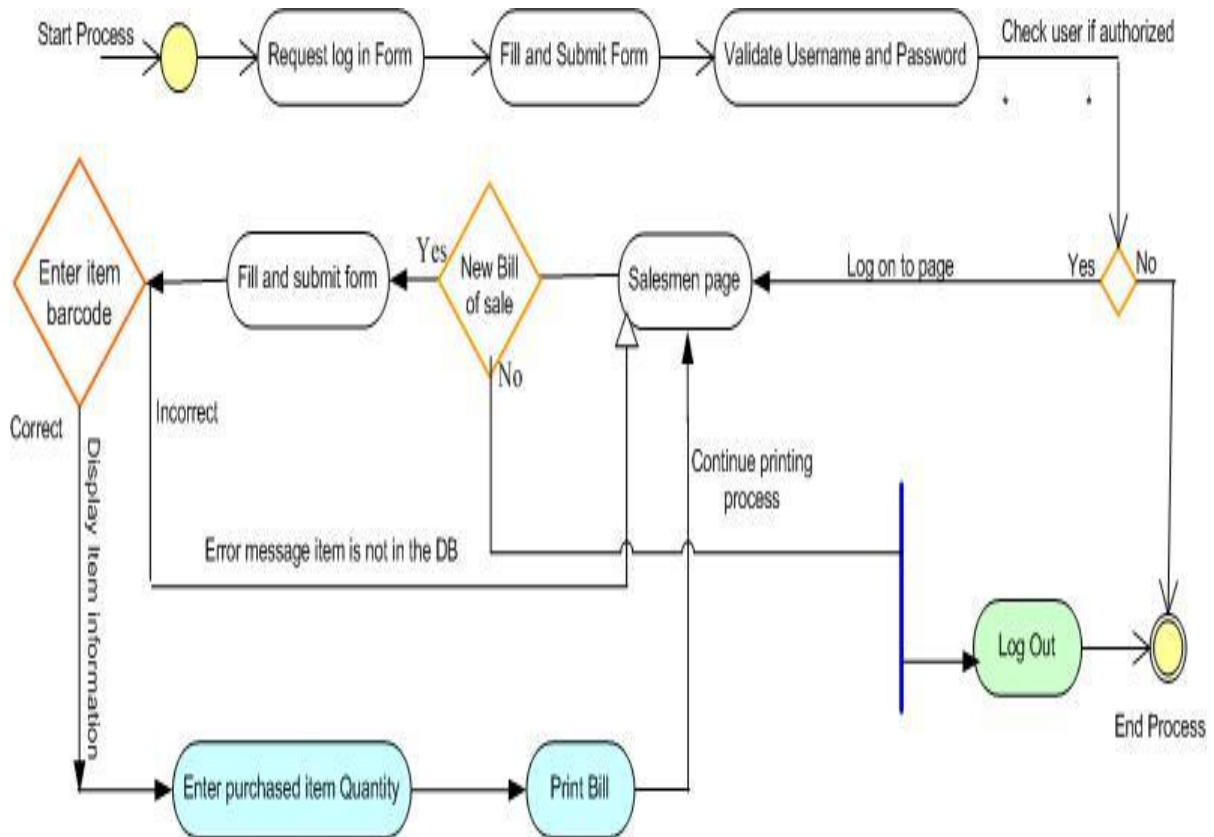


Figure 3.15.Salesmen generating bill Activity Diagram

The main responsibility of the salesmen is generating bill to customer. First salesmen log in to the system then click on new bill of sale button. Then the salesman fills all necessary fields and Click save button. The salesman enters item barcode. The system validates for the inputs if correct it displays the item information and enters the purchased item quantity and print bill else it displays an error message then the salesmen logout from salesmen page.

Supermarket Manager Activity Diagram

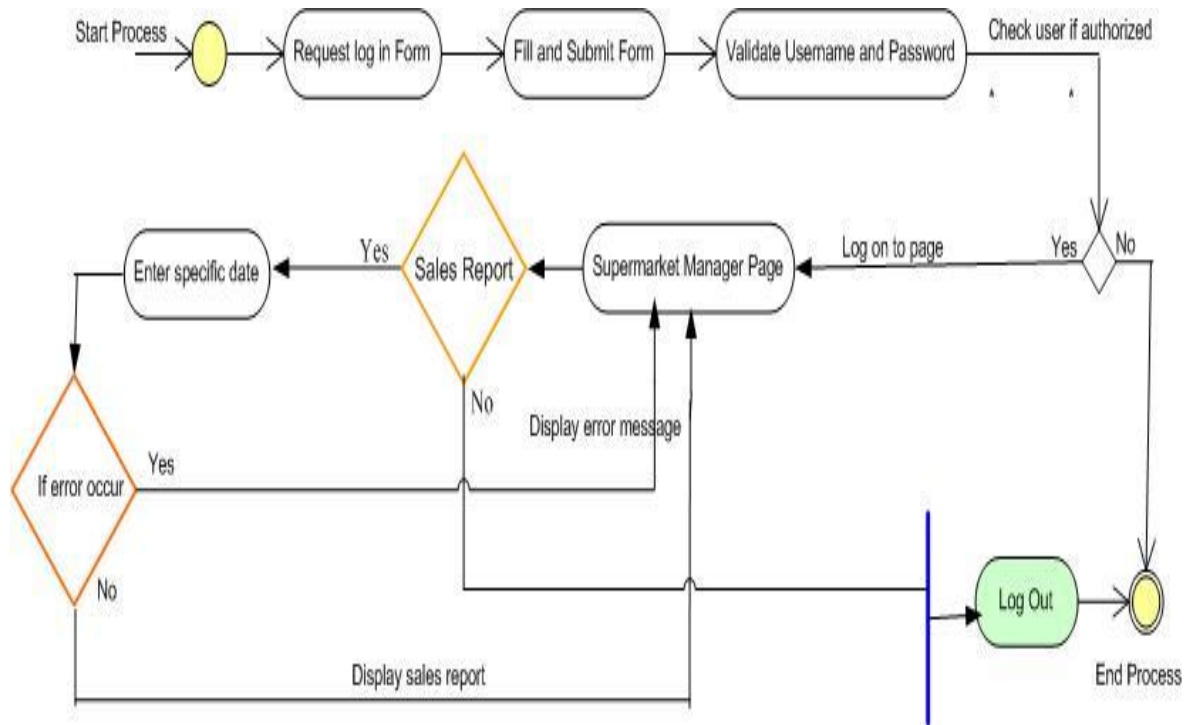


Figure 3.16.sales report Activity Diagram

The main responsibility of the supermarket manager is managing the sales activities of the supermarket. The supermarket manager checks sales report, first by log in to the system then click on the sales report button. Then enters specific date and the system validates the input if correct it displays the sales report for the specified date else it displays an error message then the supermarket manager logout from supermarket manager page

CHAPTER FOUR

SYSTEM DESIGN

4.1 INTRODUCTION

System design is the transformation of the analysis model into a system design model. During system design, we define the design goals of the project and decompose the system into smaller subsystems that can be realized by individual teams. we also select strategies for building the system, such as the hardware/software platform on which the system will run, the persistent data management strategy, the global control flow, the access control policy, and the handling of boundary conditions. The result of system design is a model that includes a clear description of each of these strategies, subsystem decomposition, and deployment diagram representing the hardware/software mapping of the system.

During system design, we focus on the processes, data structures, and software and hardware components necessary to implement it. The challenge of system design is that many conflicting criteria and constraints need to be met when decomposing the system.

4.1.1 Design goals

Supermarket management system is developed to enhance flexible and reliable web based management system of the supermarket. The goal of designing this system is listed below:

- To have Correct output for correct input
- To reuse the source code of the system and to easy in maintenance
- To have good system efficiency by writing clear algorithm
- To have the system good performance in response time and store data
- To make the system convenient to use, easy to learn and, reliable, safe, and fast maintenance: because of the architecture follow to design the system it is maintainable. The goal of this system design is to make easy maintainable and reuse.

4.2 Proposed software architecture

4.2.1 Overview

The system architecture is describes the subsystem decomposition in terms of subsystem responsibilities, dependencies among subsystems, subsystem mapping to hardware, and major policy decisions such as control flow, access control, and data storage.

The system architecture of this project is three tire architecture includes;

- The **presentation tier** contains the UI (User Interface) elements of the site, and includes all the logic that manages the interaction between the users. Presentation tire also called the Client tier, is responsible for the presentation of data, receiving user events, and controlling the user interface. The user interaction with the system is entirely through this layer.
- The **business tier** receives requests from the presentation tier and returns a result to the presentation tier depending on the business logic it contains.
- The **Data tier** is responsible for storing the application's data and sending it to the business tier when requested.

Logical View

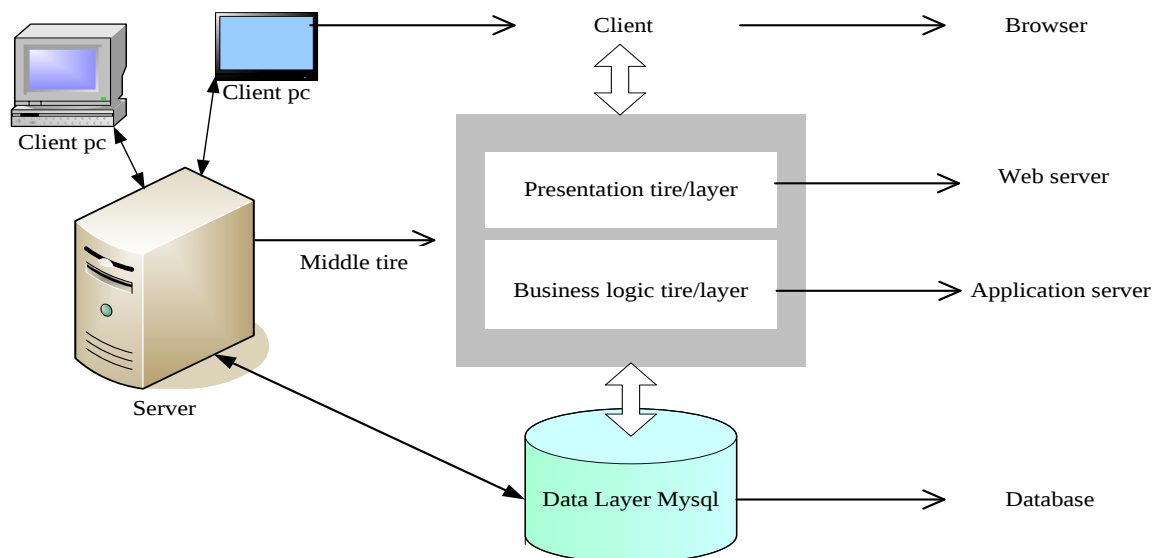


Figure 4.1. System architecture layer logical View

4.2.2 Subsystem decomposition

Supermarket management system is divided into different subsystem; the figure below shows the system decomposition.

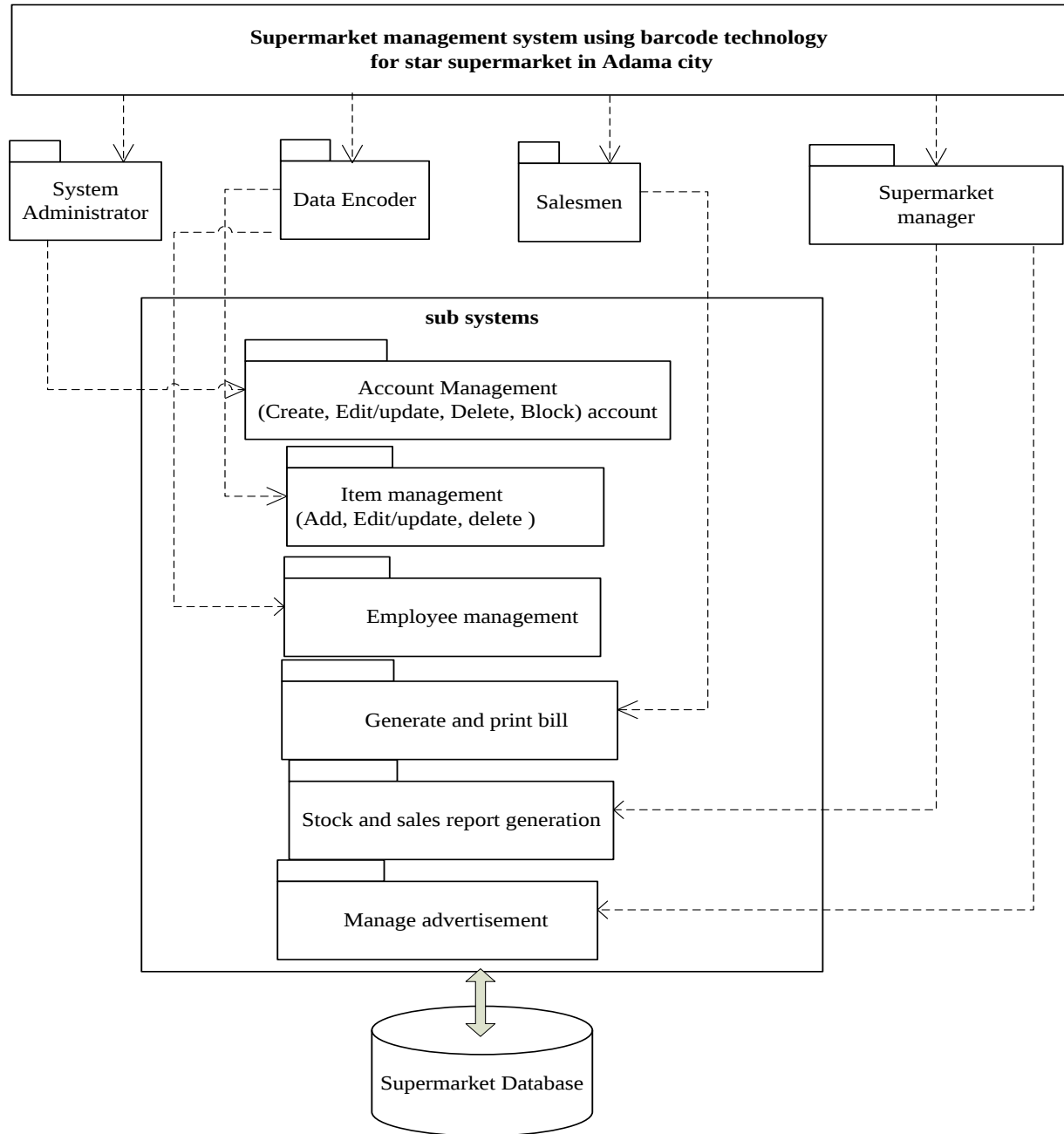


Figure 4.2.System Decomposition

Those subsystems perform different tasks:

- **Data encoder;** this subsystem used to Add, edit, delete and update items, register employee and store all data in the centralized database.
- **System administrator :** this subsystem used to create, edit/update, delete and block user account
- **Supermarket manager:** this subsystem is used to monitor reports of the stock and sales, manage advertisements.
- **Salesmen :** this subsystem is used to sale items and generate receipts to customers

4.2.3 Persistent data management

Persistent data management describes the persistent data stored by the system and the data management infrastructure required for it. The data that are stored are very critical to the information exchange during the system's functionalities. Moreover, since the system is going to be accessed by different users, it should be able to keep its data consistently. For this reason the system needs to assure data integrity.

Mapping

In order to store information persistently we map objects into tables and the attributes into fields to the specific table based on the objects found on the system. Therefore, we identified the major tables that will be implemented on the selected DBMS. In the mapping process each class is mapped to its own table, each class attribute is mapped to a column in the table, an instance of a class represents a row in the table, and one-to-many associations are implemented with a buried foreign key. The mapping objects to tables are displayed as figure below.

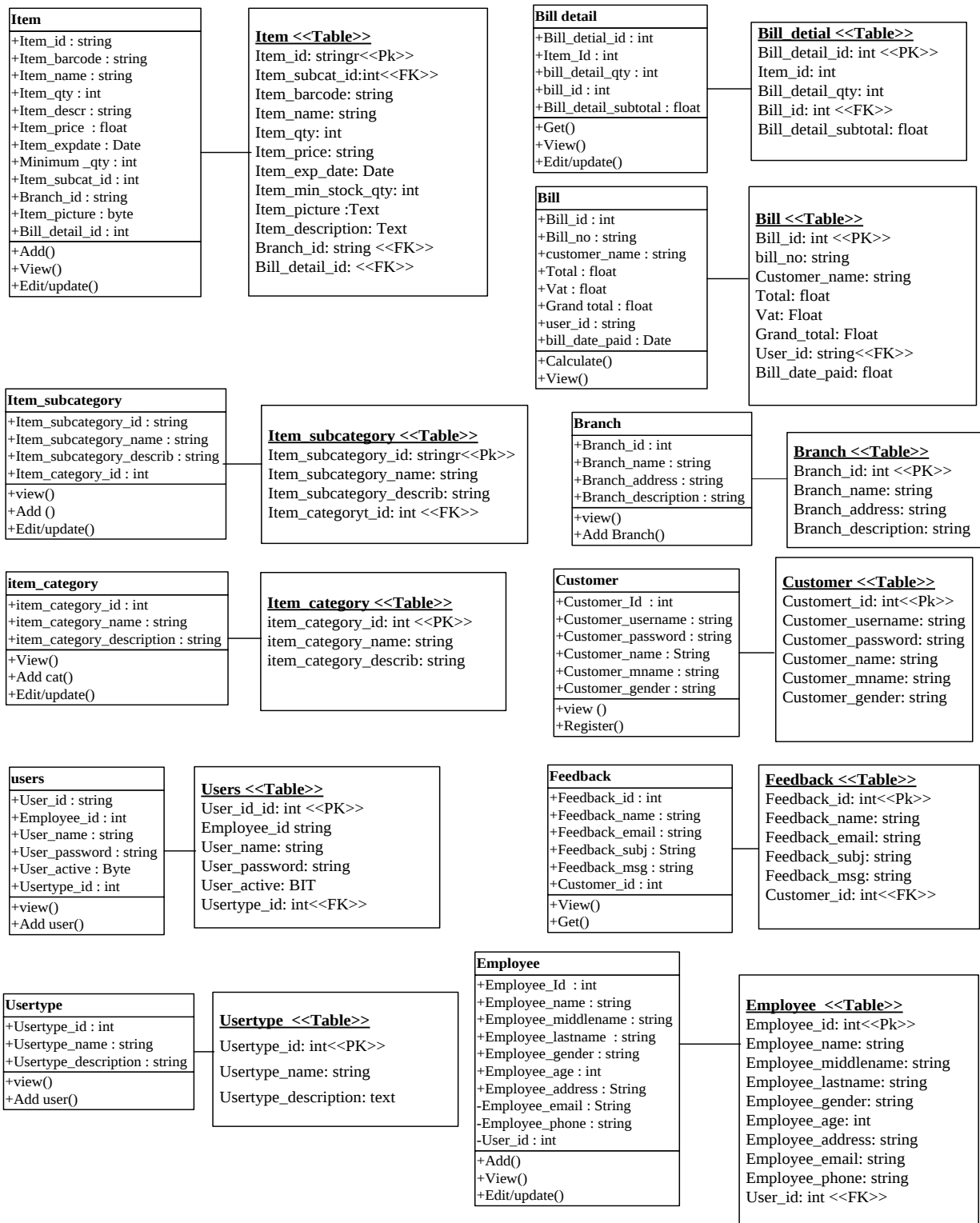


Figure 4.3.Persistent data management diagram

4.2.4 Component diagram

Component diagram shows components and dependencies. This type of diagrams is used in Component-Based Development (CBD) to describe systems with Service-Oriented Architecture (SOA). Component-based development is based on assumptions that previously constructed components could be reused and that components could be replaced by some other "equivalent" or "conformant" components, if needed.

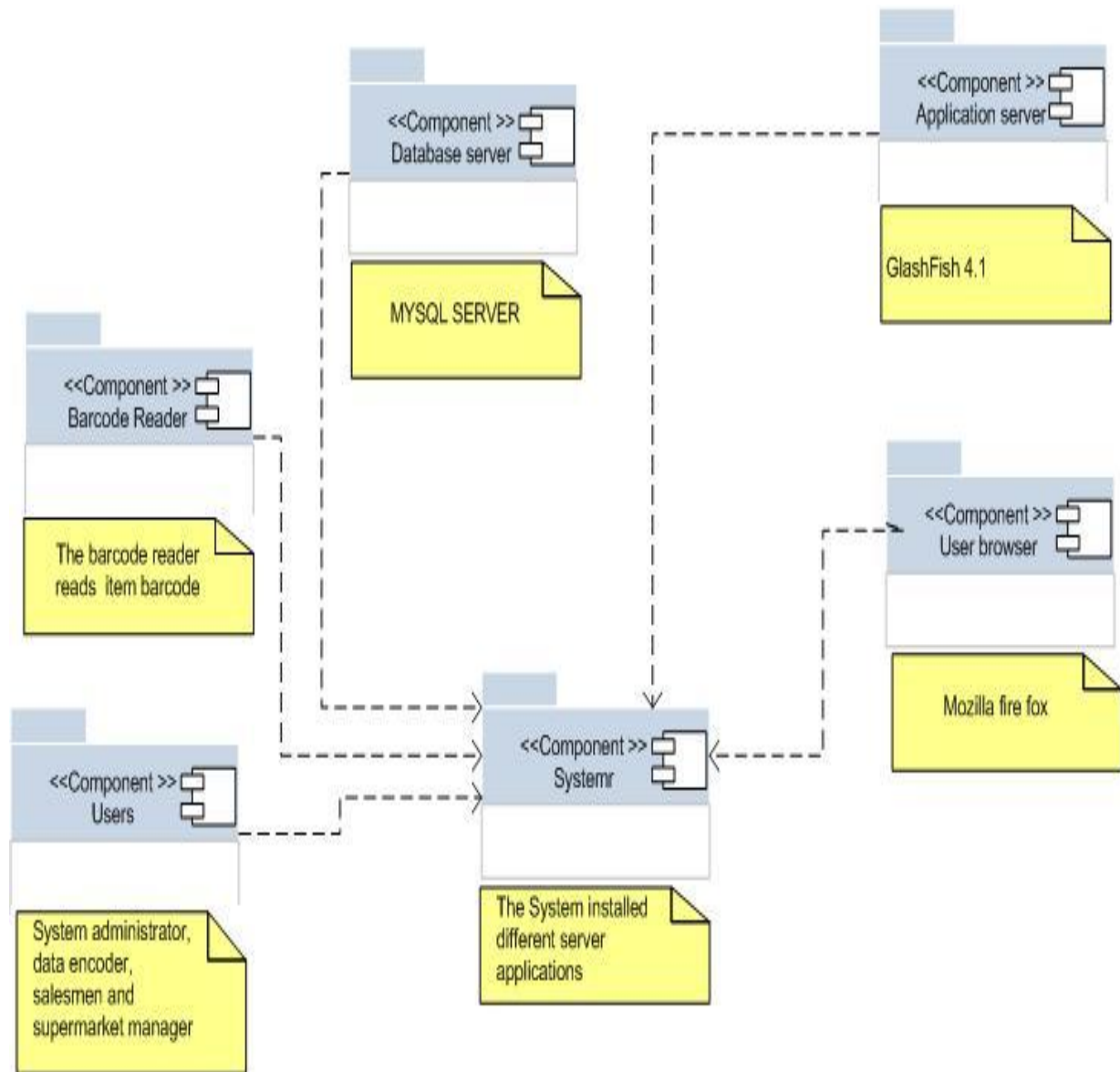


Figure 4.4.Component Diagram

4.2.5 Deployment diagram

It shows the run time system, such as how physical module code is distributed across various hard wares. It describes the physical architecture of the hardware and software in the system. They depict the software components, processors, and devices that make up the system's architecture. A deployment modeling depicts a static view of the run-time configuration of processing nodes and components that run on those nodes

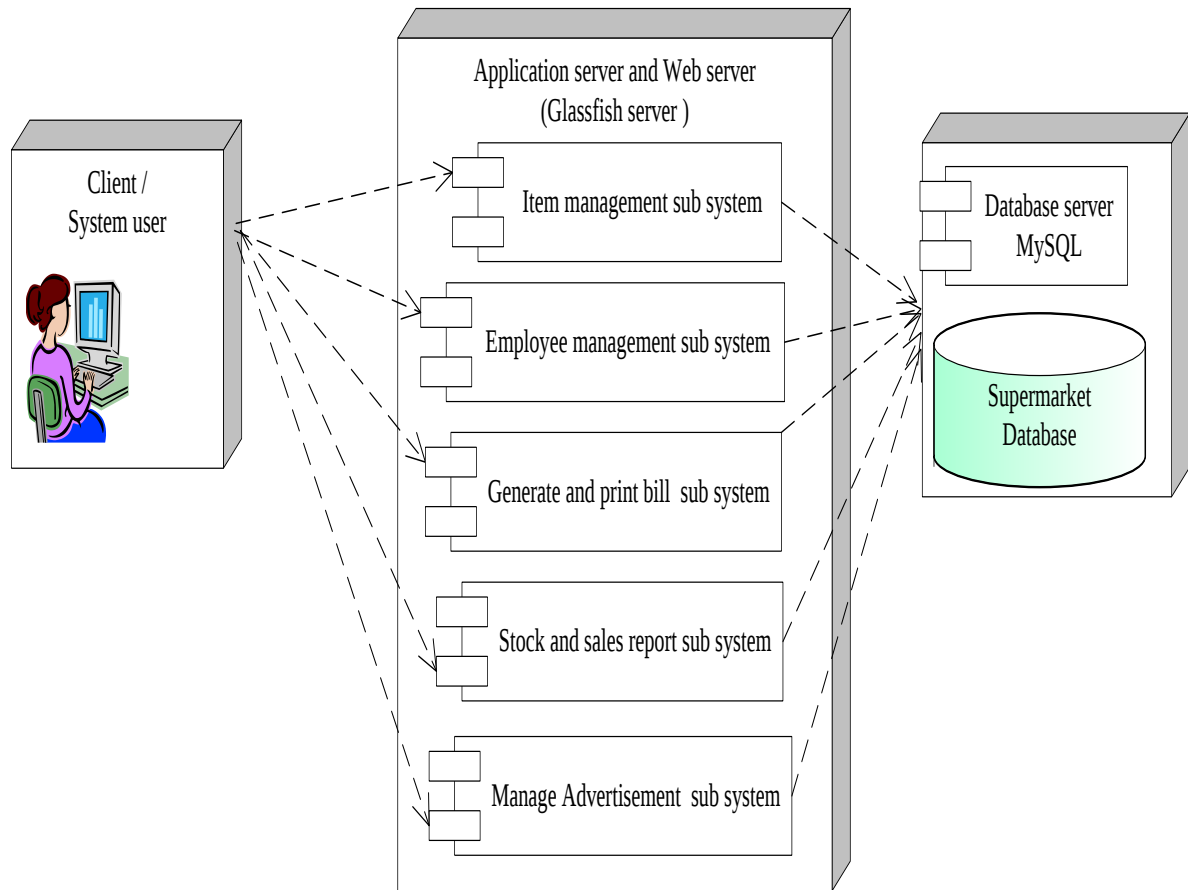


Figure 4.5.The system deployment diagram

The above deployment diagram shows the structure of run time system. From the figure we tried to identify the Hardware and software requirements of the system i.e. when the user access the system through the user interface and communicate with the system it needs a friendly user interface, in this project we used web server and glassfish server as a front end interfacing and the MySQL as a back end.

Database Tables

Table 4.1.Item table

Column Name	Data type	Null	Key	Description
item_id	String	Not null	Primary key	Describes item ID number
item_subcatagory_id	String	Not null	Foreign key	Describes item subcategory ID number
item_barcode	String	Not null		Describes barcode on the item
item_name	String	Not null		Describes item name
item_qty	Int	Not null		Quantity of item in stock
item_ descption	String	Not null		Description of item
item_price	Float	Not null		The price of item
item_exp_date	Date	Not null		Expiry date of item
Item_min_stock_qty	Int	Not null		Describes the minimum quantity the item becomes in the data base
Item_picture	Text	Not nul		Describes item picture
Branch_id	String	Not null	Foreign key	References branch_id field of branch table

Table 4.2.Employee table

Column Name	Data type	Null	Key	Description
emp_id	String	Not null	Primary key	Describes employee ID number
emp_fname	String	Not null		Describes employee name
emp_mname	String	Not null		Describes employee last name
emp_lname	String	Not null		Describes employee middle name
Gender	String	Not null		The employee position
Age	int	Not null		The employee age
Address	String	Not null		The employee address
E_mail	String	Not null		The employee e_mail
Phone	String	Not null		The employee phone
Branch_id	String	Not null	Foreign key	References branch_id field of branch table

Table 4.3.Bill table

Column Name	Data type	Null	Key	Description
Bill_id	Int	Not null	Primary key	Describes bill identifier
Bill_no	String	Not null		Describes the bill number
Bill_date_paid	date	Not null		Describes the date paid
Customer_name	String	Not null		Describes the customer name
user_id	String	Not null	Foreign key	The id of the user who make the bill
Total	Float	Not null		Describes the price of the item
Vat	Float	Not null		Describes the vat for the item
Grand_total	Float	Not null		Describes the total price of the item +vat

Table 4.4.Bill detail

Column Name	Data type	Null	Key	Description
Bill_detail_id	String	Not null	Primary key	References Bill_no field of Bill table
item_id	String	Not null	Foreign key	References item_id field of Item table
Bill_detail_Qty	Int	Not null		Describes the quantity of this bill
Bill__id	Int	Not null	Foreign key	References bill_id field of bill table
Bill_detail_subtotal	Float	Not null		Describes the subtotal price of the items

Table 4.5.item_subcategory

Column Name	Data type	Null	Key	Description
item_subcatagory_id	String	Not null	Primary key	References subcat_id field of item subcategory table
item_subcatagory_name	String	Not null		Name of item sub category
item_subcatagory_description	Text	Not null		Description of the sub category
itemcatagory_id	String	Not null	Foreign key	References itemcategory_id field of item category table

Table 4.6.Item_category

Column Name	Data type	Null	Key	Description
itemCatagory_id	String	Not null	primary key	Describes the category Id number
itemCatagory_name	String	Not null		Describes the category name
itemCatagory_descrpition	Text	Not null		Description of category

Table 4.7.Users table

Column Name	Data type	Null	Key	Description
user_id	String	Not null	Primary key	Describes the user id number
emp_id	String	Not null	Foreign key	References emp_id field of Employee table
user_name	String	Not null		Describes the user name of the user
user_password	String	Not null		Describes the password of the user
user_active	Bit	Not null		Describes the to enable and disable the user
user_type_id	Int	Not null	Foreign key	References user_type_id field of user type table

Table 4.8.User type table

Column Name	Data type	Null	Key	Description
User type_id	Int	Not null	Primary key	Describes the user type id number
User type_name	String	Not null		Describes the user type name
User type_description	String	Not null		Describes the user type description

Table 4.9.Customer table

Column Name	Data type	Null	Key	Description
Cust_id	String	Not null	Primary key	Describes the customer id
Name	String	Not null		
E_mail Address	String	Not null		Describes email of the customer
Password	String	Not null		

Table 4.10.Feedback Table

Column Name	Data type	Null	Key	Description
Feedback_id	String	Not null	Primary key	Describes Feedback id number
Name	String	Not null		Describes name of the customer who writes feedback
E_mail	String	Not null		Describes email of the customer
Subject	String	Not null		Describes subject Feedback
Feedback_detail	Text	Not null		Describes Feedback detail

Table 4.11.Branch

Column Name	Data type	Null	Key	Description
Branch_id	String	Not null	Primary key	Describes branch id number
Branch_name	String	Not null		Describes Name of branch supermarket
Branch_address	String	Not null		Describes Branch address
branch_description	Text	Not null		

4.3 Access control and security

In this system, different actors have access to different functionality of the system. During analysis, we modeled these distinctions by associating different use cases to different actors. During system design, we model access by examining the object model, by determining which objects are shared among actors, and by defining how actors can control access. Depending on the security requirements on the system, we also define how actors are authenticated to the system. Since the system administrator have all authority to make any change, item and employee management is done by the data encoder, generate and print bill is done by salesmen and generating stock and sales report and managing advertisement are done by supermarket manager.

The system must have high security to prevent intrusions and data theft. To do this every user must enter into the system using his/her specified username and password. Whenever a user enters his /her password, the system must validate the input. To show the access control we use access control matrix that each row in the access matrix represents a different access view of the classes

listed in the columns. All of these access views should be consistent. Usually, however, access views are implemented by defining a subclass for each different type of (actor, operation) tuple. The process of verifying the association between the identity of the user or subsystem and the system is called authentication.

Table 4.12.Access-control matrix

Subsystem	Operation	Actors			
		System Administrator	Data encoder	salesmen	Supermarket manager
Database Subsystem	Login ()	✓	✓	✓	✓
Account management	Create account()	✓			
	Edit/update account()	✓			
	Delete account()	✓			
	Block account()	✓			
Item management	Add item ()		✓		
	Search item()		✓		
	Update/edit item()		✓		
	Delete item()		✓		
Employee management	Register employee()		✓		
	Edit/update employee()		✓		
Generate and print bill	Create bill()			✓	
	Edit/update()			✓	
	delete()			✓	
	view()			✓	
	Print bill()			✓	
Generate reports	Stock report()				✓
	Sales report()				✓
	Print report()				✓
	View()				✓
Manage advertisement	Post new()				✓
	Update()				✓
	Delete()				✓
	View()				

4.4 Global software control

Control flow is the sequencing of actions in a system. In object oriented systems, sequencing actions includes deciding which operations should be executed and in which order. These decisions are based on external events generated by an actor. When a user wants to use the system, he/she should first login to the system with a user name and a password and submit it. Then the system will cross check the login details with the database. If the details are valid, the users can use the system and be directed to the homepage for that user type. Figure 4.6 below shows the different interface for the user according to their permission and privilege. Once the page is displayed, the user can select whatever he/she wants from the menu and continues to use the functionality that is provided by the system. And whenever the user wants to terminate the system he/she needs to logout and return back to home page.

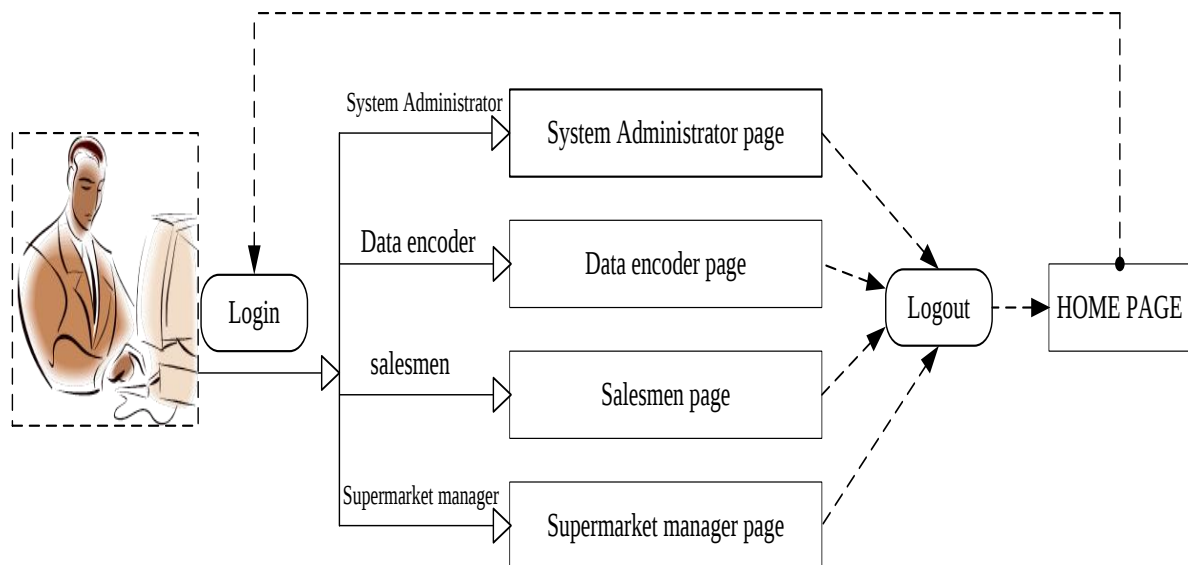


Figure 4.6. Control flow of the system

4.5 Boundary conditions

Boundary conditions is used to decide how the system is started, initialized, and shut down, and we need to define how we deal with major failures, such as data corruption, whether they are caused by a software error or a power outage. In this section system installation, start up and shut down will be identified.

System installation – supermarket management system web based application must be installed in any platform and the Net beans IDE which contains glassfish server and MySQL server must be installed on it.

Startup – the system is initialized by the request of an authorized user of the system. On start up the system will initialize the login function of the system and the user is expected to give an authorized user name and password. Once the user is logged onto the system, he/she will have the right to access everything as of his/her level of permission

System shutdown -The system shutdowns when he/she clicks *close* button on the browser. The administrator must detect whether it was properly shut down or not and needs to be able to perform consistency checks and repair corrupted data, if necessary.

When examining boundary conditions, we also need to investigate exceptional cases which is an exception that an unexpected event or error that occurs during the execution of the system such as user error that is input data mistakenly that are out of bounds, system failure or software bug.

Modeling Boundary Conditions

Boundary conditions are best modeled as use cases with actors and objects. We call it boundary use cases or administrative use cases.

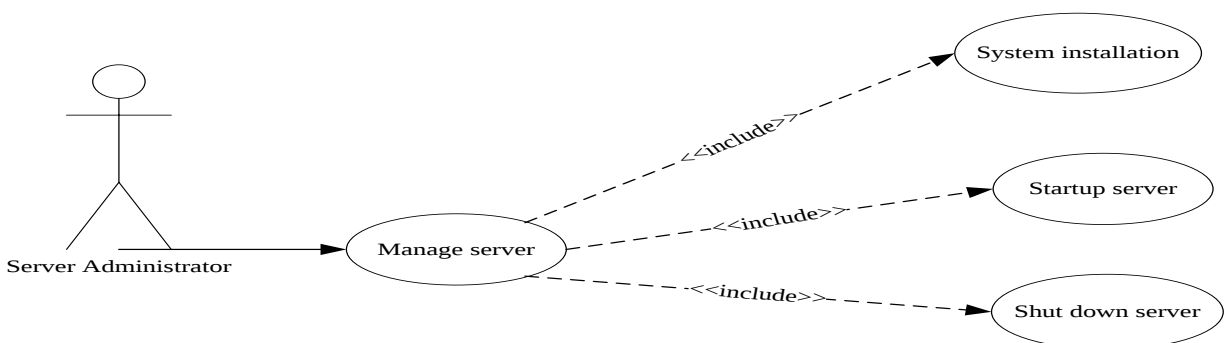


Figure 4.7. Use case for boundary conditions

Use case description

Use case name: manage server

Actor: server administrator

Includes: installation, start-up and shutdown/ termination

Description: the server administrator turns the power on of the server to start up and install the web application and check the room is in the normal temperature, air conditioned and free of any interferences and electric shock. The server administrator also shutdown properly as needed and handle the exceptions that may occur such as un-expected failure like errors, external problems and bugs during power off in this case the administrator can prevent by using UPS to the server computer and backup the system regularly and by using regularly scan the system.

Post condition: the system installed, start-up and shutdown as required

CHAPTER FIVE

IMPLEMENTATION AND RESULT

The system is implemented based on the design explained in Chapter 4. The implementation methodologies of the most interesting and significant part of the system are explained in this chapter. Implementation is the realization of an application, or execution of a plan, idea, model, design, specification, standard and algorithm.

5.1 Selection of programming language and platform

The website and the database are hosted on the server of the supermarket. The website uses Glass Fish web application server and the database works on the MySQL server. Java is the major programming language for coding the web pages. It also corporates with HTML, java script, jQuery and CSS to serve various purposes such as decorating the interface nicely and allowing update of the page content without reloading the page.

TWedge 3.1 software is needed as interface to automatically forward device data to applications (and even other devices) via multiple methods.

The system requires Android software stack to run. It also requires Wi-Fi capability and Bluetooth device. Therefore, the mobile phone must have the Android platform with a built-in camera and Wi-Fi in order to use this system. The mobile phone must also have Zxing android barcode scanner Application and Gate blue android application software installed on it.

5.2 Algorithms used

We used the pseudo code algorithm. Pseudo code is a simple way of writing programming code in English. It is not an actual programming language. It uses short phrases to write code for programs before we actually create it in a specific language. Once we know what the program is about and how it will function, then we can use pseudo code to create statements to achieve the required results for our program.

Login algorithm using pseudo code

1. Run the log in page
2. Enter user name
3. Enter password
4. Get login
5. If user compared with user roll “Administrator” is equal to 0, then
 - 5.1 Display Administrator home page
6. If the user compared with user roll “Data encoder” is equal to 0, then
 - 6.1 Display Data encoder page
7. If the user compared with user roll “supermarket manager” is equal to 0, then
 - 7.1 Display supermarket manager page
8. If the user compared with user roll “sales men” is equal to 0, then
 - 8.1 Display sales men page
9. If the user enters the wrong user name or password, then
 - 9.1 The system display error message “Error in user name or password”.

Java code

```
if (username == null || password == null || username == "" || password == "") {
    response.sendRedirect("login.jsp");
} else {
    try {
        String sql = "SELECT * FROM empuser_view where user_name='" + username
+ "' And user_password='" + password + "' And user_active=1";
        stmt = conn.DbConnector().prepareStatement(sql);
        ResultSet rs = stmt.executeQuery(sql);

        if (rs.next()) {
            //Retrieve by column name
            String id = rs.getString("user_id");
            String type = rs.getString("usertype_tbl_id");
```

```

        String name= rs.getString("user_name");
        String role= rs.getString("usertype_tbl_name");
        session.setAttribute("UID", id);
        session.setAttribute("UType", type);
        session.setAttribute("UName", name);
        session.setAttribute("URole", role);
        response.sendRedirect("index.jsp");
    }
    else{
        response.sendRedirect("login.jsp?login_attempt=1");
    }

```

Pseudo code for item expiry date

```

Declare Date itm_exp_date, current date
Declare String Color=null
Declare long daysleft=0
Compute daysleft = itm_exp_date - current date
Declare red, yellow, lightgreen
If daysleft is greater than or equal to 0
    Display yellow color
Else If daysleft is less than 0 and daysleft is greater than -30
    Display red color
Else
    Display light green color

```

Java code

```

long daysleft = 0;
String color = null;
date_difference obj = new date_difference();
daysleft = obj.DaysRemaining(itm_exp_date);
if (daysleft >= 0) {
    color = "#df0024";
}

```

```

    } else if (daysleft < 0 && daysleft > -30) {

        color = "#fff99d";
    } else {
        color = "lightgreen";
    }

```

Item availability pseudo code

```

Declare int itmqty, item_min_qty
Declare String Color=null
Compute  daysleft = itm_exp_date - current date
Declare String red, yellow, lightgreen
If itmqty is less than or equal to 1
Display red color
else if itmqty is less than or equal to item_min_qty and itmqty is greater than or equal
to 2
Display yellow color
Else
Display light green color

```

Java code

```

long itmqty = 0;
String color = null;
itmqty _difference obj = new itmqty _difference();
itmqty = obj. itmqty Remaining(item_min_qty);
if ( itmqty <= 1) {
    color = "#df0024";
} else if (itmqty <= item_min_qty && itmqty >=2) {
    color = "#fff99d";
} else {

    color = "lightgreen";
}

```

5.3 Methods Used

There are various design patterns already in existence which provide considerable benefits when applied. One such pattern is the MVC (Model-View-Controller) paradigm, which divides the system into three interoperable components:

Model: Represents the business data and any business logic that govern access to and modification of the data. The model notifies views when it changes and lets the view query the model about its state. It also lets the controller access application functionality encapsulated by the model.

View: The view renders the contents of a model. It gets data from the model and specifies how that data should be presented. It updates data presentation when the model changes. A view also forwards user input to a controller.

Controller: The controller defines application behavior. It dispatches user requests and selects views for presentation. It interprets user inputs and maps them into actions to be performed by the model. In a web application, user inputs are HTTP GET and POST requests. A controller selects the next view to display based on the user interactions and the outcome of the model operations.

We used JQuery -validation, JQuery UI and bootstrap in developing this web application system.

JQuery-validation

The jQuery - Validation plugin makes client side validation trivial, while offering lots of option for customization. The plugin comes bundled with a useful set of validation methods, including URL and email validation.

JQuery UI

JQuery UI plugin is used for the user to select a date from a pop calendar, ensuring a correct entry.

Bootstrap

Bootstrap is used for mobile first front-end framework for faster and easier web development. It contains beautiful and functional built-in components which are easy to customize.

5.4 Security and Privacy

User access control

User access control is implemented in this supermarket management System for separating the access privileges in respect of different kinds of users. The username, password and user type are assigned to the user once the account is created. Users have to login to the system (as shown in Figure 5.1) before use. Then the system will cross check the login details with the database. If the details are valid, the users can use the system and be directed to the homepage for that user type. Username and user type are saved in session in java for further usage.

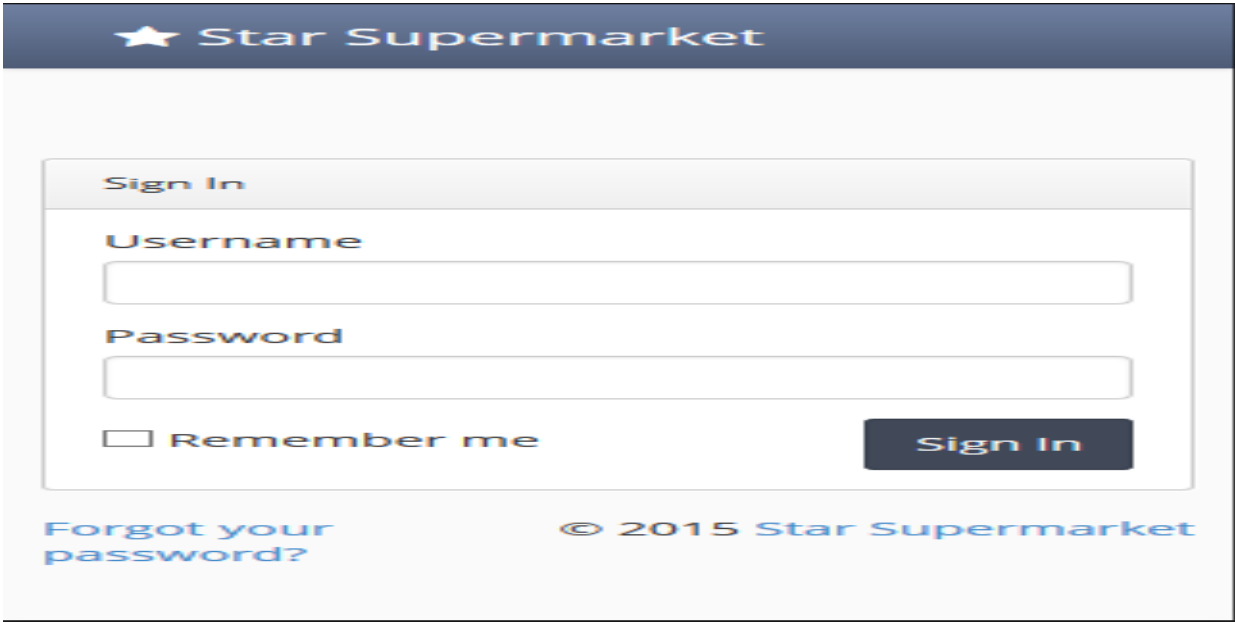
The image shows a web browser window displaying the login page for 'Star Supermarket'. At the top, there is a dark blue header with a white star icon and the text 'Star Supermarket'. Below the header, the main content area is white. It features a 'Sign In' section with a light gray border. Inside this section, there are two text input fields: 'Username' and 'Password'. Below the 'Password' field, there is a checkbox labeled 'Remember me'. To the right of the checkbox is a dark blue button with the text 'Sign In' in white. Below the 'Sign In' section, there is a link that says 'Forgot your password?' on the left and a copyright notice '© 2015 Star Supermarket' on the right.

Figure 5.1.Login page

Passwords

Password protection was a system requirement specified by the non-functional user requirements. Password protection is only required within the system maintenance interface to prevent unauthorized user accessing user accounts, sales and inventory information. Therefore the username and password for the system has been defined in the 'login1.jsp' file. When a user logs onto the system, through the file login.jsp, this file then activates login1.jsp, which checks the user's supplied password against the predefined one, if there is a match, access is granted onto the administrator, data encoder, sales men and supermarket manager system otherwise the

user is advised login failure. If a user's login is successful, then a session is started, signifying that a valid user is working on the system.

Session Enabling

After a session has been initialized, a session variable is created for the user, this variable is currently set to true and will expire when the system is idle. When this occurs, the user is redirected to an error page and is advised to login again.

5.5 System Functionality

Change of Password:

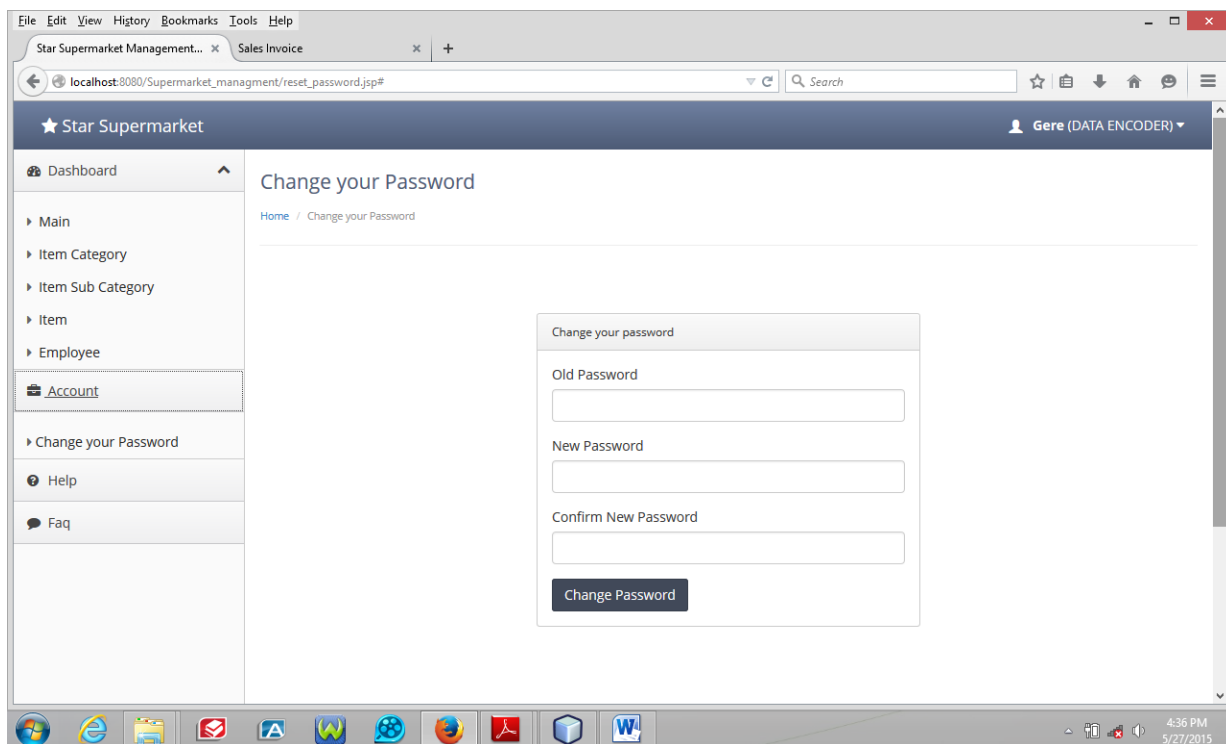
The screenshot shows a web browser window with the address bar displaying 'localhost:8080/Supermarket_management/reset_password.jsp#'. The page title is 'Star Supermarket' and the user is logged in as 'Gere (DATA ENCODER)'. The left sidebar contains a navigation menu with options: Dashboard, Main, Item Category, Item Sub Category, Item, Employee, Account (highlighted), Change your Password, Help, and Faq. The main content area is titled 'Change your Password' and contains a form with three text input fields labeled 'Old Password', 'New Password', and 'Confirm New Password'. Below these fields is a 'Change Password' button. The Windows taskbar at the bottom shows various application icons and the system clock indicating 4:36 PM on 5/27/2015.

Figure 5.2.Change of Password

The users can change their Password by clicking the 'CHANGE YOUR PASSWORD'. After clicking that button the above form pops up and there are three textbox fields with old password, new password, confirm new password. The users have to fill these textboxes in order to change their password and then click the 'CHANGE PASSWORD' button on this form.

Viewing, Editing and Deleting Records of Items

Records are viewed by clicking item, when a user clicks on this, the item details is displayed in full. To edit a record, when the 'edit' button is clicked, then a query is issued and the required data is retrieved from the database and returned to pre-fill a form (see Figure 5.3 below), the data in the form can then be altered and saved. A record set can be deleted by clicking on the 'delete' button.

Star Supermarket Management System - Items Page

Dashboard

- Main
- Item Category
- Item Sub Category
- Item
- Employee
- Account

Items

Home / Items

+ New Item Barcode Number Search

#	Branch	Item Name	Barcode Number	Item Qty	Item Price	Item Category	Item Sub category	Minimum Qty	Expire Date	Item picture
8	Adama Branch	Smart	6460458062342	400	80	Cosmetics	Powder	10	2017-06-03 00:00:00.0	Smart
9	Adama Branch	Organza shampoo	9835652400	300	90	Oil	Liquid vegetable oil	10	2017-06-03 00:00:00.0	Organza shampoo
10	Addis Ababa Branch	Riri baby food	126587240946	400	70	Food	Biscutes	10	2017-06-03 00:00:00.0	Riri baby food

Edit/Delete

Figure 5.3.Edit/delete item

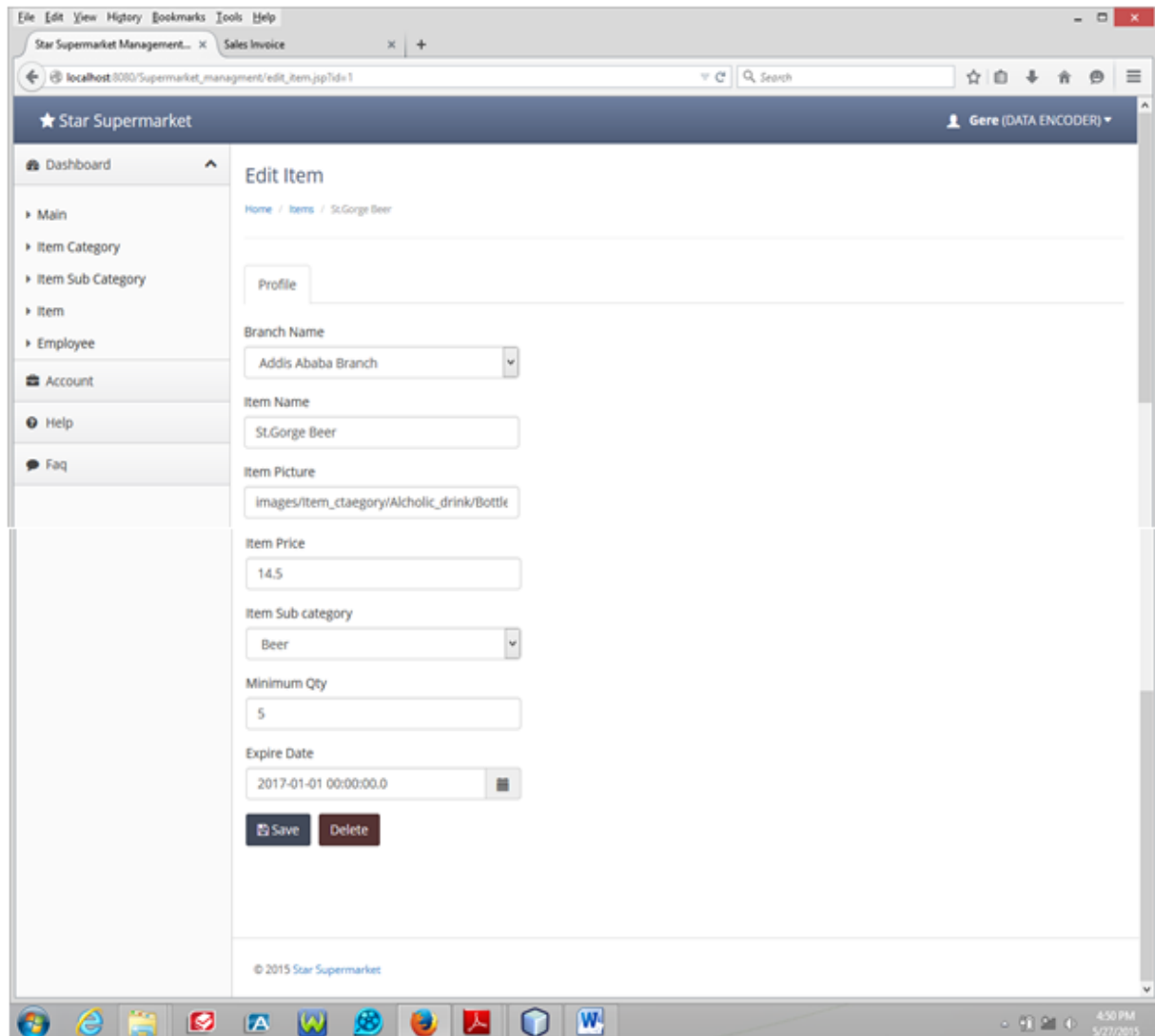


Figure 5.4.edit item record

Adding items Records

All data are added into the system via text fields ([see in figure 5.5 below](#)). When the user clicks the save button each and every field is checked against the constraints that the variable must meet. If for any reason the input does not meet the constraint defined for that particular variable the input will not succeed and the user will be advised accordingly through an error message.

Star Supermarket Management... Sales Invoice

localhost:8080/Supermarket_management/add_item.jsp

Star Supermarket Gere (DATA ENCODER)

Dashboard

- Main
- Item Category
- Item Sub Category
- Item
- Employee
- Account
- Help
- Faq

Add New Item

Home > Items > Add New Item

Profile

* Marked fields are mandatory.

* Branch Name
--Select Branch--

* Item Name

* Item Barcode number

Item Picture
 No file selected.

* Item Qty

* Item Price

* Item Sub category
--Select Item Sub Category--

* Minimum Qty

* Expire Date
2015-05-27 YYYY-MM-DD

© 2015 Star Supermarket

Figure 5.5.Adding items Record

Searching for Records

The search facility available on the system uses a “wild-card” to perform a query on all available fields within a given table. The wild card matches any inputs such as strings, characters and numbers.

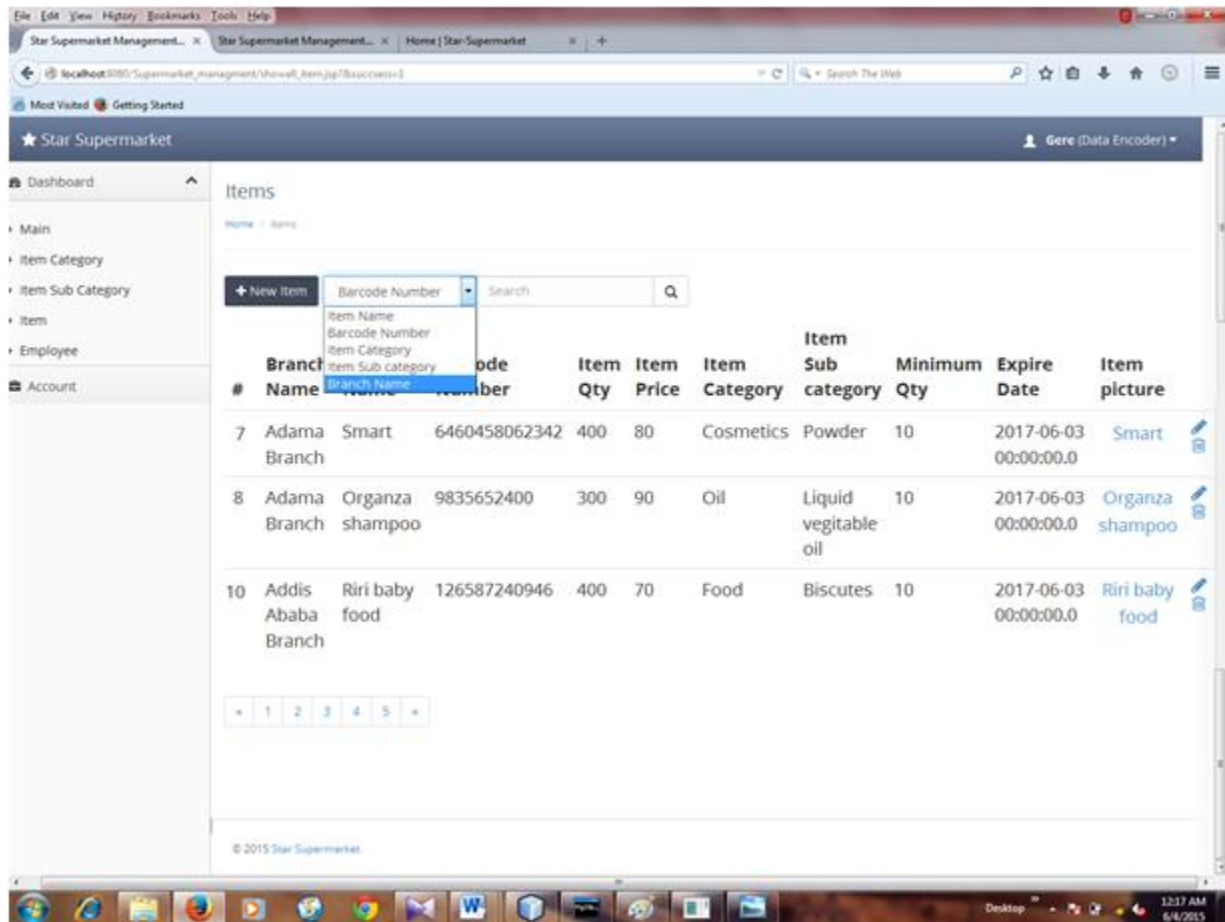
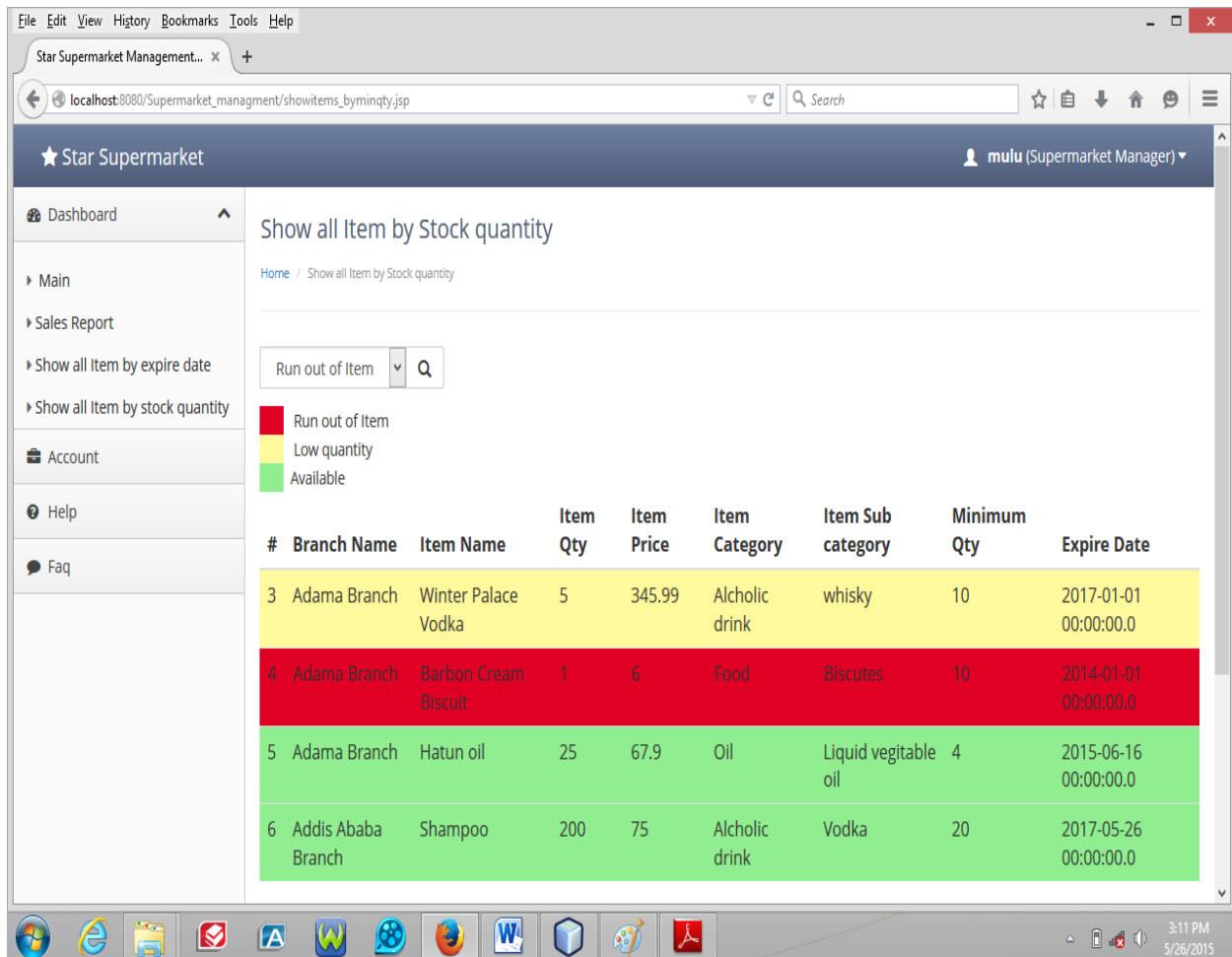


Figure 5.6.search items

Checking Stock Level

The stock level details can be retrieved by using the 'showitems_byminqty.jsp' file to lookup the item table and return all quantities as red for run out of item, yellow for low quantities and green for available.



Star Supermarket Management... x

localhost:8080/Supermarket_management/showitems_byminqty.jsp

Star Supermarket

mulu (Supermarket Manager)

Dashboard

Main

Sales Report

Show all Item by expire date

Show all Item by stock quantity

Account

Help

Faq

Show all Item by Stock quantity

Home / Show all Item by Stock quantity

Run out of Item

Run out of Item

Low quantity

Available

#	Branch Name	Item Name	Item Qty	Item Price	Item Category	Item Sub category	Minimum Qty	Expire Date
3	Adama Branch	Winter Palace Vodka	5	345.99	Alcoholic drink	whisky	10	2017-01-01 00:00:00.0
4	Adama Branch	Barbon Cream Biscuit	1	6	Food	Biscutes	10	2014-01-01 00:00:00.0
5	Adama Branch	Hatun oil	25	67.9	Oil	Liquid vegetable oil	4	2015-06-16 00:00:00.0
6	Addis Ababa Branch	Shampoo	200	75	Alcoholic drink	Vodka	20	2017-05-26 00:00:00.0

3:11 PM 5/26/2015

Figure 5.7. Checking Stock Level

Checking item expire date

The file `showitems_expireddate.jsp` is used to show the item expiry date information. Red color indicates the item is expired, yellow for warning and green for good condition.

The screenshot shows a web application interface for 'Star Supermarket'. The user is logged in as 'mulu (Supermarket Manager)'. The page title is 'Show all Item by expire date'. A search bar shows 'Expired' selected. A legend indicates: Red = Expired, Yellow = Warning, Green = Good condition. The table below lists items with their expiration status color-coded.

#	Branch Name	Item Name	Item Qty	Item Price	Item Category	Item Sub category	Minimum Qty	Expire Date
3	Adama Branch	Winter Palace Vodka	5	345.99	Alcholic drink	whisky	10	2017-01-01 00:00:00.0
4	Adama Branch	Barbon Cream Biscuit	1	6	Food	Biscutes	10	2014-01-01 00:00:00.0
5	Adama Branch	Hatun oil	25	67.9	Oil	Liquid vegetable oil	4	2015-06-16 00:00:00.0
6	Addis Ababa Branch	Shampoo	200	75	Alcholic drink	Vodka	20	2017-05-26 00:00:00.0

Figure 5.8. Checking item expire date

Generating Reports

The majority of the reporting needs defined in the specification, were such that they must not only be viewable on screen but also printable. If the user wishes to print a hard copy of the report, this can be achieved by clicking on the file print option from the browser.

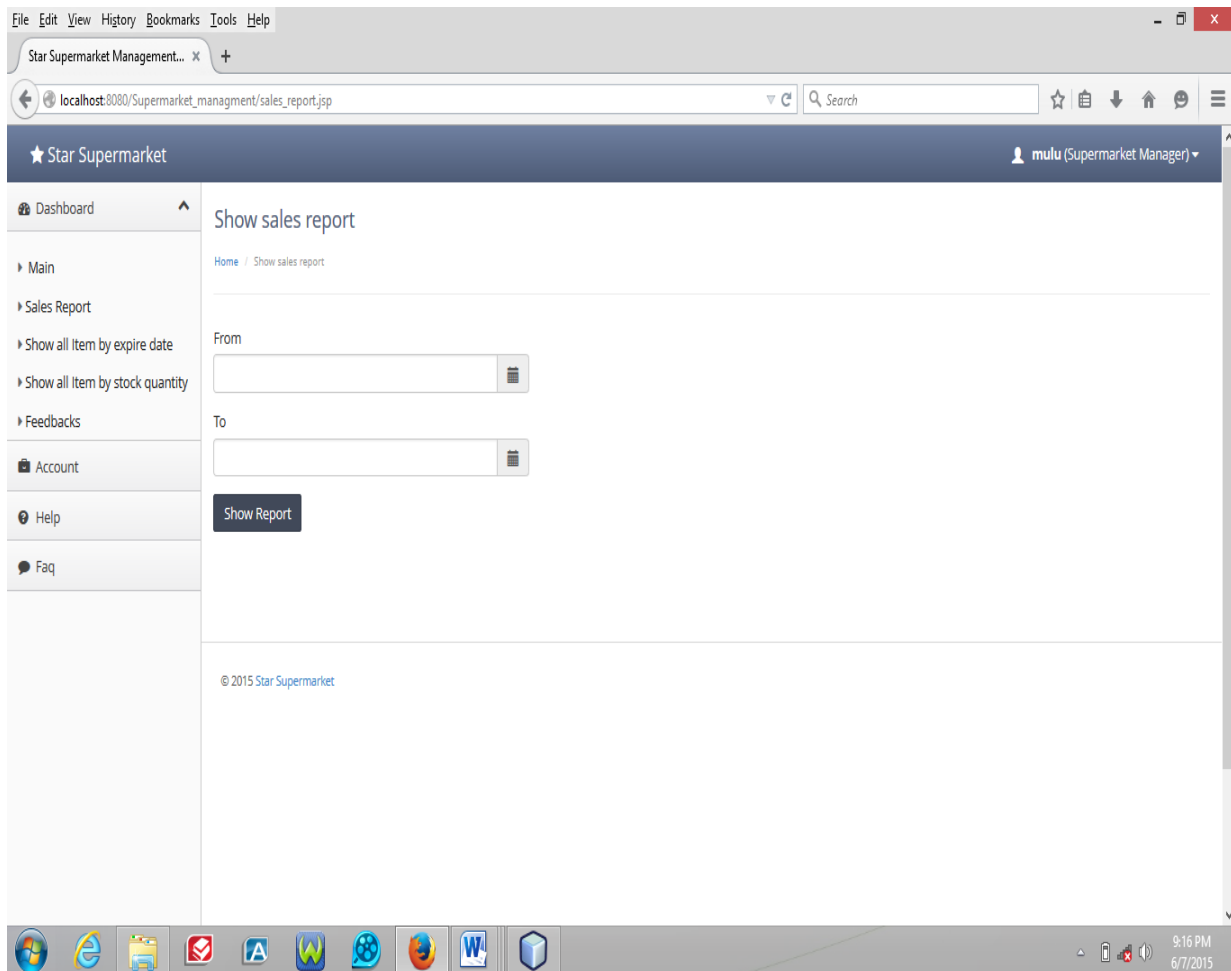


Figure 5.9.sales report

5.6 Sample Input/ Output Screens

Input: username and password

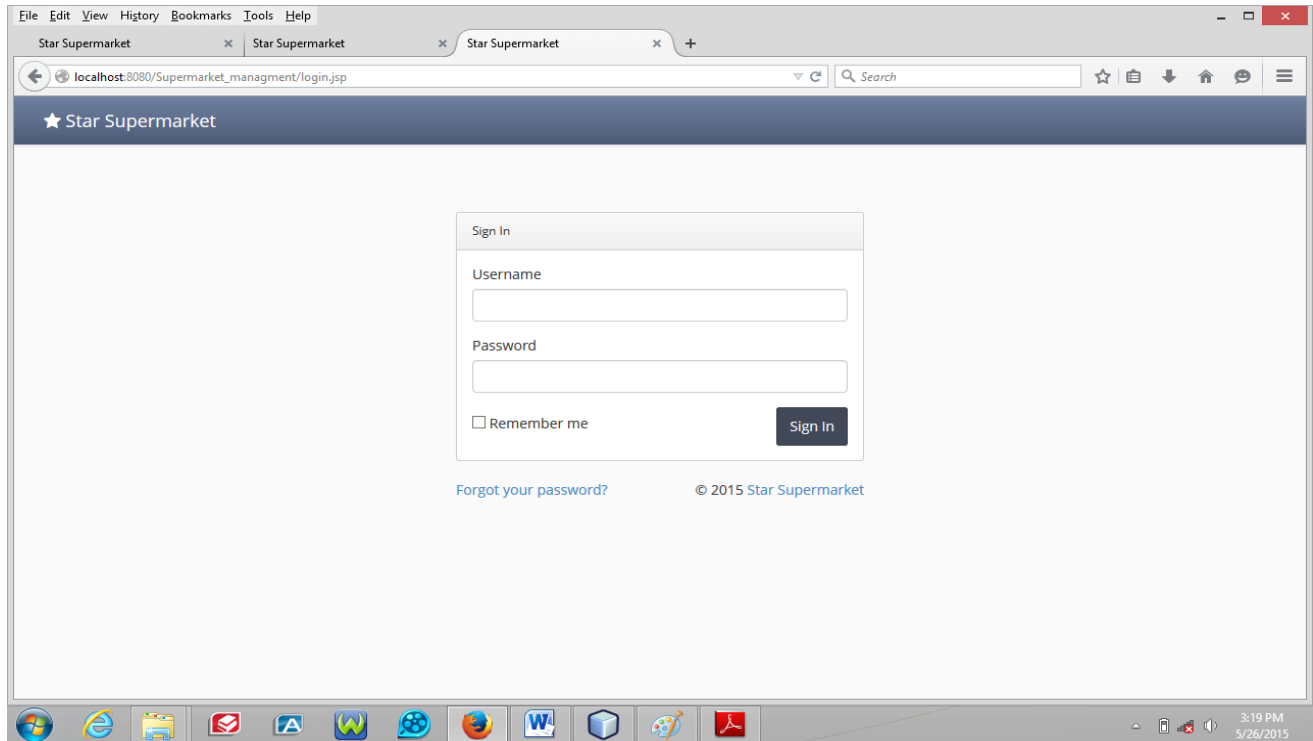


Figure 5.10.username and password input,

The above login form is used to insert a username and password of users, when the username and password is correct the system redirect to the user page otherwise it displays an error page.

Administrator page

The screenshot displays a web browser window with the URL `localhost:8080/Supermarket_management/showall_users.jsp`. The page title is "Star Supermarket" and the user is logged in as "namrud (Administrator)". The left sidebar contains navigation links: Dashboard, Main, User List, Account, Help, and Faq. The main content area is titled "Users" and includes a "New User" button, a search bar for "First Name", and a table of users.

#	First Name	Last Name	Username	Role	
1	Namrud	Kestebirhan	namrud	Administrator	Edit Delete
2	Abebe	Kebede	Abebe	Sales Clerk	Edit Delete
3	Chaltu	Asefa	Gere	Data Encoder	Edit Delete
6	Jemal	Teka	mulu	Supermarket Manager	Edit Delete

At the bottom of the table, there is a pagination control showing "« 1 2 3 4 5 »".

Figure 5.11.Administrator page

Home Page

In the home page different products are advertised and customers can access this page.

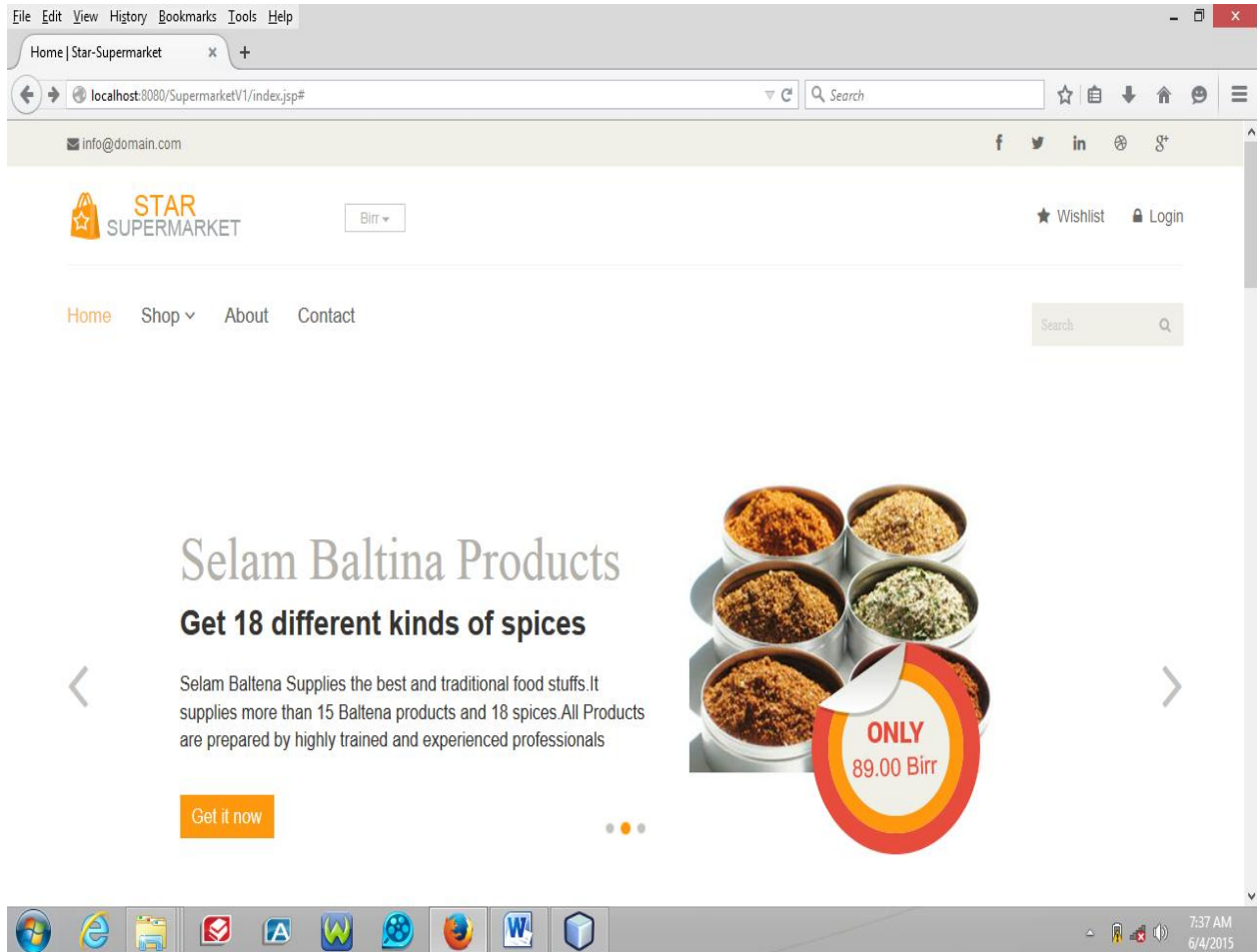


Figure 5.12.Home page

5.7 Results

Sales men login

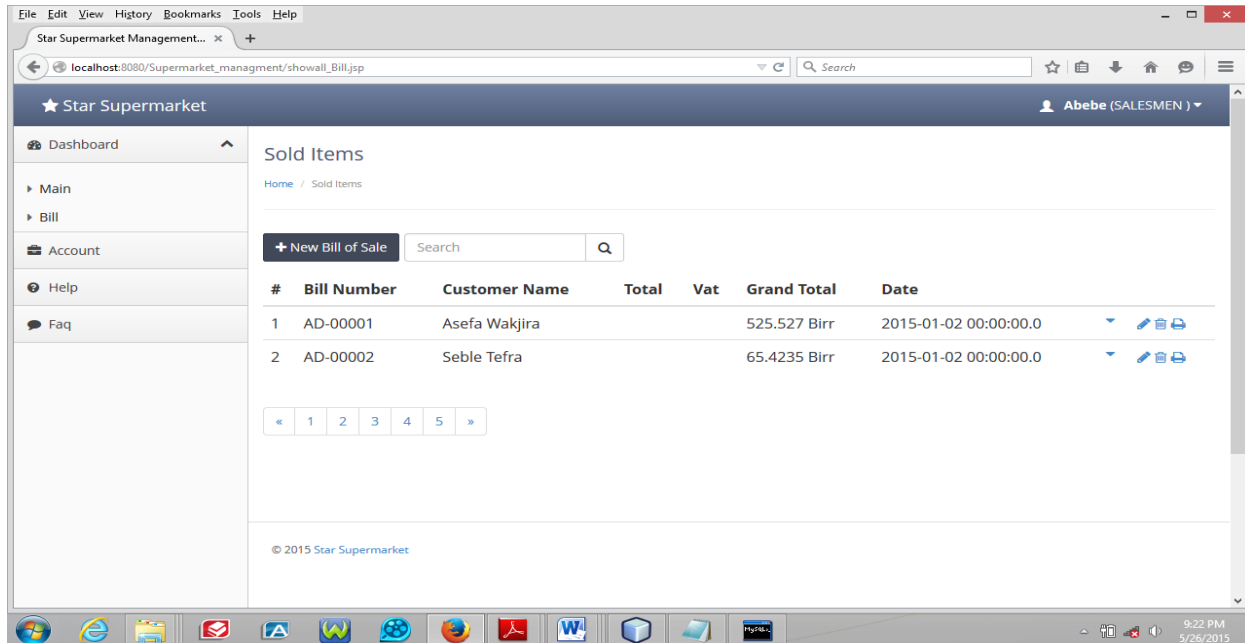


Figure 5.13.Sales men login

Bill Detail

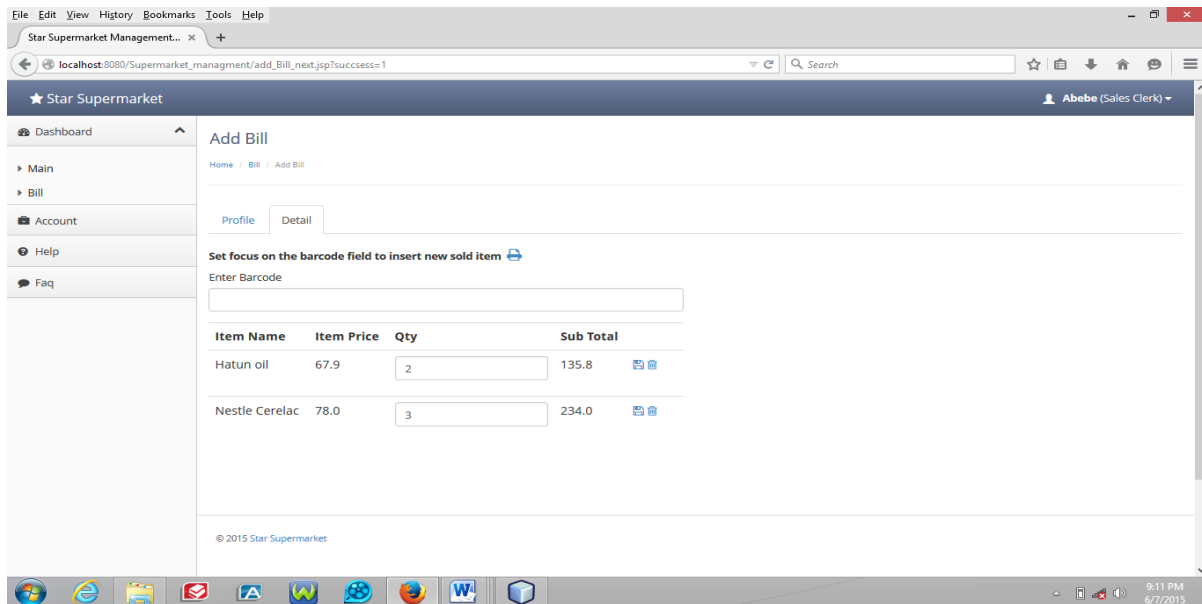


Figure 5.14.Bill Detail

Bill Generation

The screenshot shows a web application interface for 'Star Supermarket Management'. The left sidebar contains navigation links: Dashboard, Main, Bill, Account, Help, and Faq. The main content area is titled 'Add Bill' and has tabs for 'Profile' and 'Detail'. The 'Profile' tab is active, showing a form with the following fields: Bill Number, Customer Name, Total, Vat, Grand Total, and Date. The Date field is set to '2015-01-02 00:00:00.0'. At the bottom of the form are 'Save' and 'Delete' buttons. The footer of the application shows '© 2015 Star Supermarket'.

Figure 5.15. Bill Generation

Printed bill

The bill is printed when the salesmen clicks the 'PRINTER' icon. The printed bill contains bill number, the Date of purchase, Name of the supermarket, customer name, price, quantity, and total, subtotal. It also shows the grand total to be paid by the customer.

				
SALES INVOICE #AD-00001				
CUSTOMER Asefa Wakjira ADDRESS Adama Oromiya, Ethiopia DATE 2015-01-02 00:00:00.0			Star Supermarket Adama Oromiya, Ethiopia +251878078070 contact@starsupermarket.com	
ITEM	DESCRIPTION	PRICE	QTY	TOTAL
St Gorge Beer	No description	14.5 Birr	2	29.0 Birr
Winter Palace Vodka	No description	345.99 Birr	1	345.99 Birr
Barbon Cream Biscuit	No description	6.0 Birr	3	18.0 Birr
			SUBTOTAL	392.99 Birr
			TAX 15%	59.0 Birr
			GRAND TOTAL	452.0 Birr

Figure 5.16. Printed bill

CHAPTER SIX

TESTING

6.1 System Testing

The purpose of the testing procedures used throughout the system is to ensure that the system functions as intended by the developer. The processes of the testing phase partly occurred during the system's implementation.

The idea is to allow, individual system software modules to be assessed as well as overall system functionality. This Chapter discusses the use of realistic sample data, testing methods undertaken and their results.

6.2 Test Plan Overview

Testing is the last stage in the software development and it presents an interesting anomaly for the developer where he/she attempts to build software from an abstract concept to a tangible product.

During testing, the developer creates series of test cases to discard preconceived notions of the correctness of software just developed and overcome a conflict of interest that occurs when errors are uncovered. As a secondary benefit, testing demonstrates that the software functions appear to be working according to specification, that behavioral and performance requirements appear to have been met.

Testing the system follows a certain process as shown below:

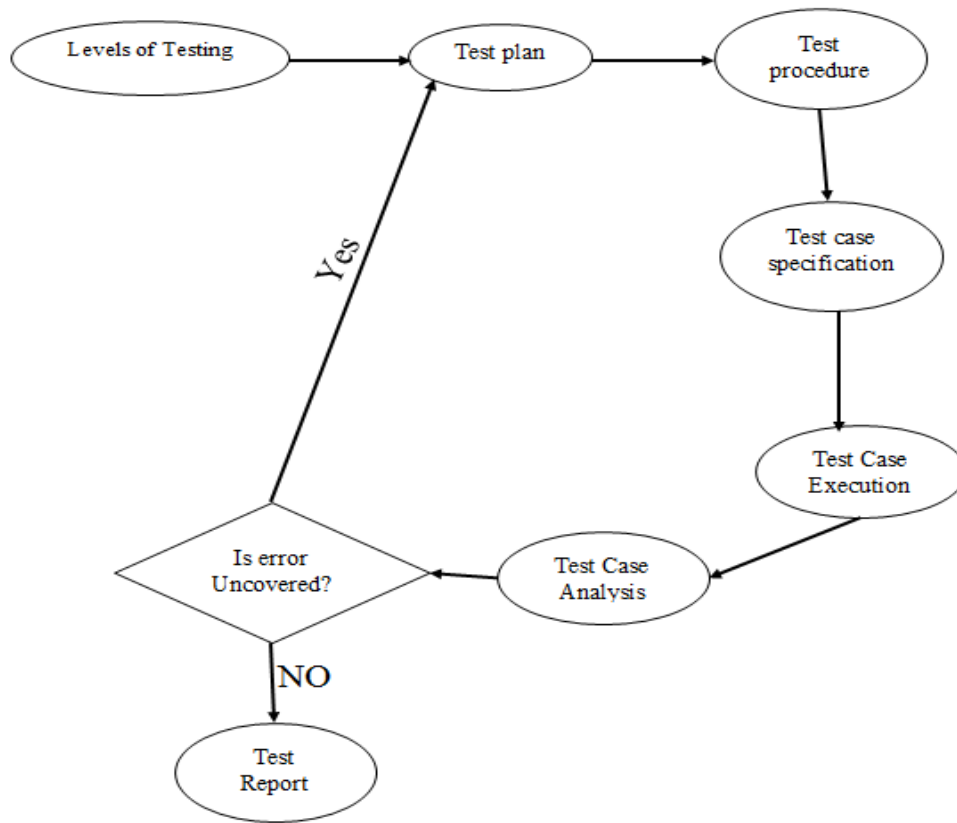


Figure 6.1. Testing process

6.3 Features to be tested/not to be tested

This project is tested by breaking in different modules. These modules will be tested separately. The modules or features to be tested are creating user account, sales report, stock level, item expiry date. The modules that will not be tested will be due to the shortage of time.

6.4 Approach

6.4.1 Software Module Testing

The purpose of Unit Testing is to ensure that each software module in the system functions properly as specified in the requirements. This testing strategy was applied to each module in the system. These test procedures ensured that valid input data was accepted and invalid data was rejected. Each unit within the application was tested to verify that all links and buttons navigated as expected.

Usability testing has also been incorporated to examine whether error messages are clear and understood. The database schema was also monitored to ensure insertions, updates and deletes were occurring and with the expected changes.

Table 6.1.System Login testing table

Test	Expected Result	Actual result	Comments
Enter invalid or no username and click login button	Display error messages advising Login fail	As expected	Test successful
Enter invalid or no password and click login button	Display error messages advising Login fail	As expected	Test successful
Enter a combination of invalid username and password	Display error messages advising Login fail	As expected	Test successful
Enter a valid username and password and click login	Display login ok and grant access to the users system	As expected	Test successful

Table 6.2.Test Item Table

SEARCHING, ADDING, EDITING AND DELETING RECORDS

Test	Expected Result	Actual result	Comments
To search for record, enter item name or a wildcard character in the search box	Display result that matches the input in the box	As expected	Test successful
Adding new item, enter all the valid inputs to the form	Insert a new record onto the item table and display successful insert message	As expected	Test successful
Adding invalid inputs	Display error message and advise invalid input	As expected	Test successful
Click on the Edit to edit record	Retrieve the corresponding item details and displayed in an editable form for editing	As expected	Test successful
Alter records on the editable form and click 'save' button	Update record and display message advising successful Editing	As expected	Test successful
To delete a record click on 'delete'	Display message on screen advising for assurance to delete a record	As expected	Test successful

Black Box Testing

The purpose of Black Box or functional testing is to assess the system's internal workings. However the overall aim of this test strategy is to examine results without knowing how the system arrived at that result. In effect, a tester only requires knowledge of the system specification rather than underlying architecture. This provides for such testing to be performed from an end user's perspective rather than a Designer's perspective. Furthermore, any ambiguities that may exist between the Black Box test results and the original specification are easily detectable, as an unexpected output would occur.

White Box Testing

The purpose of White Box testing is to certify that the underlying system architecture functions correctly. This contrasts to Black Box testing, which examines system output from knowledge about the system's use of syntax. White Box testing has been undertaken for this system, in order to examine the changes of state for each of the database tables within the system. White Box testing has two immediate benefits. Firstly, by examining the table states during update, create and delete processes for example, the developer is able to verify that the right tables are being queried or affected. Furthermore, the developer can query the record contents, to ensure the correct and relevant fields in one or more tables have been correctly queried or affected, as appropriate. The second benefit is more aimed at the client; as such testing can simulate system stress that it may endure once deployed to see how it reacts.

6.5 System Integration Testing

The purpose of performing Integration Testing is to ensure that the different parts that make up the full system function correctly, when combined to form a single working application. Integration Testing was performed at the end of each phase of the development to prove that the system still maintained functionality. The benefits become more apparent as the system increases in size and functionality.

6.5.1 Testing materials (Hardware/Software requirements)

Hard ware testing materials

- Personal computer
- Android mobile phone with Zxing android barcode scanner Application and Gate blue android application software installed on it.
- Built-in camera and Wi-Fi on the mobile phone.
- Bluetooth device.
- Item with barcode embedded on it

Software testing materials

We test the system manually without using any software testing material.

6.5.2 Test Case Specification

Table 6.3.Login test case

Test case specification identifier	Test case one
Test item	Log in
Precondition test case	The user must have an account
Input specification	User name(string) and password (string) , user name and password must be at least 5 characters
Output specification	If user name and password match, the user will enter to the page Otherwise error message will be displayed
Special procedural requirement	The user name and password must be at least 5 characters
Environment	• OS: windows 7/8, • Tools: Netbeans IDE • Browser: mozilla firefox

Table 6.4.Create user account test case

Test case specification identifier	Test case two
Test item	Create user account
Precondition test case	Administrator log in
Input specification	Enter employee name, user name, password, user role
Output specification	• User account created • Go to user profile while log in
Special procedural requirement	The user must be an employee
Inter case dependencies	Active status
Environment	• OS: windows 7/8, • Tools: Netbeans IDE • Browser: mozilla firefox

Table 6.5.item management test case

Test case specification identifier	Test case three
Test item	item management
Precondition test case	Data encoder log in
Input specification	Enter/select item list
Output specification	Item added, edited, deleted, updated, viewed
Special procedural requirement	The user must be a data encoder
Inter case dependencies	Active status
Environment	• OS: windows 7/8, • Tools: Netbeans IDE • Browser: mozilla firefox

Table 6.6.Sales report test case

Test case specification identifier	Test case Four
Test item	Sales report
Precondition test case	Salesmen log in
Input specification	Need to enter a specific date
Output specification	Sales report displayed
Special procedural requirement	The user must be Salesmen
Inter case dependencies	Active status
Environment	• OS: windows 7/8, • Tools: Netbeans IDE • Browser: mozilla firefox

Table 6.7.Check stock level test case

Test case specification identifier	Test case Five
Test item	Check stock level
Precondition test case	Supermarket manager log in
Input specification	Need to select item/category list
Output specification	Stock level displayed red for run out of item, yellow for low quantity and green for available.
Special procedural requirement	The user must be an Supermarket manager
Inter case dependencies	Active status
Environment	• OS: windows 7/8, • Tools: Netbeans IDE • Browser: mozilla firefox

Table 6.8. Check item expiry date

Test case specification identifier	Test case Five
Test item	Check item expiry date
Precondition test case	Supermarket manager log in
Input specification	Need to select an option expired, good condition and warning
Output specification	Item information displayed with red for expired, yellow warning and green for good condition.
Special procedural requirement	The user must be an Supermarket manager
Inter case dependencies	Active status
Environment	OS: windows 7/8, Tools: Netbeans IDE Browser: mozilla firefox

6.6 User Acceptance Testing

User acceptance testing was conducted at the end of the implementation phase in order to determine that the system had met the requirements defined in Chapter 4, the supermarket manager and the developers has gone through a series of evaluation, which involves the developer demonstrating the software and the manager using it briefly. The results of the testing procedures can be found in Appendix B.

CHAPTER SEVEN

CONCLUSION AND RECOMMENDATION

7.1 Conclusion

This work involves the development of web based supermarket management system using barcode technology with the basic features of managing stock detail, maintaining the records of the sales done for a specific period of time, checking the expiry date of items. Moreover it focuses on generating bill, sales reports and stock reports periodically. It is developed to replace the existing standalone system in the supermarket by increasing efficiency and effectiveness, making more interactive, speedy and user friendly. This web based system has also a feature that enables customers to access this system to inquire about item/product information from anywhere and at any time like price, availability before visiting the supermarket. This informs them to compare better price and product review.

The system is a responsive web based system which is accessible on all types of devices such as laptop, mobile devices and desktop computers. This helps for customers to access the website using different mediums. Supermarkets can advertise and promote their products and services and also the availability of new products through this system.

The system uses ZXing barcode scanner that has relatively fast processing speed. With a Zxing scanner in hand, Salesmen of the supermarket can capture the data that matters most as fast and as accurately as possible. This barcode scanner helps for the supermarket to scan in wireless communication especially to scan for bulky or heavy items.

The system is built in such a manner that it requires no special skills to manage the working of system and it is very easy to perform all business tasks for users of the system as well as the customers. The system is compatible with any modern web server and it is built according to the modern web standards.

To sum up Supermarket Management System using barcode technology has become an important component which allows supermarkets store and analyze vast amounts of information which is used for managerial decision – making. It can also reduce pressure of a supermarket workload and eliminates work stress and fatigue.

7.2 Recommendation

For the successful implementation of supermarket management system using barcode technology many things are expected to be fulfilled. Some recommendations for Star supermarket based on our project are listed below.

1. Star supermarket should assure complete, correct, and consistent product master data.
2. Star supermarket to implement the project by proving needed materials including server, barcode readers and other important devices.
3. Star supermarket should hire/assign reasonable staff (system Administrator) who can maintain the system frequently.
4. The members of this project believe that development of this project can be a motivation for the person that needs to develop advanced supermarket management system. We want to recommend any persons can update and modify this project.

7.3 Result achieved

Based on subjective observations from testing the proposed system generates bill, sales report, stock report, and print bill to customer. It also checks the expiry date of each item. Item information is also displays when the item is scanned by the Zxing android barcode scanner application installed on android mobile phone. The system performance is tested both in terms of effectiveness and efficiency. Since OOA model is used testing process following based on the Objects itself. The system correctly performs expected tasks on the way it is intended to be. Additionally bugs found during tests are solved by the project team. So the developed system can be used by the supermarkets as it is without any modification.

7.4 Limitation of the project

There are still shortages to be improved by further development. The project is only restricted to the management aspect of the supermarket such as the inventory and sales transaction. It doesn't consider customers to purchase items online. The system should include a feature for online shopping.

7.5 Future Work

In future when the company expands its business then it is needed to add features that helps for customers for online shopping.

APPENDIX – A

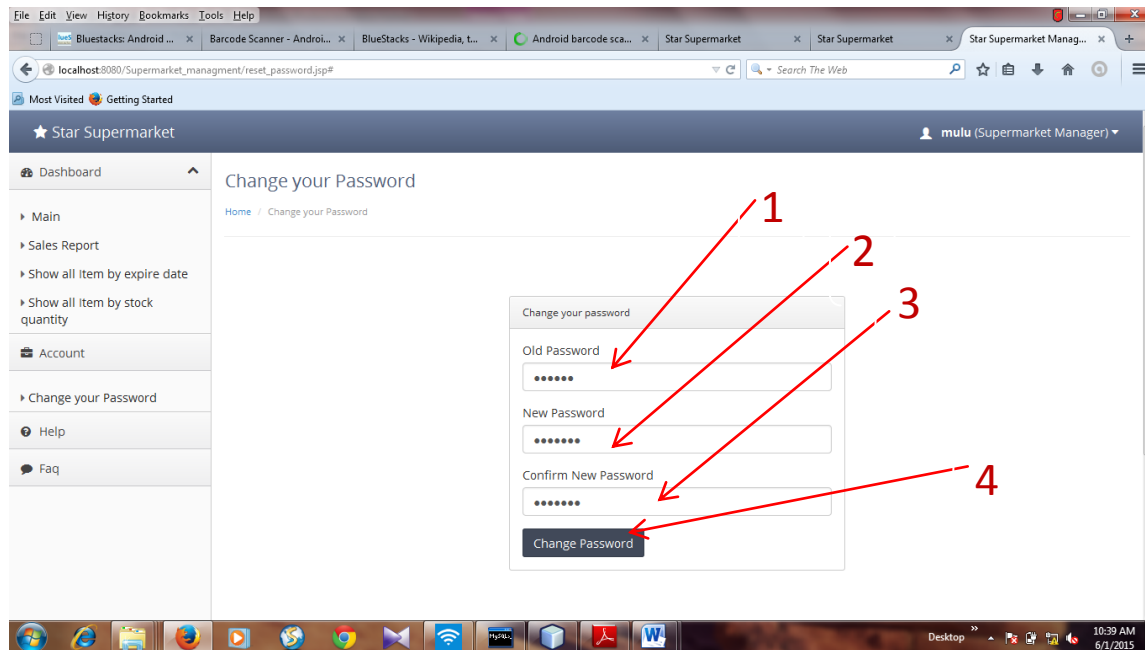
User Manual

The administrator of this system should give short training for the users of this system in addition to the user manual guide. The users of this system are Supermarket Manager, Data Encoder and salesmen. To use the system the users must register in the system and get username and password from the administrator. After getting the username and password follow the figure below.

The image shows a web form for 'Star Supermarket' with a dark blue header containing a star icon and the text 'Star Supermarket'. Below the header is a 'Sign In' form. The form has a title bar 'Sign In' and two input fields: 'Username' and 'Password'. The 'Username' field contains the text 'gere'. Below the 'Password' field is a checkbox labeled 'Remember me'. To the right of the checkbox is a dark blue 'Sign In' button. Three red arrows with numbers 1, 2, and 3 point to the 'Username' field, the 'Password' field, and the 'Sign In' button respectively. At the bottom of the form, there is a link 'Forgot your password?' on the left and a copyright notice '© 2015 Star Supermarket' on the right.

1. Insert username
2. Insert your password
3. Click **Sign in** Button, if your password and username is correct and use your account for the first time, it goes to your page else for incorrect password error message will display.

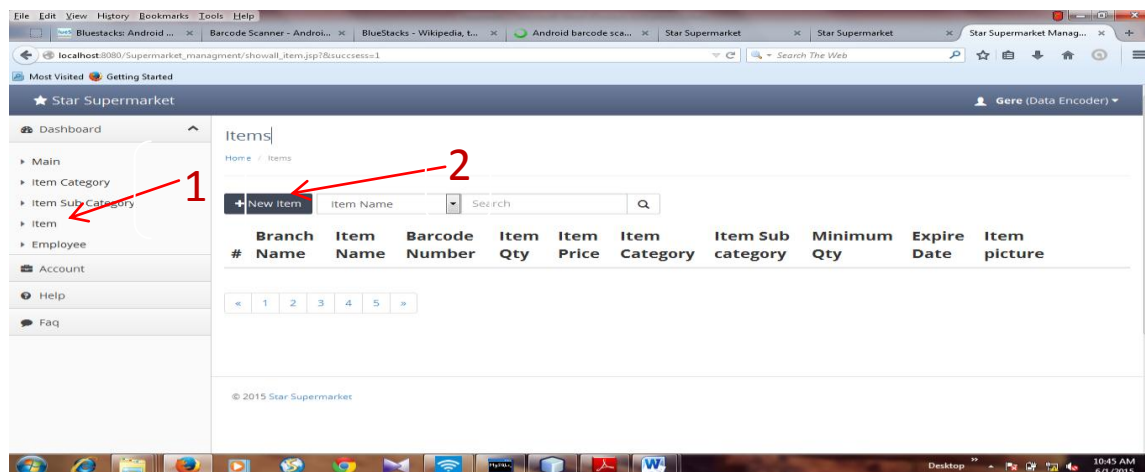
Change User password



The above figure shows how to change a user password; the user must click on Account button then click on change your password.

1. Old password
2. New password
3. Confirm New password
4. Change password

Add New Item



The above figure shows how to Add New item to the database, to do this follow the steps as number 1 click item button and number 2 click on New Item it displays the figure below.

New Item Profile

The screenshot shows a web application interface for 'Star Supermarket'. The left sidebar contains a navigation menu with options: Dashboard, Main, Item Category, Item Sub Category, Item, Employee, Account, Help, and Faq. The main content area is titled 'Add New Item' and contains a form with the following fields:

- Profile** (tab)
- * Marked fields are mandatory.**
- * Branch Name**: A dropdown menu showing 'Adama Branch'.
- * Item Name**: A text input field containing 'Organza shampoo'.
- * Item Barcode number**: A text input field containing '6006174009010'.
- Item Picture**: A section with a 'Browse...' button, a text input field containing 'shampoo3.jpg', and an 'Upload' button.
- Item Description**: A text area containing 'Organza shampoo'.
- * Item Qty**: A text input field containing '800'.
- * Item Price**: A text input field containing '75'.
- * Item Sub category**: A dropdown menu showing 'Facial accesoris'.
- * Minimum Qty**: A text input field containing '10'.
- * Expire Date**: A date picker showing '2017-06-01' and a placeholder 'YYY-MM-DD'.

At the bottom of the form are 'Save' and 'Cancel' buttons. A red arrow points from the text 'Fill this profile and click save' to the form fields.

The above figure shows how to Add New item field profiles to the database and click save button.

Generate and print bill of sale

The screenshot shows a web browser window with the URL `localhost:8080/Supermarket_managment/showall_Bill.jsp`. The application is titled 'Star Supermarket' and the user is logged in as 'Abebe (Sales Clerk)'. The left sidebar contains a navigation menu with 'Dashboard', 'Main', 'Bill', 'Account', 'Help', and 'FaQ'. The main content area is titled 'Sold Items' and contains a '+ New Bill of Sale' button, a search bar for 'Bill number', and a table of sold items.

Click on New bill of sale

#	Bill Number	Customer Name	Total	Vat	Grand Total	Date	
1	AD-00001	Selomon Bogale	0.0 Birr	0 Birr	0 Birr	2015-01-02 00:00:00.0	▼ ✎ 🗑️ 🖨️
2	AD-00001	Asefa Wakjira	0.0 Birr	0 Birr	0 Birr	2015-01-02 00:00:00.0	▼ ✎ 🗑️ 🖨️
3	AD-00001	Asefa Wakjirao65656	0.0 Birr	0 Birr	0 Birr	2015-01-02 00:00:00.0	▼ ✎ 🗑️ 🖨️

The above figure shows how to prepare new bill of sale. First click on new bill of sale then it displays the figure below.

The screenshot shows a web application interface for 'Star Supermarket Management'. The 'Add Bill' form is displayed with the following fields:

- Bill Number: star-00001
- Customer Name: abebe
- Total: (empty)
- Vat: (empty)
- Grand Total: (empty)
- Vat: (empty)
- Grand Total: (empty)
- Date: 2015-05-26

Red annotations on the form include:

- A bracket under 'Customer Name' and 'Date' with the text: "Fill customer name and date only then click on save button".
- An arrow pointing to the 'Save' button.

The above figure shows how to create bill of sale. Fill the profiles on bill number, customer name and date only then click on save button automatically it display the figure below.

Profile of New sold item

Star Supermarket

Abebe (Sales Clerk)

Dashboard

Main

Bill

Account

Help

Faq

Add Bill

Home / Bill / Add Bill

Profile Detail

Set focus on the barcode field to insert new sold item

Enter Barcode

Item Name Item Price Qty Sub Total

© 2015 Star Supermarket

The above figure shows to insert the profile of new sold item. First Set focus on the barcode field to insert new sold item then enter the barcode of the item using the barcode scanner then it displays the item information as item name, item price.

Star Supermarket

Abebe (Sales Clerk)

Dashboard

Main

Bill

Account

Help

Faq

Add Bill

Home / Bill / Add Bill

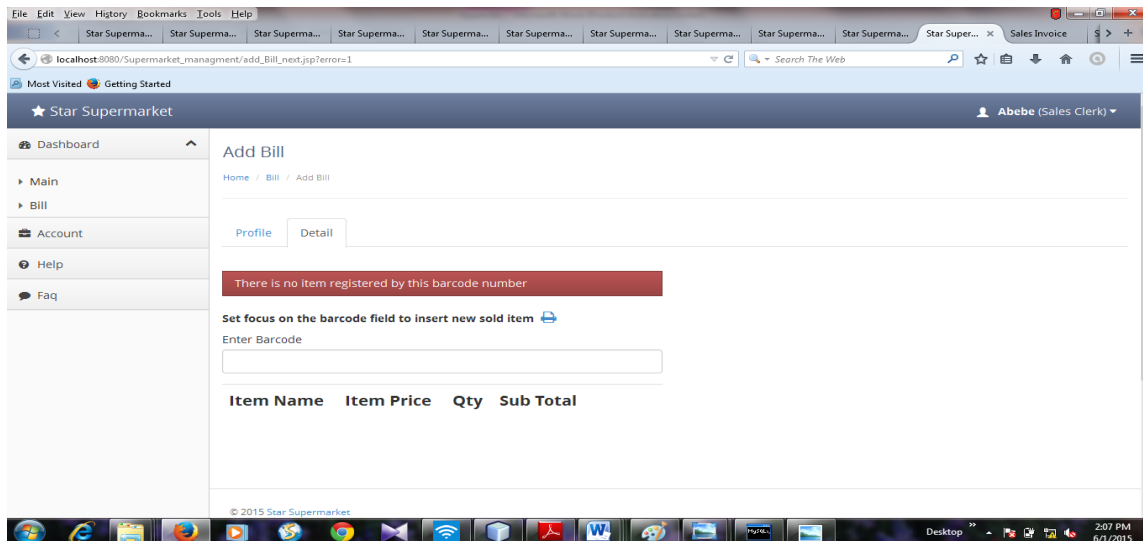
Profile Detail

Set focus on the barcode field to insert new sold item

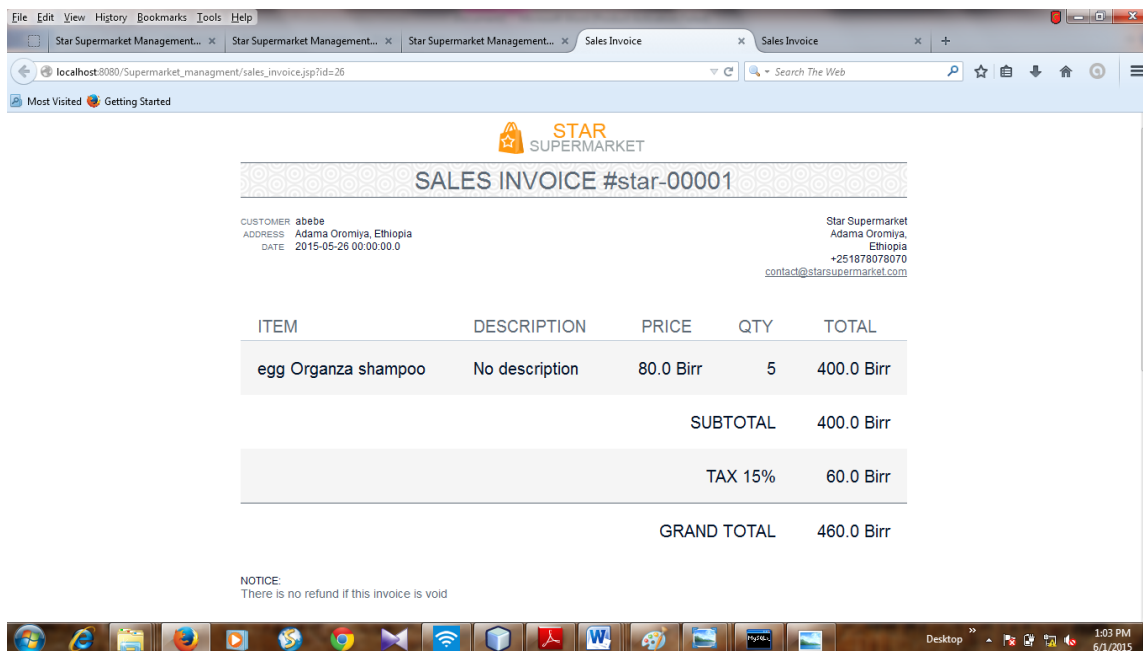
Enter Barcode

Item Name	Item Price	Qty	Sub Total
Meta Beer	13.6	0	0.0

If the barcode of the item is not recognized by the barcode scanner the system displays an error message of “**There is no item registered by this barcode number**” as in the figure below.



Print Bill



The above figure shows sales invoice print preview. This displays by clicking the print button.

APPENDIX – B

User Acceptance Testing

Functional requirements	Result
The database shall be able to store and retrieve stock information.	Test successful
The system shall provide efficient search facilities for items by name, category and subcategory.	Test successful
The system shall automatically calculate the bill and print receipt	Test successful
The system shall allow the data encoder to add, edit/update and delete for items, employees, from the system.	Test successful
The system shall allow the users to change username and password	Test successful
The system shall be able to produce sales reports	Test successful
The system shall be able to produce alerts on expired items	Test successful

System Performance Testing

Performance	Result
All user inputs must be validated within the client's browser to reduce error and increase system management	Test successful
The execution of user demands as rapidly and efficiently as possible	Test successful
To be able to handle the, including throughput and data storage.	Test successful
To be able to operate within any major web browser, such as Internet Explorer, Mozilla, Google chrome and others.	Test successful

BIBLIOGRAPHY

BOOKS

1. Introduction to java 8th edition Y.Daniel Liang
2. Java programming with eclipse by David Turner and Jinseok chae 2009
3. The java EE 6 Tutorial by Oracle 2013
4. Developing web applications using java server pages and servlets by IBM Corp. 2012
5. Parnell, B. (2009). Bar Code Scanning – The Conception of an Industry. Datalogic Scanning.
6. Eric Jendrock, Ricardo Cervera-Navarro, Ian Evans, Kim Haase, William Markito Java EE 7 Tutorial,2014
7. Bar Code Verification Best Practice work team (May 2010).
8. Grady Booch, “Introduction to software engineering in Object-Oriented Analysis and Design”
9. Robert Pirsig, “software life cycle”

WEB SOURCES

10. <http://www.tutorialspoint.com>
11. <http://www.bootstrap-tutorial.com> simply easy learning by tutorialspoint.com
12. www.dbmsmag.com/9606d15.html, DBMS Object Analysis and Design.
13. Zebra. <http://zebra.sourceforge.net>
14. Zxing. <http://code.google.com>
15. <http://www.w3schools.com>
16. <http://www.varsguide.com>