# RETAIL POINT OF SALE (POS) SYSTEM WITH INVENTORY


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# Abstract

Creating an exciting experience is the key to success for many small businesses and determining the right support and technology is a benefit. This project is to develop and evaluate a Point of Sale (POS) system for industry needs. Point of Sale (POS) systems not only enable the basic cash functionality but also increasingly support more retail processes. We develop a centralized Point of Sale system that will be more user friendly and more efficient comparing to all existing Point of Sale system in our country.

# Acknowledgements

We are very delighted and thankful to Suman Ahmmed, Assistant Professor, Department of Computer Science and Engineering for supporting us to build the foundation of our project and guiding us throughout the project. Never the less, utmost gratitude to our parents, teachers, siblings and friends for their constant support and faith on us.

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# Chapter 1

# Introduction

POS means the Point Of Sale refers the purchase systems or technically speaking, the location of a transaction known as checkout. These systems build up through some technical device and path such as barcode scanner, POS terminal, Payment terminals, optical scanners, Cash drawer or resister and magnetic card readers. POS systems are widely used in retail, supermarket and hospitality department stores, and as they become more rapidly developed, and people are also increasingly aware of the quality of service and time. There are several technical and real-time benefits that make it easier to use. POS is a real-time process which generally utilizes sales data for commercial purposes, reducing the time required to perform administrative operations such as order, customer management, inventory control, order tracking and compliant regulations. In a business with the ability to connect other desired user systems across physical or net boundaries, newly developed POS systems are more trustworthy. We call it chain digitalization. These POS systems allow for the interconnection between wholesalers and providers for the exchange of information, e.g. for sales, order, product and customer. The goal of this project is to develop a centralized POS system for improved management of any business associated with the operation of Bangladeshi supermarkets. With several extra features, our system will support a multi-outlet and centralized database system.

## 1.1 Motivation

Today, even the smallest company's cash register, transactions, payment statement prefers to be linked to a computer via POS system. POS systems are more popular than conventional cash registers as they not only raise sales but also have a reliable and back-up system. It provides information on your inventory, products and customers in real time, but it may be surprisingly large. Sometimes it is a real challenge in a small business to keep information about thousands of items. A good POS system can allow you to worry

about when and how a desired product is being reordered. When the time comes for a refurbishment, POS systems will give you both the latest price, retailer price you paid, and the average previous price that you paid; the display device will also display several information. You can do the best deal with your suppliers or dealers. The report gives you inventory activities, cash transactions, the list of customers, the highest sales item for the day, week or month and numerous other things. Many advanced POS systems enable entrepreneurs to track their inventory year after year, which makes it easier to compare orders this year to last year. You can do so in the coming days, months and years to predict your goal. Problems Statement 1 and Problem Statement 2 and Problem Statement 3 can be resolved by developing a centralized POS system to target Bangladesh's supermarkets. [1].

### 1.1.1 Problem Statement 1

Now a day's using POS system is very common in Super Markets like Agora, Mena Bazar. But in our study we found that they are currently using separate database for every outlet. This will increase a lot of manual work to keep track of their currently available inventories of a product in every outlets. To prevent this problem they need a centralized Point of Sale system.

### 1.1.2 Problem Statement 2

In a super market like agora there are a lots of item. But in our study we find that none of existing POS system provider currently available in Bangladesh provides an important features like Expired product alert. Because of that they need to check all of their products after a certain amount of time and it's a vast amount of work. To prevent this problem they need a POS system which will give alert of those products which will be expired soon.

### 1.1.3 Problem Statement 3

In Bangladesh all of the existing Point of Sale system runs based on client server methodology. But "server down' is a very common scenario for a developing country like Bangladesh. Because of that sometimes they need to manually calculate the products amount and issue the receipts. To prevent this problem they need a system that will save a certain a period of transaction in case of server inactivity.

## 1.2 Objectives of the Thesis

We will build a system that will have all features that a super shop owner or manager actually needs. Or system will be totally centralized and all of the outlets will have the same Point of Sale system. Because of that the whole system will be more time efficient and need less amount of man power. We also implement the features like Expire date alert to notify the manager these products will expire soon. Our system will provide a certain amount of offline server support and generates a receipts that will directly give a message to the customs.

## 1.3 Organization of the Thesis

The thesis is organized as follows:

**Chapter 2** Point of Sale (POS) system overview

**Chapter 3** Methodology and Development tools.

**Chapter 4** Feasibility and Requirements analysis.

**Chapter 5** Existing System Study and Proposal.

**Chapter 6** Algorithms and Implementation.

**Chapter 7** Impacts and Standards.

**Chapter 8** Project Work Division.

# Chapter 2

# POS System Overview

Now a day's Point of Sale (POS) systems work with transactions. POS system provide us information about long term, short time transactions etc. POS system like modern and advanced computerized system can be cost-efficient for different type of business with as little as 30000 taka in annual sales, important savings and sometimes providing return on investment within more than one year. For having an accurate track of sales, a POS system is improving inventory management day by day. One can spot broken inventory and can total count the inventory so easily. Daily reports in detail can be helpful in many ways. It will give us alerts about ordering products when stocks or low or expired products, product which are saved or recorded in history can be helpful to predict future inventory more correctly. It automatically manages the sales, counts and every calculation so it determines to predict or improve future plan. POS systems execute many time-demanding tasks, such as calculations, dealing with inventory store and disparities and cash register work remediation. The system can free up employees that can generate income or increase customer service. Using barcode scanners means faster checkout and the daily inventory is more accurate. Today every advanced POS system have ability to receive and have inventory function. It helps to pinpoint the inventory loss, while also decreasing out-of-stock conditions that can have negative impact on sales. POS system can reduce theft more than 2%. When curl does occur retailer will be able to aware of it. With advanced technology POS system can serve latest security features such as video surveillance to security pin codes, MSR badges etc. It is possible to prevent a non-authorized personnel attempt who wants to breaks the security of the system. A POS system can store many kinds of detailed information such as the names, addresses, phone, and email addresses of customers. To personalize marketing, sales and promotional activities and communication sophisticated POS databases can be used to target promotions to specific groups of customers [2].

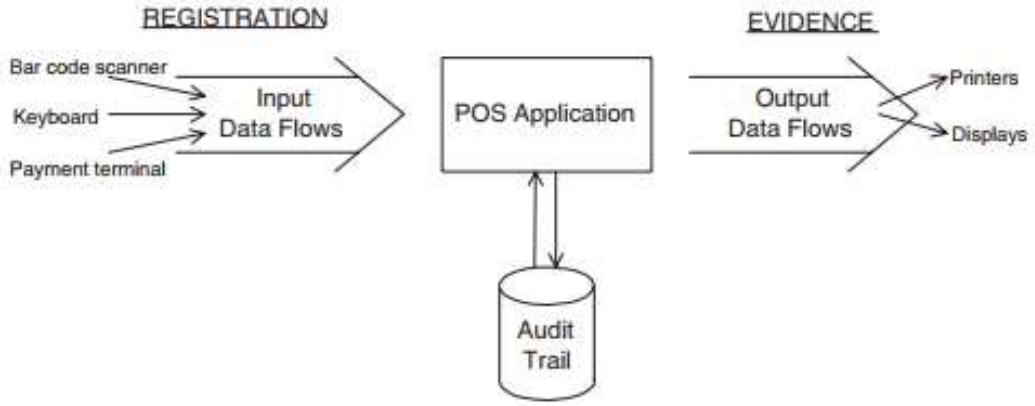


**Figure 2.1: POS** system model with data flows input and output.

## 2.1 PURCHASING A POS SYSTEM

It is very important while you are choosing a point of system for your business. Right POS system will give a great improvement in business and fairly comfortable life for retailers and customers. On the other side wrong POS software can make your business fiery spectacle. Today POS system. Is so advanced that we don't need to old time cash register and we don't need to depend on glorified calculator for process payments. So, it plays a big role in in the success or failure in the business. There are hundreds of POS system now a days. So, it is important to do some research when you are selecting a new POS system for any business purpose. You have to consider features customer needs, their services, costs and many more.

## 2.2 WIRELESS POS SYSTEM

Wireless POS system is the latest and advanced solution in this era. It is very significant to make faster and easier process while making payment or receiving services. A WPOS system have a base station directly connected to a central network and more than one device can communicate wirelessly. WPOS system can include many features like consummate sales, record and make history of customer orders, payment, credit card payment, and many things connected to other systems in a specific network. This system can be cost-effective by doing in many ways.[3]

## 2.3 OBJECTIVES AND AIM

In the past, replacing cash register was the main purpose of POS system. Now, not only replacing the cash register but also many purposes are being added. There are many objectives and aims of POS system like reduce costs and time, faster responds, improve customer service and payment method, buy in smarter way, and improve marketing and promotions and transactions and so on.

# Chapter 3

# Methodology

We are using object-oriented development and MVC architecture to design and implement our proposed system. It is very easy to find problems, locate the problems and fix the bugs very fast without effecting other components and files. We develop the system using object oriented process and use Unified Modeling Language (UML) to design class and use case diagrams to provide a blue print for implementation. We are going to use ASP .NET MVC architecture based on the programming language C# using Microsoft Visual Studio 2017. This is an object-oriented and event-driven language which makes interactive user interfaces easy to design. Because this is a product of Microsoft so it is simple to operate it in windows platform. This ensures that many libraries needed to run the system are available on the user computer and also not expensive. The Point of Sale system runs with a MySQL database as an information system which helps to collect, save, process and retrieve information at the back end of the system[4].

## 3.1 Concepts of Operation

The Point of Sale is a real-time inventory and sales system database and it is capable to connect multiple outlets. This can be used to monitor inventory, sale or distribution of stocks among multiple branches of a larger franchise. This system will provide notification when there will be low stock and expired product through e-mail or phone at a specific time interval. In our consideration, our principal objective is not to maintain any storage but to reduce the tracking strain.

## 3.2 Why a Methodology?

It is implicitly acknowledge that when you build a software product you build it for commercial or critical use and use the most competitive, cost-effective and sound engineering techniques. A methodology which has proven successful and effective in terms of cost,

time, and quality and so on is necessary in order to apply the engineering techniques for building a product. Methodologies for software development (also called techniques of software development) have evolved over time to develop software products. You determine the software engineering methodology best suited to the given circumstances when you undertake a project to build a software product. We choose waterfall methodology to build our project from scratch.

### 3.2.1 Waterfall or Waterfall life cycle model

Firstly, a project team is established to collect all the requirements from the customer or the users in the Waterfall model. The phase of design software begins after these requirements are collected and the requirements are documented. The software coding phase begins once the software design is completed. The software testing phase begins when the complete construction of the software product has been completed. Finally, the software release phase starts once the software product is tested and is successfully operational.

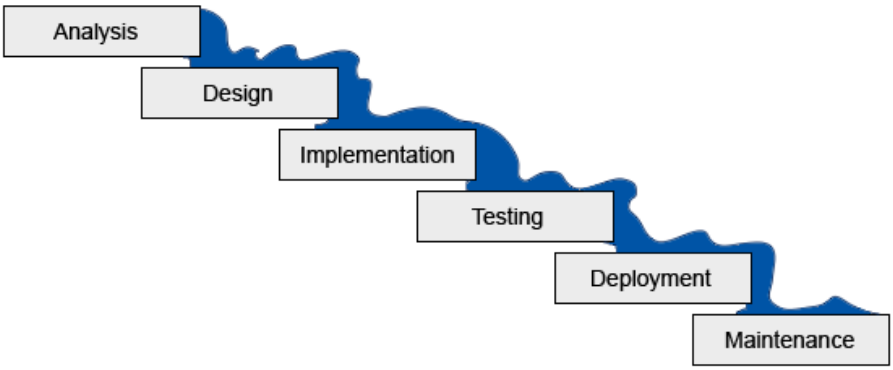


**Figure 3.1:** Classic waterfall model.

### 3.2.2 Why Waterfall model?

The Waterfall model is appropriate in our scenario. We build this project from scratch with a small amount non skilled developers. Because of that, it's hard to divide the parts of workload to individual. So we decided to involve all of our resources in a single work phase and after finishing that part of work we will move to next phase. We will ensure our work completeness by using quality gates in our methodology.

## 3.3 Project Requirements

Sometimes users want to use old method of payment. We build a management system which is very easy to learn and use. But our design will not compromise the any kind of security issue or integrity of business or any user personal process. We collected a number of requirements for the project from our primitive research, website visits, and interview to the concerned personnel and their experiences regarding the concepts of its development. We have even visited some organization Dhaka City, analyze its importance and try to develop the project by fulfilling all the weakness that were found in the application. We then decided to build same type of application with different logic flow will be suitable for the organizations.

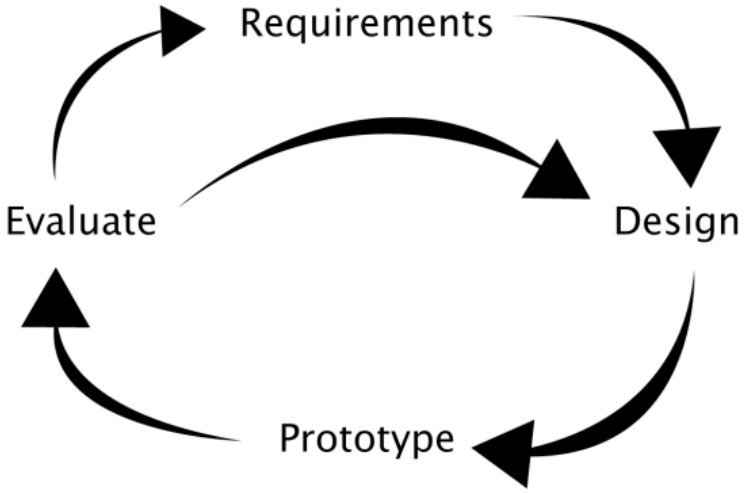


**Figure 3.2:** An iterative process to develop a project.

## 3.4 Development Tools

### 3.4.1 Microsoft Visual Studio 2017

Microsoft Visual Studio is vastly use for developing user interface and applications such as Windows Form applications, web sites, web applications, and web services. This editor can code for cross platforms and supported by Microsoft Windows, Windows Mobile, .NET Framework, .NET Compact Framework and Microsoft Silverlight. The basic tasks like create, debug and deploy applications are simplified by this tools. This provides a great working environment for .NET Framework and also supports applications focused on Windows platforms. It supports databases like IBM DB2 and Oracle, in addition to Microsoft

in house SQL Server. We have used Visual Studio Community 2017, v 14.0.23107.10 for developing the Point of Sale System Application. Visual Studio has several advantage to use like,

**Multi-Targeting support:** Previously, only a specific. NET Framework version was support for every Visual Studio release. From Visual Studio 2008 Microsoft provide "Multimedia Targeting." It allows VS to support for multiple versions of .NET Framework and enabling programmers to get benefit from new features offered by Visual Studio without migrating existing applications into a new version of the. NET Framework.

**HTML Editor and support for CSS:** With VS 2008, web designers discover it is dramatically enhanced for HTML developer and extensive CSS support.

**ASP .Net support:** Combining ASP.NET with Visual Studio offers new web application development and web design functionally that simplify the creation of new websites based on the standards of next generation.

**LINQ introduction:** Microsoft introduce LINQ which is a new feature that expands the ability to query within language syntax. LINQ introduces data query and update patterns. There are a set of new assemblies which allow the use of LINQ with SQL data bases and collections.

### 3.4.2 Microsoft SQL server Management Studio Express

Microsoft SQL Server Management Studio Express (SSMSE) offers a tool for graphic management to write and execute SQL queries using MySQL. SSMS provides SQL Server instances and databases tools for configuring, monitoring and managing instances. We use SSMS for deploying, monitoring, updating and building queries and scripts for data-tier components of our application. Using SSMS we can use either our local computer or in the cloud, to search, design and manage our bases and data warehouses. And more importantly this tool is free to use which is a huge advantage.

## 3.5 Technology Used

### 3.5.1 Structure of .NET Framework

The .Net structure is basically separate into 3 layers namely bottom, middle and top layer. Bottom layer is the core of .NET Framework and provides the runtime environment for

the execution of programs. Middle layer controls services for .Net framework and make it available and standardize across languages. User and program interfaces are in the top layer as figure,

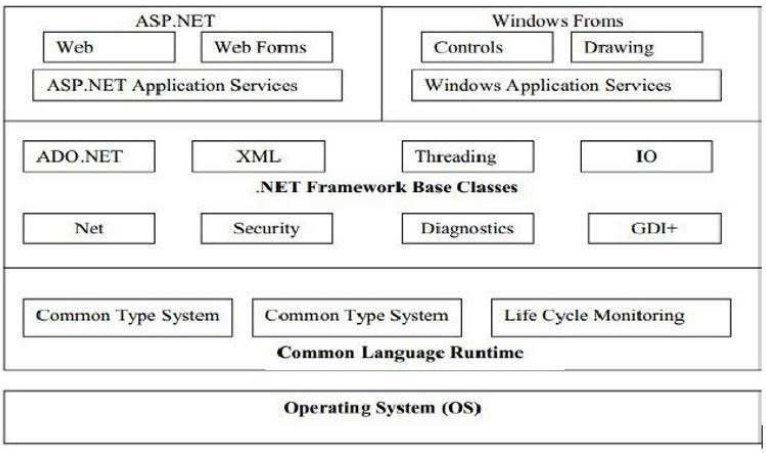


**Figure 3.3:** Net Framework Architecture.
Source: Teacher's Handout.

When looking at this diagram, the first thing to notice is that the .NET Framework lays on the top of the operating system. There has been a lot of things about the. NET being carried over by some third-party firms so that a majority of the. NET Framework could also run on different platforms. ADO.NET, which provides access and data management for .NET Framework. ASP .NET and Windows Forms are the third layer of the framework. ASP.NET should not be considered as the next Active Server pages version after ASP 3.0, but rather as a dramatically new shift in the development of Web application. With ASP.NET, robust Web applications can now be built that are even more featured than Win32 applications from the previous time.

### 3.5.2 ASP .NET

ASP.NET is a Microsoft-developed and distributed Web Application Framework for Web Sites, Web Applications, and Web Services (WS) programmers. ASP.NET is a framework that allows dynamic html pages to be generated by using server side scripts. ASP.NET page is similar to the HTML page, and normally a VB.NET or C# is used for the ASP page.

**Features:**

1. Facilities to learn, comprehend and use.
2. Constructed for individual web pages.

3. As like as PHP and JSP.
4. Visual Basic or C# server scripting.
5. Complete control of HTML, CSS and JavaScript.

### 3.5.3 C#

C# is an object oriented programming language. It was introduced by Microsoft Corporation. C# is one of the vastly use and common language infrastructure programming languages.

**Features:**

1. It is aimed at combining high Visual Basic productivity with raw C++ power.
2. In C# Microsoft dealt with C++ issues such as the management of memory, indicators etc. and so on.
3. Application Console, Windows App and Web App can be developed by using C#.

### 3.5.4 MVC (Model-View-Controller) Architecture

MVC is applied separately into three parts – model, visual and controller.

**Model:** Model is the objective form of data and its corporate logic. It keeps the application data, recover and store it from database as model objects. In MVC architecture only a model object can directly access to the database.

**View:** This ensures that all or part of the data is displayed to your user.

**Controller:** A request handler to check the Model and View interactions.

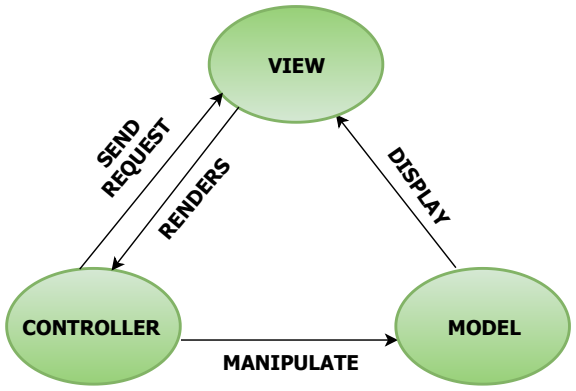


**Figure 3.4:** Model-View-Controller **(MVC)** Architecture.

The flow of user requests is shown in ASP.NET MVC in this figure.


**Figure 3.5:** Handling request in Model-View-Controller **(MVC)** Architecture.

### 3.5.5 Microsoft SQL (Structured Query Language) Server

Microsoft SQL Server is an application for creating Microsoft Windows server operating systems computer databases. A database environment which is available in internet to access from other media like workstation or personal computer etc. Desktop, business and web based database applications are created with Microsoft SQL Server. It is used to build web-based database applications and desktop systems. It is used at various levels and for various purposes. SQL Server makes deploying, managing, and optimizing business data and analytical applications easier and easier. As a data management platform, it performs a single management console that allows data managers to monitor, manage and adjust every database and associated service in organization. The programming infrastructure provides an organized management, which can be programmed with SQL administration objects to allow users to adapt and extend their environment and software suppliers to create instruments and functions and expand their outgoing functionalists. SQL Server simplify the access of the SQL Server related databases and services integration, services of analysis, services for reporting across a large variety of distributed databases and servers by providing an in-depth management console. The main features are given in the following:

**Robustness:** Make the deployment safer. SQL Server offers rich data protection and resources for the network security features.

**Confidentiality:** To secure your data for any malicious user SQL Server supports Kerbero's authentication. All domain accounts take place on a virtual server and required Microsoft policy for standard logins.

**Integrity:** In the database itself SQL Server supports fully integrated encryption capability with a key management infrastructure. Client server messages are encrypted by default.

## 3.6 Architecture of System and Software

To build this Point of Sale application, C# (C Sharp) programming language is used with ASP .NET MVC architecture. Server will be communicated with both types of clients using the client server architecture. HTTPS thus maintains security in both a private and an Internet connected network. A client-server model is used for the application. The language of programming for the Point of Sale application will be in C# using ASP .NET MVC architecture. The server communicates with both types of clients using client server architecture. Thus, the security of both a private and an internet-connected network will be upheld by HTTPS. A client-server model is used for the application[5].

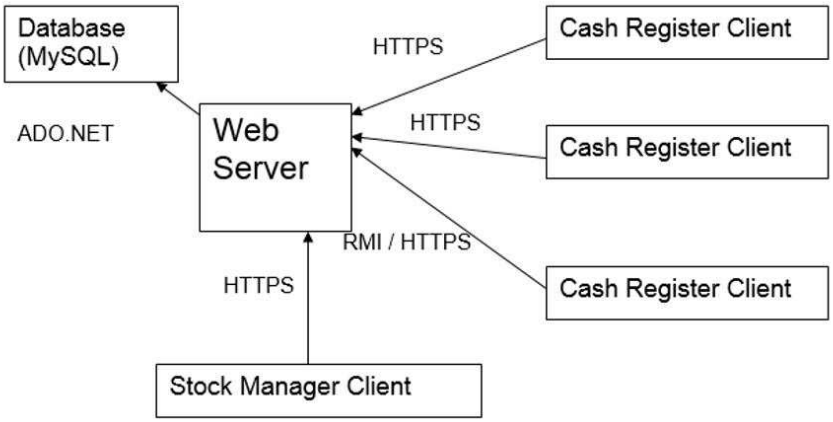


**Figure 3.6:** Point of Sale System using Client-Server Architecture Model.

Server communicate with inventory and sale database, MySQL Database Connectivity will also use as a MySQL ADO.NET driver. The server transfers to the MySQL database after receiving customer requests. When Cash register clients communicate with the server, the Cash Register clients will keep local log files. Here we use Microsoft ASP.NET because Microsoft C# with Microsoft SQL Server database is the programming language for the application. The Microsoft .NET Framework provides data interfaces for simple database interfacing which can also be used with HTTPs.

# Chapter 4

# Feasibility Analysis

## 4.1 Feasibility Study

From different points of view, this software has been tested for different feasibility criteria.

### 4.1.1 Operational Feasibility Study

It is the measure of how well the problems are solved by a proposed system and takes advantage of the opportunities identified during the problem analysis. This Point of Sale system provides better solution to the transaction process of any retail super shop or multi outlets business system by adding typical requirements and necessities. The system also provides a better library solution. This system's solution will be acceptable to the ultimate Point of Sale solution [6].

### 4.1.2 Schedule Feasibility

We defined an organized schedule sub-section for developing the system. The reasonable timeline shows that it is possible to complete the system development on the desired time frame.

### 4.1.3 Economic Feasibility

The most common method of evaluating the effectiveness of the candidate system is economic analysis. More commonly known as the cost-benefit analysis, the process is to understand the benefit over a candidate and compare them with costs. The system is estimated to be cost effective. The system is a desktop application on a medium scale and has an affordable price. Improved efficiency and better performance are the benefits. It is found that the system is economically feasible to compare costs and benefits.

### 4.1.4 Feasibility of Technology

The technical feasibility of a computer system means it's feasibility with technological resources (like hardware and software, etc.) In order to accommodate technical improvements financial consideration also include here. If the budget is a serious constraint, then it is not considered feasible for the project. All the necessary cautions were taken into consideration in this project to make it technically feasible[7]. The system requires tools such as:

1. Visual Studio 2017
2. .NET Framework 5
3. Microsoft SQL server 2012, etc. Which are available within the estimated cost and schedule.

## 4.2 Requirements Analysis

### 4.2.1 Functional Requirements

The proposed system is made for the purposes of retail transaction. Thus, various processes included inventory can be performed. Recently ordered inventories will be added with already available stocks and sold items that can be reduced from the available stocks.

### 4.2.2 Software Requirements

The proposed system will work under Windows Operating System 7 or higher.

### 4.2.3 Hardware Requirements

- Minimum of 250 GB hard disk or higher.
- 4 GB memory or Higher
- Intel dual core, AMD Phenom CPU or higher
- Monitor
- Mouse
- Keyboard
- Power Supply
- Printer
- Barcode Scanner

### 4.2.4 Information Requirement

The system requires the specific inputs to perform it properly. To provide and gain desired output, some information is needed. The system requires information such as the name of the employee's address, contact number, etc. to recognize the authorized individuals who can use the system. Item ID, name of the item and other item information is also required [4].

### 4.2.5 Control and Security Requirement

Data security and control is required in the creation of a system. This minimizes issues related to unauthorized manipulation of data and data loss. A unique username and password for authorizing outlet's staff will be provided.

## 4.3 Software Requirements Specification

### 4.3.1 Use Cases

| ***Name*** | ***UC-1: Selling Products*** |
|---|---|
| *Summary* | *All products that a customer wants to buy are sold, inventory and sales is updated in the database and a hardcopy of the cash memo is produced.* |
| *Rationale* | *In a super shop it is hard to keep track of all the inventory and sales manually .Moreover creating a cash memo manually for each customer is tough. So, an automated system can be developed for this tasks.* |
| *Users* | *Salesmen* |
| *Preconditions* | *Customer needs to bring the products that he wants to buy to the sales counter.* |
| *Basic Course of Events* | ***1.*** *The salesman in the counter takes every product one at a time and scans the barcodes on the tag of the product using a barcode scanner.*<br>***2.*** *The system matches the barcodes with the product database and calculates the total price of all the scanned products.*<br>***3.*** *The salesman tells the total price shown on the computer screen after scanning all products brought by a customer and a cash memo is created.* |
| *Alternative Paths* | ***1.*** *After step 3 the customer may wish to remove some products. In this case the salesman removes the products from the product list shown on the computer screen.* |
| *Post conditions* | *The customer pays, takes the products and the cash memo is created and given to him.* |

**Table 4.1:** ***Use case for Selling Function.***

| ***Name*** | ***UC-2: Low Inventory Alarm*** |
|---|---|
| *Summary* | *A message will be shown if any product's stock becomes less than 20 units. The message will show the name of the product's name and the amount of it that is left for sales.* |
| *Rationale* | *In a super shop it is hard to keep track of the amount of product that is left for sales. So a system should be developed to alert the shop's manager about any product that is low in stock of the store and needs to be ordered.* |
| *Users* | *Shop Manager* |
| *Preconditions* | *The product needs to be in the product's database* |
| *Basic Course of Events* | ***1.*** *One or more products' amount in stock becomes less than 20 units.*<br>***2.*** *A message is shown on the top left side of the software's UI along with the names and the amount that is left of the products' that are less than 20 units in stock.* |
| *Alternative Paths* | *None* |
| *Post Conditions* | *The Shop Manager will order new products that are needed and shown in the alarming message.* |

**Table 4.2:** ***Use case for Low Inventory Alarm Function.***

| ***Name*** | ***UC-3: Insert New Product Information*** |
|---|---|
| *Summary* | *The Shop Manager can insert information about new products.* |
| *Rationale* | *A new product that is going to be sold in the super shop needs to be in the product's database of the system.* |
| *Users* | *Shop Manager* |
| *Preconditions* | *A new product needs to be confirmed as a product to be sold in the super shop.* |
| *Basic Course of Events* | ***1.*** *The Shop Manager fills up a form with all needed information and clicks on the 'Submit' button.* ***2.*** *A message is shown to confirm the insertion.* |
| *Alternative Paths* | ***1.*** *In step 1 the Shop Manager may forget to insert one or more information. In this case an error message will be shown and the Shop Manager will have to insert all required information properly in the form and submit again.* |
| *Post Conditions* | *Sales of the inserted product can now new managed with the system.* |

**Table 4.3:** ***Use case for Inserting New Product Information Function.***

| ***Name*** | ***UC-4: Reading Product Information*** |
|---|---|
| *Summary* | *The Shop Manager can read information about products.* |
| *Rationale* | *A new product that is sold in the super shop has some information that may need to be read by the Shop Manager or Salesman.* |
| *Users* | *Shop Manager, Salesman* |
| *Preconditions* | *The information of the product that the user needs information of needs to be in the product database along with its information.* |
| *Basic Course of Events* | ***1.*** *The user inputs the name of the product.*<br>***2.*** *The information of the product is shown.* |
| *Alternative Paths* | ***1.*** *In step 1 the user may input wrong name of the product. In this case an error message will be shown.* |
| *Post Conditions* | *The user reads information about the searched product.* |

**Table 4.4:** ***Use case for Reading Product Information Function.***

| ***Name*** | ***UC-5: Update Product Information*** |
|---|---|
| *Summary* | *The Shop Manager can update information of products.* |
| *Rationale* | *Information of a product that is sold in a super shop may need to be updated.* |
| *Users* | *Shop Manager* |
| *Preconditions* | *The product's information that needs to be updated must be in the product database.* |
| *Basic Course of Events* | ***1.*** *The Shop Manager inputs the name of the product to update its information.*<br>***2.*** *All information about the product in the database is shown.*<br>***3.*** *The Shop Manager updates the information over there and press the submit button.*<br>***4.*** *A message is shown to confirm the update was made in the database.* |
| *Alternative Paths* | ***1.*** *In step 1 the Shop Manager may input a wrong name that is not in the database. In this case, an error message will be shown and the user needs to input the name again.* |
| *Post Conditions* | *The update remains in the database until a later update is made on it.* |

**Table 4.5:** ***Use case for Updating Product Information Function.***

| ***Name*** | ***UC-6: Delete Product Information*** |
|---|---|
| *Summary* | *The Shop Manager can delete information of products.* |
| *Rationale* | *Information of a product that is sold in a super shop may need to be deleted for some reason.* |
| *Users* | *Shop Manager* |
| *Preconditions* | *The product's information that needs to be deleted must be in the product database.* |
| *Basic Course of Events* | ***1.*** *The Shop Manager inputs the name of the product to update its information.*<br>***2.*** *All information about the product in the database is shown.*<br>***3.*** *If the Shop Manager wants, he deletes the information over there by pressing the delete button.*<br>***4.*** *A message is shown to confirm the deletion was successful.* |
| *Alternative Paths* | ***1.*** *In step 1 the Shop Manager may input a wrong name that is not in the database. In this case, an error message will be shown and the user needs to input the name again.*<br>***2.*** *In step 3, the Shop Manager may not want to delete the information and can press 'Cancel' button to go back.* |
| *Post Conditions* | *The deleted information will not be in the database.* |

**Table 4.6:** ***Use case for Deleting Product Information Function.***

### 4.3.2 Functional Requirements

| | |
|---|---|
| *Name* | *FR-1: Retrieve product name and price with barcode* |
| *Summary* | *During every sell operation the barcodes of every product is scanned to retrieve the name and price.* |
| *Rationale* | *Retrieving product name and price while sales using barcodes and barcode scanners, is an easy and faster process. Salesmen can easily do it without any complication.* |
| *Requirements* | *During a sale operation the salesman will use a barcode scanner to scan the barcodes of the products that were brought for purchase by the customers. Using these scan results the name of the products and prices will be retrieved.* |
| *References* | *UC-1* |

**Table 4.7:** ***Functional Requirement 1.***

| | |
|---|---|
| *Name* | *FR-2: Reducing stock of sold products after every sales* |
| *Summary* | *After every sales the stock of every sold products will be reduced from the database by the sold amount* |
| *Rationale* | *To keep track of every product's stock it is needed to reduce the amount that was sold. This update should remain in the database.* |
| *Requirements* | *After every sell operation the stock of every product is reduced from the database by the amount of that product which was sold in the sell operation.* |
| *References* | *UC-1* |

**Table 4.8:** ***Functional Requirement 2.***

| | |
|---|---|
| *Name* | *FR-3: Checking stock of sold products after every sales* |
| *Summary* | *After every sales the stock of every sold products will be checked to see if its stock is less than 20 units* |
| *Rationale* | *To keep track of every products stock and to determine if it is low is important.* |
| *Requirements* | *After every sell operation the stock of every product is tested. If the amount is less than 20 units then its name and remaining amount will be sent as a message to the user.* |
| *References* | *UC-2* |

**Table 4.9: *Functional Requirement 3.***

| | |
|---|---|
| *Name* | *FR-4: Checking stock of sold products after every sales* |
| *Summary* | *After every sales the stock of every sold products will be checked to see if its stock is less than 20 units* |
| *Rationale* | *To keep track of every products stock and to determine if it is low is important.* |
| *Requirements* | *After every sell operation the stock of every product is tested. If the amount is less than 20 units then its name and remaining amount will be sent as a message to the user.* |
| *References* | *UC-2* |

**Table 4.10: *Functional Requirement 4.***

### 4.3.3 Nonfunctional Requirements

| | |
|---|---|
| *Name* | *NF-1:Fast retrieval of product name and price with barcode* |
| *Summary* | *During every sell operation the barcodes of every product is scanned to retrieve the name and price. This should be a fast process.* |
| *Rationale* | *Fast retrieval of product name and price is a must because it saves time.* |
| *Requirements* | *After scanning the barcode the search for the product name and price must be should be very fast and must take under 500ms.* |
| *References* | *UC-1* |

**Table 4.11:** ***Nonfunctional Requirement 1.***

# Chapter 5

# System Study & Proposal

We studied two popular available Point of Sale systems.

1. **PHP POINT OF SALE**
2. **DEALPOS**

## 5.1 Menu Bar

We Analysis on Menu bar of the two benchmark products (PHIPPOINTOFSALE DEALPOS). Our both benchmark have top and side menu bar. Side Menu bar is same in both benchmark. Side Menu bar have only page option. But Top menu bar is different. Title Of option page, Search Contain, Time of current location this feature have in the DEALPOS system. On the other hand the PHP POINT OF SALE top menu bar is different with DEALPOS. PHP POINT OF SALE have so many options. Change Language, Notification and User Info with photo.

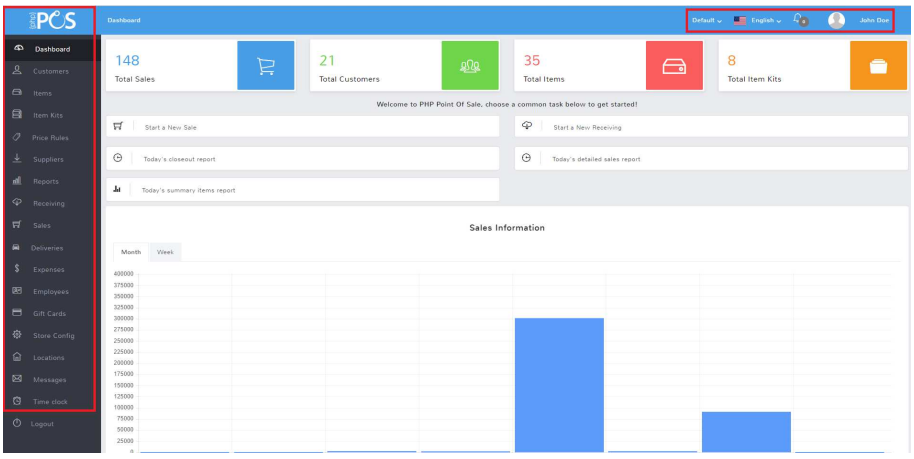


**Figure 5.1:** PHP POINT OF SALE menu bar.

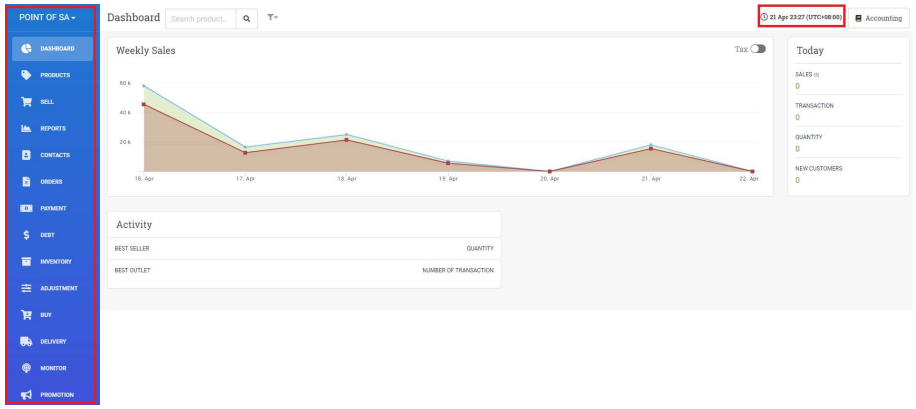


**Figure 5.2:** DEALPOS menu bar.

## 5.2 Dashboard Interface

A dashboard provides important checks and allows you to see in more detail if exceptions and trends are necessary for further study. A dashboard must be simple to use. People interact best with meaningful, colorful information so a dashboard should looks like that. A dashboard connects to your files, apps, services and APIs, but all these data are presented in tables, lines charts and bar charts in the interface. A data dashboard provides a central position for companies to monitor and analyze performance, making it the most efficient way to track multiple data.

### 5.2.1 PHP POINT OF SALE Dashboard

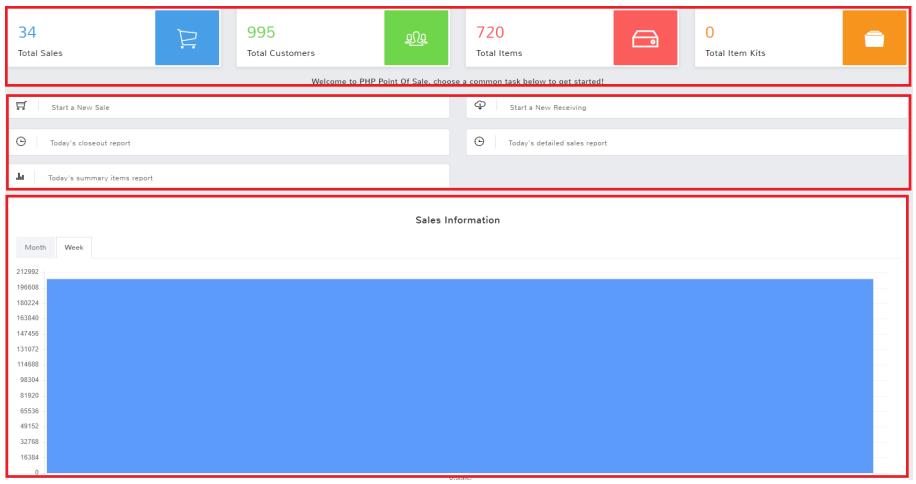


**Figure 5.3:** PHP POINT OF SALE dashboard.

1. Total Sales: It will show how many products have been sold out in number. So the admin can know the information easily.
2. Total Customers: It will show the total number of customers in number.
3. Total Items: It will show the total items number.
4. Total Items Kits: It will show the total item kits number.
5. Some Quick Links:
   (a) Start a new sale
   (b) Todays closeout report
   (c) Todays summary items report
   (d) Todays detail sale report
6. Graph: The graph will show the sales information of monthly.

### 5.2.2 DEALPOS Dashboard


**Figure 5.4:** DEALPOS dashboard.

1. Search Option: Can search product
2. Showing date and time
3. Graph: Showing weekly sale with tax and without tax
4. Quick Links:
   (a) Sales
   (b) Transaction
   (c) Quantity
   (d) New customers

## 5.3 Product or item list

### 5.3.1 PHP POINT OF SALE Product

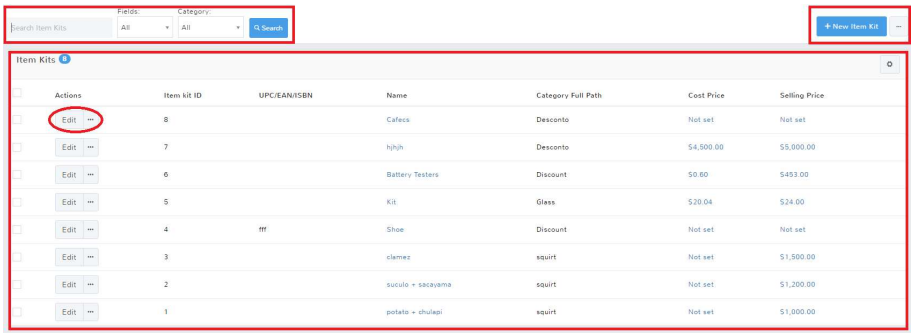


**Figure 5.5:** PHP POINT OF SALE product list viewer.

The PHP POINT OF SALE have so many option on product. It's search the product on price and category. Have Add button to ass new product in the system. When add the product the fill up all information of the product. The PHP POINT OF SALE show all the information in the product list with product photo.

### 5.3.2 DEALPOS Product

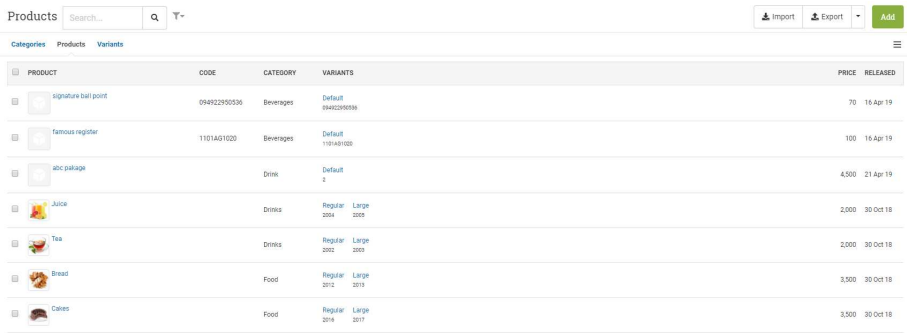


**Figure 5.6:** DEALPOS product list viewer.

DEALPOS product page are same to PHP POINT OF SALE. It's different on show the product list. It's show product on category.

## 5.4 Sale or Create Invoice

We know that Create Invoice is most useful feature of Point Of Sale (POS). 30, we analysis how to create Invoice 0f the Point Of Sale. This Invoice create by Product. When Customer Buy Products than the vendor create the invoice from customer products. When add the product in the invoice list at the same time calculate the total Amount With vat and discount. It's Virtual Invoice. We Analysis the three benchmark product. Finally we make our Sale System.

### 5.4.1 PHP POINT OF SALE Invoice (How to work?)

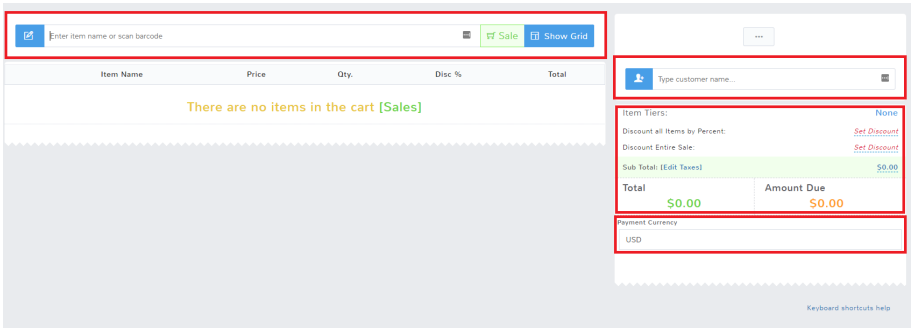


**Figure 5.7:** PHP POINT OF SALE invoice generation system.

This PHZPPOINTOFSALE have a search box. The search box is find the product and add to invoice list on the other hand scan the Barcode and directly added in the invoice product list with Quantity, Price, Discount and Total Amount of the product. If the customer take the wrong product or the customer can't take a product then the vendor can remove the product list. If the vendor add the wrong product then the vendor am remove the particular product. If need to add the customer name then vendor can add the customer name. Add Discount. At the same automatically calculate the total Amount of the list of product with discount amount. Customer can pay so many type of payment system (Cash, Visa, Master Card, American Express, etc.). The customer don't buy any product or remove all product from the invoice list then vendor can remove all product from invoice list. The customer can pay the Gift Card. It's the Extra feature.

### 5.4.2 DEALPOS Invoice (How to work?)

This DEALPOS is a touch System Application. It's have a category option. The Vendor can touch to select. The item or product and add to invoice list. Vendor can add the product by Barcode. Can add outlet change date. Add customer name. At the same automatically calculate the Total Amount of the list of product with discount Amount.

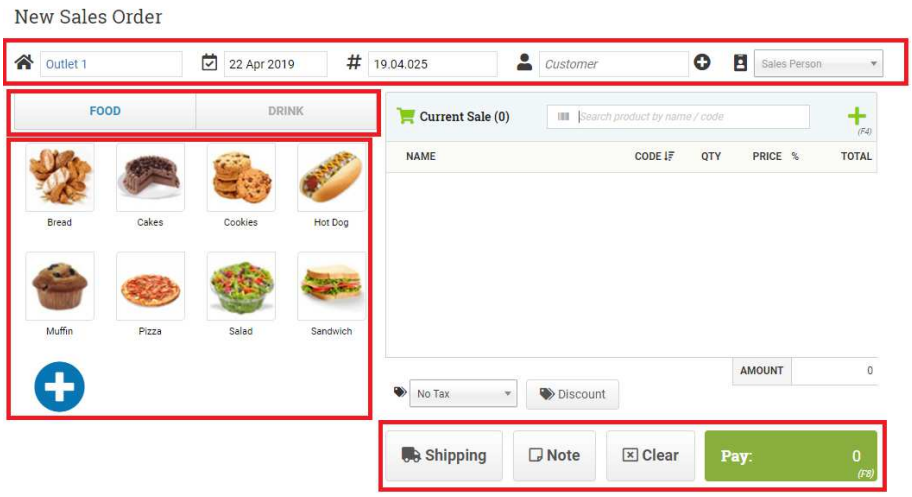


**Figure 5.8:** DEALPOS invoice generation system.

The customer don't buy any product or remove all product. From the invoice list then vendor can remove all the product from invoice list.

## 5.5 Contact Info. of Customers

Customer management collects data on customer acquisition records, so that the most important customers can be identified based on their expenditure while monitoring the entire relationship between retailers and customers. Customer management features help companies to track their brand's customer to build closer relationships with buyers on an ongoing basis. A good retail customized management system can contribute to driving loyalty and creating brand ambassadors.

### 5.5.1 PHP POINT OF SALE Contact

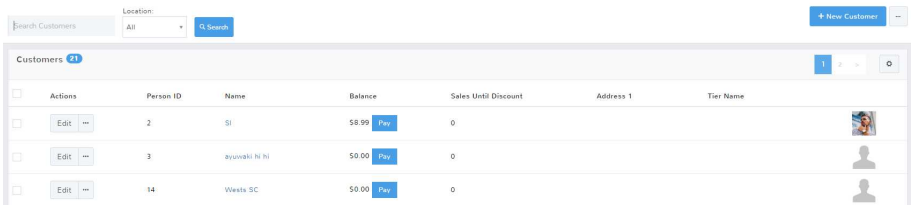


**Figure 5.9:** PHP POINT OF SALE contact management.

In PHP POINT OF SALE, user can store customer details like id name, email, phone number. User can edit the details also, can search also.

### 5.5.2 DEALPOS Contact

In DEALPOS user can store customers, sales persons, supplier's details except photos. User can search, can edit export and import the data.

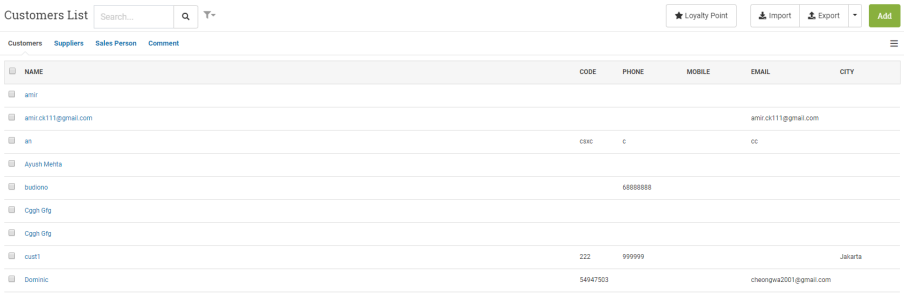


**Figure 5.10:** DEALPOS contact management.

## 5.6 Report

### 5.6.1 PHP POINT OF SALE Report

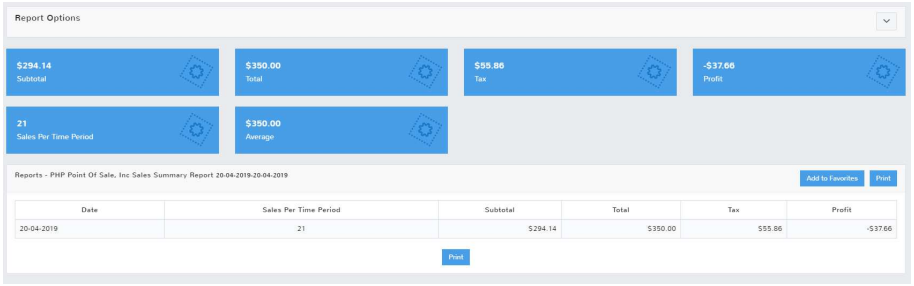


**Figure 5.11:** PHP POINT OF SALE Report generation system.

PHP POINT OF SALEs report shows the entire sale summary. It thoroughly search by date and the report shows subtotal, total tax and profit. It can also print the report.

### 5.6.2 DEALPOS Report

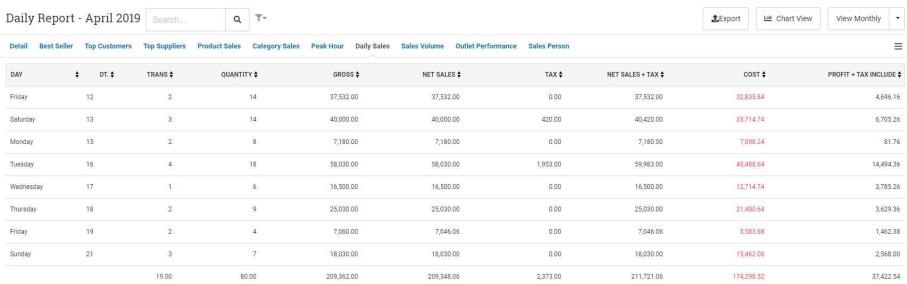


**Figure 5.12:** DEALPOS Report generation system.

DEALPOS report shows best seller, top customers, top suppliers, peak hour etc. This report system has export option. The different is it can shows the outlets report result.

## 5.7 Comparison Table

| Name of Features | PHP POINT OF SALE | DEALPOS |
|---|---|---|
| Dashboard | ✓ | ✓ |
| Products | ✓ | ✓ |
| Sell | ✓ | ✓ |
| Reports | ✓ | ✓ |
| Contacts | ✓ | ✓ |
| Online Orders | * | * |
| Payment | ✓ | ✓ |
| Gift Cards | * | ✓ |
| Inventory | ✓ | ✓ |
| Employees | * | ✓ |
| Buy | * | * |
| Expire date alert | * | * |

**Table 5.1:** ***Comparison Table.***

# Chapter 6

# Project Implementation

## 6.1 Structure of Application Code

As mentioned above we use the three tier application architecture to create this Point of Sale system using Visual Studio 2017. The code editor was provided to us as a white blank area and the explorer solution for all code files. The code editor is used to convert the logical into code and ensure that the solution explorer remains secure. We kept each code file with the Solution Explorer by creating the folder and adding those files to the same folder. Point of Sale system was the main directory. The folders, sub-folders and their files are given below[8].

## 6.2 Logic

**Step 1:** Start program.
**Step 2:** Login and validation Process.
**Step 3:** Choose Sell, Product Entry or Modification Analysis.
**Step 4:** Use compatible hardware for selling and entry purpose.
**Step 5:** Collect cash in either cash or card.
**Step 6:** Either Generate report or invoice.
**Step 7:** If Admin can configure a new sore assign new employee and update inventory.
**Step 8:** Stop program.

## 6.3 Login Algorithm and Validation

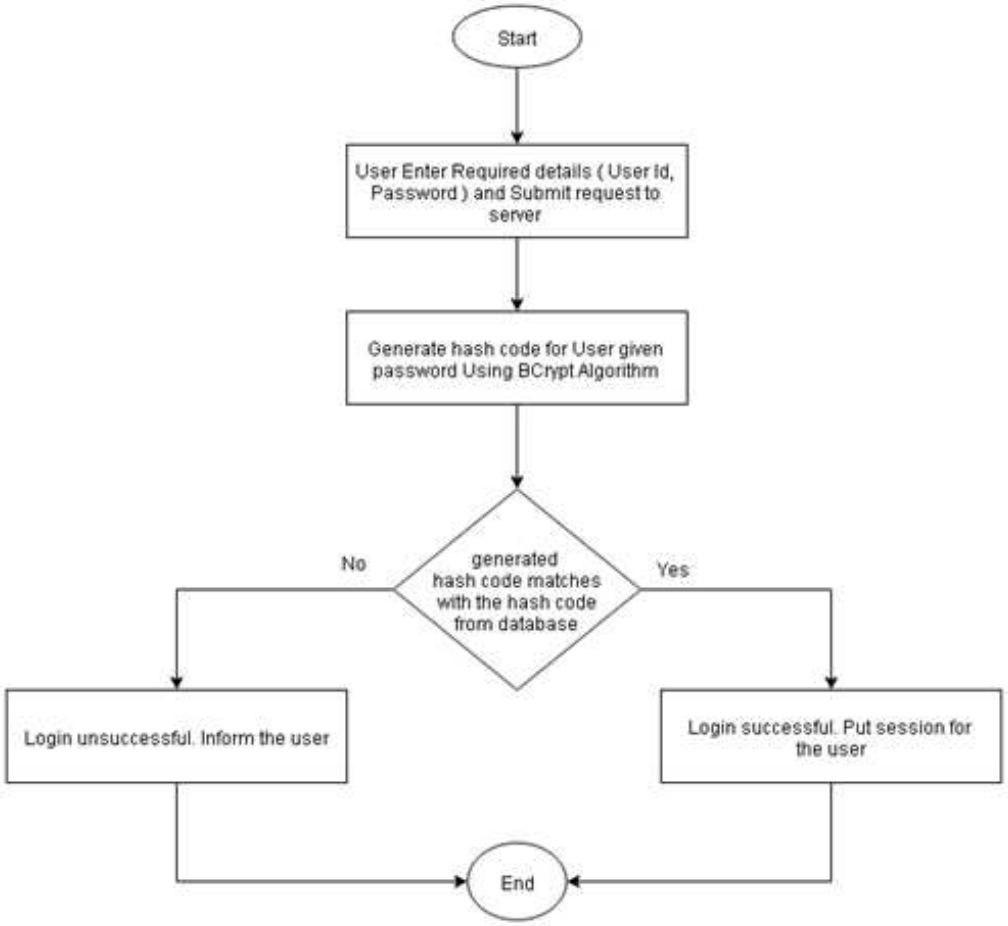


**Figure 6.1:** Login & validation Process Flow.

## 6.4 Project Demonstration

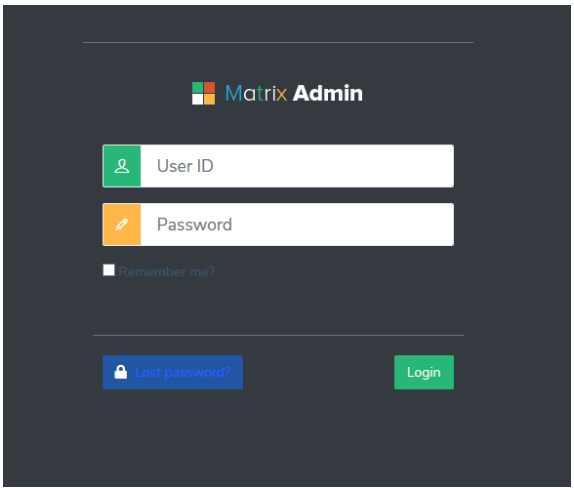


**Figure 6.2:** login page.

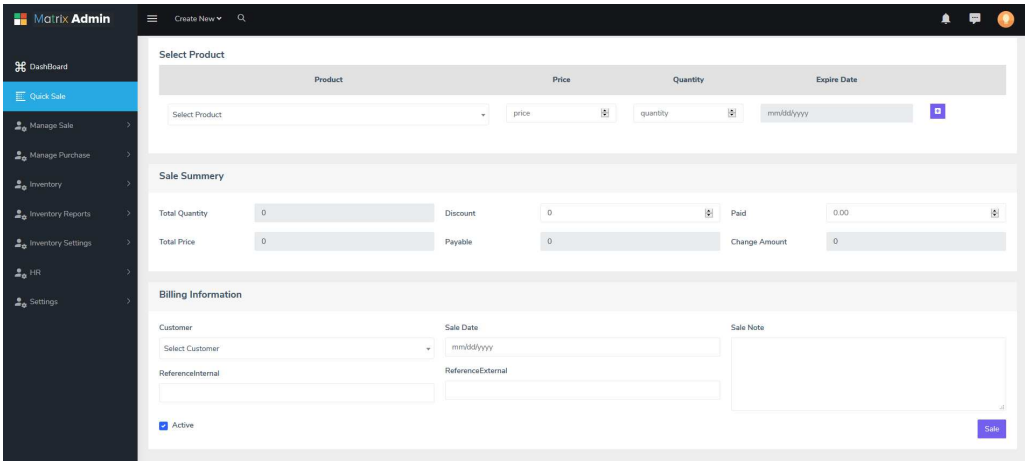


**Figure 6.3:** Procedure to sell a product

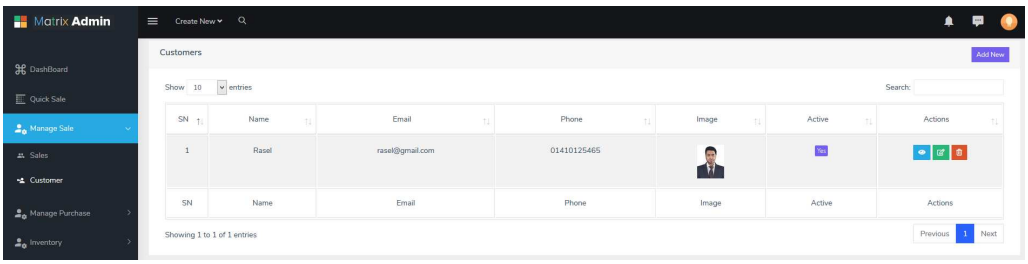


**Figure 6.4:** Customer Details

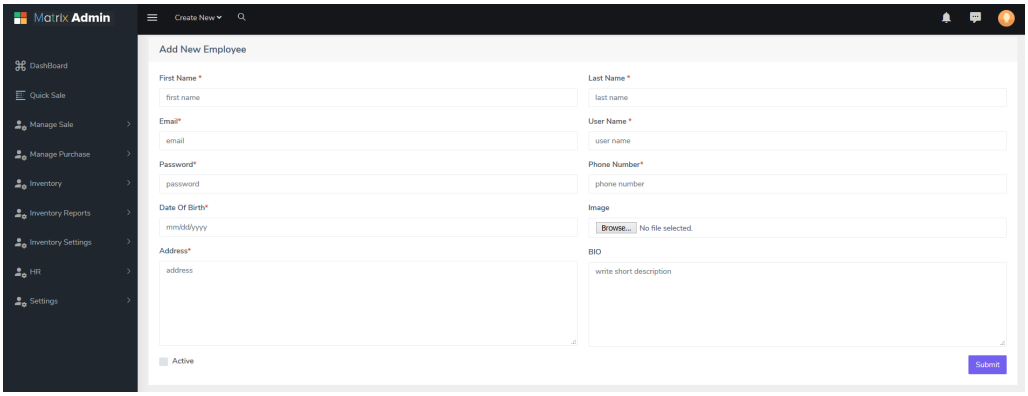


**Figure 6.5:** Procedure to add new customer

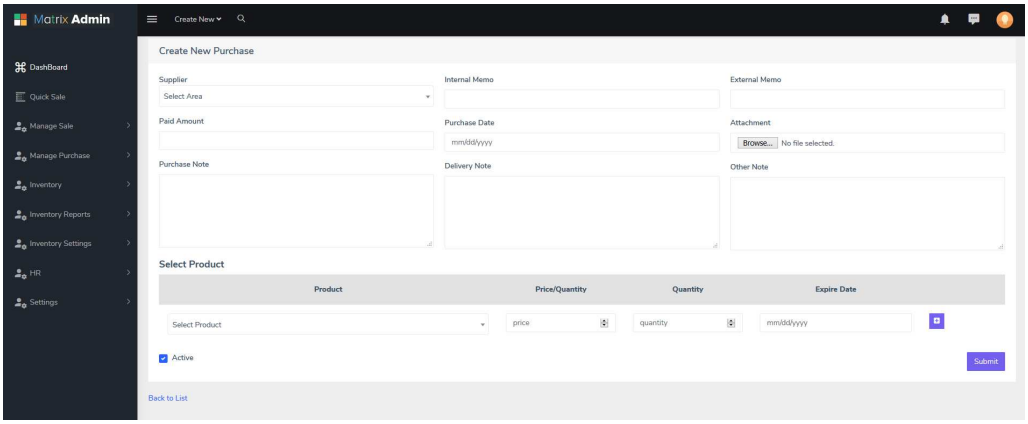


**Figure 6.6:** Procedure to add new purchase

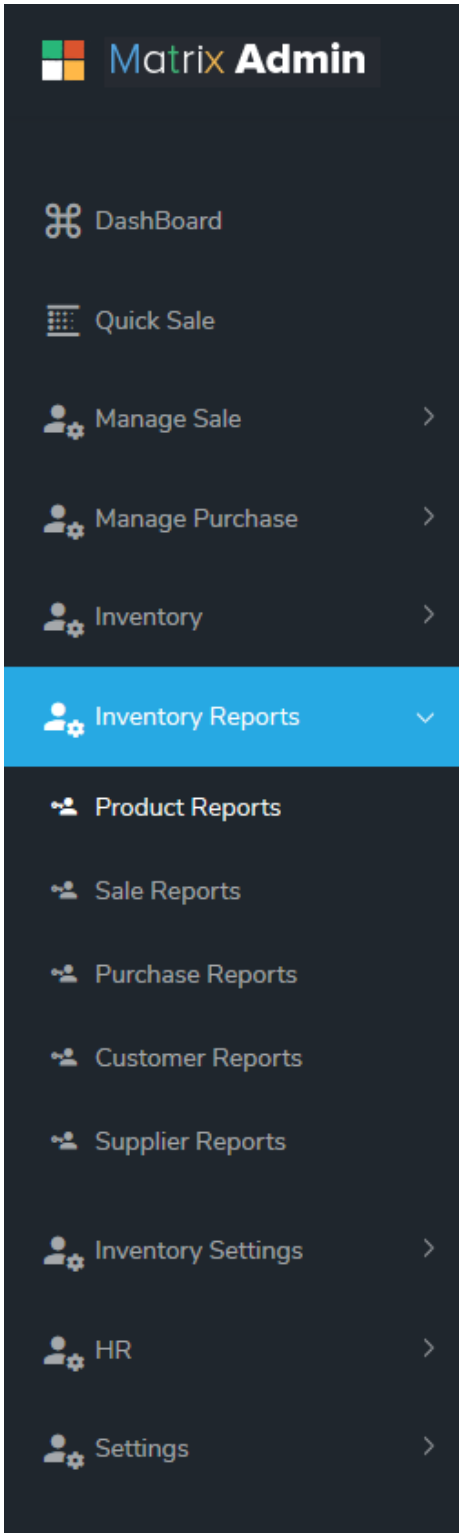


**Figure 6.7:** Procedure to generate reports

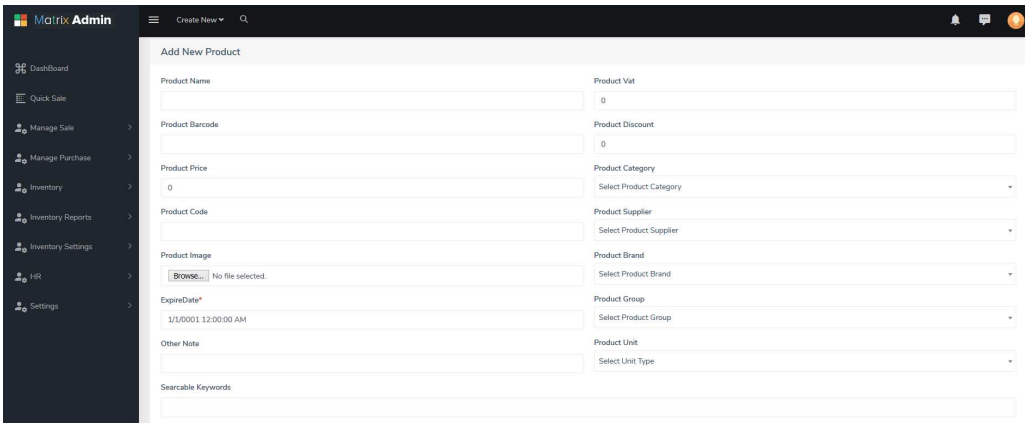


**Figure 6.8:** Procedure to add new product

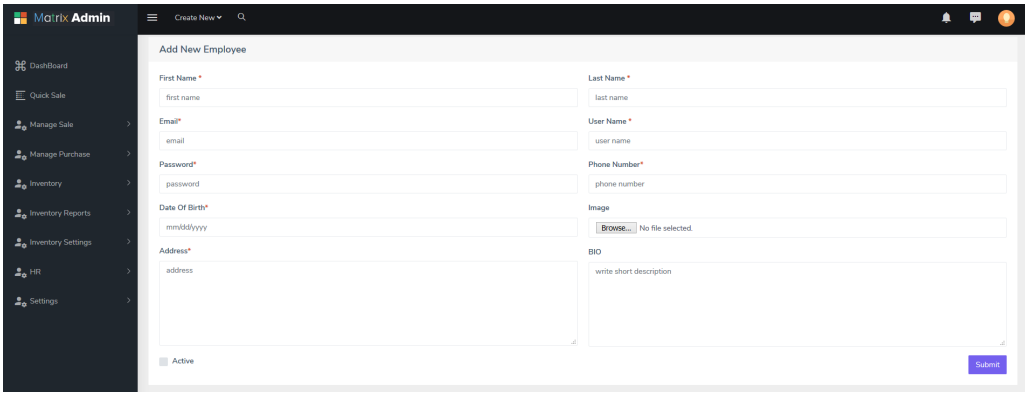


**Figure 6.9:** Procedure to add new employee

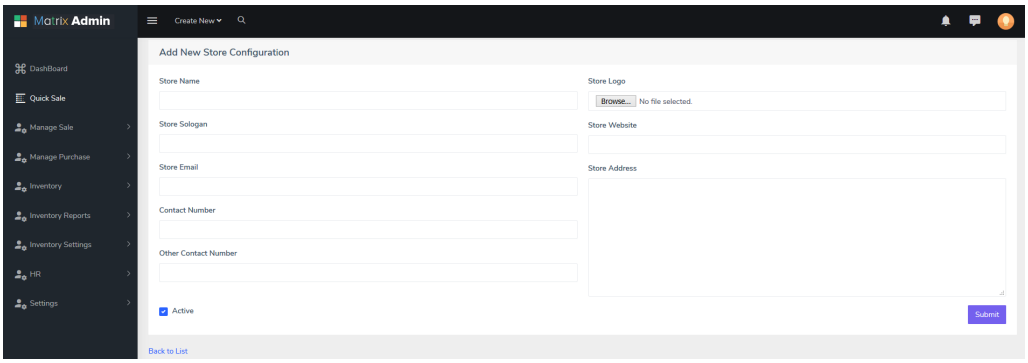


**Figure 6.10:** Procedure to assign a new store

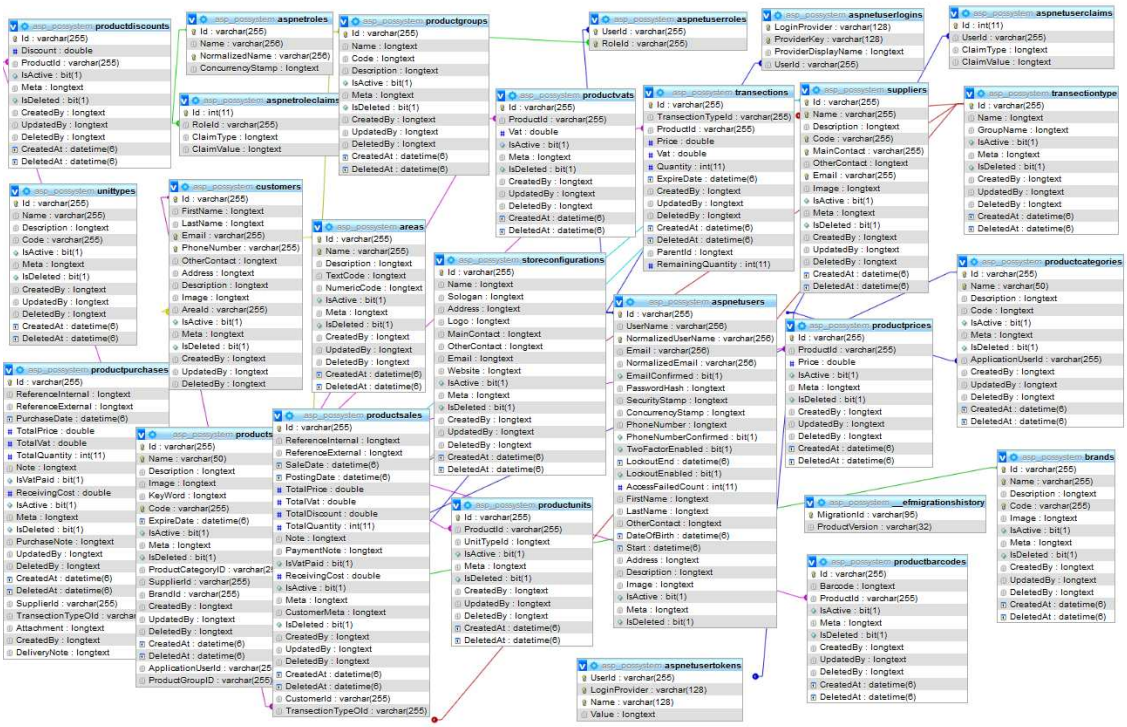

**Figure 6.11:** Current Database Design (MySQL)

## 6.5 Debugging and Testing

Debugging is the method of repairing a bug in the code in the sense of software engineering. This applies, in other words, to the detection, evaluation and elimination of errors. This operation starts after no proper execution of the code and finishes by solving the problem and checking the program successfully. It is considered an extremely complex and repetitive process because at all levels of debugging errors need to be fixed. Debugging is the method of repairing a bug in the code in the sense of software engineering. Testing is a method in which a program is executed in order to find error. It should be free of errors to make our code work well. When testing is done correctly it will eliminate all the code errors[9].

## 6.6 Testing purpose

**1.** Finding defects that the programmer can create during the creation of the code.
**2.** Gaining trust and providing quality level information.
**3.** To stop faults
**4.** To ensure that the end result meets the requirements of company and consumer.
**5.** To ensure that it follows the BRS specification for business requirements and the SRS specifications for system requirements.

### 6.6.1 Testing Types

**Unit Testing:** This focuses on the tiniest software design module. In this we measure an individual unit or group of interrelated units. By using sample data and analyzing the corresponding outputs it is often achieved by programmer.
**Alpa Testing:** This is a form of validation testing. It is a type of acceptance testing that is conducted before customers purchase the product. It's usually done by people with Quality Assurance Engineers.

### 6.6.2 Test Results

Our Developed system is passed with 1/3 of unit testing means 75% accuracy in testing.

# Chapter 7

# Impacts & Standards

Over the last twenty years, sales data, stock purchase and tracking (Merchandise Systems) were collected in store using software and hardware like POS system. We studied several POS system documentation (like PHP POINT OF SALE and DEALPOS) to observe performance. Our findings were very similar to that provided by the vendor company after the POS technology has been installed. In average, customers experience a sales increase in the range of 10% to 24% six months after installation of their systems for up to two years and then an 8% to a 10% increase afterwards. Clients with customer databases are nevertheless entitled to increase sales further because customer profiling enables them to continue to expand business not only with existing customers, but with new ones as well [10].

## 7.1 Retailer Expectations

In the light of a properly deployed, integrated POS system with merchandise and customer profile scheme following results are generally possible after the first one year.

| | High Performance[4] | Mid Performance[5] | Low Performance[6] |
|---|---|---|---|
| Sales Increase | + 20% | + 10% | + 5% |
| Expense Decrease | – 15% | – 8% | – 2% |
| Margin Increase | + 25% | + 15% | + 8% |
| Net Profit Increase | + 30% | + 12% | + 6% |

**Figure 7.1:** Performance Study.

More than 40 Independent Retail Clients data from Dionco Inc., the National Technology Study of 1998 and the POS 1997 from BC Ferries have been gathered for this white paper.

All those factors are maintain to achieve a total profitability rise but it is safe to predict that within a year of technology deployment and full use, a shop can increase its net profit by at least 10% . This would lead to a significant return on investment, with the majority of independent retailers spending about 2% of their sales on technology[11]..

## 7.2 Higher sales/Lower operating costs?

1. **The accurate collection** of the exact item details and sold with the suggested replacement increases the goods inventory position. That ensures that the sales of non-inventory goods are not lost and that the total sales ultimately increase.

2. **Faster customer inspection** by scanning items increases the customers ' output in the cash register. This reduces a customer's likelihood of a long line and not a purchase at busy times.

3. **"Gift receipts"** are produced by identifying the number of transaction and make returns much more precise by identifying the selling price. These receipts can be linked to a bar-coded sticker on the item to make the return track even more accurate and customer dissatisfaction.

4. **Transaction Contract** function will suspend a transaction while the customer either goes to his car to receive his checks or charges card or returns to the store to get a supplementary item or resumes the transaction on the customer's return. This speeds up customer processing and reduces waiting time behind that customer.

5. **Capture of customer information** allows individual customers to continue marketing on the basis of buying habits. This form of micro marketing is increasing and a business can grow significantly.

6. **Suggested re-ordering** can greatly improve the inventory position of core goods and not only increase sales, but also substantially reduce operating costs by allowing personnel to count and prepare orders manually.

There should be some standards in each project. By following certain coding, UI (User Interface), web development, ethics and software standards, we are developing our project.

## 7.3 Constrains

### 7.3.1 Manufacturability

The system we are building we know all the resources and the maximum number of them is available online. Modern technology can model our system in such a way that it can be changed as necessary and the system will be completely profitable for us.

### 7.3.2 Sustainability

It is a sustainable system because having a pos system in a retail shop is a mandatory things now a days, so if we meet the customer needs in full and if we keep the system, it is supposed to last for a very long time.

## 7.4 Findings

To gather the information we need we visit one of the biggest and leading chain group of industry of our country "United Group". Technically, United IT have made some excellent contributions to research on POS solution and inventory collecting ,making basic discoveries, designing numerical algorithms, and inventing new diagnostic techniques. We also visit some retail shop like Bata, Shopno, Agora to collect the answer of our queries. We study their problems and try to find the solution with the best logical way possible.

## 7.5 Standards

There should be some standards in each project. By following certain coding, UI (User Interface), web development, ethics and software standards, we are developing our project.

### 7.5.1 Code

**1. MSDNs:** Microsoft coding standards for ASP .NET framework controls based on C# or visual basic programming language. We use C# for our project and maintain Microsoft coding standards.
**2. W3Cx:** The World Wide Web Consortium (W3C) is an international organizations that work together with member of organizations, staff and the public to develop standards and guidelines for Web Development growth in the long-standing future. By following this standards our project become compatible with cross platform with different internet browsing applications.

### 7.5.2 UI (User Interface)

**1. SAP Design Guild:** SAP Design Guidelines demonstrate the philosophy and overview of all plans, patterns and controls in the user experience and interface. Our project user interface will maintain SAP standards.

### 7.5.3 Ethics

We followed NSPE (National Society of Professional Engineers) in ethical standard because it maintains a professional standard.

## 7.6 Project Limitation

The project is still under development and its features and upgradation will be completely dependable on client's demand. Because of using the technology build my Microsoft this software couldn't be host from those server who doesn't support ASP.

## 7.7 Lesson Learned

We work along to gather and develop this system. After all of this research's we can say that it's not an easy task to start a new product within a short period of time when there are too many competitors available in market.

## 7.8 Future Work

We want to start a small tech startup POS provider vendor in Bangladesh. Focusing that, we are trying to gather the drawbacks of our competitors and add more features based on market's needs and client's demands.

## 7.9 Conclusion

The technology "POS Program with Inventory" built for a business is designed to achieve maximum efficiency and reduce the time needed to handle payroll operation. It is designed to replace the current manual recording system, reducing the time needed for calculations and data storage. The system uses front end HTML, CSS, JavaScript and Microsoft ASP.NET MVC as backend and SQL for Database[12].

# Chapter 8

# Project Work Division

Since this is a project with a fairly large amount of study and doings, we have divided the workload among our group members in the followings:

| **Job/Name** | **Saif** | **Sakib** | **Halima** | **Mir** | **Shaila** |
|---|---|---|---|---|---|
| Coding | ✓ | | | | ✓ |
| Algorithms | ✓ | | | | ✓ |
| UI design | ✓ | ✓ | | ✓ | |
| Database creation | ✓ | | | | ✓ |
| Prototype design | | ✓ | ✓ | ✓ | ✓ |
| Use cases design | | ✓ | ✓ | ✓ | ✓ |
| Gathering information based on our needs | ✓ | ✓ | ✓ | ✓ | ✓ |
| Video capture | ✓ | ✓ | ✓ | ✓ | ✓ |
| Video editing | | ✓ | | | |
| Latex programming | | ✓ | | | |
| Industry visit | ✓ | ✓ | ✓ | ✓ | |
| Client site visit | ✓ | ✓ | ✓ | ✓ | ✓ |
| Poster making | ✓ | ✓ | | | |
| Paper selection | ✓ | ✓ | | | ✓ |
| Paper study | ✓ | ✓ | ✓ | ✓ | ✓ |
| Report writing | ✓ | ✓ | | | ✓ |
| PPT creation | ✓ | ✓ | | ✓ | |
| Presentation | ✓ | ✓ | ✓ | ✓ | ✓ |

**Table 8.1:** ***Project Work Division.***

## 8.1 Gantt Chart

It is one of the most popular ways of illustrating the schedule of the project. A Gantt chart is a graphical representation of a project showing each activity task as a horizontal bar, the length of which is proportional to its completion time. A project deliverables Gantt chart within the time frame. The Gantt chart of this project is shown below:

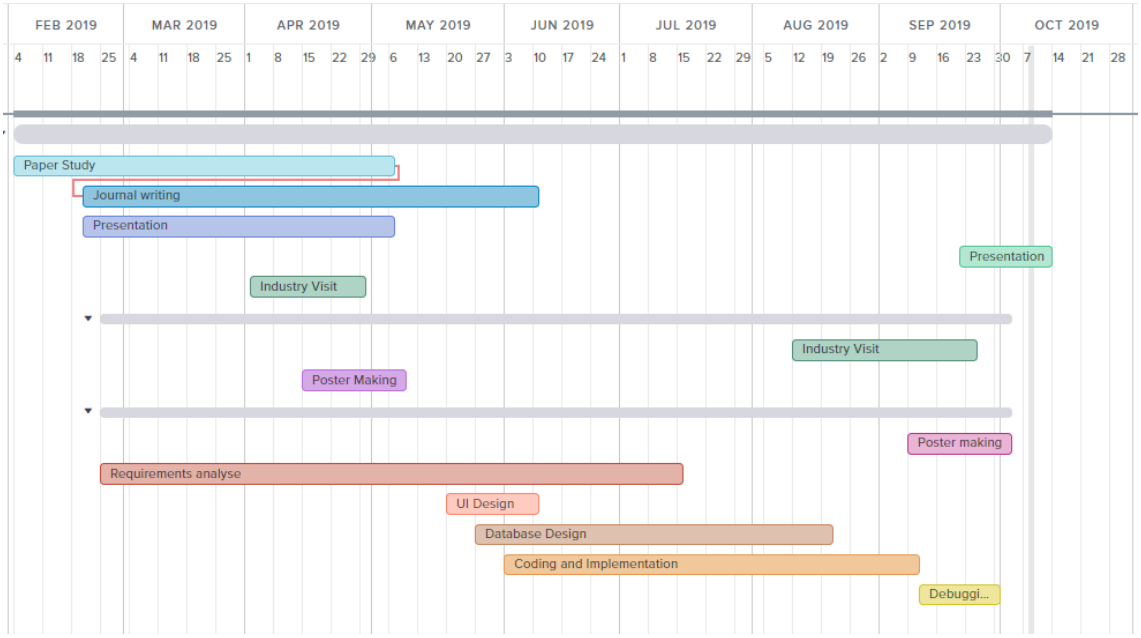


**Figure 8.1:** Project Gantt Chart.

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