

**Point of Sale with Enhanced Inventory Management**

BY

WONG WENG KIN

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF BUSINESS INFORMATION SYSTEMS (HONS)

Faculty of Information and Communication Technology

(Perak Campus)

JANUARY 2017

UNIVERSITI TUNKU ABDUL RAHMAN

**REPORT STATUS DECLARATION FORM**

Title: \_\_\_\_\_  
\_\_\_\_\_

Academic Session: \_\_\_\_\_

I \_\_\_\_\_

(CAPITAL LETTER)

declare that I allow this Final Year Project Report to be kept in  
Universiti Tunku Abdul Rahman Library subject to the regulations as follows:

1. The dissertation is a property of the Library.
2. The Library is allowed to make copies of this dissertation for academic purposes.

Verified by,

\_\_\_\_\_  
(Author's signature)

\_\_\_\_\_  
(Supervisor's signature)

Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
Supervisor's name

Date: \_\_\_\_\_

Date: \_\_\_\_\_

**Point of Sale with Enhanced Inventory Management**

BY

WONG WENG KIN

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF BUSINESS INFORMATION SYSTEMS (HONS)

Faculty of Information and Communication Technology

(Perak Campus)

JANUARY 2017

## DECLARATION OF ORIGINALITY

I declare that this proposal entitled “**Point of Sale with Enhanced Inventory Management**” is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

Signature : \_\_\_\_\_

Name : \_\_\_\_\_

Date : \_\_\_\_\_

## **ACKNOWLEDGEMENTS**

I would like express my sincere thanks and appreciation to my supervisor, Dr Rehan Akbar who has guiding me and helping me for this project. It is my pleasure to going to develop a point of sale to my family business. Thank you for the support.

To thank my friend Chong Zhen Lun, Koay Wei Seng and Chia Min Jun who has giving me a lot of idea and spending time to listen for my problem. Finally I want to thanks to my parent for their support and encourage throughout the course.

## **Abstract**

The purpose of this project is to overcome a few problem that currently facing by Yat Yat Mini Market. The propose application is Web Base Point of Sale with Enhanced Inventory Management which is an application for business transactions involving the collection, modification retrieval of all transaction data, help seller to record the transaction and manage inventory.

The platform of this application is web base platform that allows user easy accessible the application anywhere, easier installation and maintenance, and accessible for a range of device. This software is applicable for the manufacturer, companies, super markets, hyper markets, retailer stores, and small scale businesses and franchises to help their business to run in a manageable manner. Next, there is a few unique module of this application which is shelf management, stock alert and debtor profile that does not exist in the current point of sale application.

In this project, the proposed application will be fully working as a real point of application to manage the business in term of transaction and inventory management. The support module will be analytic report, GST calculation, item checkout, price lookup, access product information, and separate tax exemption.

# TABLE OF CONTENTS

<b>DECLARATION OF ORIGINALITY</b>	<b>i</b>
<b>ACKNOWLEDGEMENTS</b>	<b>ii</b>
<b>ABSTRACT</b>	<b>iii</b>
<b>TABLE OF CONTENTS</b>	<b>iv</b>
<b>LIST OF FIGURES</b>	<b>iv</b>
<b>LIST OF TABLES</b>	<b>iv</b>
<b>Chapter 1 : Introduction</b> .....	<b>1</b>
<b>1.1 Motivation</b> .....	<b>1</b>
<b>1.2 Problem Statements</b> .....	<b>1</b>
<b>1.2.1 Face difficulty to manage and search stock without shelf management</b> .....	<b>1</b>
<b>1.2.2 Forget to restock a product</b> .....	<b>2</b>
<b>1.2.3 Forget debtor detail</b> .....	<b>2</b>
<b>1.3 Project Scope</b> .....	<b>3</b>
<b>1.3.1 Shelf Management Module</b> .....	<b>4</b>
<b>1.3.2 Stock Alert Module</b> .....	<b>4</b>
<b>1.3.4 Item Checkout Module</b> .....	<b>4</b>
<b>1.3.5 Item Check in Module</b> .....	<b>4</b>
<b>1.3.6 Report Module</b> .....	<b>5</b>
<b>1.3.7 Access Product Information</b> .....	<b>5</b>
<b>1.4 Project Objectives</b> .....	<b>6</b>
<b>1.5 Impact, significance and contribution</b> .....	<b>6</b>
<b>1.6 Background information</b> .....	<b>6</b>
<b>The component of point of sale</b> .....	<b>7</b>
<b>The trend of point of sale machine</b> .....	<b>8</b>
<b>1.6.3 Platform for Point of Sale</b> .....	<b>9</b>
<b>Chapter 2 : Literature Review</b> .....	<b>11</b>
<b>2.1 Introduction</b> .....	<b>11</b>

2.2 Bindo POS.....	11
2.3 Vend Point of Sale.....	13
2.4 Light Speed.....	15
2.6 Comparison between 5 existing point of sale system .....	19
2.7 ManageByStats.....	21
<b>Chapter 3 : System Design .....</b>	<b>24</b>
3.2 System Design/ Overview .....	24
3.2.1 Use Case Diagram .....	24
3.2.3 Class Diagram .....	25
3.2.2 Entity Relation Diagram .....	26
3.2.3 Activity Diagram.....	27
3.2.4 Sequence Diagram.....	34
3.2.5 Data Dictionary .....	41
3.2.6 Block Diagram.....	48
3.3.7 User Interface Design.....	49
<b>Chapter 4 : Methodology and Tools.....</b>	<b>64</b>
4.1 Design Specification .....	64
4.1.1 Methodologies and General Work Procedures .....	64
4.2 Chapter Summary .....	73
<b>Chapter 5 : Functionality .....</b>	<b>74</b>
5.0 Overview .....	74
5.1 Login Page Testing.....	74
5.1.1 Error username or password .....	74
5.2 Register Page Testing .....	74
5.2.1 Duplicate username.....	74
5.2.2 Empty input.....	75
5.3 Home Page Testing .....	75
5.3.1 Add item for check out.....	75
5.3.2 Delete item for check out .....	75
5.3.3 Search function .....	76
5.3.4 Total Bill .....	76
5.3.5 Pay bill .....	77



5.3.6 Payment value lower than the transaction bill .....	77
5.3.7 Balance.....	78
<b>5.4 Inventory Page .....</b>	<b>78</b>
5.4.1 Inventory section.....	78
5.4.2 Empty field.....	79
5.4.3 Profit margin of an item .....	79
Figure 5.13: Profit margin of an item .....	79
<b>5.5 Supplier Page.....</b>	<b>80</b>
5.5.1 Supplier Section .....	80
5.5.2 Empty input.....	80
5.5.3 Phone validation.....	81
5.5.4 Email address validation .....	81
<b>5.6 Shelf Page.....</b>	<b>82</b>
5.6.1 Hover edit icon.....	82
5.6.2 Request for shelf name.....	82
5.6.3 Shelf name validation.....	83
5.6.4 Insert shelf level .....	83
5.6.5 Shelf level validation .....	84
5.6.6 Delete shelf .....	84
<b>5.7 Customer Page .....</b>	<b>85</b>
5.7.1 Customer section.....	85
<b>5.8 Report Page .....</b>	<b>85</b>
5.8.1 Report section .....	85
<b>5.9 Print function .....</b>	<b>86</b>
<b>Chapter 6 : Testing .....</b>	<b>87</b>
<b>6.0: Overview.....</b>	<b>87</b>
<b>6.1: Feedback form question .....</b>	<b>87</b>
<b>6.2: Feedback form result.....</b>	<b>90</b>
<b>Chapter 7 : Conclusion.....</b>	<b>99</b>
<b>Reference .....</b>	<b>101</b>
<b>Plagiarism Check Summary .....</b>	<b>104</b>

## LIST OF FIGURES

Figure Number	Title	Page
Figure 1.1	Debtor record.....	3
Figure 1.2	Component of point of sale .....	7
Figure 2.1	Bindo inventory management system.....	12
Figure 2.2	Vend POS Sales Report .....	14
Figure 2.3	Light Speed Interface.....	16
Figure 2.4	Check Statement	
Figure 2.5	Sales report list .....	18
Figure 2.6	IRS sales interface.....	18
Figure 2.7	Graph from ManageByStats.....	22
Figure 2.8	financial information .....	22
Figure 2.9	ManageByStats Dash Board .....	23
Figure 3.1	Use Case diagram for Slippi POS .....	24
Figure 3.2	Class diagram for Slippi POS.....	25
Figure 3.3	Entity Diagram of Slippi POS .....	26
Figure 3.4	Activity diagram of register account .....	27
Figure 3.5	Activity diagram of login .....	28
Figure 3.6	Activity diagram of create shelf.....	29
Figure 3.7	Activity diagram of check out product .....	30
Figure 3.8	Activity diagram of check in product .....	31
Figure 3.9	Activity diagram of creating or edit customer profile.....	32
Figure 3.10	Activity diagram of view report.....	33
Figure 3.11	Sequence diagram of register account .....	34
Figure 3.12	Sequence diagram of login .....	35
Figure 3.13	Sequence diagram of creating shelf .....	36
Figure 3.14	Sequence diagram of check out product and cash register .....	37
Figure 3.15	Sequence diagram of check in product.....	38
Figure 3.16	Sequence diagram of creating customer profile .....	39
Figure 3.17	Sequence diagram of view report .....	40
Figure 3.18	Block Diagram for Slippi Point of Sales .....	48
Figure 3.19	Login Page .....	49
Figure 3.20	Register Page.....	50
Figure 3.21	Landing Page .....	51
Figure 3.22	Home Page .....	52
Figure 3.23	Home Page Search Function.....	53
Figure 3.24	Total Customer Paid prompt Box .....	53
Figure 3.25	Inventory Page .....	54
Figure 3.26	Insert or Edit Product information .....	55
Figure 3.27	Product Restock .....	56
Figure 3.28	Supplier Page .....	57
Figure 3.29	Supplier Edit or Insert Page .....	57
Figure 3.30	Shelf Page Floor Plan.....	58
Figure 3.31	Drag and Drop Component .....	58
Figure 3.32	Customer Page .....	59
Figure 3.33	Debtor Detail.....	60

Figure 3.34 : Insert Debtor Information .....	61
Figure 3.35 : Report Page.....	62
Figure 3.36: Report Graph.....	62
Figure 3.37: History Page.....	63
Figure 3.38: Receipt.....	63
Figure 4.4.1 : System Development Life Cycles .....	64
Figure 4.4.2 : Phased Development Phase.....	65
Figure 4.4.3 : NetBeans IDE logo .....	68
Figure 4.4.4 : MySQL Workbench logo .....	69
Figure 4.4.5 : Java logo.....	70
Figure 4.4.6 : HTML .....	70
Figure 4.4.7 : JSP.....	71
Figure 4.4.8 : Java Servlet .....	71
Figure 4.4.9 : GlassFish .....	72
Figure 5.1: Error username or password.....	74
Figure 5.2 : Duplicate username .....	74
Figure 5.3 : Empty input .....	75
Figure 5.4 : Add item for check out .....	75
Figure 5.5 : Delete item for check out .....	75
Figure 5.6 : Search function .....	76
Figure 5.7: Total Bill .....	76
Figure 5.8: Pay Bill.....	77
Figure 5.9: Payment value lower than the transaction bill .....	77
Figure 5.10: Balance .....	78
Figure 5.11: Inventory section.....	78
Figure 5.12: Empty field.....	79
Figure 5.13: Profit margin of an item .....	79
Figure 5.14: Supplier section.....	80
Figure 5.15: Empty input .....	80
Figure 5.16: Phone validation .....	81
Figure 5.17: Email address validation.....	81
Figure 5.18: Hover edit icon .....	82
Figure 5.19: Shelf name.....	82
Figure 5.20: Shelf name validation.....	83
Figure 5.21: Shelf level .....	83
Figure 5.22: Shelf validation .....	84
Figure 5.23: Delete shelf .....	84
Figure 5.24: Customer section.....	85
Figure 5.25: Report section .....	85
Figure 5.26: Print function .....	86
Figure 6.1: Feedback Form1 .....	87
Figure 6.2: Feedback Form 2 .....	88
Figure 6.3: Feedback Form 3 .....	88
Figure 6.4: Feedback Form 4 .....	89
Figure 6.5: Result 1 .....	90
Figure 6.6: Result 2 .....	91

<b>Figure 6.7: Result 3 .....</b>	<b>92</b>
<b>Figure 6.8: Result 4 .....</b>	<b>93</b>
<b>Figure 6.9: Result 5 .....</b>	<b>94</b>
<b>Figure 6.10: Result 6.....</b>	<b>95</b>
<b>Figure 6.11: Result 7.....</b>	<b>96</b>
<b>Figure 6.12: Result 8.....</b>	<b>97</b>
<b>Figure 6.13: Result 9.....</b>	<b>98</b>

## LIST OF Table

Table Number	Title	Page
Table 1.1	Trend of point of sale machine .....	8
Table 1.2	Platform for point of sale .....	9
Table 2.1	Comparison between existing points of sales system .....	20
Table 3.1	Data Dictionary - Login.....	41
Table 3.2	Data Dictionary - Supplier .....	42
Table 3.3	Data Dictionary – Shelf .....	43
Table 3.4	Data Dictionary - CustomerDetail .....	44
Table 3.5	Data Dictionary - Product.....	45
Table 3.6	Data Dictionary - Sales.....	46
Table 3.7	Data Dictionary - TransDetail.....	47
Table 3.8	Data Dictionary - Customer .....	47

## **Chapter 1: Introduction**

### **Chapter 1 : Introduction**

#### **1.1 Motivation**

Yat Yat Mini Market is my family business, which has been founded and established in Tanjung Malim, Malaysia in 2012. The mini market is selling grocery item such as body shampoo, biscuit and snack to their customer. Currently they are using a desktop base application point of sale to help them to manage the business. However, the application is not user-friendly enough for the mini mart user as they are not familiar with computer. Besides, the application is not able to fulfill their need in term of convenience and functionality. Next, due to the application is only able to work in desktop a lot of things there are not about to do such as unable to perform item checkup without a desktop. Therefore, this project is to develop a web application point of sale to help them to overcome the work that is not able to do in the current application.

#### **1.2 Problem Statements**

Currently Yat Yat Mini Market do not have a proper inventory management control and they are facing difficulty to manage their storage due to too much of items. The consequences will be wasting time, difficult to stock count and increase expenses due to the item not found or lost. Next, it is difficult to manage many items, as human memory is limited, retailers are difficult to remember which item is been sold or located at which location. According to Paul King (2014) the architecture of the brain is a signaling network, which is not very conducive to perfect storage and recall comparing with a digital computer. Lastly, due to the current economy is not ideal and the mini market is located in a small town, there got a lot of low income household. Hence, the customer may request to credit the payment. As there is a lot of customer request for credit payment, owner is facing the difficulty to remember all the debt from customer.

The following are the description of the problem facing by user of the store:

##### **1.2.1 Face difficulty to manage and search stock without shelf management**

For Yat Yat Mini Market, the owner might own a number of stocks that are storing in the shop. Due to too much of stock, store owner are facing the difficulty to manage and allocate the stock in shelf. Moreover, due to too much of stock, store owner might forget a particular stock is located at which shelf. Consequently this might cause the store owner to spend more time on searching a

## **Chapter 1: Introduction**

product. Furthermore, when store owner fail to search the particular item they may claim that the product is missing or been stolen, this may increase the cost for the store owner.

### **1.2.2 Forget to restock a product**

As the human memory are quirky, complicated, and unreliable (Thorin Klosowski, 2013), the store owner might forget to restock a product when a product is sold or less than a certain amount. This may cause store owner to face a shortage of products, and decrease the sales due to the product is not available. Thus, shortage cost will be increase and profit will decrease.

### **1.2.3 Forget debtor detail**

To maintain the customer loyalty Yat Yat Mini Market is allowed trustable customer to perform separate payment or credit payment. Currently, Yat Yat Mini Market is using paper to record customer who are request for credit payment. As four year past experience, they are losing quite a lot of number of bill, due to the paper that record customer detail are missing and not standardize. The paper that they record customer information are as show in figure 1.1. When the customer is settled their bill the owner will cross the record as the bill is paid. The information record in the record book are only the debtor name, date of purchasing and total amount of credit. The owner might face difficulty to search the debtor, because of lacking customer information.

## Chapter 1: Introduction

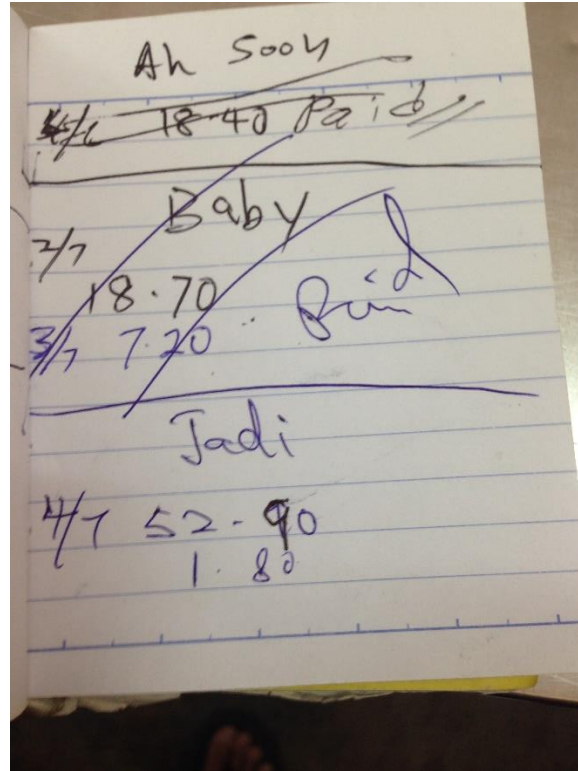


Figure 1.1 : Debtor record

Hence, the point of sale application and inventory management are very important to Yat Yat Mini Market, without a good point of sale application together with inventory management, the business of a store may not operate effectively and efficiently.

### 1.3 Project Scope

The name of this application is “Slippi POS”. Although this application is to solve Yat Yat Mini Market problem, it is applicable for many companies, super markets, hyper markets, retailer stores, and small scale businesses and franchises as well. Besides, the platform of this application is web base platform. The purpose of using web base platform is because it allows the user to access the application anywhere. This is useful when the owner is going to purchase stock by themselves, they are able to refer to their inventory through this web application. Next, it is easier installation and maintenance as the owner are not require to install the whole application into their desktop. Through web base platform user is able to access the application by a range of device, therefore without desktop user are still able to access the application as well.



## **Chapter 1: Introduction**

This application will implement shelf management, stock alert, customer profile, item checkout, item check in, report, and access product information.

Description of the features are as below:

### **1.3.1 Shelf Management Module**

In this module, user require to drag and drop the shelf into the floor plan provided in application. Once the floor plan is configured, the application is able to show the item location to user after the product is inserted in the application. Besides, the arrangement and the number of the shelf are able to configure by users. To specify the location of the item, user has to create a unique name for each shelf.

### **1.3.2 Stock Alert Module**

Stock alert module is when the particular item quantity drops to a certain amount that are set by user, the application will show the particular item in report module and Login Landing Page. The purpose is to remind the user the particular product has to be restock in order to avoid shortage cost.

### **1.3.3 Customer Profile Module**

Customer profile module are purposely create for storing customer information and the credit amount that particular customer own to the owner. This module is programmed to inform user the total amount of money that each debtor own and the detail of the transaction make by the debtor.

### **1.3.4 Item Checkout Module**

When item is going to purchase by customer, user have to scan the bar code or key in the reference code of the product. This process is to record the item is been sold, decrease the quantity of the product in the inventory to keep the inventory record up to date and to be a part of report information.

### **1.3.5 Item Check in Module**

Any new arrival item that are going to sell to customer are compulsory to check in. Users are require to key in the information of the each new arrival product such as product name, supplier name, quantity of the product, buying and selling price. The purpose of this module is to keep inventory up to date and allow user to search the item information is the future.

## **Chapter 1: Introduction**

### **1.3.6 Report Module**

This module is to generate a two type of report. First type of report is inventory report that include product detail, quantity of each item that is sold and the quantity of each item left in inventory. This report is able to show the user which product is the highest sale rate and the quantity of the product. On the other hand, sale report is showing the sale of day, week, month and year information to user. This report is to let user monitor the sale and the revenue of the business.

### **1.3.7 Access Product Information**

This module is work as a search function that enables user to search product information that had been checked in through this application. Besides, user is allow to edit the information of this module as well, such as change the product selling price and product name. There is a few example for using this module:

- 1) When user wants to know about the product detail.
- 2) When user wants to know the quantity of the product left in inventory.
- 3) When user wants to edit the detail of the product.

## **Chapter 1: Introduction**

### **1.4 Project Objectives**

The proposed new system would meet the following objectives.

1. To design and develop an online point of sale system with enhanced inventory management feature.
2. To implement an efficient way of controlling and managing inventory.
3. To implement a better inventory management system including shelf management, and stock alert.

### **1.5 Impact, significance and contribution**

This project is to help Yat Yat Mini Market and other retailer that are facing difficulty to use their point of sale or do not have any point of sale system. The benefit of this application is to help user reduce any cost that made by mistake, problem created from the existing point of sale and increase the convenience level of the point of sale by applying web base platform.

Yat Yat Mini Market is my family business. For the past four years' experience, the current point of sale application they are using had made a lot of problem and lack of required function for user. Therefore, I had decide to develop a point of sale application to solve and overcome the current problem.

By using this application user are able to access the application anytime and anyplace with internet connection. Besides, this application is included a few unique module to help the business such as shelf management, stock alert and customer profile module. Furthermore, this application able to help owner to reduce unnecessary cost such as customer profile that help owner to record debtor information and the total amount that debtor are owning.

### **1.6 Background information**

Point of sales is an upgrade version of the traditional cash register (Matt Veland, 2012), and now it able to run on e-commerce as well. The use of point of sale system is, it will record for the retailer once a transaction is made and update inventory in real time (Matt Veland, 2012). After updated the inventory, retailer able to monitor the stock inventory at any time and enable retailer to optimize their future purchase decision (Matt Veland, 2012). The point of sales system mainly includes the features to record and track customer orders, connect to another system in the network

## Chapter 1: Introduction

and manage inventory (Margaret Rouse, 2011). A point of sale generally included following component in table 1.0. According to RevelSystem.com the trend of point of sales is keeps changing, as showing in Table 2.0; since 1897 the point of sale systems have been modified and improved remarkably. Started from manual systems and the followed by better and advanced systems; now today in 2015 we have the most advances point of sale systems in the form web applications, web services, and sophisticated mobile based applications.

### The component of point of sale

 <b>Receipt Printer</b>	 <b>Point of Sale System</b>	 <b>POS Software</b>
 <b>POS Terminal</b>	 <b>Touchscreen</b>	 <b>Receipt Paper</b>
 <b>Cash Drawer</b>	 <b>Barcode Scanner</b>	 <b>Credit Card Reader</b>
 <b>Customer Display</b>	 <b>POS Keyboard</b>	 <b>Payment Terminal</b>

Figure 1.2 : Component of point of sale

## Chapter 1: Introduction

### The trend of point of sale machine

 <p>Ritty's Incorruptible Cashier in year 1879</p>	 <p>Mechanical Cash Register in year 1884</p>
 <p>Electronic Cash Register In year 1970</p>	 <p>Point of sale System</p>
 <p>Revel Systems iPad Point of Sale</p>	

Table 1.1 : Trend of point of sale machine

## Chapter 1: Introduction

### 1.6.3 Platform for Point of Sale

In today's global technological era there exist 3 types of point of sales systems platforms which are:

1. Computer-based point of sales system running is desktops, laptops etc.
2. Web-based point of sales system that require internet.
3. Mobile apps point of sales system application that run on mobile platform.




1. Computer base	2. Web-base	3. Mobile base
		

Table 1.2: Platform for point of sale

### 1.6.3 Background of Inventory Management

Point of sale system is one of the best methods of inventory management, as they automate the inventory process and allow business owners and managers to set stock alerts and make changes immediately' (Host Merchant Service, 2014). Besides, inventory management should allow for reporting and tracking all the items of inventory (Donald Reimer, 2008). The type of reporting that inventory management able to provide is stock status report, inventory movement report and parts history report. According to Retail Express (2013) the benefit of having inventory management included:

- Better decision-marking: Inventory management able to generate a report that contains a collection of real-time data about customer purchased item. By having this report user able to identify which product is most preferable by the customer. Therefore, user able to make a better decision for continue to selling the particular product or denial to sell the product.

## **Chapter 1: Introduction**

- Improve profitability and cash flow: User able to purchase the right amount of inventory to meet demand, and reducing the amount of slow-moving stock in warehouse by looking on the Inventory management report

## **Chapter 2: Literature Review**

### **Chapter 2 : Literature Review**

#### **2.1 Introduction**

This chapter is going to discuss the similar point of sales application and sub function that currently existing in the market in term of functionality, advantage, and disadvantage. The discussion will illustrate the comparison among the bench mark application. In the comparison, the functionality of application will be listed down to show the similarity and difference function offer by each application.

#### **2.2 Bindo POS**

Bindo is a cloud based iPad point of sale system that supports mobile platform (TrustedPOS, 2015). It only targets for small to medium sized businesses with the ability to store large quantity of inventory information. Before users start to use Bindo point of sale, they are require to register an account for sign in purpose.

There are a few useful features provided by Bindo Point of Sale. One of the features is that system is able to store costumer detail for tracking purpose. For example, ‘users can add and store individual customer information into the system. Once customer information is stored, the customer tab will shows all recorded customer and their individual details. The detail included customer purchase history, frequently used credit card, billing and shipping address, store credit account and loyalty account. By utilizing customer information, retailer are able to improve customer loyalty to boost their sales’.

Another feature Bindo point of sale provided is inventory management. Bindo support millions of pre-scanned item with using UPC (Universal Product Code). When the UPC is not found of a product in the database, users are allow to create a custom barcodes to represent the product. Once all the product detail is inserted, all product are listed and searchable under the inventory tab. This tab will ease the users to search a product and view the product information. As shown in Figure 2.1, the Bindo inventory management system is designed for real time update, track stocks, and sales for generates the custom report. The custom report is able to help the user to make a better decision for the business operation.



## Chapter 2: Literature Review



The screenshot displays a web interface for an inventory management system. At the top, there are three tabs for time periods: 'Last 30 days' (selected), 'Last 60 days', and 'Last 90 days'. Below the tabs is a table with the following columns: Product name, Price, Quantity, Sold, Margin, and Sales. The table lists several products, including a Polyester Hoodie, Wool Beanie, Short Sleeve T-shirt, and a New Jacket, with their respective prices, quantities, sold counts, margins, and sales figures. The 'Sales' column includes small red and green icons indicating trends.

	Product name	Price	Quantity	Sold	Margin	Sales
	Polyester Hoodie	\$39.00	12	32	41.3%	\$1,248.00 
	Wool Beanie	\$12.00	0	40	36.5%	\$480.00 
	Short Sleeve T-shirt	\$20.67	64	64	30.5%	\$1,389.00 
	Blue, Small	\$19.00	30	38	32.9%	\$722.00 
	Yellow, Medium	\$24.00	5	8	29.7%	\$192.00 
	Red, Large	\$19.00	29	25	28.8%	\$475.00 
	New Jacket	\$52.00	88	12	26.0%	\$4,624.00 

Figure 2.1 : Bindo inventory management system

Lastly, Bindo point of sale provided a wide variety of business report that included information in the POS. It automatically generate to users when request is been made, users doesn't need to key all the information in order to generate a report. The report function doesn't required users to spend more time and money to generate a valuable report. Besides, the report are adjustable by time period that allow users to decide. Type of report included, sale summary, daily earning, product sold, product sold summary, product sold breakdown, transaction breakdown, inventory, tax summary, batch, refund, time clock, sales performance, sales accounting, customer, serialized, account receivable, and export report.

The limitation of Bindo point of sale is it only applicable on iPad and doesn't not support android users. Next, accounting feature is not included, retailer are require to do accounting in other application or hire an accountant to do accounting. Next, using Bindo POS are required to have a strong wireless router to maintain cloud connection. Lastly, users might facing difficulty to search a product without a shelf management feature and facing shortage of a product due to forget to restock.

## Chapter 2: Literature Review

### 2.3 Vend Point of Sale

Vend point of sale is a cloud based point of sale founded in New Zealand in year 2010. User are able to use Vend feature as long as they connect to internet. When users lost connection to the internet, the web application will still operate on their own so that user will not miss any sale when users is offline. Vend point of sale is a great option to every type of business except service and hospitality (TrustedPOS, 2015).

Moreover, it provides a number of features including online dashboard to see the key matrix with mobile support environment, inventory management that able to add, remove, and edit inventory items and pricebook versability feature to maintain multiple price books. Moreover, Vend point of sale inventory management are design to help user to manage order management as well. There is a few function in order management (Vendhq, 2015), which is:

1. Stock orders: ‘The system able to create stock orders quickly with CSV uploads or by scanning product barcodes. Email orders directly to suppliers through Vend, then easily receive, modify and bulk print labels when orders arrive.’
2. Autofilled orders: ‘The system will automatically generate stock orders whenever a product drop below a pre-set levels with customizable reorder point. Therefore, store owner never have too much or too little stock in the inventory’.
3. Supplier returns: ‘The system able to record and return damaged, faulty, or unsold consignment stock back to suppliers’.

In addition, Vend point of sales system also has a nice and useful reporting design feature for users. The reporting feature includes three types of reports namely sales reports, inventory reports and payment reports. The system is easy to understand and user friendly. The reporting design for Vend Point of Sale system is shown in Figure 2.2. Furthermore, Vend point of sale are designed to ease of use, the user interface are laid out logically, everything divided into easily understandable subcategories.

## Chapter 2: Literature Review

Sales Report

Report Type: Sales Summary | Measure: Revenue | Date Range: 4th May 2015 - 31st May 2015

Filter | Export Data

Summary	2015				TOTALS BY SUMMARY				
	4th May	11th May	18th May	25th May	Revenue	Cost of Goods	Gross Profit	Margin	Tax
<b>Totals</b>	\$10,291.00	\$8,504.43	\$16,926.64	\$4,760.00	\$40,482.06	\$21,066.49	\$19,415.57	48%	\$4,048.21
Revenue	\$10,291.00	\$8,504.43	\$16,926.64	\$4,760.00					
Cost of Goods	\$5,200.75	\$4,471.40	\$9,112.99	\$2,281.35					
Gross Profit	\$5,090.25	\$4,033.03	\$7,813.65	\$2,478.65					
Margin	49%	47%	46%	52%					
Tax	\$1,029.10	\$850.44	\$1,692.66	\$476.00					

Figure 2.2 : Vend POS Sales Report

The limitation of the Vend point of sale is they do not provide account feature to handle accounting same like Bindo point of sale. Next, Vend point of sale are unable to send inventory request to suppliers from point of sale interface, user require to contact supplier by another way round. (TrustedPOS, 2015). Lastly users might facing difficulty to search a product without a shelf management feature and the autofilled order might not work to those suppliers who do not have a internet assess or rely on e-mail.

## Chapter 2: Literature Review

### 2.4 Light Speed

Light Speed point of sale is a web-based and support mobile platform. The target user for using Light Speed is all type of retailer except restaurant or bulk grocer (TrustedPOS, 2015). Generally Light Speed have 2 version, Light Speed Pro and Light Speed Cloud. Light Speed Pro is a system that run on server based, users are not require to connect to internet in order to use the system. While Light Speed Cloud are the opposite of Pro version, Light Speed Cloud do not require a backups and software update, it only require internet access to run the system.

Light Speed accept any kind of payment type, for example cash, debit, credit, check, gift card and store credit. Once a transaction is made, a receipts will be printed or send through email to customer. Next, Light Speed inventory management is design for the use of tracking incoming stock, warehouse reserved inventory, slot available inventory places and total inventory users own. Additionally, Light Speed allow user to manage multi-store inventory. When a store are facing shortage of an item, users are able to get the product at the other store by using this inventory function. Nevertheless, Light Speed reporting function is customize by user by filtering the report detail for a day, week, month or year.

In summary, Light Speed offering both server base and cloud base solution for retailer, and it support either mobile or desktop platform. The multi-store inventory management are able to synchronize across all the store own by the users. Furthermore, the limitation of Light Speed are users require to stay connect on internet when using Light Speed Cloud version or require backup data frequently when using Light Speed Pro version. Lastly, the limitation is users might facing difficulty to search a product without a shelf management feature and facing shortage of a product due to forget to restock.

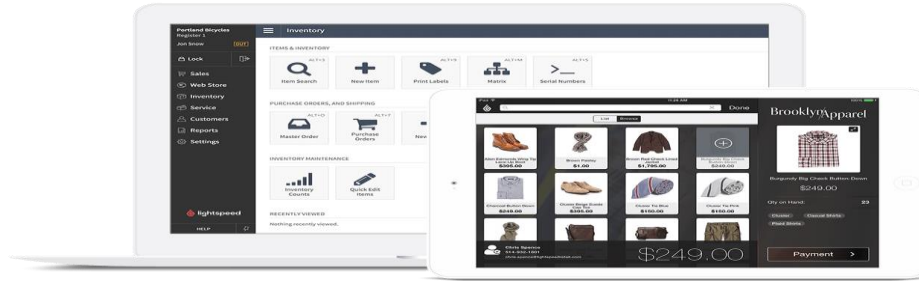


Figure 2.3 : Light Speed Interface

### 2.5 IRS Point of Sales

IRS point of sale is developed by IRS Software Sdn. Bhd Company. This company is a point of sales software development company in Malaysia. According to [www.irs.com](http://www.irs.com), they provide a different type of point of sales system for different business such as F&B and retailing business. Currently Yat Yat Mini Market is using this system to run their retailing business. The system is equipped with several hardware to fully function such as bill printer, bar code scanner, display pole, cash drawer, desktop and other input hardware.

The system are programmed with hotkey that providing quick access to specific function. Every function are able to trigger using the keyboard, such as pressing Ctrl + I will lead the user to Item screen to view product information, pressing F9 will open the cash drawer. This could help the user to trigger any function or processing of transaction effectively in term of time. Furthermore, this system has a module to record the stuff information. When the user wants to view staff information they are able to view it in this module.

Next, this system provided check function to record each cashier daily transaction. When the cashier starts using the system they are required to register cash in for the starting amount of money for money changing. At the end of working, the system will allow the user to print out a statement for calculating the total cash received, as shown in figure 2.4. If the cash in the drawer is not equal to the total cash received in the statement, mean the cashier is short during receiving money from customer or pay extra to the customer.

## Chapter 2: Literature Review

This system provided an easy import and export data function. The user are able to export customer, vendor and item information into excel file and import the excel file into the system. Other than import and export data the system included backup function to store every data in the database into a folder. The backup folder is usable when the user want to restore the system. This is useful because it secure the data from any disaster happen, user are not require to redo everything from scratch.

Moreover, this system provided a variety of report. The report that can be generated by this system is separate in a different categories such as item, sales, discount, customer, and analysis. When user selected one of the category the type of report will be listed, as shown in figure 2.5. The different report will show different information for the user and this report is able to improve decision making by the user.

The limitation of this system is lacking of record customer total debt function to record debtor detail. When debtor requests for credit cash payment, user is required to record the detail in another document. The system does not have the stock alert function to remind the user to restock. This could decrease the revenue because of no item is available for the customer. Lastly, the system does not have shelf management for manage the shelf and item location. This might cause item not found because the user is unable to find the item due to lack of shelf management.

## Chapter 2: Literature Review

Calculate		Print	
(*) SUB-TOTAL :	0.00		
CHEQUE TRANSACTION			
(+) SALES (0)	0.00		
(*) SUB-TOTAL :	0.00		
AMEX TRANSACTION			
(+) SALES (0)	0.00		
(*) SUB-TOTAL :	0.00		
*** TOTAL AMOUNT :	22.00		
SUMMARY :-			
TOTAL SALES : (4)	22.00		
TOTAL O/R : (0)	0.00		
PREPAID TOP-UP : (0)	0.00		
TOTAL F.O.C : (0)	0.00		
TOTAL ITEM DISCOUNT : (1)	0.18		
TOTAL SALES DISCOUNT : (0)	0.00		

Figure 2.4 : Check Statement

Report Navigator	
Shopping Cart	Sales
	Sales Listing By Date Range
	Sales Listing By Date Range (With Profit)
	Sales Listing By Month & Year
	Sales Listing By Month & Year Comparison
	Product Sales Listing By Date Range
	Product (Matrix) Sales Listing By Date Range
	Product (Matrix) Sales Listing By Yearly
	Product (Matrix) Sales Listing By Date Range - Matrix...
	Product Sales Listing By Date Range (With Cost)
	Product Sales Listing By Month & Year
	Salesperson Sales Listing By Date Range
	Salesperson Sales Listing By Date Range (With Disco...
	Salesperson Sales Listing By Month & Year
	Salesperson Sales Listing By Payment Mode
	Salesperson Product Sales Listing By Date Range
	Salesperson Product Sales Listing By Month Year
	Customer Sales Listing
	Sales Profit Listing By Date Range
	Sales Profit Listing By Month Year
	F.O.C Item Listing
	Sales Order Listing
	Sales Listing By Payment Mode - Date Range
	Sales Listing By Payment Mode - Month Year
	Sales Tax

Figure 2.5 : Sales report list

WELCOME TO YAT YAT SENG TRADING

Customer: [F11] Salesperson: [F6] Payment Term: [Dropdown] Cash [Icon]

Barcode: [F7]

No	Item No	Description	UOM	Qty	Price	%	U/Price	Amount	Picture	Remark
0								0		

Sales Order: [F5] Price Level: Price 1 [Dropdown] SALES [Icon]

Doc# [Dropdown] Options [Dropdown]

Sub-Total: 0.00 Rounding: 0.00  
 GST/SVC Tax: 0.00 0.00  
 Disc: 0.00  
 Tax: 0.00

Payment (F10) Reprint Hold Bill Del Order Clear (F1) Last Bill (Ctrl+L) Drawer (F2) Exit (F4)

Figure 2.6 : IRS sales interface

## Chapter 2: Literature Review

### 2.6 Comparison between 5 existing point of sale system

The comparison between five points of sales system has been summarized in table 2.1

P.O.S Brand Feature:	Bindo POS	Vend POS	Light Speed POS	IRS POS
Register & Card Terminal	✓	✓		
Inventory Management	✓	✓	✓	✓
Stock Management	✓	✓	✓	✓
CRM & Customer	✓	✓	✓	✓
Analytic Report	✓	✓	✓	✓
Storefront	✓	✓		
Invoice Generate	✓		✓	
Purchase Order	✓		✓	✓
Gift Card	✓	✓	✓	
Online Dashboard	✓	✓		
Mobile Support	✓		✓	
Desktop Support		✓	✓	✓
Staff Profile				✓
Backup & Restore	✓	✓	✓	✓
Hot Key Design				✓



## Chapter 2: Literature Review

Discount function				✓
Customize Preference				✓
Login & Logout	✓	✓	✓	✓

Table 2.1 : Comparison between existing points of sales system

In summary, there are a few limitations of the existing system. Firstly, it does not provide shelf management for a particular product that describes the exact location of the product including shelf number and level in the store thus makes it easy to locate the items. The shelf management feature is to provide convenience to the people to search a particular item like books in a library system. In this way, users can easily find the item when they know the exact location of the item in the store or warehouse. Secondly, the benchmark system do not include a proper quantity alarm features to alert the retailer to restock a product that is lesser than a certain quantity number. Lastly, the debtor profile is not included in those benchmark system. These might reduce the revenue of the owner if they forget the total amount of debt they currently own. When the owner forgets the detail of the debtor they might face difficulty to search the debtor. In this regard, the proposed system addresses these limitations of the existing systems by adding the enhanced features of shelf management, quantity alarm, and debtor profile. It makes it more useful and applicable both for the retailer as well as customers.

## Chapter 2: Literature Review

### 2.7 ManageByStats

ManageBystats is a business management tool for amazon sellers. This tool is web base application that allow user to assess in any places and anytime. According to managebystats.com the application is using cloud to store the user business data. This could minimize the user problem as they are not required to worry about storage size and swift data to another place because of the storage is centralize and store in cloud.

In this application, it provided the need of Amazon seller to manage their business. The main function of this application is Seller Tools that help the user to manage and organize the Amazon business. In the Seller Tools it contained the information of customer, product, inventory and sales, user can easily assess it at any time as long as there is internet access. Furthermore, this application allow user to group their product into different category or product line. This could ease the user to manage and view the performance of the same product.

The user can select the graph tap to view the performance of their business in Amazon, as show in figure 2.7. This function allows user to select the period of time for the performance of the business or the different type of product. For example as the figure 2.7 show, user are allow to choose a different brand of product, product line and product information. After the choice is selected the graph view displays on the screen.

## Chapter 2: Literature Review

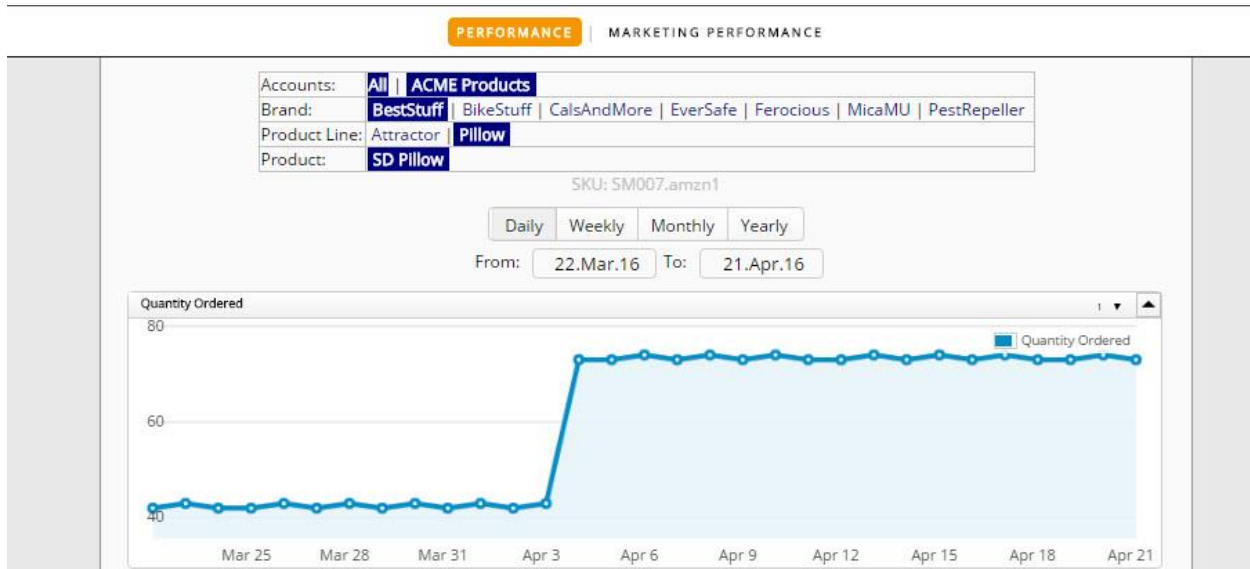


Figure 2.7 : Graph from ManageByStats

ManageByStats also included the financial documentation that included every financial information of the Amazon business, as shown in figure 2.8. The user is given a few choices of the report format, such as user can either choose brand or product line and the report timeline. This information able to give the user a clear picture of their business finance. It allows user to export and print it out as a hardcopy as well.

The screenshot shows the financial report interface for the year 2016, with a date range from 01.Jan.16 to 31.Dec.16. The report is filtered by 'Yearly' and includes a 'SAVE AS CSV' button. The table is divided into 'Orders' and 'Refunds' sections, with columns for various financial metrics.

Brand	Orders					Refunds					Other (Adj.)		Amazon Payout		Cost (Approx.)	Inbound (Approx.)	Ads Cost (Approx.)	Sales Tax (Collected)	Gross Profit (Approx.)
	Product Charges	Promo Rebates	Amazon Fees	Other	Qty	Product Charges	Promo Rebates	Amazon Fees	Other	Qty	Other (Adj.)	Amazon Payout	Cost (Approx.)	Inbound (Approx.)	Ads Cost (Approx.)	Sales Tax (Collected)	Gross Profit (Approx.)		
(Retrocharge)	\$0.00	\$0.00	\$0.00	\$2.05	0	\$0.00	\$0.00	\$0.00	-\$2.05	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
(Adjusted & Reimbursed)	\$0.00	\$0.00	-\$5.95	\$0.00	0	\$0.00	\$0.00	\$0.00	\$0.00	1	\$26.33	\$20.38	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20.38
(Undefined Brand)	\$13,922.75	-\$260.04	-\$4,222.94	\$1,173.50	899	-\$179.35	\$4.27	\$27.03	-\$15.61	13	\$129.90	\$10,579.51	-\$54,200.00	\$0.00	\$0.00	\$0.00	\$0.00	-\$480.80	-\$44,101.29
<b>BestStuff</b>	\$335,512.72	-\$14,851.92	-\$129,842.89	\$22,170.69	26,535	-\$7,835.10	\$215.75	\$1,380.43	-\$667.12	670	\$1,552.01	\$207,634.57	-\$10,947.06	\$0.00	\$0.00	\$0.00	\$0.00	-\$2,708.77	\$193,978.74
<b>CalsAndMore</b>	\$110.84	-\$2.08	-\$61.32	\$22.99	12	\$0.00	\$0.00	\$0.00	\$0.00	0	\$4.31	\$74.74	-\$54.00	\$0.00	\$0.00	\$0.00	\$0.00	-\$6.18	\$14.56
<b>EverSafe</b>	\$53,149.05	-\$1,299.64	-\$15,906.63	\$3,879.53	3,590	-\$689.37	\$6.90	\$87.12	-\$38.70	53	\$350.46	\$39,538.72	-\$11,462.00	\$0.00	\$0.00	\$0.00	\$0.00	-\$1,315.14	\$26,761.58
<b>Ferocious</b>	\$183,733.66	-\$5,232.20	-\$48,711.24	\$13,926.65	6,514	-\$4,708.82	\$117.80	\$685.55	-\$364.02	176	\$1,844.91	\$141,292.29	-\$55,554.75	\$0.00	\$0.00	\$0.00	\$0.00	-\$5,391.72	\$80,345.82
<b>MicaMU</b>	\$89.70	\$0.00	-\$28.90	\$1.35	6	\$0.00	\$0.00	\$0.00	\$0.00	0	\$0.00	\$62.15	-\$60.00	\$0.00	\$0.00	\$0.00	\$0.00	-\$1.35	\$0.80
<b>PestRepeller</b>	\$39.95	\$0.00	-\$32.25	\$27.36	1	\$0.00	\$0.00	\$0.00	\$0.00	0	\$0.00	\$35.06	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	-\$4.99	\$30.07
<b>Total</b>	\$586,558.67	-\$21,645.88	-\$198,812.12	\$41,204.12	37,557	-\$13,412.64	\$344.72	\$2,180.13	-\$1,087.50	913	\$3,907.92	\$399,237.42	-\$132,277.81	\$0.00	\$0.00	\$0.00	\$0.00	-\$9,908.95	\$257,050.66
<b>FBM Shipping Fees :</b> -\$739.57																			-\$739.57
<b>Amazon Service Fees :</b> -\$4,109.99																			-\$4,109.99
<b>Amazon Sponsored Ads Payments :</b> \$0.00																			\$0.00
<b>Total :</b> \$393,673.92																			\$251,487.16

Figure 2.8 : financial information

## Chapter 2: Literature Review

Next, this application provided a dashboard to show user the system health status, total payout Bi-Weekly and Restock Alerts information, as shown in figure 2.9. The restock alert information shows a few information such as SKU, total supply quantity, in stock supply quantity, units shipped last 30 days, restock lead time and stock cover trailing 30 days. This information could help the user to make the order decision.

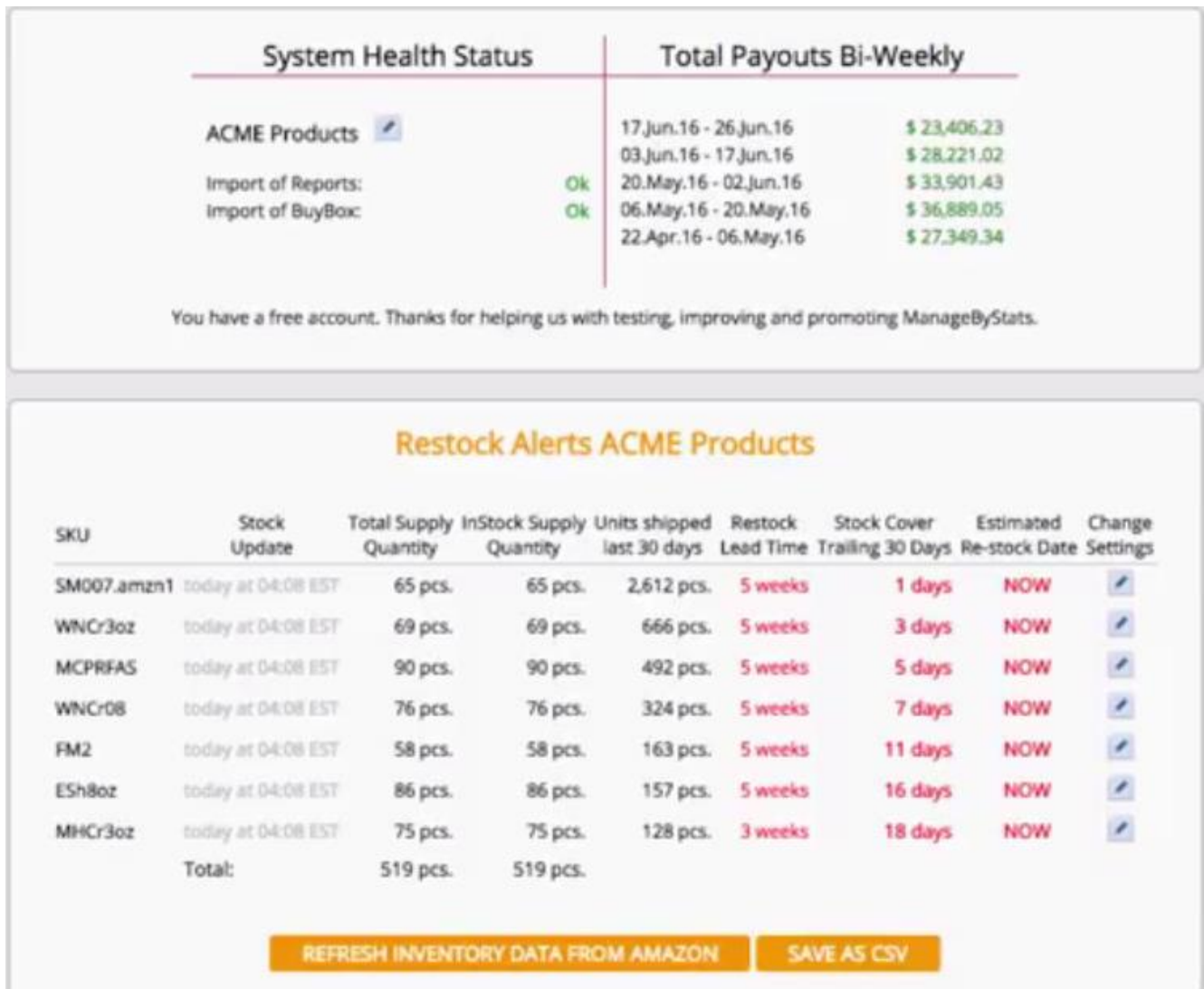


Figure 2.9 : ManageByStats Dash Board

Lastly, the limitation of this application is only usable for Amazon seller. The information and data are extracted from Amazon, therefore this application is not for non-Amazon user. The application does not have the debtor management module to store debtor information.

Chapter 3 : System Design

3.2 System Design/ Overview

This section will contain a diagram that illustrates the application. The diagram will be use case diagram, activity diagram, class diagram, data dictionary and user interface design.

3.2.1 Use Case Diagram

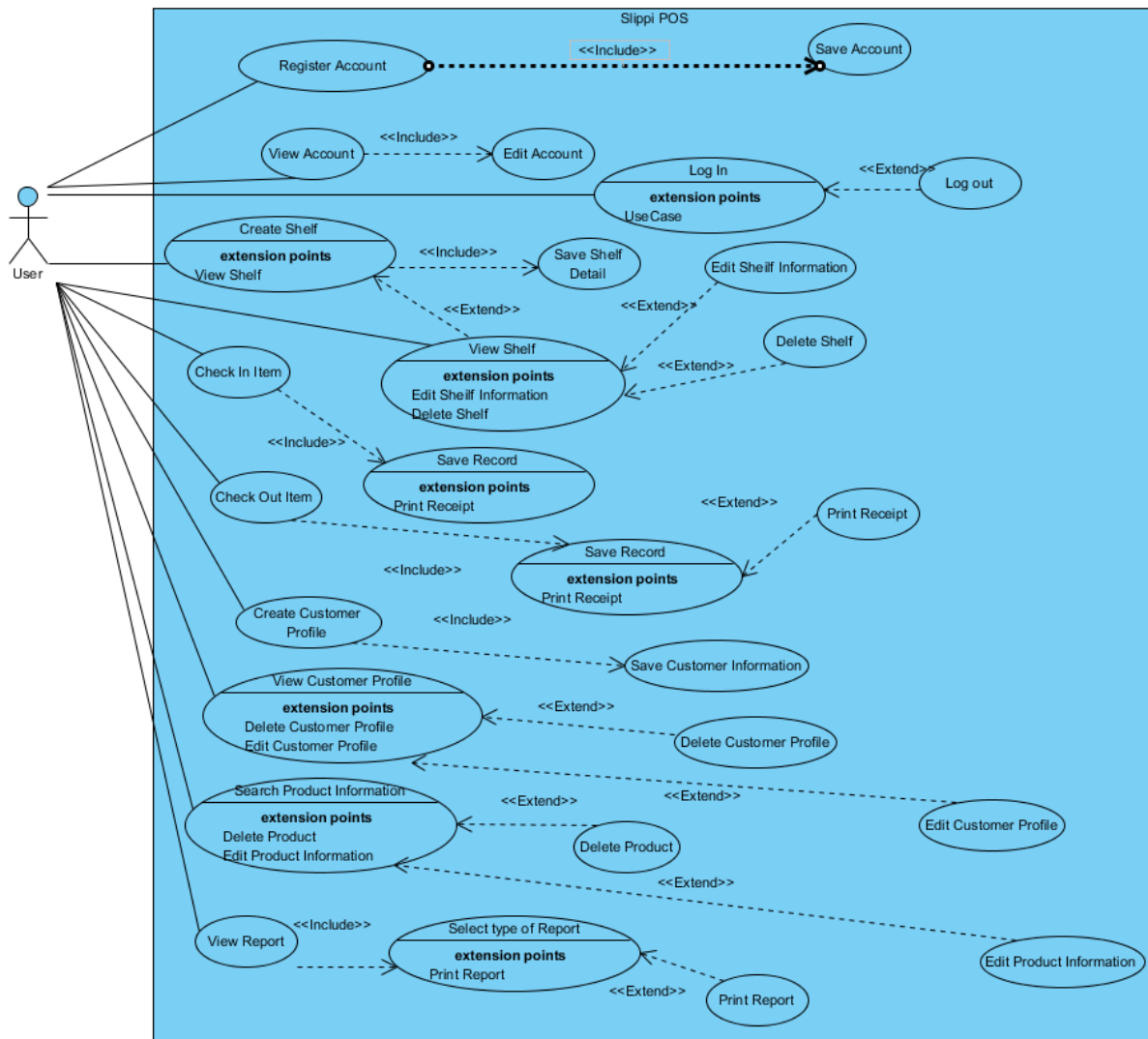


Figure 3.1 Use Case diagram for Slippi POS

## Chapter 3: System Design

### 3.2.3 Class Diagram

The class diagram will be illustrated each class of the application with attribute and operation. The relation will be draw as a line to link both class together with cardinality. There is total 7 class in this application, such as user, login, shelf detail, supplier, staff, product, sales, transaction detail and debtor class. Each class has the own attribute and operation.

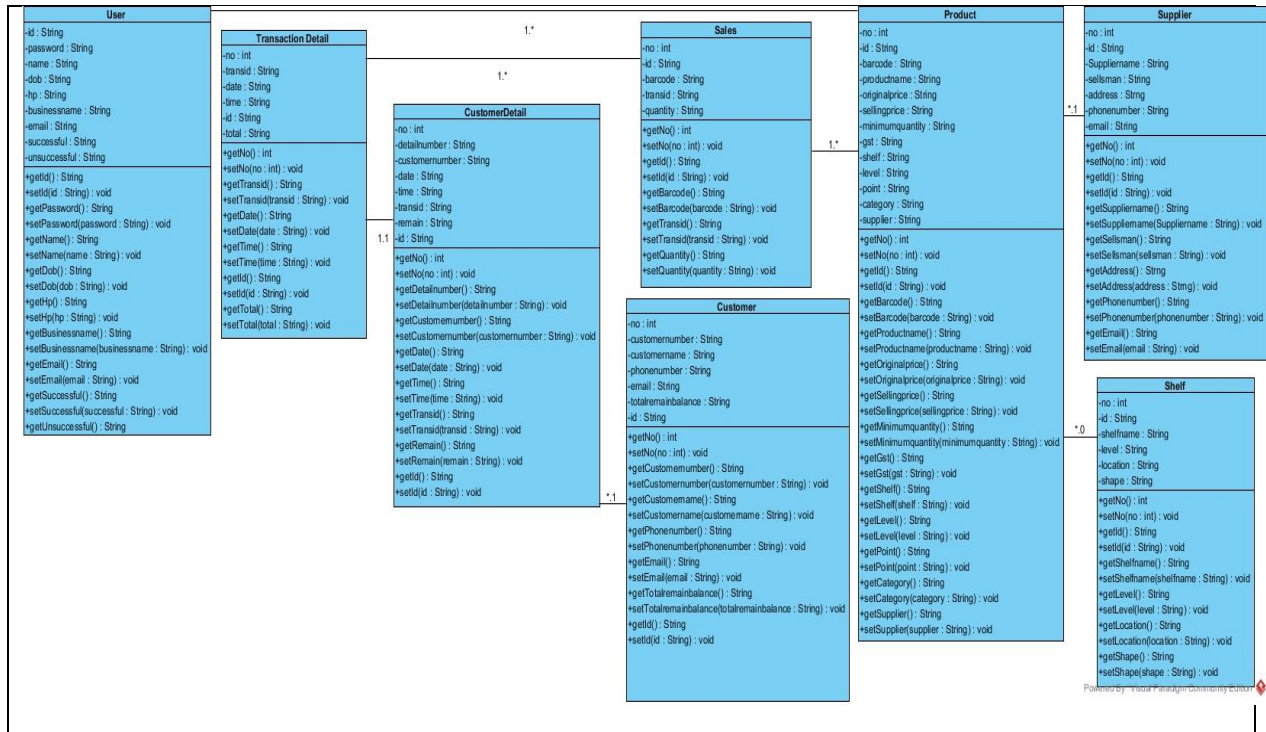


Figure 3.2 : Class diagram for Slippi POS

3.2.2 Entity Relation Diagram

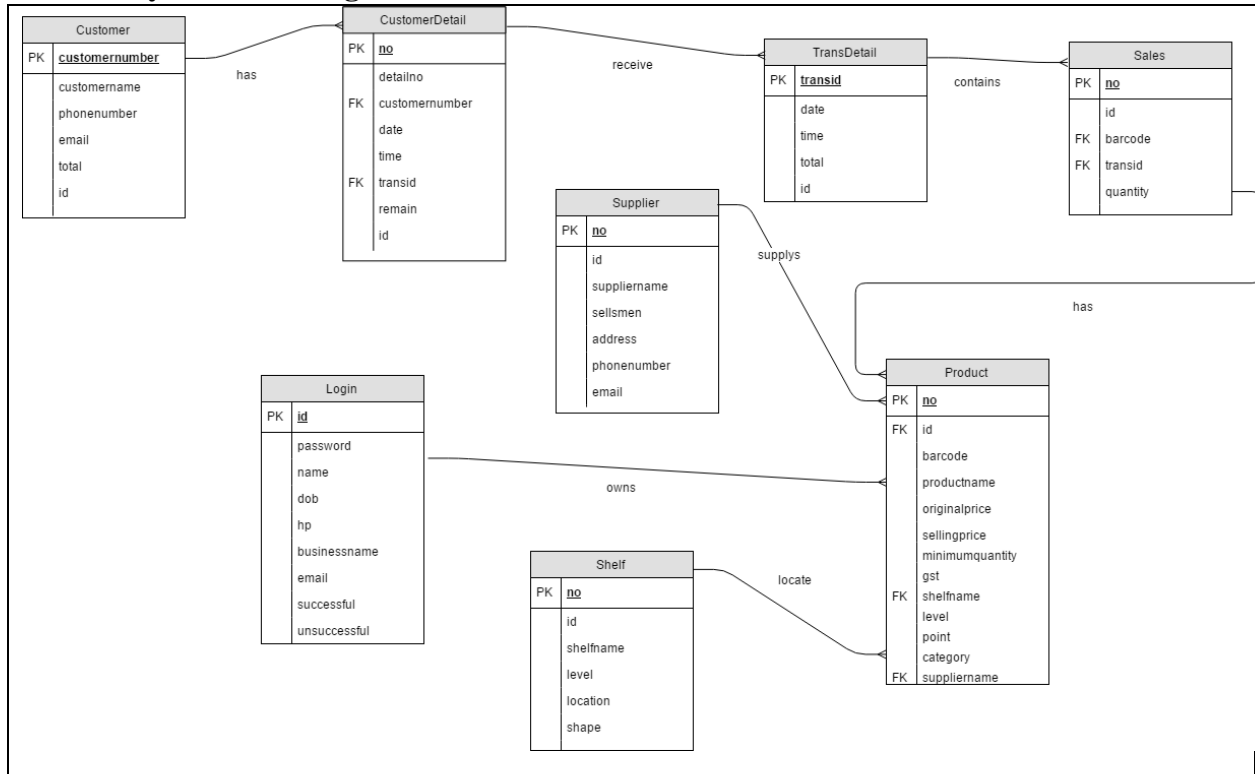


Figure 3.3: Entity Diagram of Slippi POS

3.2.3 Activity Diagram

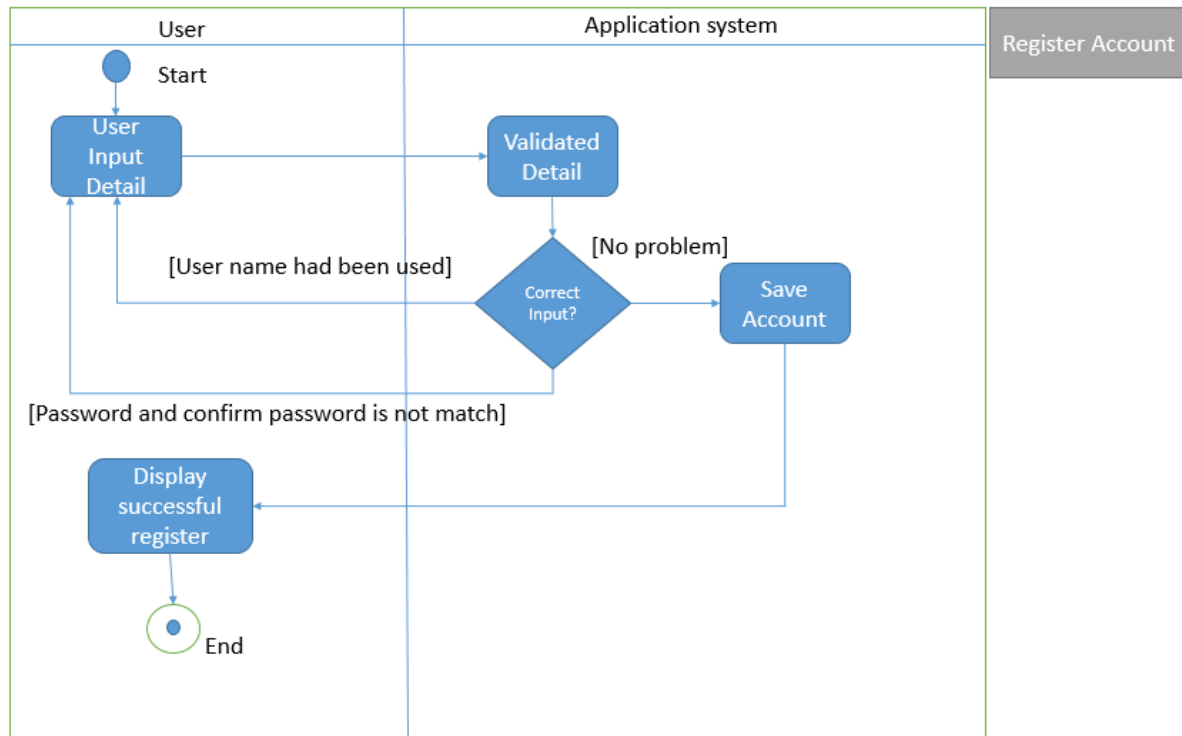


Figure 3.4 : Activity diagram of register account

Before user starts to use this application they are required to register an account to use the application. The register form are required user to input detail such as username, password, date of birth, current address, email address and phone number. After user submits the form the application will validate the information. If the information is not valid the system will ask the user to enter the information again. If the information is no problem the system will save the account and display successful register message to the user.



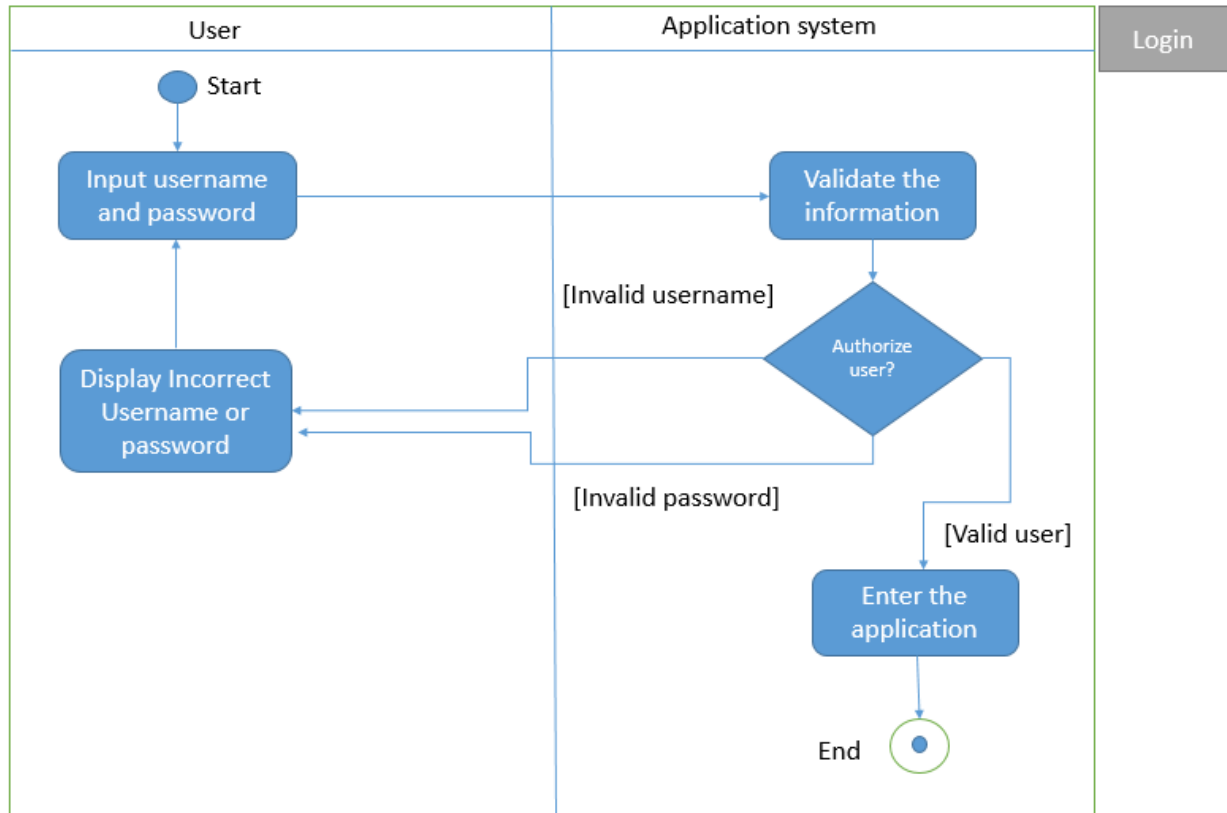


Figure 3.5 : Activity diagram of login

Before user operates the application they are required to log in. In the login page, they need to enter registered username and password. After they click login button the application will validate the username and password. The application will not allow user enter the application until they key in an authorize account username and password.

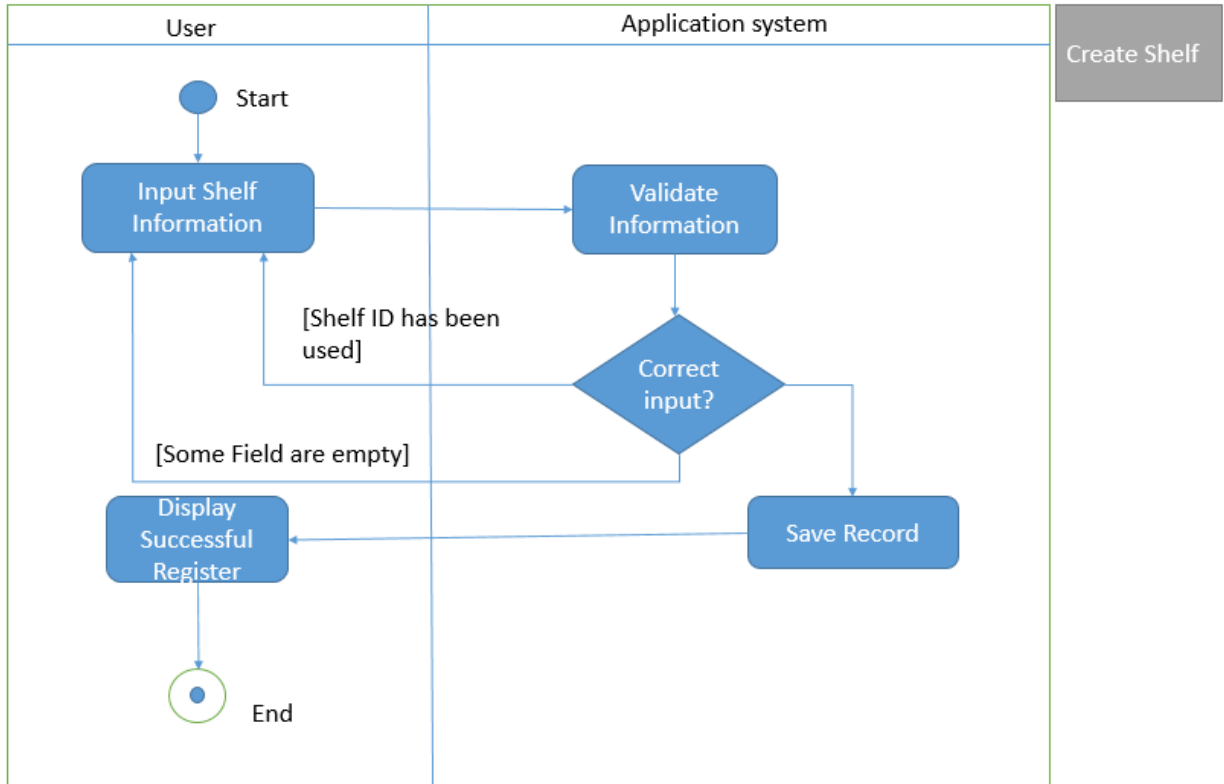


Figure 3.6 : Activity diagram of create shelf

The diagram shows the process of creating a shelf. The user are required to key in shelf information. After user key in the information, the application will validate the information either the shelf ID has been used or some input field is empty. If the validation is success the shelf information will be recorded and display the successful register message to user.

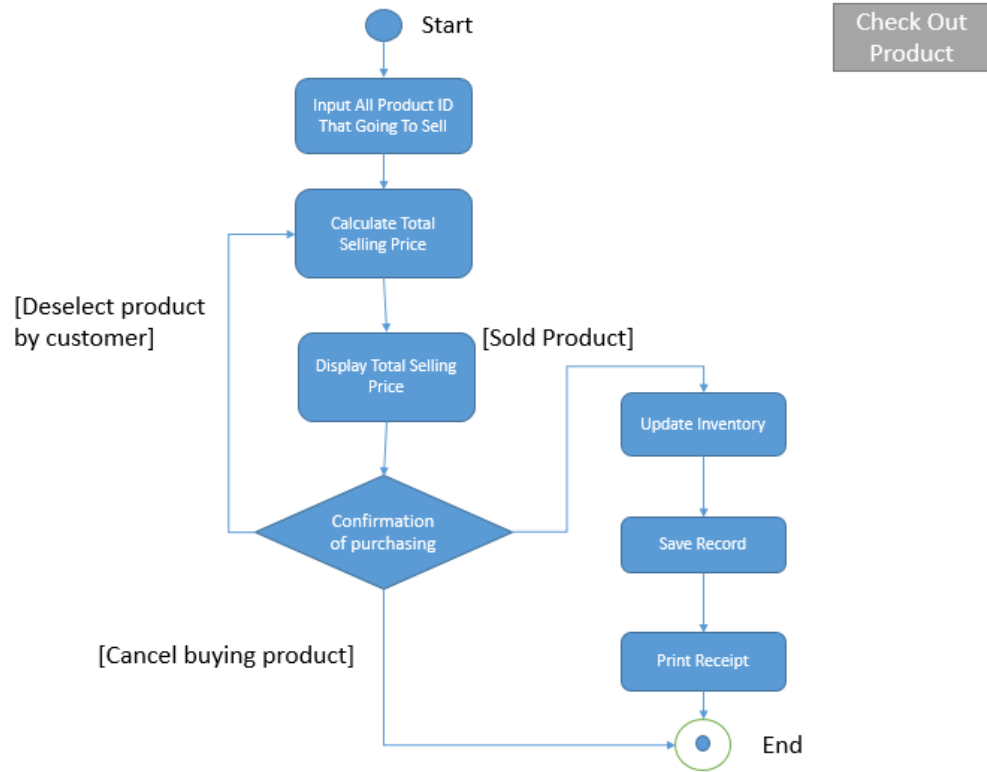


Figure 3.7 : Activity diagram of check out product

The diagram shows the process of check out product. The user requires to input all product ID that going to buy from the customer. Then the application will calculate the total selling price and display the total amount to the customer. If the customer going to abandon those product the system will cancel the bill or the customer deselect product the application will recalculate the total amount of selling price and display to the customer again. Once the customer agree to purchase those item, the inventory will be updated and the transaction record will be saved. Then the application will print out a receipt to the customer.

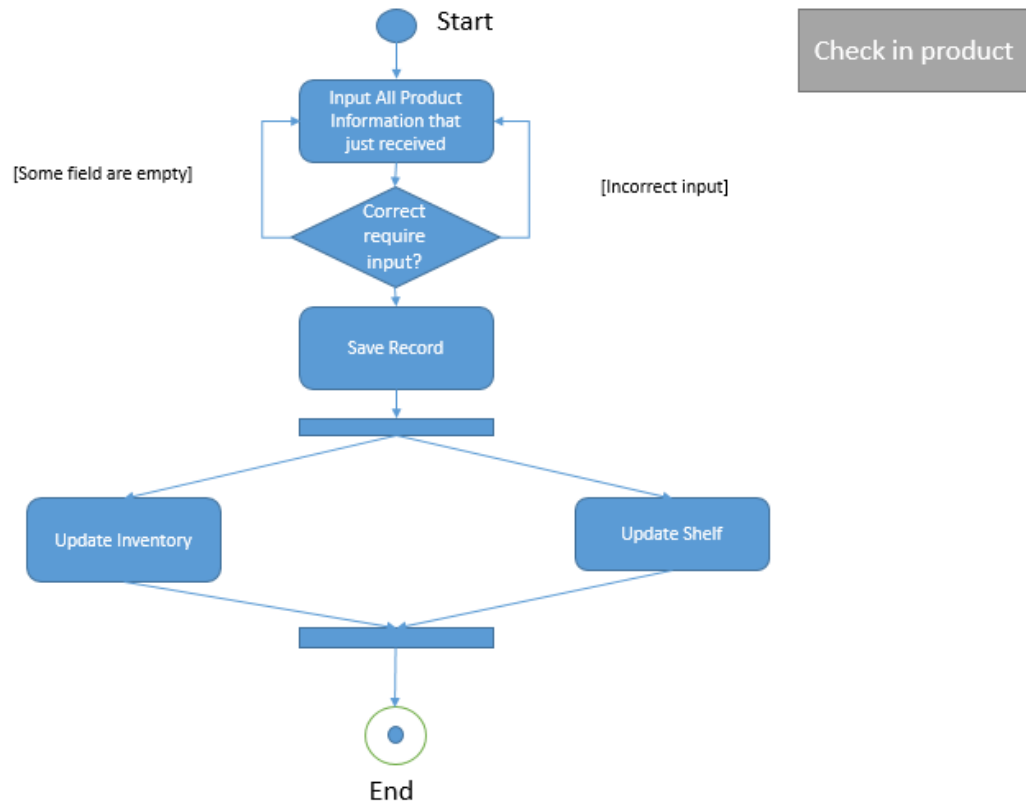


Figure 3.8 : Activity diagram of check in product

The diagram is showing check in process of this application. When there is item arrive in the shop the user are required to input all the information into this application. The application will validate all the input field to make sure the requirement is meet. If the validation is done the application will update the inventory and shelf in the system.

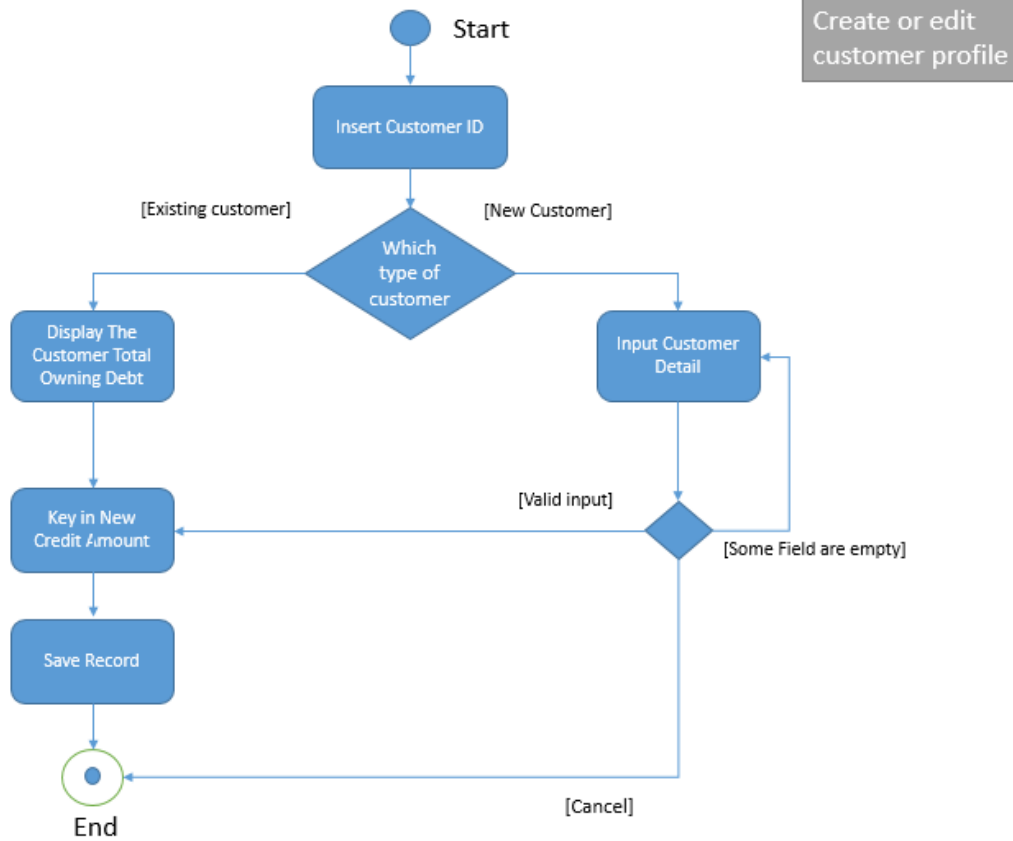


Figure 3.9 : Activity diagram of creating or edit customer profile

This diagram shows create or edit debtor information in the application. Firstly, the application will ask user either the debtor is a new debtor or existing debtor. If the debtor is new, the users are require to register the new debtor information. If the debtor is existing in the application, the user are only require to edit the total credit amount that owns by the debtor.

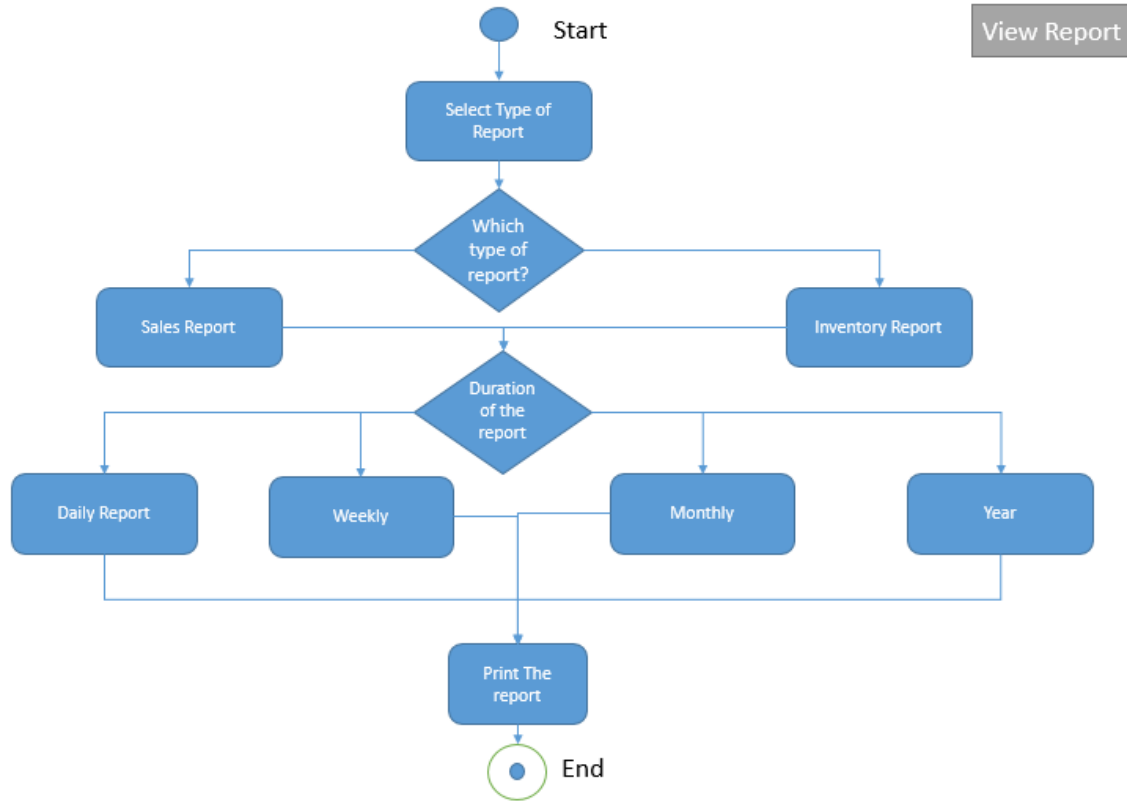


Figure 3.10 : Activity diagram of view report

This diagram is showing the report function in the application. There is two type of report which is sales report and inventory report. After the users selected the type of report they are required to select the duration of the report either by daily, weekly, monthly or year. Then the application will display the report to the users and allow the user to print the report.

3.2.4 Sequence Diagram

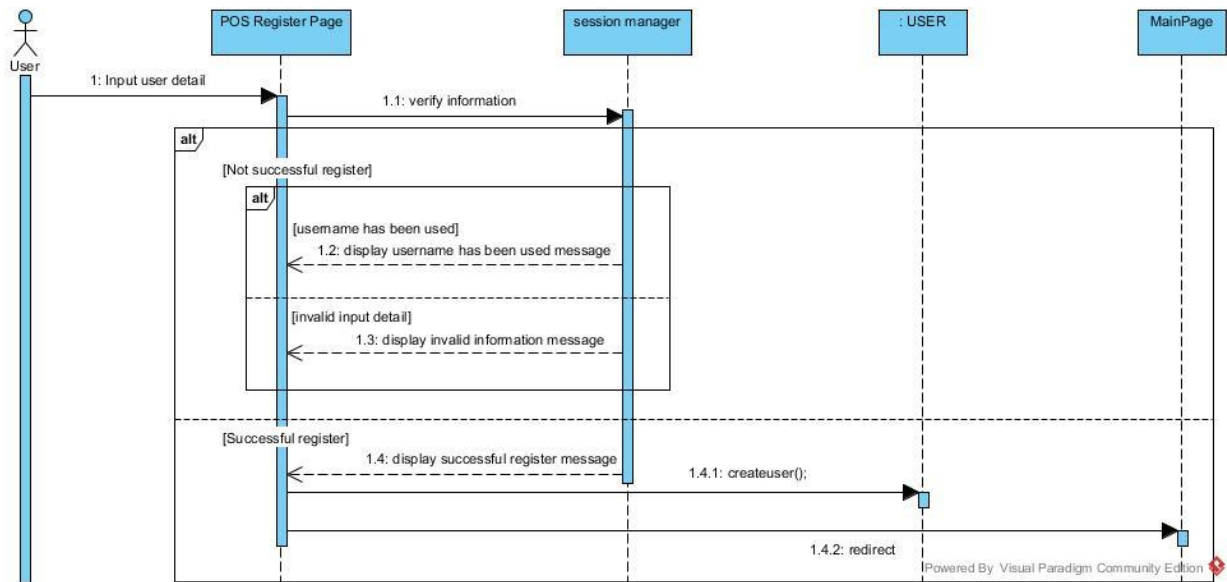


Figure 3.11: Sequence diagram of register account

This diagram shows the register account process in the application. The user requires to insert all the information requested in the register page. After user click submits button, the form will send to session manager to validate the information. If the session manager found incorrect information, it will send a message to the register page and prompt the incorrect message to the user. On the other hand, the information is correct, session manager will send a successful message to register page and display to user and save the account in database. Then the application will redirect the user to main page.

### Chapter 3: System Design

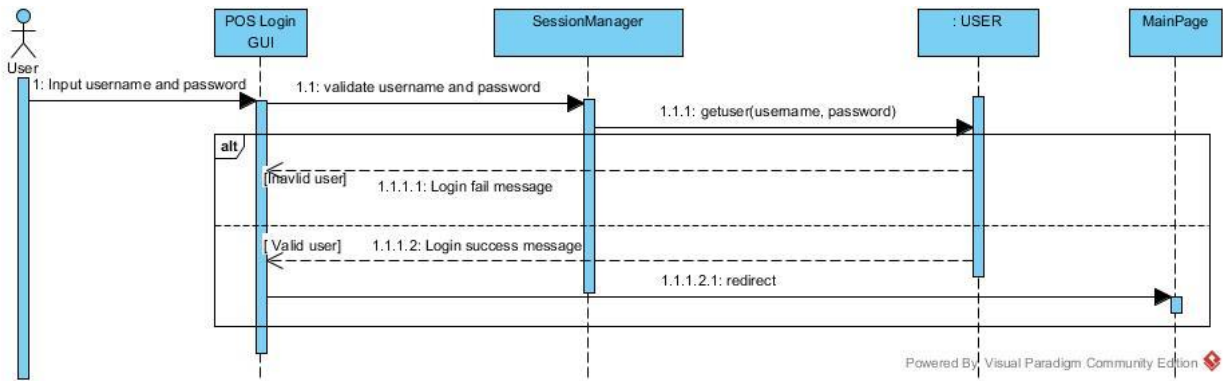


Figure 3.12 : Sequence diagram of login

This diagram shows the login process in the application. The user is requested to enter the username and password. After the user submits the username and password, the application will validate the account. If the username and password are valid then it will redirect the user to main page. On the other hand, if the username or password is invalid, the login page will display invalid username or password message to the user.



## Chapter 3: System Design

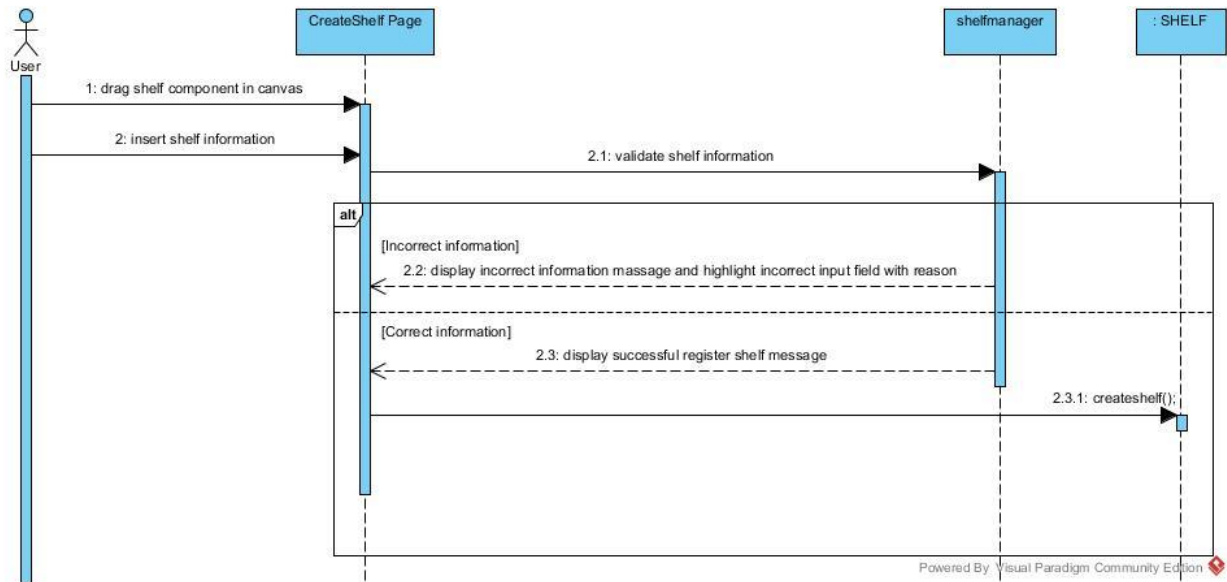


Figure 3.13 : Sequence diagram of creating shelf

This diagram shows the process of creating shelf in the application. The user is requested to drag the shelf from a shelf list menu into the canvas. The canvas is representing the floor plan of the shelf location. After the user dragged the shelf into the canvas it will prompt a form to let user insert the shelf detail. Then the application will validate the information. If the information is found invalid the user is required to insert the shelf information again. On the other hand, if the information is valid then the application will save the shelf information into database and create the shelf on the canvas.

### Chapter 3: System Design

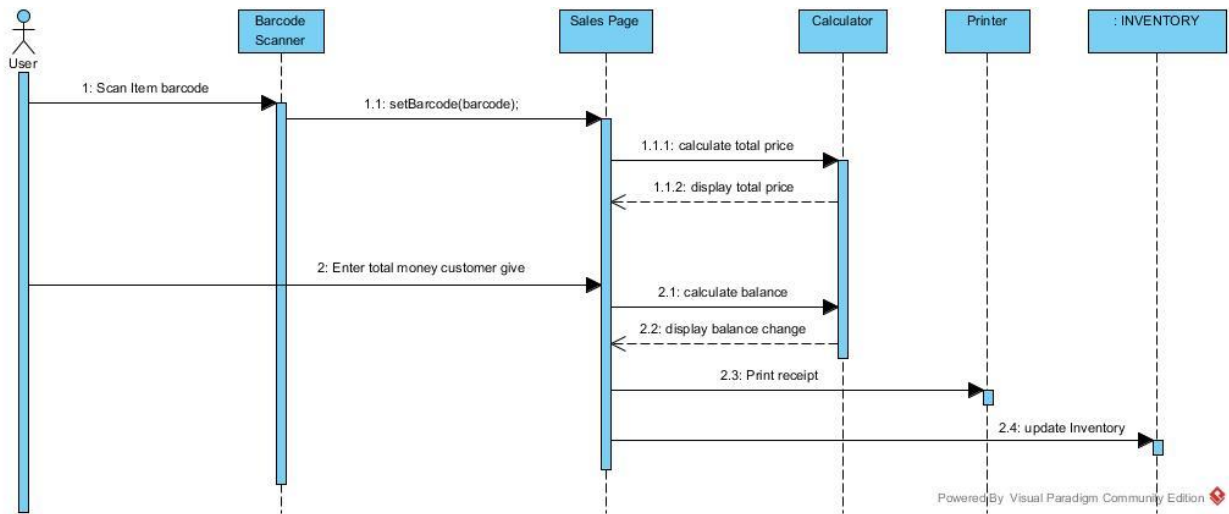


Figure 3.14 : Sequence diagram of check out product and cash register

The diagram shows the process of check out product and cash register. The user is required to insert the product code into the application by using keyboard to enter the code or barcode scanner. After the barcode is entered, the application will calculate the price of the product. Then the total price will be displayed. After the user received the cash from the customer, the user is required to enter the number of cash customer give. Then the application will calculate the balance to the customer. Then a receipt will be printed, the sales record will be recorded and the inventory will be updated.

## Chapter 3: System Design

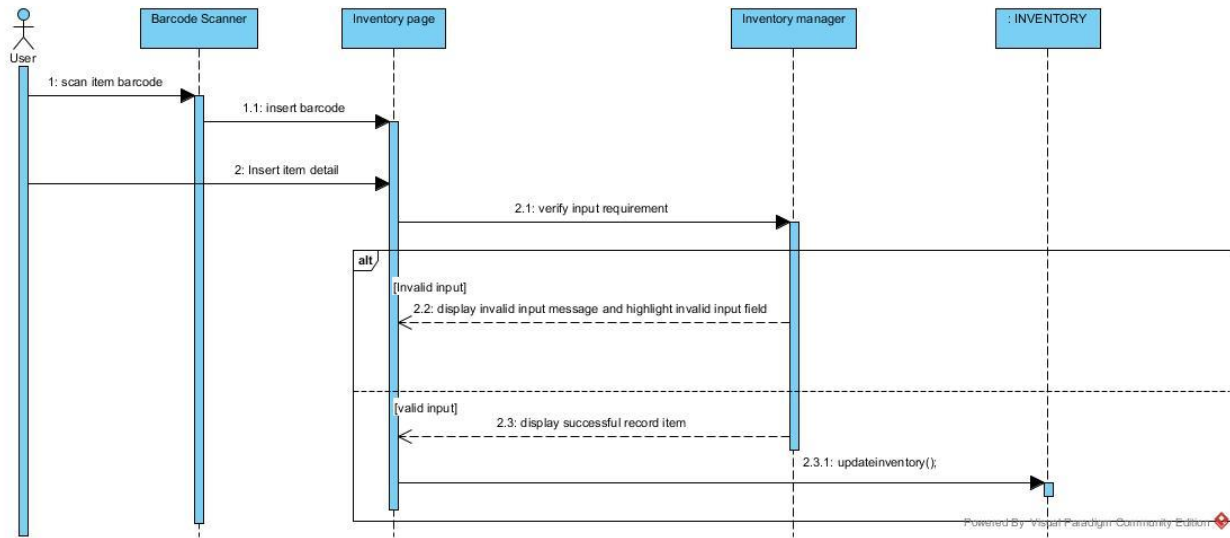


Figure 3.15 : Sequence diagram of check in product

The diagram shows the process of check in product in the application. The user is required to insert the code and detail of the product in inventory page. After the user submitted the information the application will validate the information to make sure the information is correct. Then the user will receive the successful message or invalid information message depending on the validation result. If the information is valid the record will be saved into database.

### Chapter 3: System Design

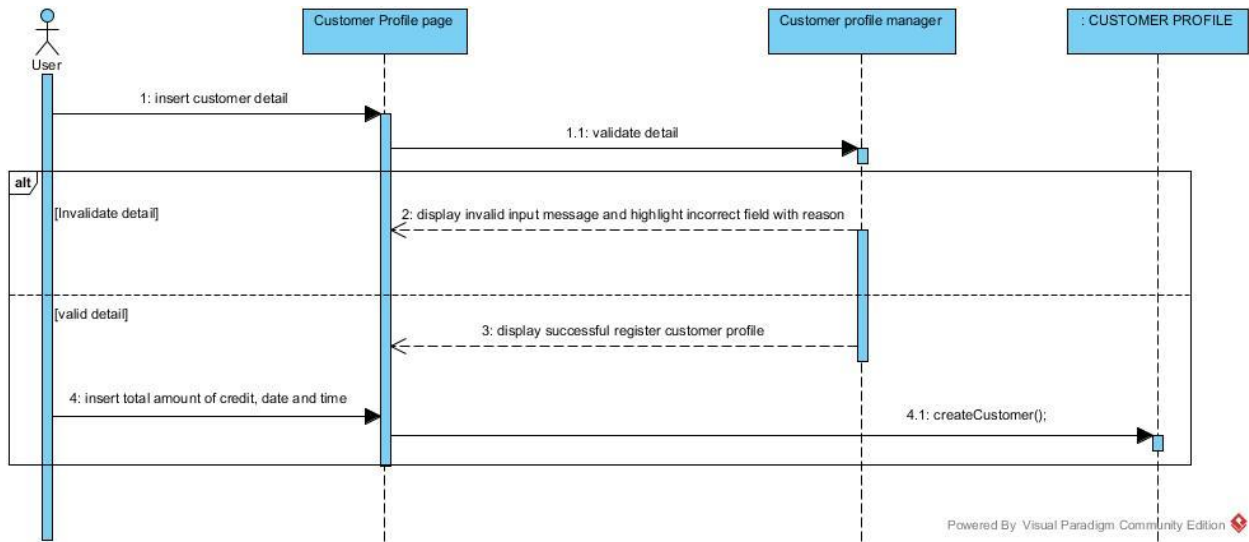


Figure 3.16 : Sequence diagram of creating customer profile

The diagram shows the process of creating customer profile in the application. The user is requested to insert customer detail. After the user submitted the information, the application will validate the information. Then the user will received successful create customer profile or invalid information message, depending on the result of validation. If the information is valid the application will save the customer profile into database.

### Chapter 3: System Design

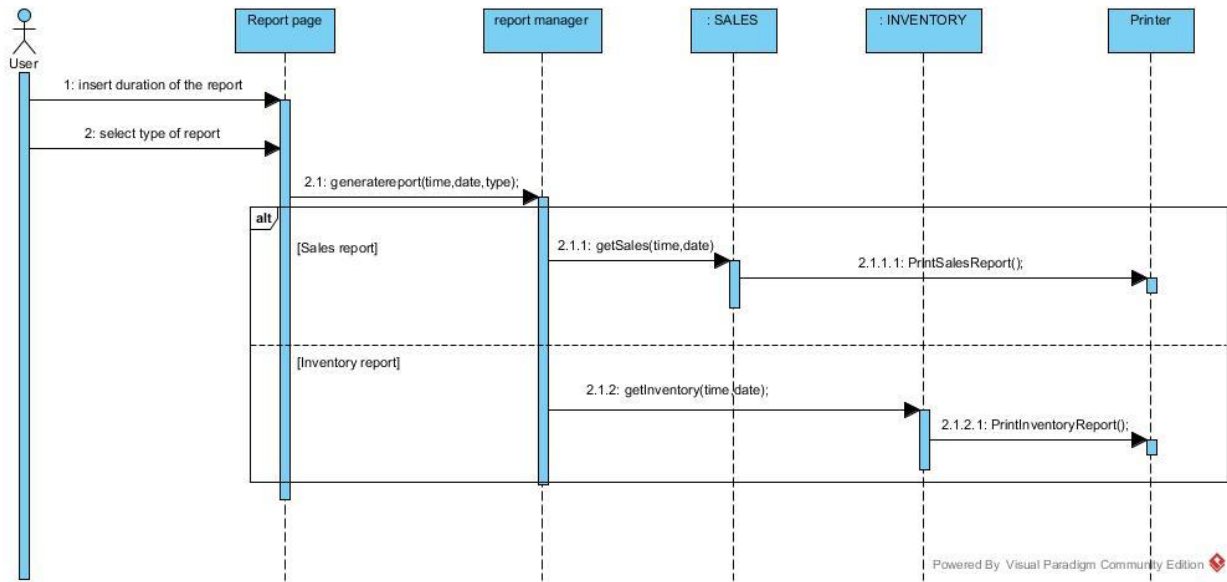


Figure 3.17 : Sequence diagram of view report

The diagram shows the view report process in the application. The user is requested to choose the duration of the report and select type of report. Then the application will generate the report base on the requirement from the user.

## Chapter 3: System Design

### 3.2.5 Data Dictionary

Data dictionary is the dictionary that explains the attribute in the class diagram. The information will be shown are field name, data type, field length, constrain, description and the example of value store in the database.

Login

Field Name	Data type	Field Length	Constrain	Description	Value stored
id	varchar	30	Not null	Login username	Ali97
Password	Varchar	10	Not null	Account password	Ali97
NAME	Varchar	10	Not null	User name	Ali97
DOB	Date	10	Not null	User date of birth	1995-04-23
HP	Varchar	11	Not null	User contact number	999-9999999
Email	Varchar	30	Not null	User email address	Ali97@hotmail.com

Table 3.1 : Data Dictionary - Login

### Chapter 3: System Design

#### Supplier

Field Name	Data type	Field Length	Constrain	Description	Value stored
No	Integer	30	PK	Supplier number	1
id	Varchar	30	Not null	User ID	Alvin
Suppliername	Varchar	30	Not null	Supplier name	YAT YAT
Sellman	Varchar	30	Not null	Supplier representative name	Alvis
Addr	Varchar	30	Not null	Supplier company address	No 60, jln tongkat ali
HP	String	11	Not null	Phone number of supplier	016 9730666
Email	String	30	Not null	Supplier Email address	yatyat@gmail.com

Table 3.2 : Data Dictionary - Supplier

### Chapter 3: System Design

#### Shelf

Field Name	Data type	Field Length	Constrain	Description	Value stored
No	varchar	15	PK	Shelf Identify code	1
id	Varchar	30	Not null	User ID	Alvin
ShelfName	Varchar	15	Not null	Shelf Name	A1
level	Number	2	Not null	The number of shelf stage	5
Shape	Varchar	10	Not null	Shelf shape	vertical

Table 3.3 : Data Dictionary – Shelf



### Chapter 3: System Design

#### CustomerDetail

Field Name	Data type	Field Length	Constrain	Description	Value stored
No	Int	11	PK	Customer Detail Identify code	1
id	Varchar	30	Not null	User ID	Alvin
Detailnumber	Varchar	6	Not null	Detail Number	1
Customernumber	Varchar	6	FK	Customer number	4
Date	Varchar	10	Not null	Date	2017-03-23
Time	Varchar	8	Not null	Time	03:03:03

Table 3.4 : Data Dictionary - CustomerDetail

#### Product

Field Name	Data type	Field Length	Constrain	Description	Value stored
No	Int	11	PK	Product Reference Code	1
id	Varchar	30	FK	User ID	Alvin
Barcode	Number	20	Not null	Product barcode	9555023630853

### Chapter 3: System Design

Productname	Varrchar	20	Not null	Product Name	Bottle
Originalprice	Number	10	Not null	Product original price	8.99
Sellingprice	Number	10	Not null	Product selling Price	10
Minimumquantity	Number	5	Not Null	The minimum quantity to trigger restock notification	30
GST	Varchar	3	Not null	Product applicable for GST	Yes/No
Shelfname	Varchar	10	FK	Product allocation place	A1
Level	Varchar	10	Not null	Shelf level	2
Point	Varchar	10	Not null	Product location	1
Currentquantity	Number	5	Not null	Product quantity in hand	3
category	Varchar	20	Not null	Product category	Water
Suppliername	Varchar	20	FK	Product Supplier	Ali

Table 3.5 : Data Dictionary - Product

### Chapter 3: System Design

#### Sales

Field Name	Data type	Field Length	Constrain	Description	Value stored
No	Int	11	PK	Sales Identify code	1
id	Varchar	30	Not null	User ID	Alvin
Barcode	Varchar	15	FK	Product Reference Code	A2001
TransID	Varchar	10	FK	Transaction Identity	5
Quantity	Number	5	Not null	Quantity of each same item	5

Table 3.6 : Data Dictionary - Sales

#### TransDetail

Field Name	Data type	Field Length	Constrain	Description	Value stored
No	Int	11	PK	TransDetail Identify code	1
id	Varchar	30	Not null	User ID	Alvin
TransID	Varchar	10	Not null	Transaction Identity	5
Time	Time	10	Not null	Transaction Time	00:00:00

### Chapter 3: System Design

Date	Date	10	Not Null	Transaction Date	1995-04-23
Total	Varchar	6	Not null	Total amount of bill	100

Table 3.7 : Data Dictionary - TransDetail

#### Customer

Field Name	Data type	Field Length	Constrain	Description	Value stored
No	Int	10	PK	Customer ID	1
Customername	Varchar	10	Not null	Customer Name	Ali
Email	Varchar	20	Not Null	Customer email	<a href="mailto:Chong@gmail.com">Chong@gmail.com</a>
HP	Varchar	10	Not Null	Customer contact number	016-9999999
Total	Varchar	6	Not Null	Customer total credit	100
id	Varchar	30	Not null	User ID	Alvin

Table 3.8 : Data Dictionary - Customer

## Chapter 3: System Design

### 3.2.6 Block Diagram

The block diagram will illustrate the main function of this proposed application. The diagram included the application name, stock alert function, shelf management, debtor profile and point of sales function.



Figure 3.18 : Block Diagram for Slippi Point of Sales

## Chapter 3: System Design

### 3.3.7 User Interface Design

#### Login Page

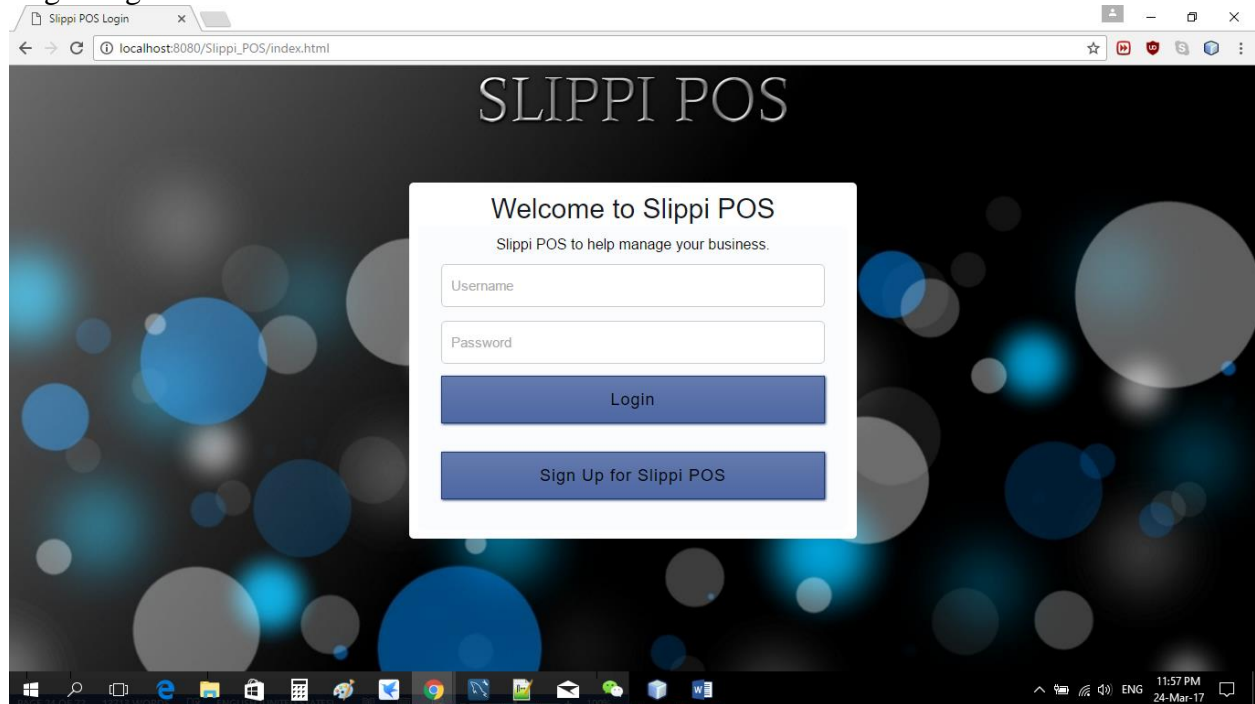
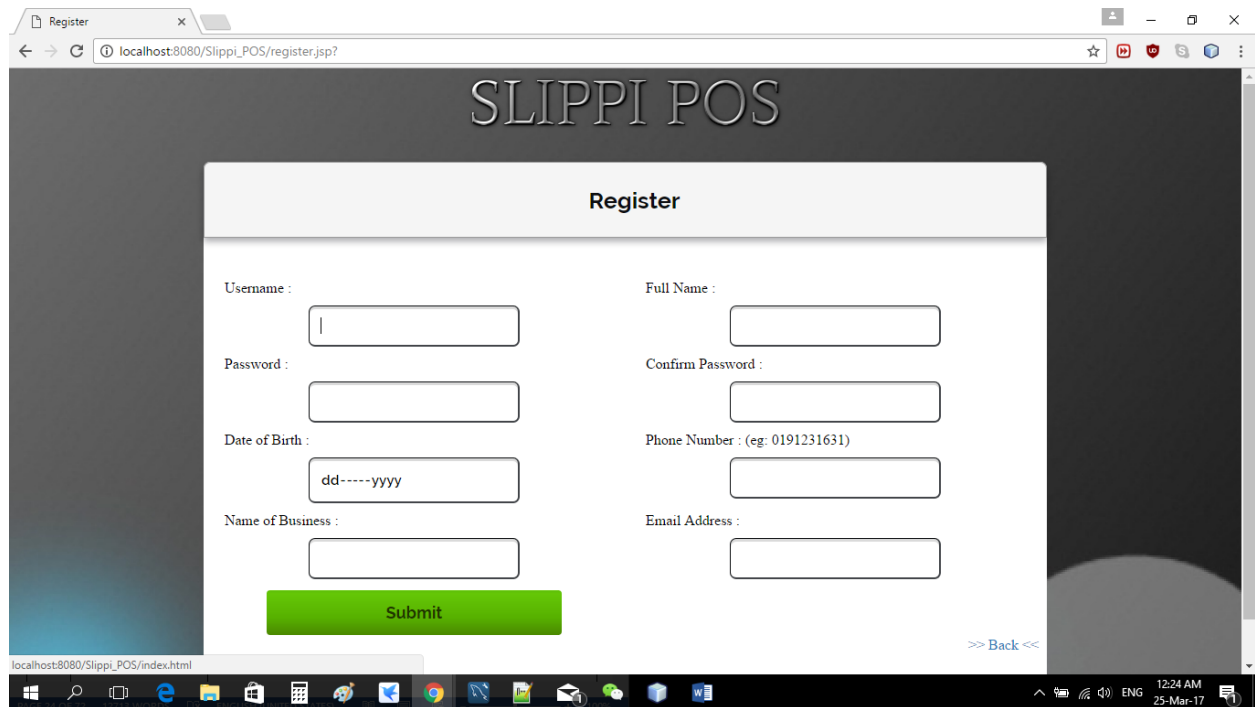


Figure 3.19 : Login Page

Login Page is the page that identify user. The member require to enter the username and password in order to use the application. The authentication will be process after the user click login. If the username and password was correct the user is able to use the application and the page will be redirect, else the application will request the user to enter again the username and password or sign up for a new account.

## Chapter 3: System Design

### Register Page



The screenshot shows a web browser window with the URL `localhost:8080/Slippi_POS/register.jsp?`. The page title is "SLIPPI POS" and the main heading is "Register". The form contains the following fields:

Username :	<input type="text"/>	Full Name :	<input type="text"/>
Password :	<input type="password"/>	Confirm Password :	<input type="password"/>
Date of Birth :	<input type="text" value="dd-----yyyy"/>	Phone Number : (eg: 0191231631)	<input type="text"/>
Name of Business :	<input type="text"/>	Email Address :	<input type="text"/>

At the bottom of the form is a green "Submit" button and a blue ">> Back <<" link. The browser's taskbar at the bottom shows the time as 12:24 AM on 25-Mar-17.

Figure 3.20 : Register Page

Register Page is the page that let the user to sign up a new account. The user is require to enter all the input in order to register a new account. Once the user insert all the information and click Submit button, the application will verify the input. If the input is violated the rule, the application will request the user to the correct information, else the application will register the new account and redirect the user to the login page.

## Chapter 3: System Design

### Landing Page

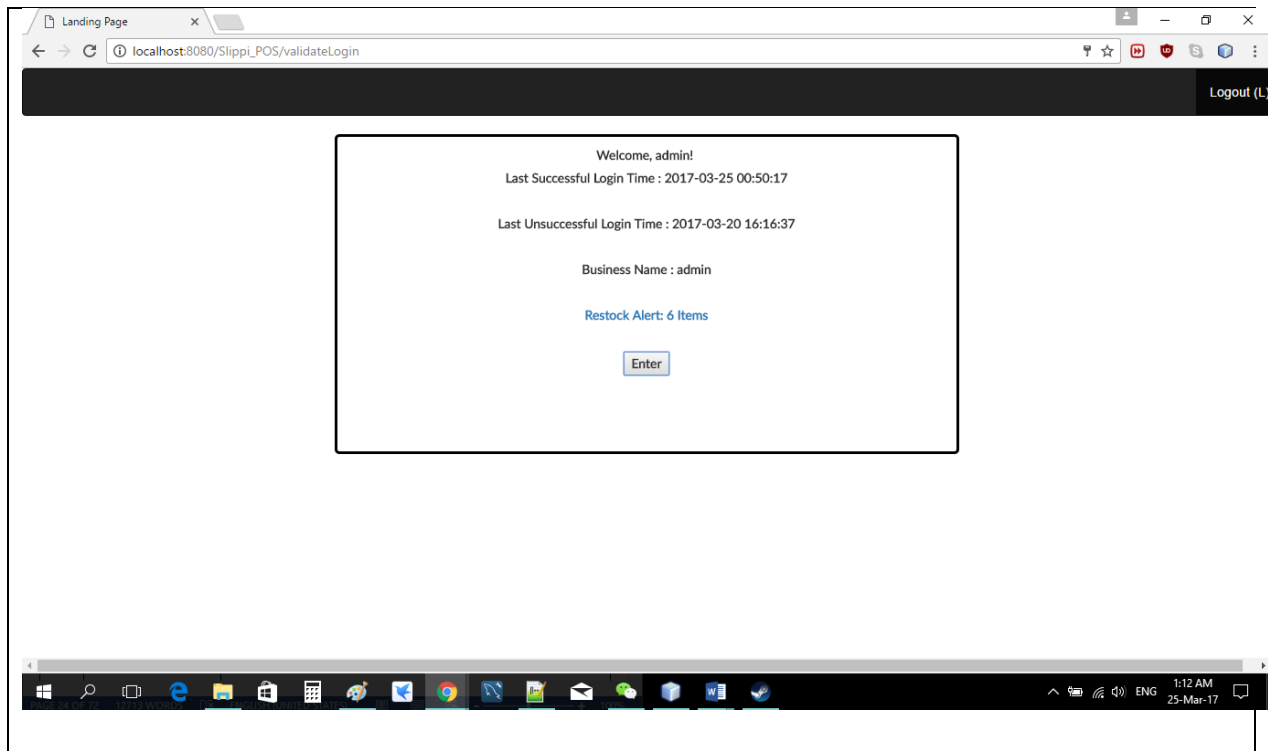


Figure 3.21 : Landing Page

Landing Page is to show the user the previous successful login, unsuccessful login record, business name, and restock alert information. The successful login and unsuccessful login record is to allow the user to observe whether there is an unauthorised user trying to login by this account, by checking the last time login time and unsuccessful login time. The restock alert is to remind the user there is a number of stocks are required to reorder. The user is able to view the information by clicking the Restock alert.



## Chapter 3: System Design

### Home Page

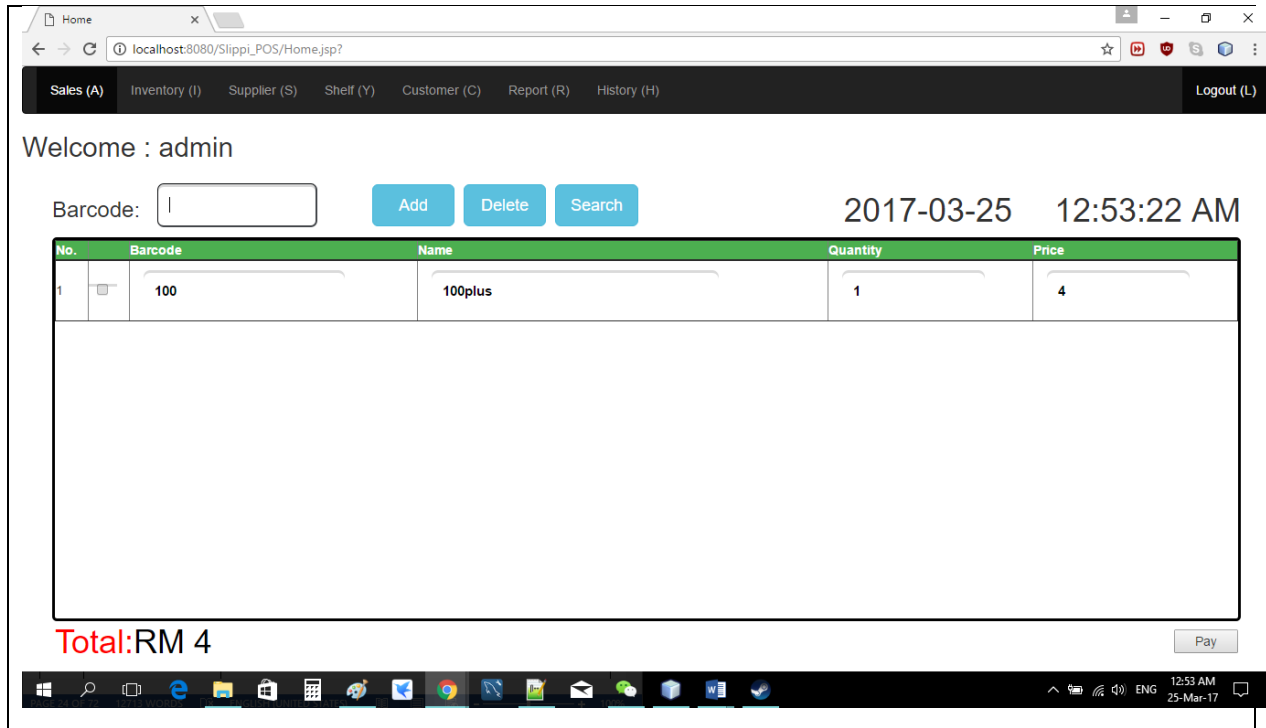


Figure 3.22 : Home Page

Home Page is the page that allow user to perform check out item. When a customer checking out the item, the user has to insert all the item information into this page by insert the barcode in the barcode input section. After the barcode is entered, the information of the product will be showing in the box and the total amount of bill will be displayed in the Total tag. The information will be show are barcode, product name, quantity of the product and the price.

The user able to increase the quantity of the product by edit the quantity slot or insert the product barcode again. After the quantity is edited, the total bill will be updated as well. Next, the user is able to delete the product from the box by checked the checkbox beside the barcode and click delete button. After the product is deleted, the total amount of bill will be updated.

## Chapter 3: System Design

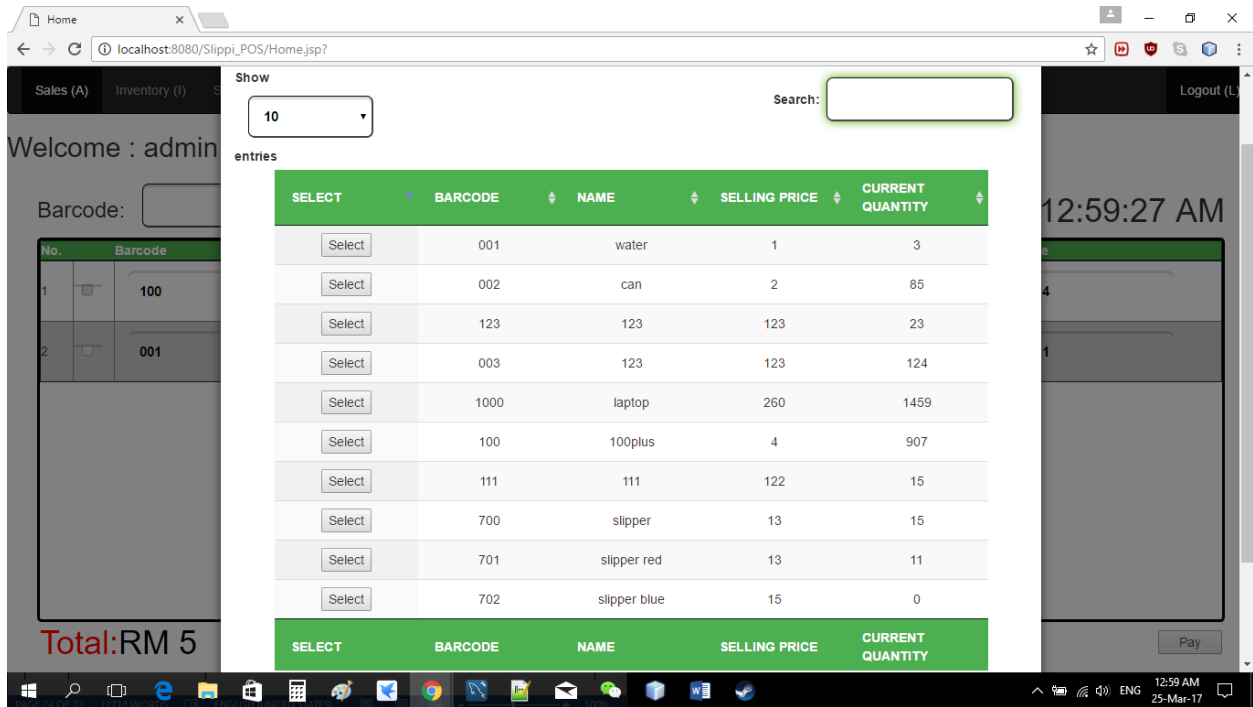


Figure 3.23 : Home Page Search Function

When the user click the search button, the application will prompt out a list of product table. The user able to choose a product from the table by clicking the select button. Then the selected item will be written in the box. The purpose of this search box is to assist the user to search a product easily.

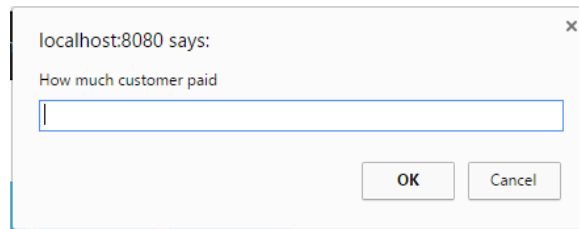
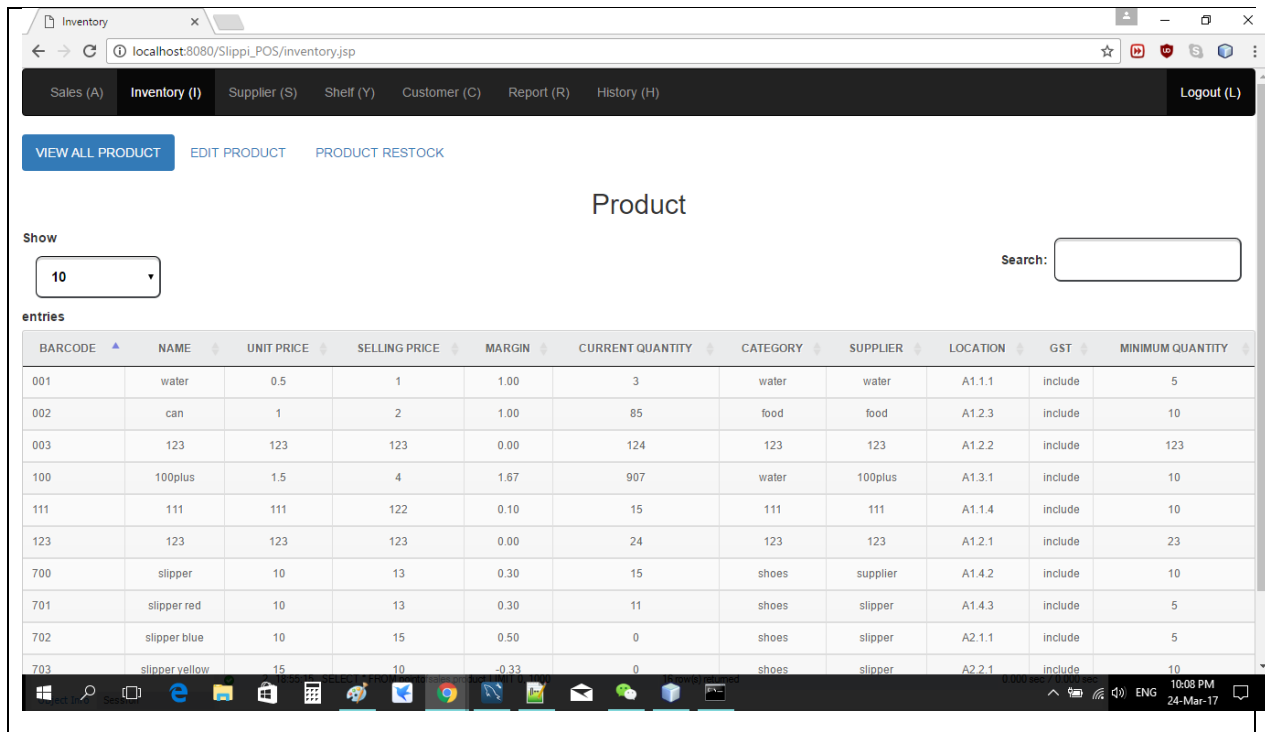


Figure 3.24 : Total Customer Paid prompt Box

After every product is inserted, the user has to click the pay button or press the space bar button in the keyboard. Then the application will request the user to enter the total amount of money received from the customer, as shown on figure 3.33. If the amount is lesser than the total amount of bill, the application will request the user to enter the total amount of money receive from the customer again. Once the transaction is success, the application will update the information to the database.

## Chapter 3: System Design

### Inventory Page



The screenshot shows a web browser window displaying the 'Inventory Page'. The browser address bar shows 'localhost:8080/Slippi\_POS/inventory.jsp'. The page has a navigation menu with 'Inventory (I)' selected. Below the menu are buttons for 'VIEW ALL PRODUCT', 'EDIT PRODUCT', and 'PRODUCT RESTOCK'. The main heading is 'Product'. There is a 'Show' dropdown menu set to '10' and a search input field. Below this is a table of product entries.

BARCODE	NAME	UNIT PRICE	SELLING PRICE	MARGIN	CURRENT QUANTITY	CATEGORY	SUPPLIER	LOCATION	GST	MINIMUM QUANTITY
001	water	0.5	1	1.00	3	water	water	A1.1.1	include	5
002	can	1	2	1.00	85	food	food	A1.2.3	include	10
003	123	123	123	0.00	124	123	123	A1.2.2	include	123
100	100plus	1.5	4	1.67	907	water	100plus	A1.3.1	include	10
111	111	111	122	0.10	15	111	111	A1.1.4	include	10
123	123	123	123	0.00	24	123	123	A1.2.1	include	23
700	slipper	10	13	0.30	15	shoes	supplier	A1.4.2	include	10
701	slipper red	10	13	0.30	11	shoes	slipper	A1.4.3	include	5
702	slipper blue	10	15	0.50	0	shoes	slipper	A2.1.1	include	5
703	slipper yellow	15	10	-0.33	0	shoes	slipper	A2.2.1	include	10

Figure 3.25 : Inventory Page

Inventory Page is able to provide every product information to the user. The information are including barcode, name, unit price, selling price, margin of earning, current quantity, category of the product, supplier name and minimum quantity of the product.

## Chapter 3: System Design

The screenshot shows a web browser window with the URL `localhost:8080/Slippi_POS/inventory.jsp`. The page has a navigation bar with links for Sales (A), Inventory (I), Supplier (S), Shelf (Y), Customer (C), Report (R), and History (H), along with a Logout (L) button. Below the navigation bar, there are three buttons: VIEW ALL PRODUCT, EDIT PRODUCT (highlighted in blue), and PRODUCT RESTOCK. The main heading is "Edit or Insert Product".

The form contains the following fields and controls:

- Item Code :
- Description :
- Unit Price :
- Selling Price :
- Markup % :
- Reorder Level :
- Current Quantity :
- Incoming Quantity :
- GST Included :
- Supplier :
- Category :
- Location :
- Shelf :
- Shelf Level :  Point :

A green "Save" button is located at the bottom right of the form.

Figure 3.26 : Insert or Edit Product information

The section is to allow the user to edit or insert a new product information. To edit the product information, the user are require to enter the product barcode into the item code input. After the barcode is inserted, the information will be fetched to every input location. The user is able to modify the information and click save. To enter a new product, the user is required to enter all the information and click save button.

## Chapter 3: System Design

The screenshot shows a web browser window with the URL `localhost:8080/Slippi_POS/inventory.jsp`. The application has a navigation menu with options: Sales (A), Inventory (I), Supplier (S), Shelf (Y), Customer (C), Report (R), History (H), and Logout (L). The main content area is titled 'PRODUCT RESTOCK' and features a 'Show' dropdown menu set to '10' and a search input field. Below this is a table with the following data:

NO.	BARCODE	NAME	CURRENT QUANTITY	MINIMUM QUANTITY	LOCATION
1	001	water	3	5	A1.1.1
2	702	slipper blue	0	5	A2.1.1
3	703	slipper yellow	0	10	A2.2.1
4	704	slipper green	0	15	A2.4.2
5	705	slipper gold	0	5	A2.5.1

At the bottom of the table, it says 'Showing 1 to 5 of 5 entries' and includes 'Previous' and 'Next' navigation buttons. The Windows taskbar at the bottom shows the time as 10:09 PM on 24-Mar-17.

Figure 3.27 : Product Restock

This section will be showing the product information that is going to stock out soon. The information is to inform the user the product quantity is going to run out. Therefore, the user is able to make decision for reorder product.

## Chapter 3: System Design

### Supplier Page

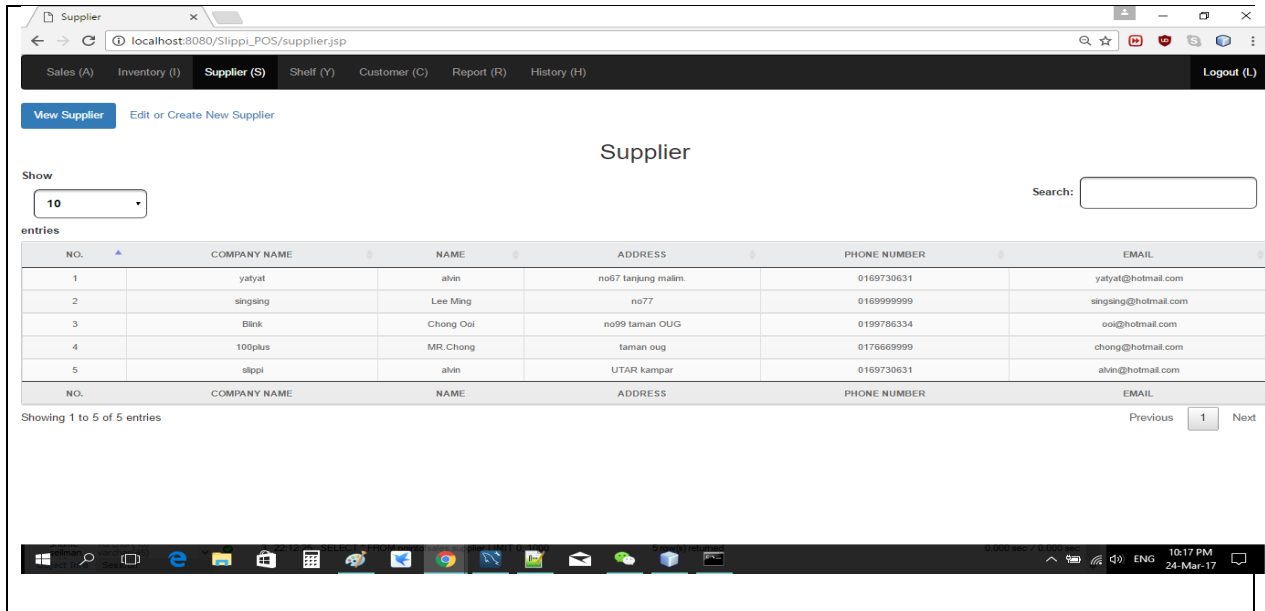


Figure 3.28 : Supplier Page

Supplier page is showing the supplier information, as shown on figure 3.37.

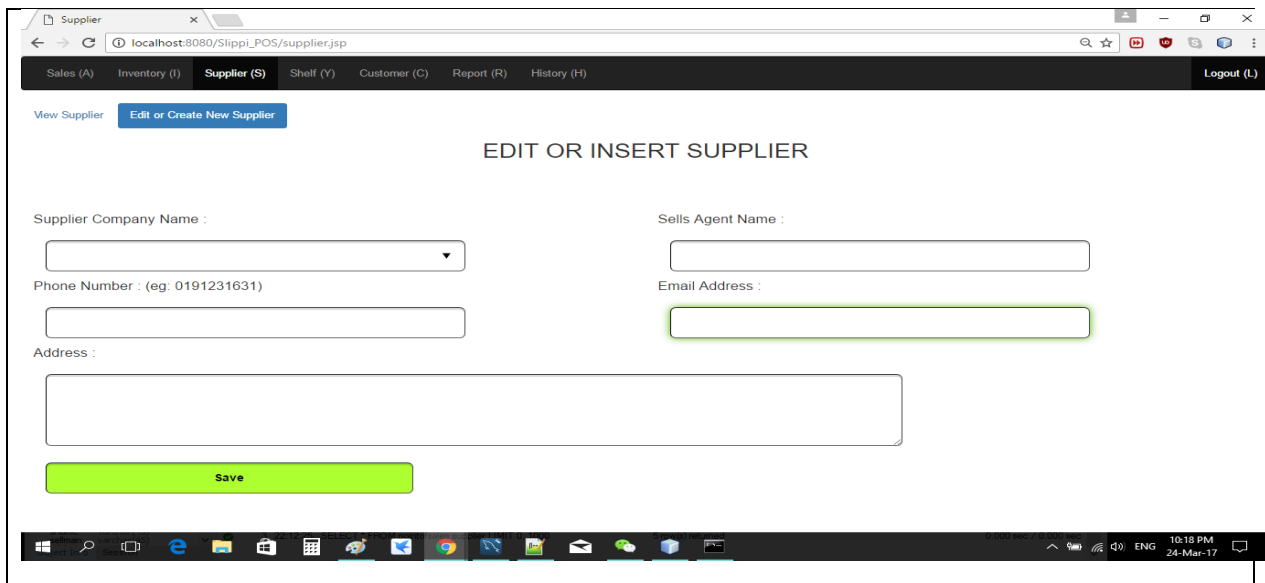


Figure 3.29 : Supplier Edit or Insert Page

This section is to register or edit supplier information. The user is required to enter all the information required in order to register the supplier.

Shelf Page

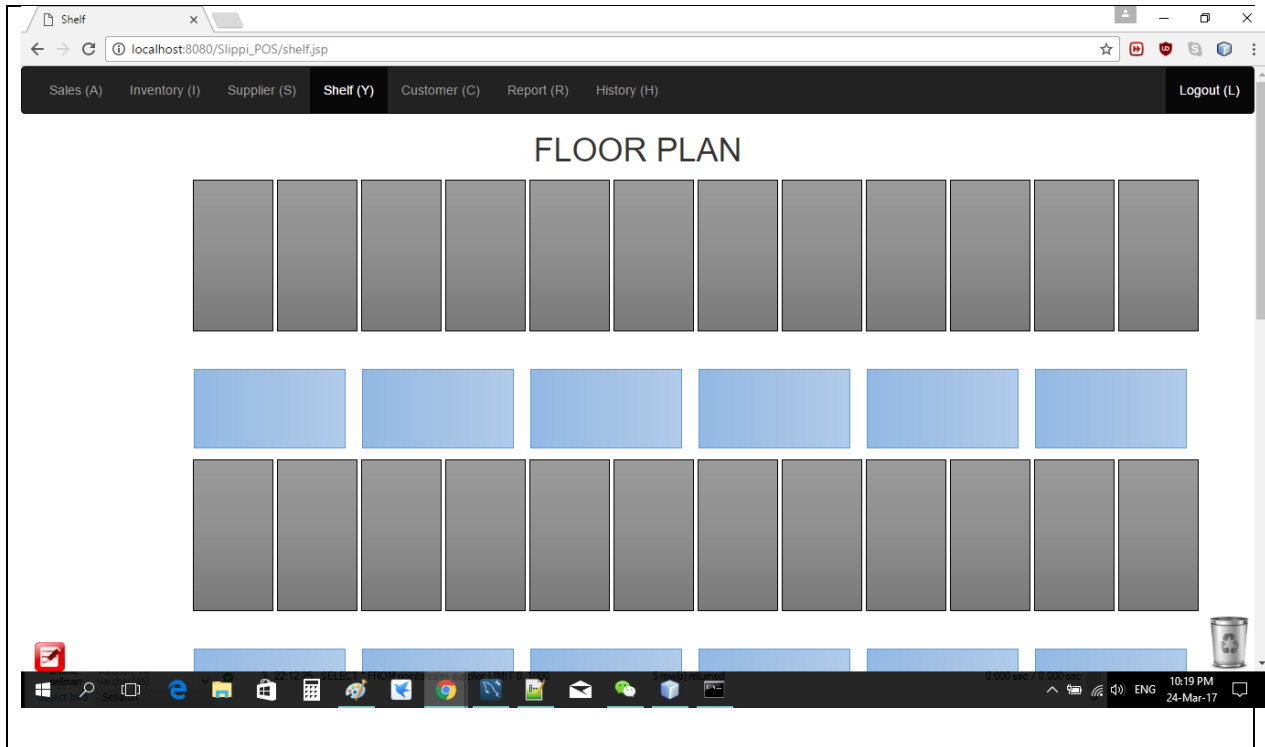


Figure 3.30 : Shelf Page Floor Plan

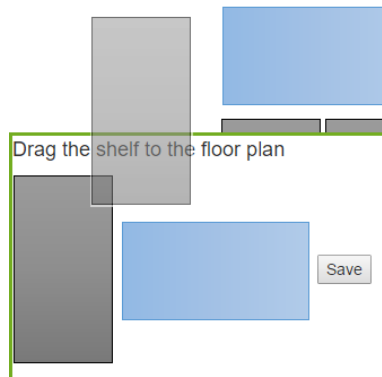


Figure 3.31 : Drag and Drop Component

Shelf Page included floor plan that allow user to design the shelf layout, as shown on figure 3.39. To design the layout, the user is able to drag and drop the shelf in the floor plan by hover the red colour icon. When the user hovered the red colour edit icon it will show the shelf component, as shown on figure 3.40.

# Chapter 3: System Design

## Customer Page

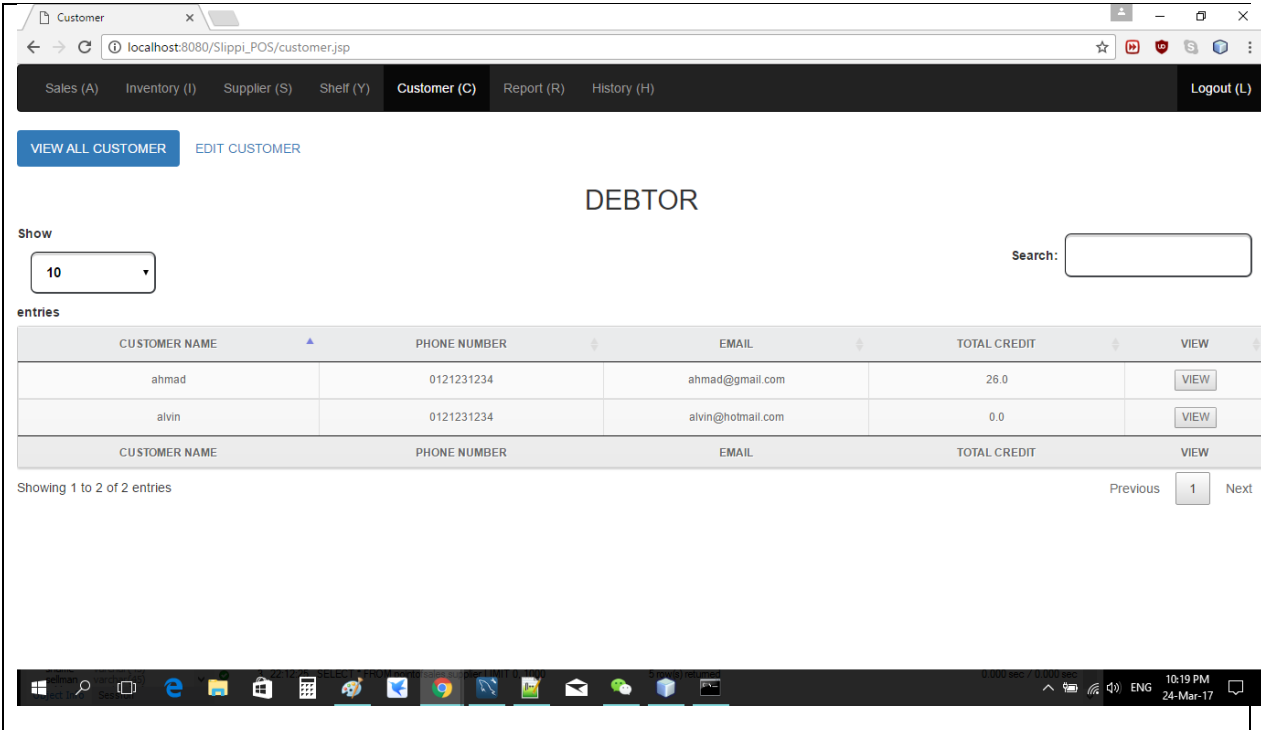


Figure 3.32 : Customer Page

Customer Page is the page that showing the debtor detail. The information included customer name, phone number, email address and total credit.



## Chapter 3: System Design

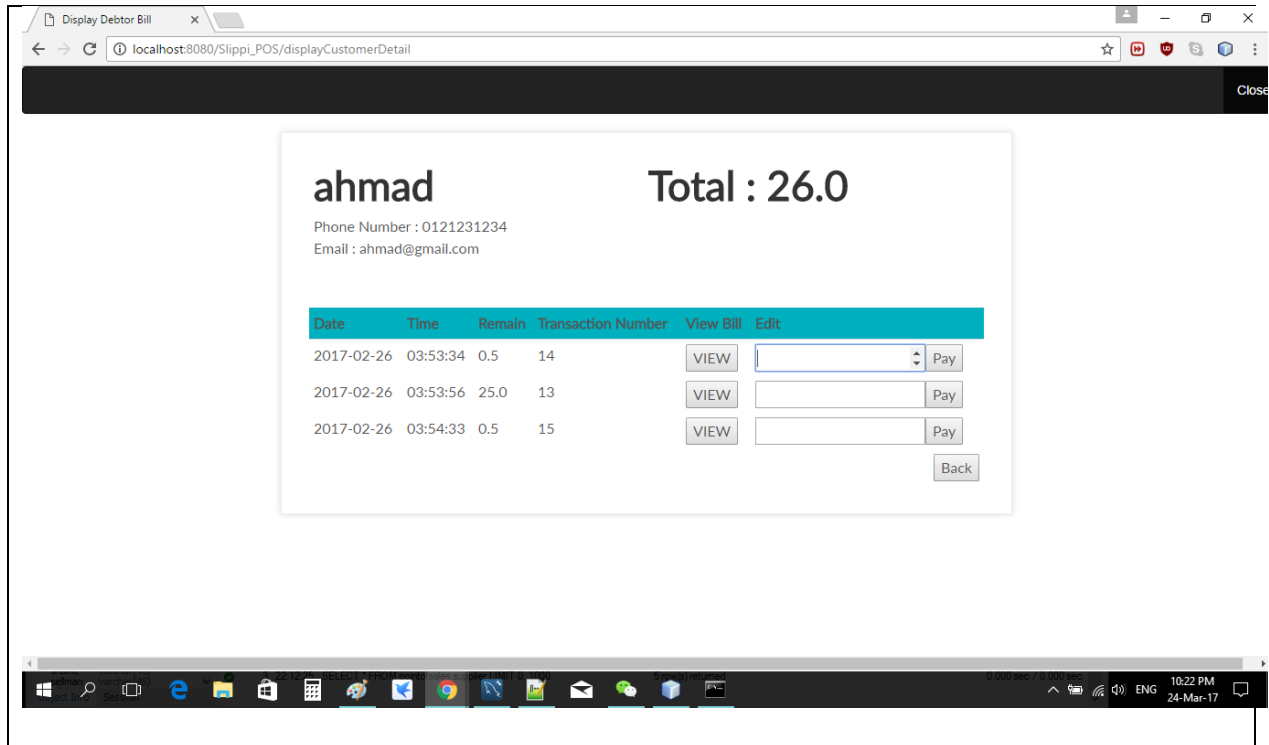


Figure 3.33 : Debtor Detail

Debtor detail will be displayed after the user clicked the view button in the Customer page, as shown on figure 3.42. This page contains the credit bill of the debtor. The information included date, time, remaining balance of the bill, transaction number of the bill. The user is able to view the bill detail by clicking on the view button. Next, when the debtor goes to pay the remaining balance of a credit bill, the user has to key in the amount of payment in the payment input and click the pay button. After the user clicked the pay button the application will update the debtor information.

## Chapter 3: System Design

The screenshot shows a web browser window with the URL `localhost:8080/Slippi_POS/customer.jsp`. The browser's address bar and navigation buttons are visible. Below the browser, a navigation menu contains links for `Sales (A)`, `Inventory (I)`, `Supplier (S)`, `Shelf (Y)`, `Customer (C)`, `Report (R)`, and `History (H)`. A `Logout (L)` button is located in the top right corner. The main content area features two buttons: `VIEW ALL DEBTOR` and `REGISTER DEBTOR`. The `REGISTER DEBTOR` button is highlighted in blue. Below these buttons, the title `REGISTER DEBTOR` is centered. The form is divided into two columns: `CUSTOMER INFORMATION` and `TRANSACTION DETAIL`. The `CUSTOMER INFORMATION` column contains input fields for `Name`, `Phone Number`, `Email`, and `Total`. The `TRANSACTION DETAIL` column contains input fields for `Transaction Number`, `Total`, and `Remain`. A green `Submit` button is positioned at the bottom right of the form. The Windows taskbar is visible at the bottom of the screen, showing the time as 1:49 PM on 25-Mar-17.

Figure 3.34 : Insert Debtor Information

This section is to let the user to register the debtor information. After the user entered all the information and click submit, the application will save the information into the database.

## Chapter 3: System Design

### Report Page

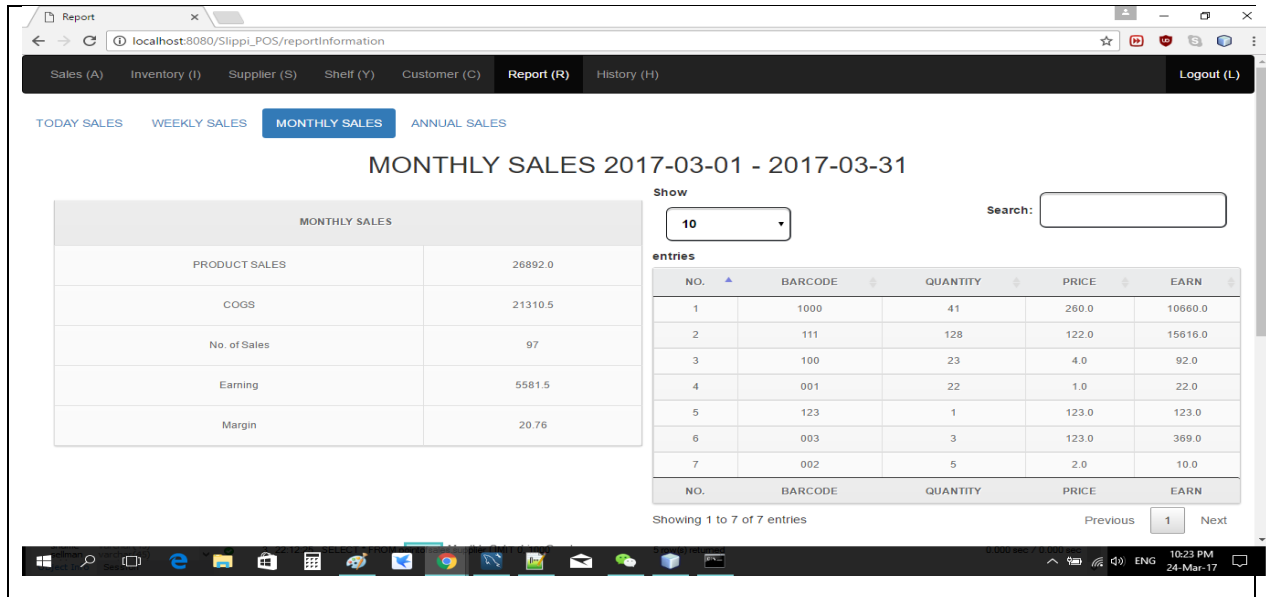


Figure 3.35 : Report Page

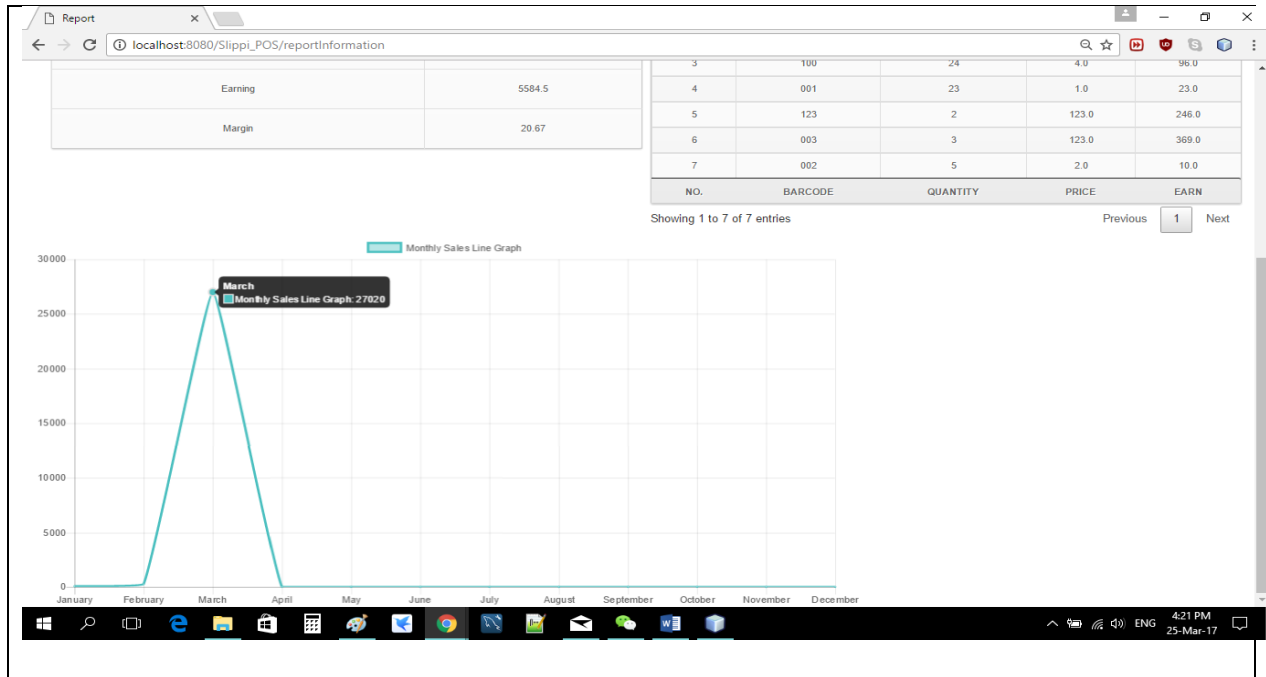


Figure 3.36: Report Graph

Report page is to let the user view the total product sales, cost of goods sold, number of sales, total earning and margin of daily, weekly, monthly and yearly. At the below of the page it will show the total product sales, as shown on figure 3.45.

## Chapter 3: System Design

### History Page

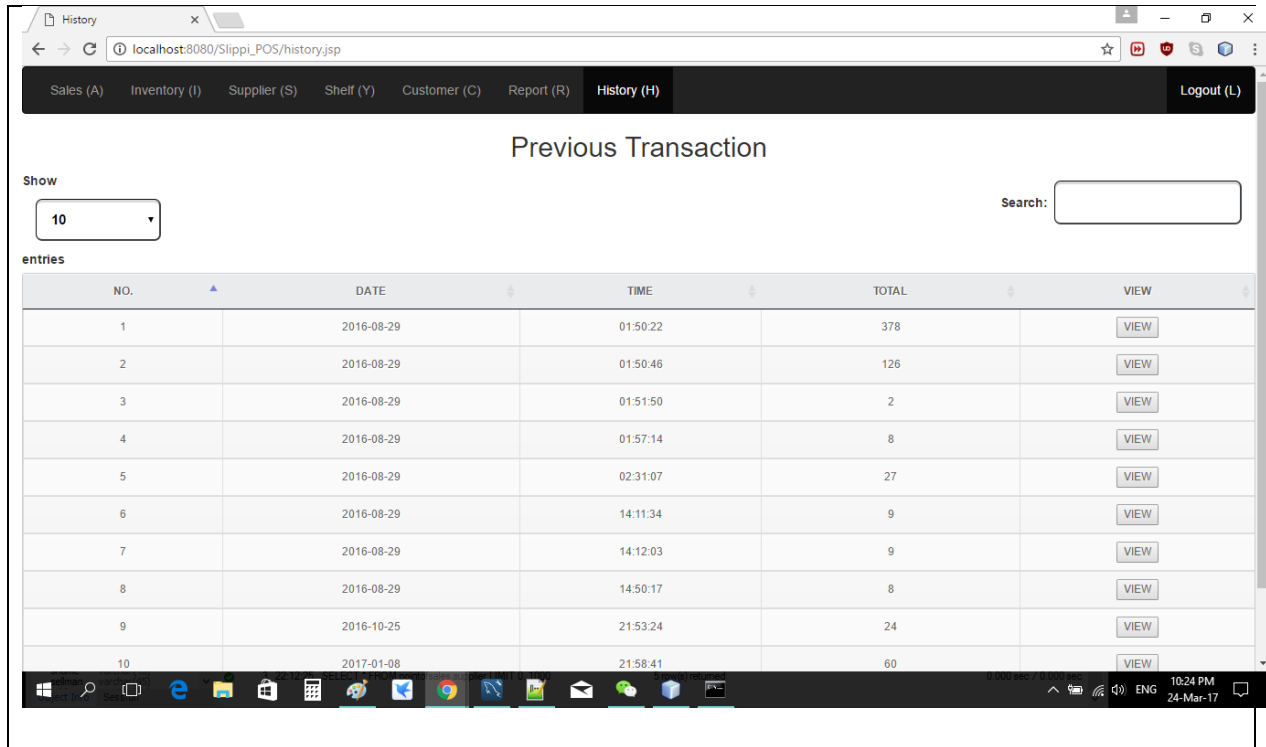


Figure 3.37: History Page

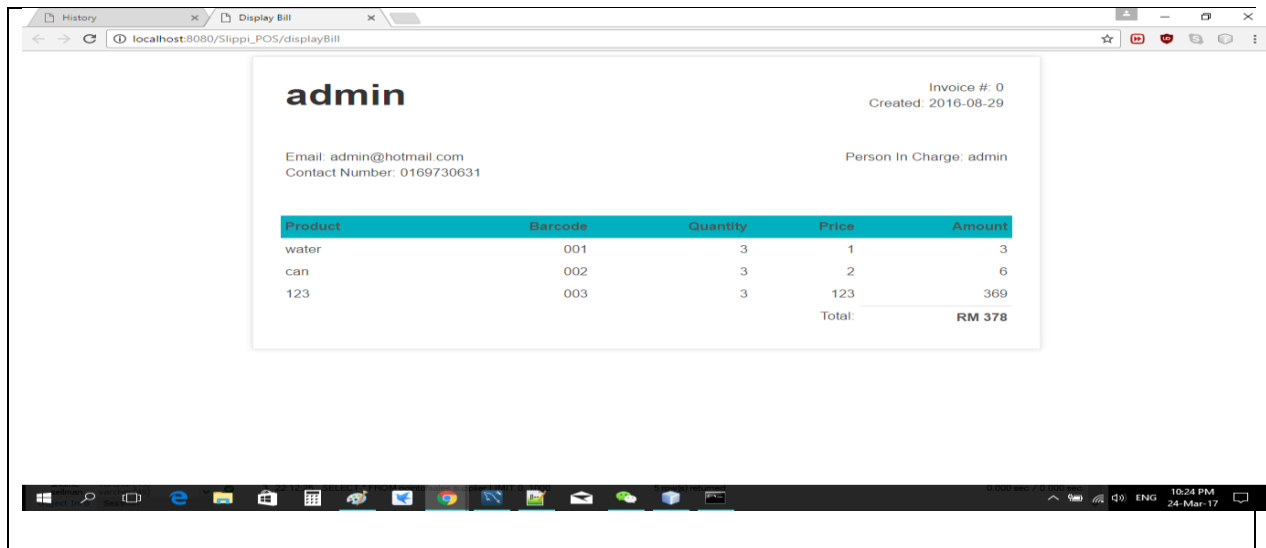


Figure 3.38: Receipt

History Page contain all the history transaction. The information is as shown on figure3.46. The view button is to display the receipt of the transaction, as shown on figure 3.47.

## Chapter 4: Methodology and Tools

### Chapter 4 : Methodology and Tools

#### 4.1 Design Specification

This part is to explain the methodologies, describe user requirements, system performance definition and verification plan. Each step of system development life cycle for this application will be clearly explained and justify.

##### 4.1.1 Methodologies and General Work Procedures

System development life cycle is a process that includes four main phases to create software to meet the project objective. According to Jirava, “development life cycle is perceived as the time frame that spans from the development of a new system to its eventual retirement. It is a process that starts with the emergence of an idea, goes through its implementation, and ends with its termination, moving across all the intermediate stages in which its viability and usability are prioritized” (Jirava, 2004).

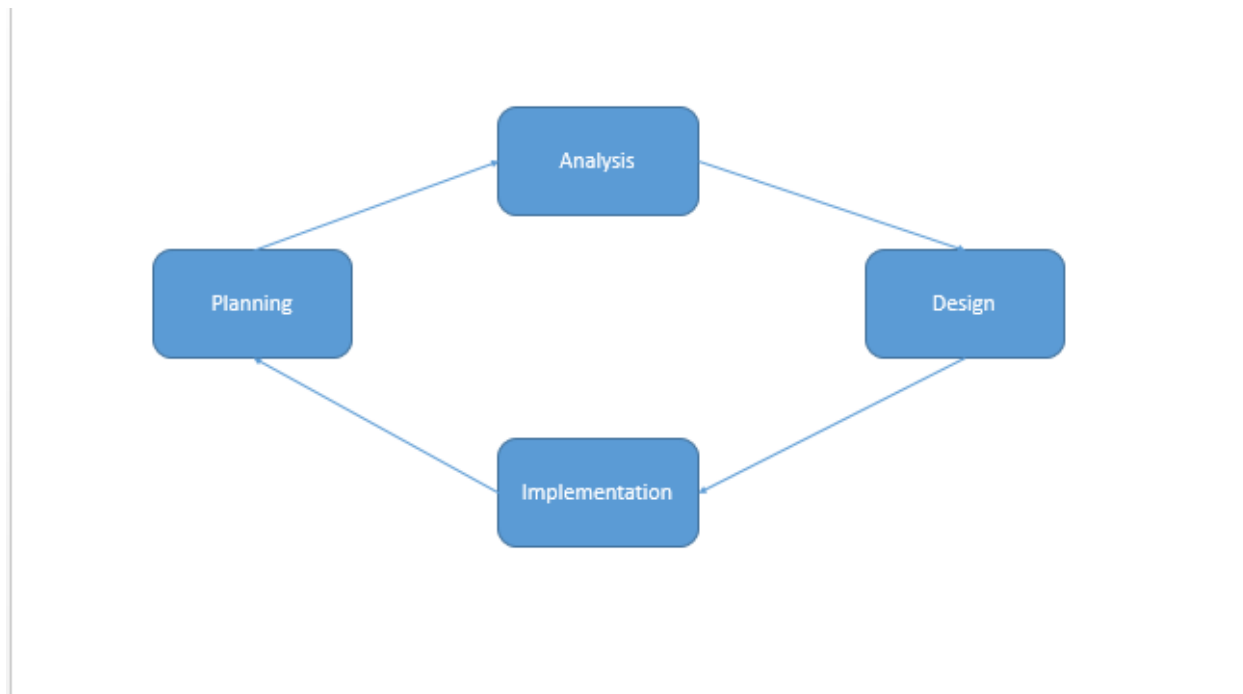


Figure 4.4.1 : System Development Life Cycles

These 4 phases are including planning, analysis, design, and implementation. In this project, phased development method is selected as a Rapid Application Development life cycles. The



## **Chapter 4: Methodology and Tools**

will be figure out in two weeks duration. Then the developer will contact the user and discuss the solution.

### **Analysis Stage**

In this stage, developer are required to meet Yat Yat Mini Market owner to have a discussion that currently the problem that they are facing in detail and identify requirement such as functional requirement, non-function requirement, hardware, and software requirement. Then the developer is going to solve the problem by creating a new module. The idea of the new module is come from either research or perform a survey to gain realistic idea.

### **Function Requirement**

#### ***Account Registration***

- The application should able to let non-member register an account.
- To make sure all of the Account ID is unique.
- The application shall update and save the new account while the information successfully validated.

#### ***User Login***

- The application shall let validate member to log in to the application.

#### ***Reset Password***

- The application shall provide a reset password function.
- The application shall ask user to insert detail to prove whether the user is the owner of the account or not.
- The application shall change the password while the information is successfully validated.

#### ***Report Management***

- The application shall generate report for users.
- The application shall allow user to print out the report.

#### ***Shelf Management***

- The application shall let user to configure the setting of the shelf position and detail.
- The application is able to let user search specific item location.

## **Chapter 4: Methodology and Tools**

### ***Inventory Management***

- The application shall contain all the information of the product within the user inventory.
- The application shall let user to key in information detail.
- The application shall be consistence in term of product quantity within the user inventory.
- The application shall be interlink with item check out and check in management to provide accurate information on the inventory.
- The application shall alert owner while the product quantity is less than predefine quantity.

### ***Item check in and check out Management***

- The application shall let user to key in the information of new arrive item.
- The application shall update the item quantity while the item is been sold out.
- The application shall calculate the total item that going to sell to a customer.
- The application shall update the sales information while a transaction is complete.

### ***Customer Profile Management***

- The application shall let user to insert customer detail who want to have a credit payment for a transaction.
- The application shall prompt the information while requested by the user.

## **Non-Function Requirement**

### ***Security Requirements***

- The application should validate the username and password to login the application.
- The application should ask user the current password while user want to change password.



## Chapter 4: Methodology and Tools

### *Operational Requirements*

- The application should operate in any operation system.
- The application should operate in any browser.

### **Hardware and Software Requirements**

#### *Hardware Requirements*

- At least 2GB RAM memory.
- Touch screen or mouse, keyboard and bar code scanner as input.
- Monitor as display output.
- Computer or laptop.
- Modem for internet access.

The hardware requirement are owner must have a laptop or computer to use this application. When there is a computer or laptop a bar code scanner may require for the faster way to read bar code. The RAM require for this application is at least 4GB to store information. Lastly, to access the application internet access are require due to the application is web base platform. The speed of the application is depend on the internet speed.

#### *Software Requirements*

- Compiler: NetBeans IDE



Figure 4.4.3 : NetBeans IDE logo

## Chapter 4: Methodology and Tools

According to NetBeans official website, this software is an open source software created by Sun Microsystems (NetBeans). This software provide support for a number of language such as Java, PHP, C and C++ and frameworks. Besides, this software is able to integrate with several components, for instance MySQL and GlassFish. Therefore, it is suitable to use for this project as the component that requires for this project is able to work with this software.

- Back End: MySQL Workbench



Figure 4.4.4 : MySQL Workbench logo

According to Oracle official website, is said “MySQL Workbench enables a DBA, developer, or data architect to visually design, generate, and manage all types of databases including Web, OLTP, and data warehouse databases. It includes everything a data modeler needs for creating complex ER models, and also delivers key features for performing difficult change management and documentation tasks that normally require much time and effort. MySQL Workbench is available on Windows, Linux and Mac OS” (Oracle). This software provide the sufficient tool that require for this project.

## Chapter 4: Methodology and Tools

- Programming language technology: Java, HTML, JSP and Java Servlet



Figure 4.4.5 : Java logo

The reason to choose java is it support object oriented programming concept that create an advantage of code reuse and recycles, design benefit and software maintenance easily. Next, the java virtual machines are compatible in everywhere such as web browsers, web servers, and smartphone.



Figure 4.4.6 : HTML

This application is used HTML to create the web page. HTML is HyperText Markup language that can work together with CSS, javascript and JQuery to design the web page.



Figure 4.4.7 : JSP

JSP is java server pages that allow the developer to create a dynamic web page for this application. This technology is support by java programming language. Therefore, it able to create a dynamic web page for this web application.



Figure 4.4.8 : Java Servlet

According to oracle website, Java Servlet is a technology to create functionality in the web server (Oracle). As this application is a web base application the function will be created in web server. Therefore, Java Servlets is the choice for this application in order to create functionality for this application.

## Chapter 4: Methodology and Tools

- Server: GlassFish



Figure 4.4.9 : GlassFish

This project is using glass fish to host the web application to the registered member. First of all, GlassFish is an open-source application server that running in JAVA EE platform. This software server supports the component that this project requires such as JPA, Enterprise JavaBeans and servlet that run in the project.

This application will be using NetBeans IDE that able to support several components to build the web application. When the project is created java programming language is going to create several java class that supports the application functionality. Next, the application are using servlet to handle the request from the client in the web server. Then the request will be redirected or dispatch to requested location. Furthermore, this application using HTML to design the webpage with the combination of CSS, JQuery and JavaScript. JSP is work as HTML but it allows developer to build a dynamic web page with the combination of Java language. Lastly, MySQL workbench is functioning as a backend database management system. This allows the application to retrieve any information that requested by the user from the relational database.

### **Design stage**

This stage is going to design the application with a diagram. The use of diagram is to plan the application in term of workflow, functionality process, application design and database structure. Once the diagram is done the diagram will be presented to Yat Yat Mini Market. This could help

## **Chapter 4: Methodology and Tools**

the developer to improve the application while the user is going feedback to enhance the application.

### **Implementation Stage**

After the improvement of the design is done based on user feedback this stage is going to execute. This stage is going to implement the application with the software and tool stated at software requirement based on the design diagram. The functionality of the application is based on the use case diagram. The different user of the application has different function depend on the use case diagram that had been illustrating the relation of each function. The process of the function will be implemented according to an activity diagram. All of the condition and flow will be convert to coding that found in an activity diagram. Lastly, the database implementation will be following the class diagram. The relation and the require data are illustrated in class diagram, therefore developer will be designing the database based on the class diagram. In the implementation process developer may request to change the way to implement the application while they found another better way to implement it.

### **4.2 Chapter Summary**

In short, this chapter discussed about the methodology and technology for this proposed application. The methodology of this project is Phased Development that is category in rapid application development process. Each of the phase has been justify and the project timeline had been schedule according to the gantt chart. The technology using in this project is NetBeans IDE, MySQL Workbench, Java, HTML, JSP, Java Servlet and GlassFish.

## Chapter 5: Functionality

### Chapter 5 : Functionality

#### 5.0 Overview

This chapter will talk about each module functionality of the application.

#### 5.1 Login Page Testing

##### 5.1.1 Error username or password

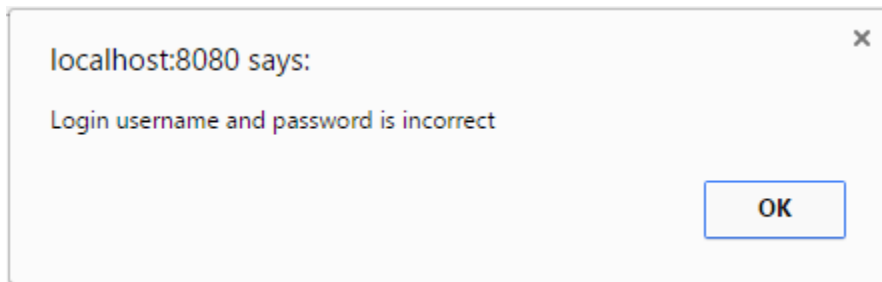


Figure 5.1: Error username or password

This prompt box will be show when the user enter the incorrect account username and password.

#### 5.2 Register Page Testing

##### 5.2.1 Duplicate username

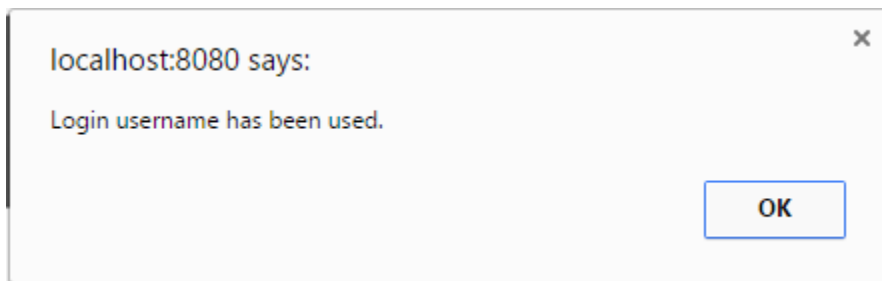


Figure 5.2 : Duplicate username

This prompt box will be show when the user enter the duplicate username in the register page.

## Chapter 5: Functionality

### 5.2.2 Empty input

Full Name :

Confirm Password :

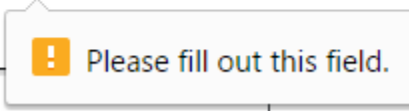


Figure 5.3 : Empty input

The message will be shown when the user try to register the account with empty input of any field.

## 5.3 Home Page Testing

### 5.3.1 Add item for check out

Barcode:     2017-03-26 2:36:59 AM

No.	Barcode	Name	Quantity	Price
1	100	100plus	1	4

Figure 5.4 : Add item for check out

New row will be append when the user entered the barcode and click add or pressed enter key.

### 5.3.2 Delete item for check out

Barcode:     2017-03-26 2:40:32 AM

No.	Barcode	Name	Quantity	Price
1	100	100plus	1	4
2	001	water	1	1

---

Barcode:     2017-03-26 2:41:54 AM

No.	Barcode	Name	Quantity	Price
1	001	water	1	1

Figure 5.5 : Delete item for check out



## Chapter 5: Functionality

The user is able to delete the item from the box by checked the checked box beside the barcode and click delete button.

### 5.3.3 Search function

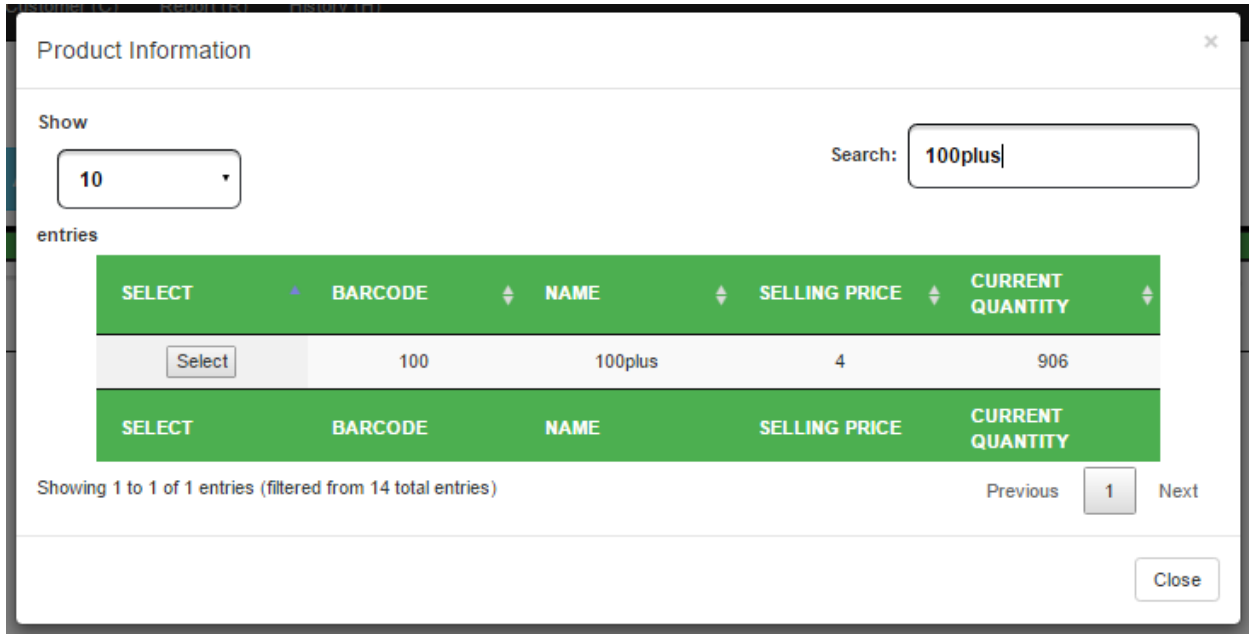


Figure 5.6 : Search function

The user is allow to search a product by click the search button. After the model is showed, the user is able to search the item by key in the item name or barcode in the search box. Once the user found the item, the user may click select button to append the product into the box.

### 5.3.4 Total Bill

**Total:RM 4**

Figure 5.7: Total Bill

The total bill will be update when there is a changed on the bill.

## Chapter 5: Functionality

### 5.3.5 Pay bill

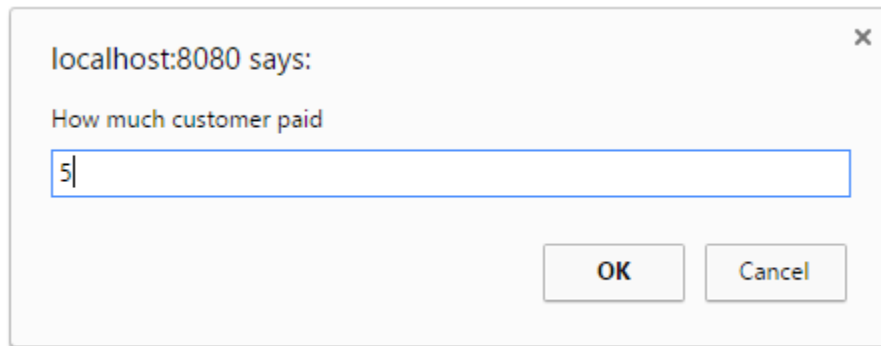


Figure 5.8: Pay Bill

The prompt box will be shown when the user click the pay button or pressed space bar in the keyboard.

### 5.3.6 Payment value lower than the transaction bill

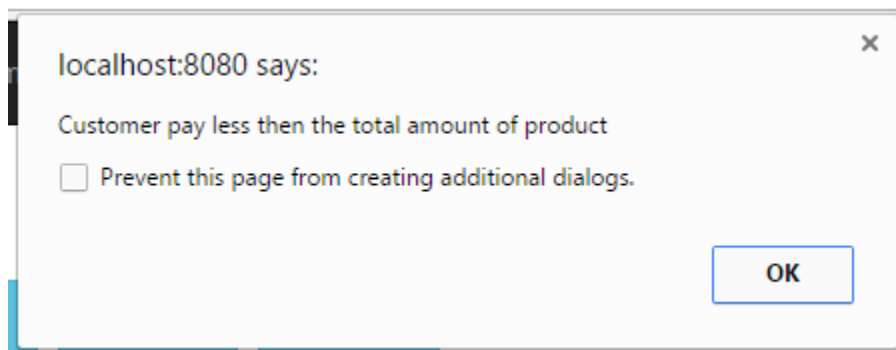


Figure 5.9: Payment value lower than the transaction bill

The alert box will be shown when the user enter the payment value lower than the transaction bill.

## Chapter 5: Functionality

### 5.3.7 Balance

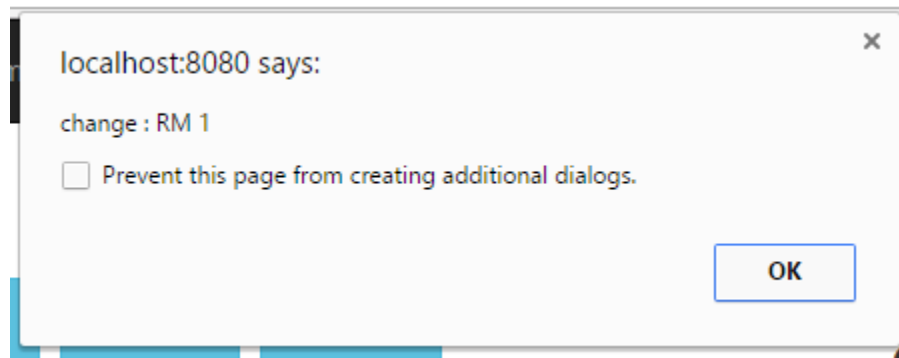


Figure 5.10: Balance

After the user enter the amount of customer payment, the application will show the balance change, as shown in figure 5.10.

## 5.4 Inventory Page

### 5.4.1 Inventory section



Figure 5.11: Inventory section

The view all product tab button will show all product list as shown in figure 3.25. The edit product tab button will show product form as shown in figure 3.26. Lastly, the product restock tab button will show a restock item list as shown in figure 3.27.

## Chapter 5: Functionality

### 5.4.2 Empty field

Item Code :

Description :

Please fill out this field.

Figure 5.12: Empty field

The prompt box will be show when there is an empty input for the product form.

### 5.4.3 Profit margin of an item

Unit Price :

Selling Price :

Markup % :

Figure 5.13: Profit margin of an item

The markup % will be update when the unit price or selling price was changed.

## Chapter 5: Functionality

### 5.5 Supplier Page

#### 5.5.1 Supplier Section

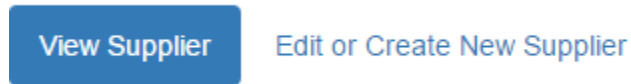


Figure 5.14: Supplier section

The view Supplier tab button will show all the supplier list, as shown on figure 3.28. Next, the edit or create new supplier tab button will show the supplier form, as shown on figure 3.29.

#### 5.5.2 Empty input

Supplier Company Name :

Phone Number : (eg: 01912)

Please fill out this field.

Please fill out this field.

The image shows a form with two input fields. The first field is labeled "Supplier Company Name :" and is empty. The second field is labeled "Phone Number : (eg: 01912)" and is also empty. Both fields have a yellow warning icon and a tooltip that says "Please fill out this field." The tooltip for the phone number field is positioned directly below the input field, while the tooltip for the company name field is positioned to the right of the input field.

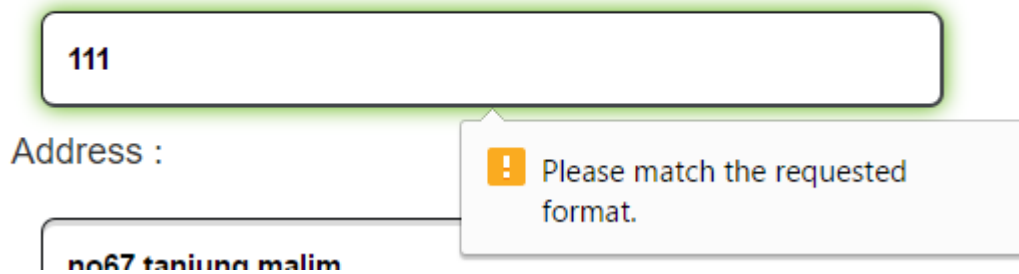
Figure 5.15: Empty input

The application will not allow empty input in the form.

## Chapter 5: Functionality

### 5.5.3 Phone validation

Phone Number : (eg: 0191231631)



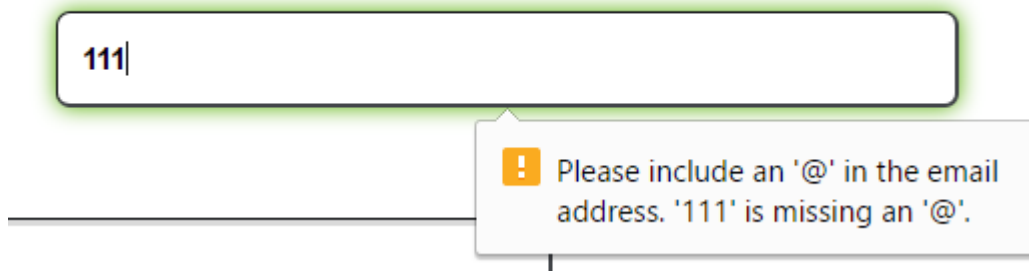
The screenshot shows a form with two input fields. The first field, labeled 'Phone Number : (eg: 0191231631)', contains the text '111'. The second field, labeled 'Address :', contains the text 'no67 tapiung malim'. A yellow error message box is positioned to the right of the address field, with a line pointing to the address input. The error message reads: 'Please match the requested format.'

Figure 5.16: Phone validation

The application will check the phone number format before saving in database.

### 5.5.4 Email address validation

Email Address :



The screenshot shows a form with one input field labeled 'Email Address :'. The field contains the text '111|'. A yellow error message box is positioned below the field, with a line pointing to the input. The error message reads: 'Please include an '@' in the email address. '111' is missing an '@'.'

Figure 5.17: Email address validation

The application will validate the email address before saving into the database.

## Chapter 5: Functionality

### 5.6 Shelf Page

#### 5.6.1 Hover edit icon

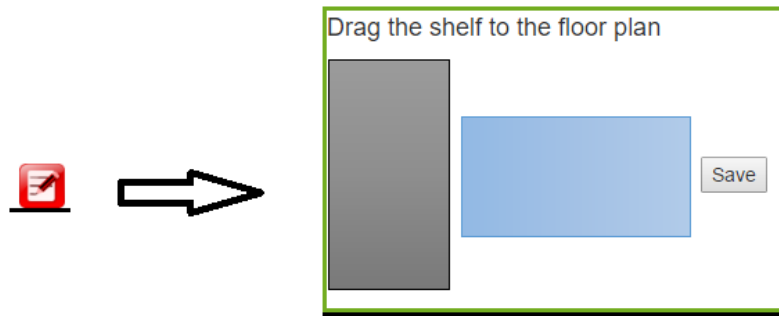


Figure 5.18: Hover edit icon

The user able to choose a shelf component by hover the red edit icon.

#### 5.6.2 Request for shelf name

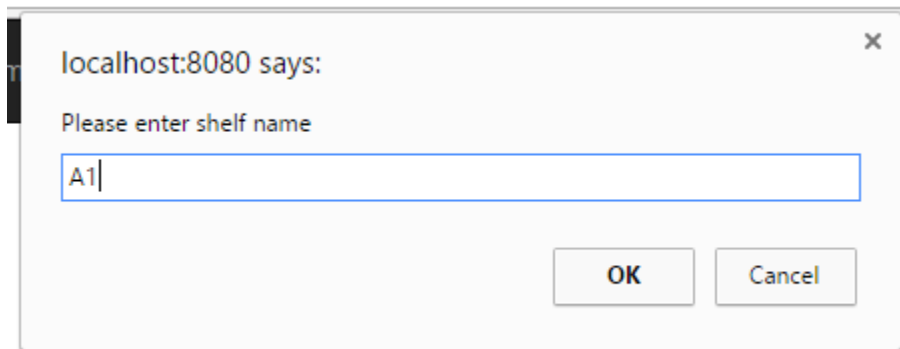


Figure 5.19: Shelf name

The prompt box will be show after the shelf component is dropped into the floor plan.

## Chapter 5: Functionality

### 5.6.3 Shelf name validation

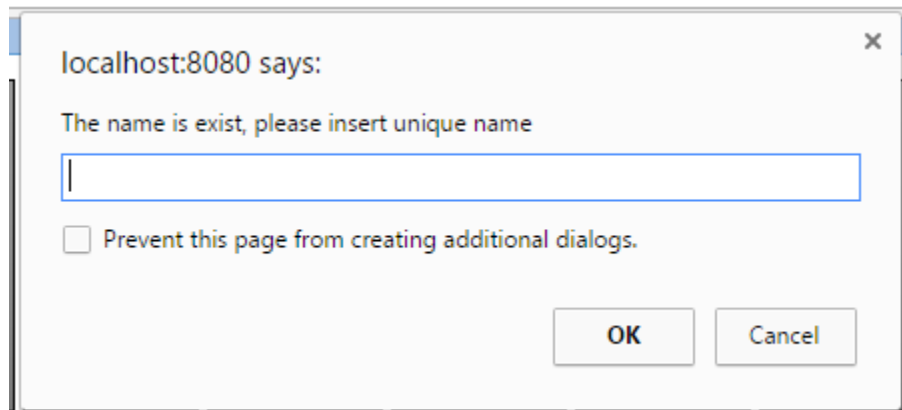


Figure 5.20: Shelf name validation

The application will request user enter shelf name again when there is duplicated name.

### 5.6.4 Insert shelf level

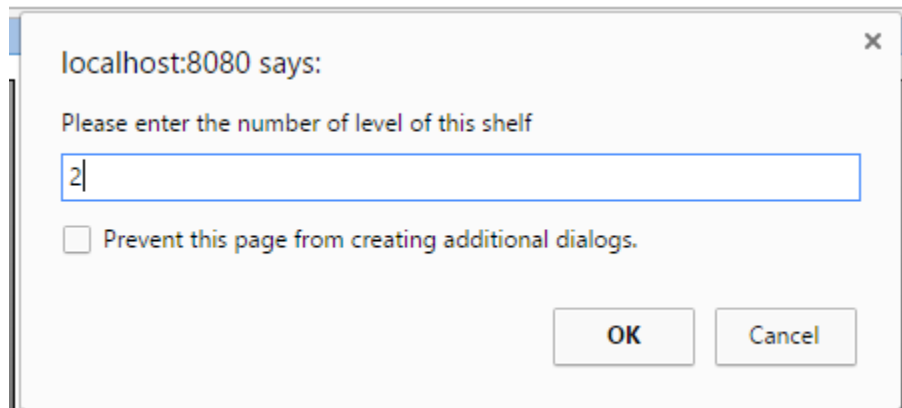


Figure 5.21: Shelf level

After entered the shelf name. the application will request user to enter the shelf level.



## Chapter 5: Functionality

### 5.6.5 Shelf level validation

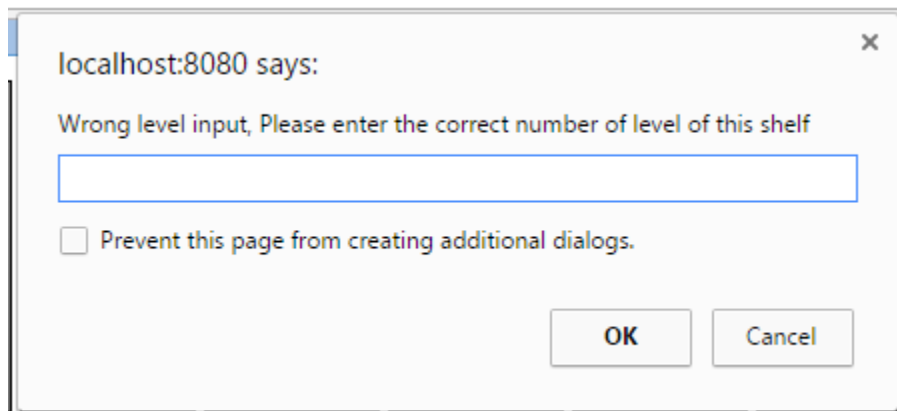


Figure 5.22: Shelf validation

The shelf level only accept number and must be more than 0, else the application will request user enter again, as shown in figure 5.22.

### 5.6.6 Delete shelf

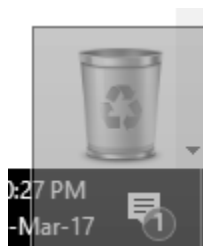


Figure 5.23: Delete shelf

The shelf component will be delete after dragged the shelf into the recycle bin.

## Chapter 5: Functionality

### 5.7 Customer Page

#### 5.7.1 Customer section



Figure 5.24: Customer section

The view all debtor tab button will show all the debtor information as shown in figure 3.32. The register debtor tab button will show the debtor form as shown in figure 3.34.

### 5.8 Report Page

#### 5.8.1 Report section



Figure 5.25: Report section

Each of the tab button will display different duration of report.

## Chapter 5: Functionality

### 5.9 Print function

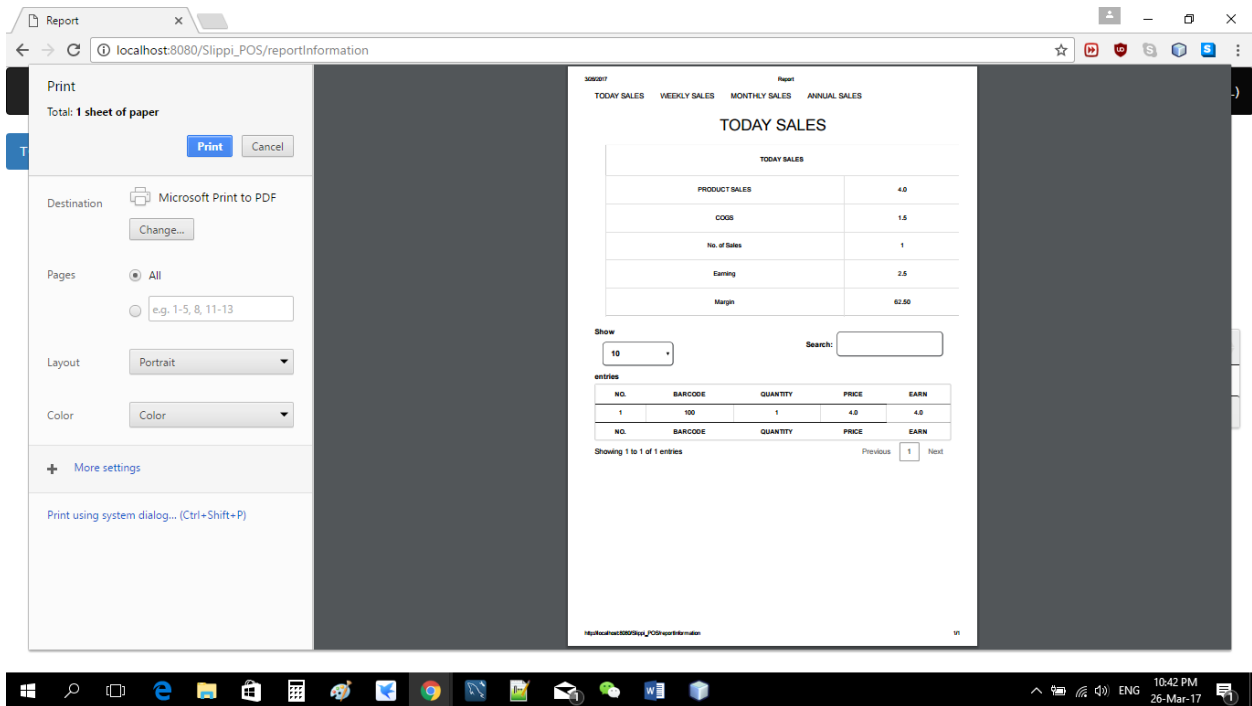


Figure 5.26: Print function

The user able to print all the page content by pressing Ctrl + P.

## Chapter 6: Testing

### Chapter 6 : Testing

#### 6.0: Overview

After developed the application, I have invited 10 person to test the application. Before letting the user to test the application, I have designed a feedback form for the user to give feedback for the application after the application testing.

#### 6.1: Feedback form question

The following figure are the feedback form question.

**Slippi POS Feedback Form**

I am currently doing my University Final Year Project 2 and I have developed a point of sale application. I hope through the user testing, you will leave me some feedback so that I can enhance the application.

**\* Required**

**How easy was it to access Slippi POS? \***

1      2      3      4      5

Not easy at all                                    Extremely easy

**How easy was it to setup Slippi POS application? (Open web browser to register account and without installation) \***

1      2      3      4      5

Not easy at all                                    Extremely easy

Figure 6.1: Feedback Form1

## Chapter 6: Testing

How user-friendly is the application interface? \*

1      2      3      4      5

Not at all user-friendly                                    Extremely user-friendly

How often does the application freeze or crash? \*

1-5 times

6-10 times

11-15 times

Other: \_\_\_\_\_

Figure 6.2: Feedback Form 2

How useful of each module? \*

Slightly useful      Moderately useful      Extremely useful

Sales Module	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inventory Module	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supplier Module	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shelf Module	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Customer Module	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Report Module	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
History Module	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How successful is the application in performing its intended task? \*

1      2      3      4      5

Not at all successful                                    Extremely successful

Figure 6.3: Feedback Form 3

## Chapter 6: Testing

Overall, are you satisfied with the performance of the application, neither satisfied nor dissatisfied with it, or dissatisfied with it? \*

	1	2	3	4	5	
Extremely dissatisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremely satisfied

How likely are you to recommend this application to others? \*

	1	2	3	4	5	
Not at all likely	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Extremely likely

How can I improve the application? \*

Your answer

---

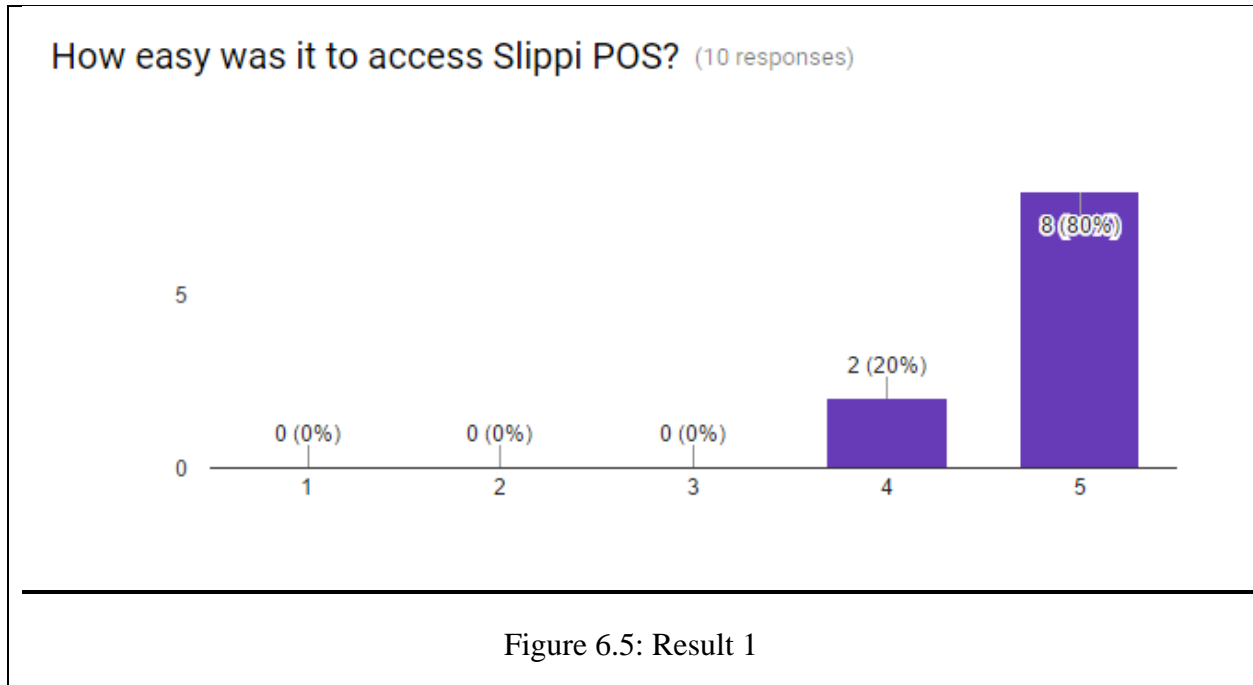
Figure 6.4: Feedback Form 4

## Chapter 6: Testing

### 6.2: Feedback form result

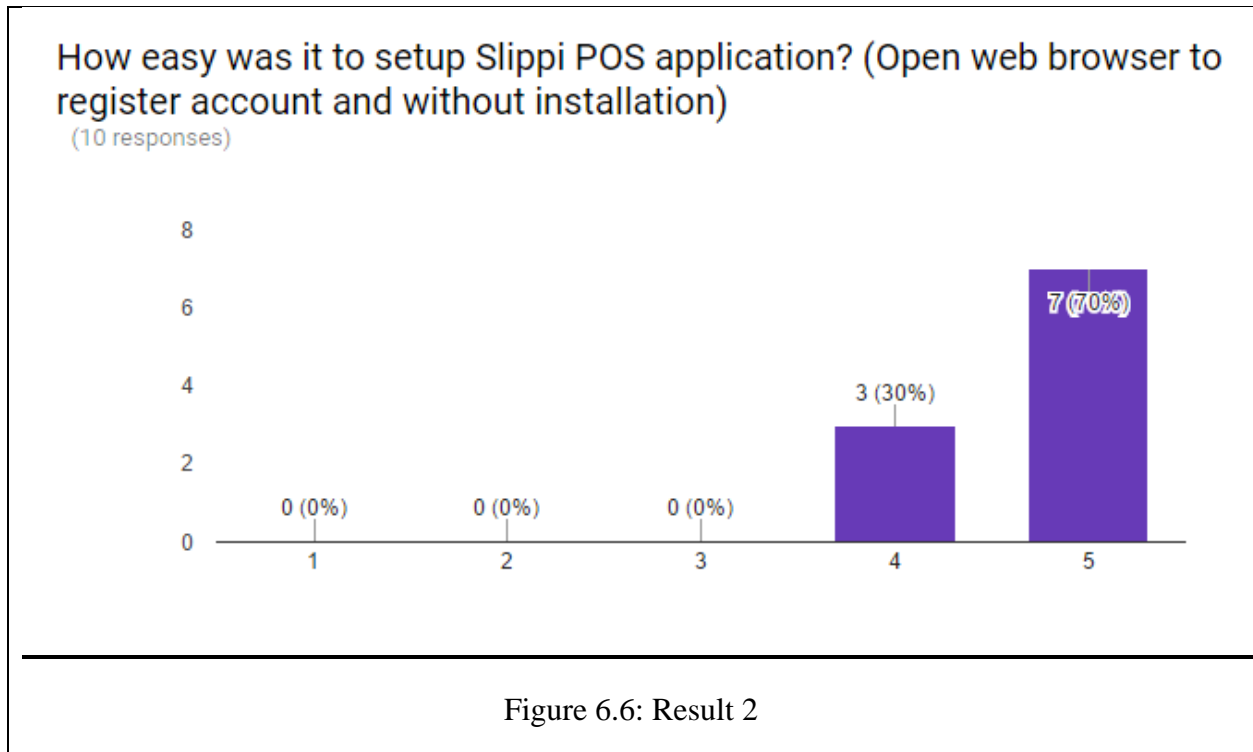
The feedback result will be showing in a summary form created by the Google form.

#### Result for question 1



The result showed most of the respondent vote the Slippi POS is extremely easy to access. This is because the user only require to open browser from any platform such as desktop, laptop or mobile to access the application rather than only access to single platform that is already installed the application.

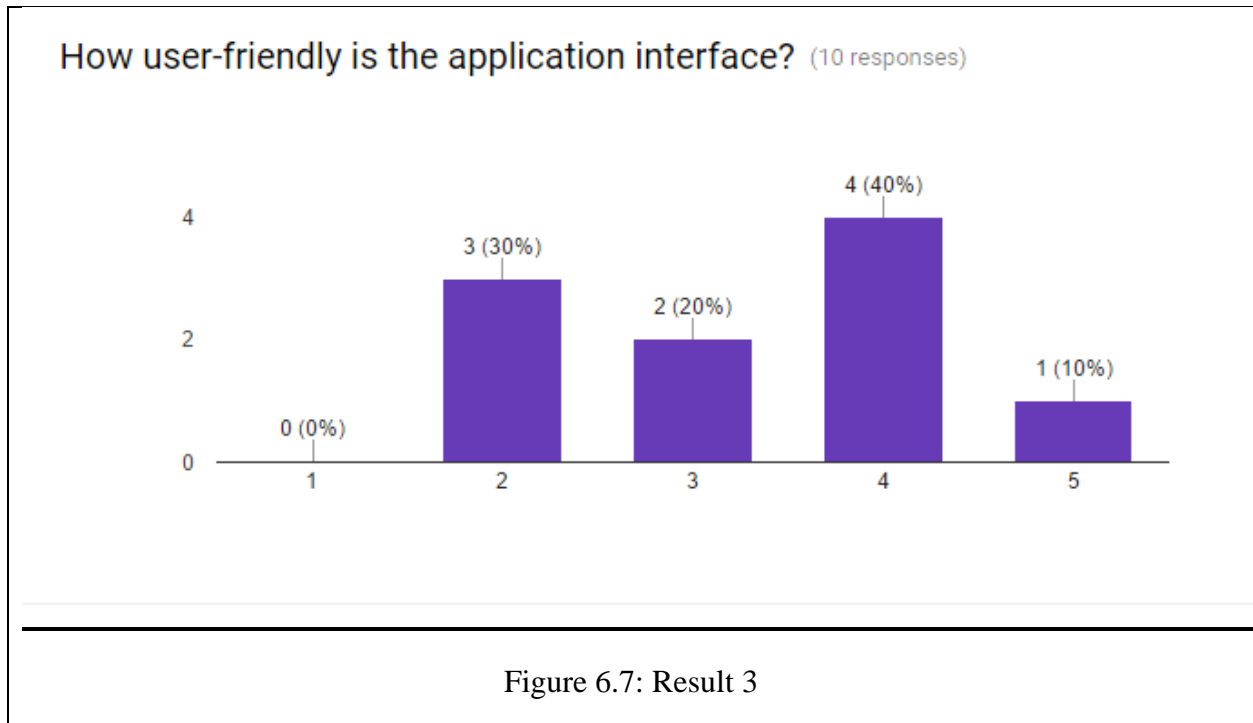
**Result for question 2**



The result showed that almost all of the respondent voted the application is easy to setup. This is because of the application will be host in the internet and they only require to open web browser to access the application. Therefore, the user is not require to install any software such as database or EXE file to use the application.

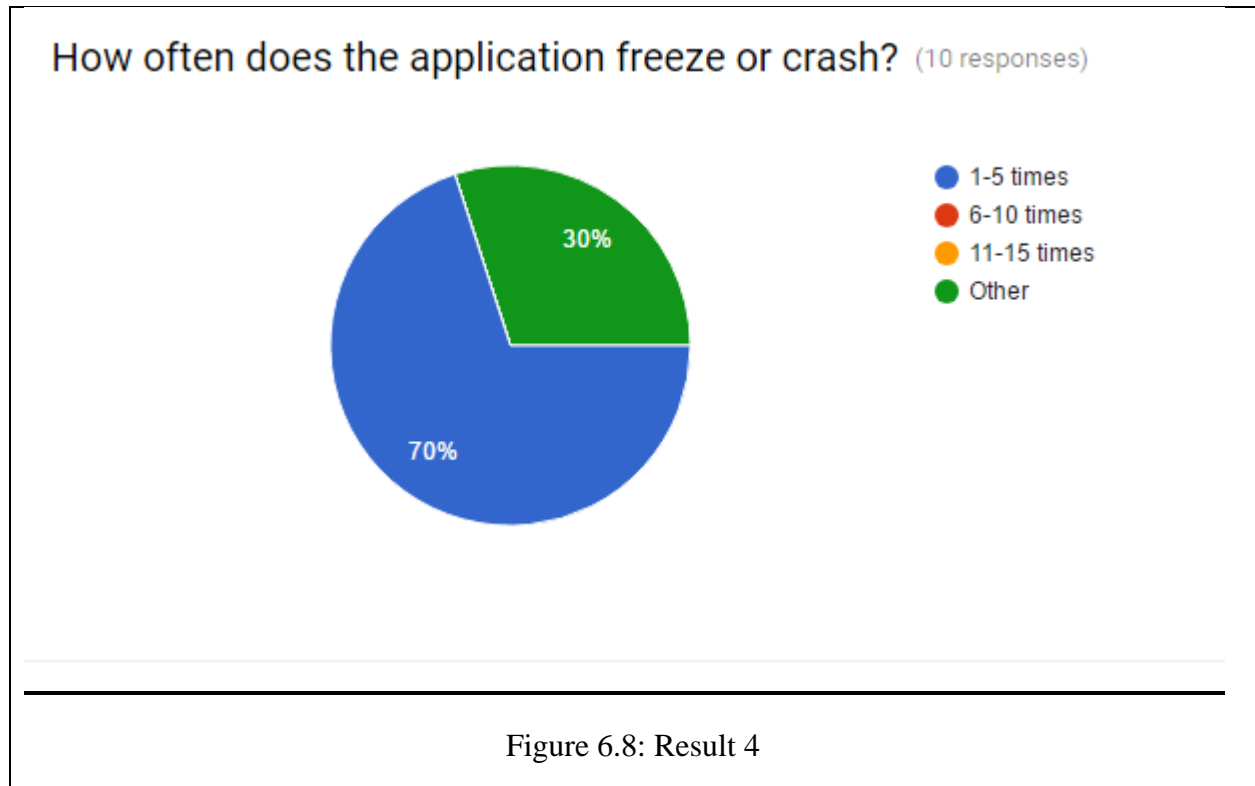


**Result for question 3**



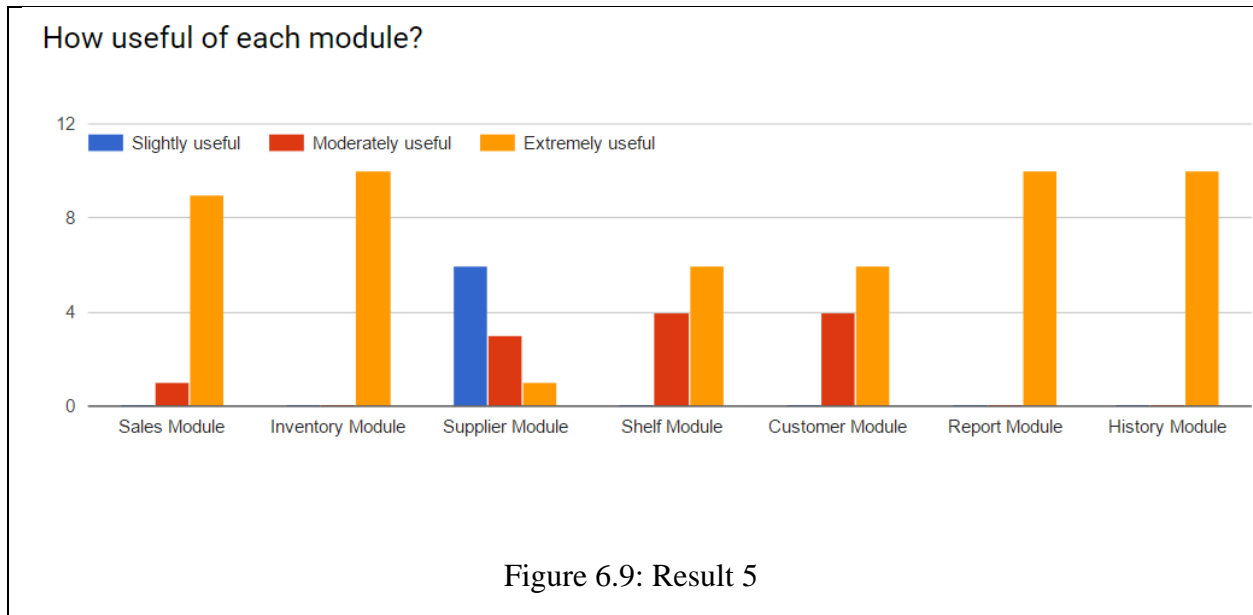
The result showed that most of the respondent vote the application interface design is moderate. This might because of the HTML and JSP lack of professional CSS design.

**Result for question 4**



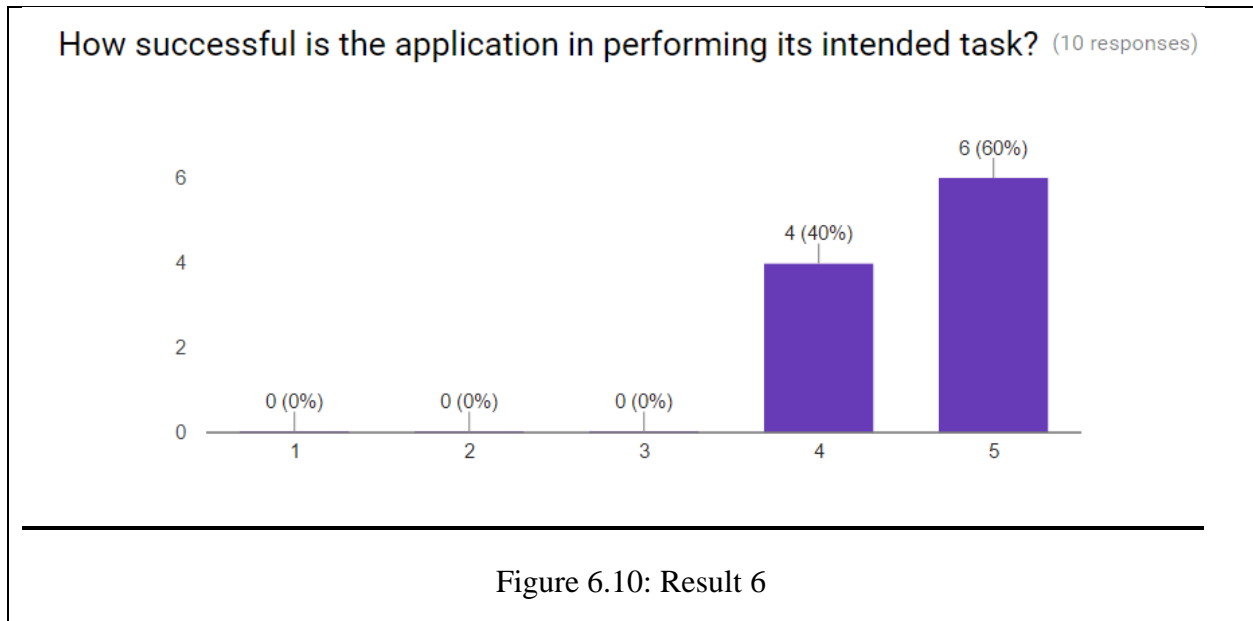
As the pie chart showed, there is 70% of the respondent voted 1-5 times freeze or crash during the application testing and the remaining 30% respondent vote other which is 0 times freeze or crash on the application. The crash is occur when the user inserted wrong input in the application and saved in the database.

**Result for question 5**



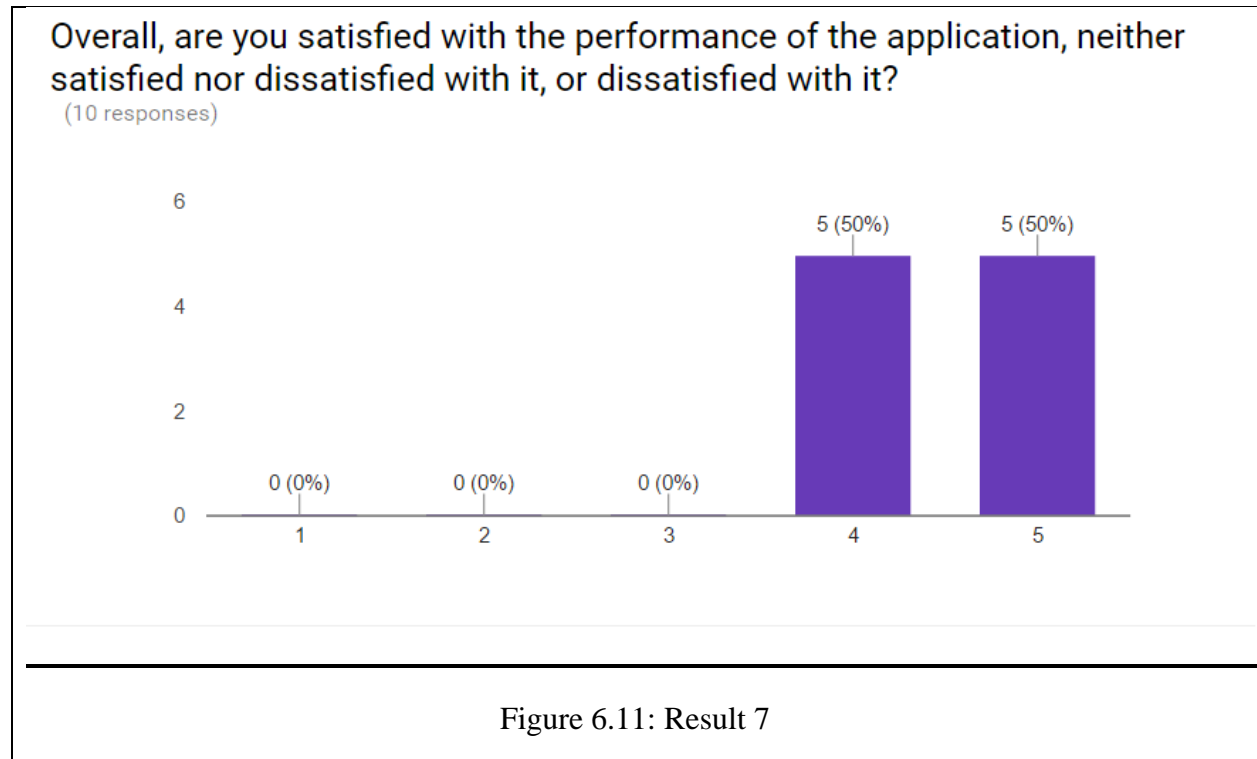
The result showed that, most of the module is extremely useful except supplier module. According to the respondent feedback, they said the supplier module is lack of recording each incoming stock and less useful because it is just function as storing supplier name card purpose.

**Result for question 6**



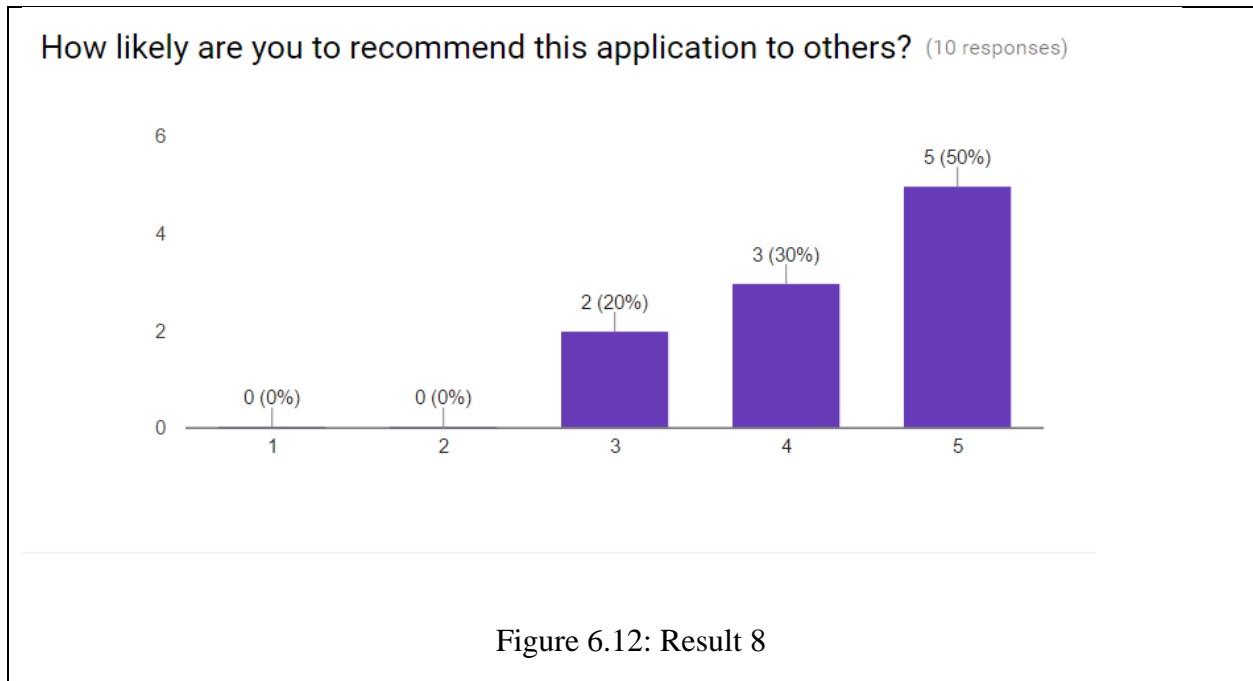
Base on the result showed, 60% of the respondent voted that the application performing extremely successful. This is because when the application encounter error, the application will show error message and keep running instead of showing 404 file not found page or crash. The application will keep running due to the java code implement try and catch method.

**Result for question 7**



Base on the bar graph, users are satisfied with the application performance and the application is working as the user expectation. Hence, with this final version application it will be working fine for the real business.

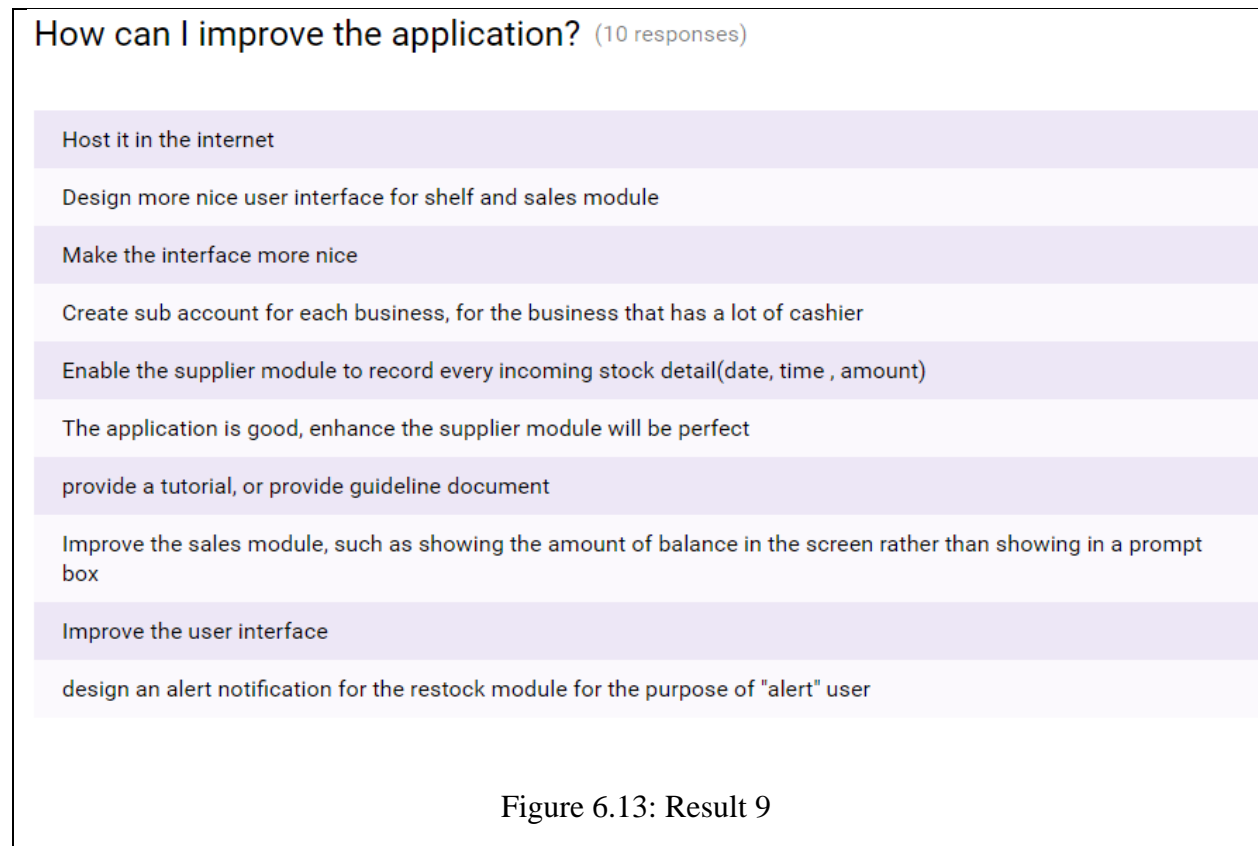
**Result for question 8**



As the bar graph showed, half of the respondent will extremely likely to recommend the application to their friends. This might because of the application is working well, fulfill user requirement and the application is sufficient to assist the business activities.

## Chapter 6: Testing

### Result for question 9



As the result showed, there is 3 respondent said the application require to enhance. Next, there is few respondent said account, supplier, sales and restock alert module require to improve. Lastly, there is a respondent suggested me to provide a user guideline or tutorial for the module function.

## **Chapter 7: Conclusion**

### **Chapter 7 : Conclusion**

This project will be developing a web base point of sale with Enhanced Inventory Management. The web base application is able to apply by different business such as manufacturer, companies, supermarkets, hypermarkets, retailer stores, and small scale businesses and franchises. The purpose of point of sale application is to help the business owner to manage their business and record each transaction has been made. Using the point of sale software is much more efficient and effective than using paper to record everything. It helps the business owner to handle the inventory, business transaction, and generate report to help the business owner to make a better decision. The reason is the point of sale software is easy and fast to perform comparing with manually calculate the item going to buy by customer one by one. Furthermore, when the application is host and deployed in the cloud the user is able access the application any time and any place. Besides, the installation and operating system platform is not a constrain to use this application due to the application is in web based form.

Next, the main purpose of this project is to solve the problem that is facing by Yat Yat mini market user. The problem that they currently facing are difficult to manage and search stock without shelf management, forget to restock a product when the product is sold and forget debtor detail. The solution of this problem will be designed in application. The name of the solution is shelf management, stock alert function, and debtor profile. This three solution will be integrated with a complete point of sale application function that is able to help the business owner to manage the business.

Furthermore, the technology will be used to create this application are NetBeans IDE, MySQL Workbench, Java, HTML, JSP, Java Servlet and GlassFish. Each of this technology is important to create this application. Moreover, the design of this application had been illustrated in the diagram from such as use case, activity, class and block diagram. The development phases will be based on those diagram to design the application.

Hence, the final product will be a complete point of sale system that able to help the user to manage their business. Each function of this application will be interlinked with another to provide the



## **Chapter 7: Conclusion**

consistency record, such as product check out function will link with inventory to update the quantity of the product.

The future work will be creating an apps that support IOS and Android platform to connect to this application, for the purpose mobile friendly. The second future will be based on the user feedback comment, such as enhance the account and restock module. The third is to enhance all the interface design by improving the CSS style sheet. Lastly, to enhance the application to enterprise system level such as including account, procurement, human resource module.

## Reference

## Reference

BarcodesInc 2015. *POS Hardware, Supplies, & Equipment*. Available from:

<<https://www.barcodesinc.com/cats/pos.html>>. [13 June 2016].

BindoPOS 2015. *Explore All Features*. Available from:

<<https://bindopos.com/en/ipad-pos-for-retail/features>>. [13 June 2016].

Bindo 2015. *Reports*. Available from:

<<http://support.bindo.com/article/79-reports>>. [13 June 2016].

Donald R 2008. *THE SMALL BUSINESS STRATEGY GROUP*. Available from:

<[http://www.growingsmallbusiness.com/News/content\\_inventory.html](http://www.growingsmallbusiness.com/News/content_inventory.html)>. [13 June 2016].

ExpressTechnology 2013. *Views - Advantages and Disadvantages*. Available from:

<<https://www.toadworld.com/platforms/sql-server/w/wiki/10274.views-advantages-and-disadvantages>>. [13 June 2016].

IRS n.d., *About Us*. Available from: <<http://www.irs.com.my/about-us/>>. [12 June 2016].

Jirava, P. (2004). System development life cycle. In *Scientific Papers of the University of*

Pardubice Series D. (pp. 118–125). Pardubice: Univerzita Pardubice.

Joe T 2013. *Top Ten Benefits of a Gantt Chart*. Available from:

<<http://www.brighthubpm.com/templates-forms/2434-top-ten-benefits-of-a-gantt-chart/>>. [1 June 2016].

MAGIC WEB SOLUTIONS n.d., *The benefits of web-based applications*. Available from:

<<http://www.magicwebsolutions.co.uk/blog/the-benefits-of-web-based-applications.htm>>. [1 July 2016].

## Reference

ManageByStats n.d., *About ManageByStats*. Available from:

<<https://managebystats.com/main/>>. [13 June 2016].

Margaret R 2012. *Point-of-Sale Terminal (POS terminal)*. Available from:

<<http://whatis.techtarget.com/definition/point-of-sale-terminal-POS-terminal>>. [13 June 2016].

Matt V 2012. *POS, Retail Automation, Company News*. Available from:

<<http://www.amsretail.com/blog/bid/122683/A-Brief-Introduction-to-Point-of-Sale-Systems-for-Retailers>>. [13 June 2016].

Motea A 2015. *What is System Development Life Cycle?* Available from:

<<https://airbrake.io/blog/insight/what-is-system-development-life-cycle>>. [1 June 2016].

NetBeans n.d., *welcome to the NetBeans Community*. Available from:

<<https://netbeans.org/about/>>. [10 July 2016].

Oracle n.d., *Java Servlet Technology*. Available from:

<<http://www.oracle.com/technetwork/java/index-jsp-135475.html>>. [10 July 2016].

Oracle n.d., *MySQL Workbench*. Available from:

<<http://www.oracle.com/us/products/mysql/mysql-workbench-066221.html>>. [10 July 2016].

Parthenopi, K. (n.d.) *RAPID APPLICATION DEVELOPMENT*. Available from:

<[http://www.theijst.com/force\\_download.php?file\\_path=wp-content/uploads/2015/01/33.-ST1412-089.pdf&id=976](http://www.theijst.com/force_download.php?file_path=wp-content/uploads/2015/01/33.-ST1412-089.pdf&id=976)>. [20 June 2016].

Pauk K 2014. *Why can we not remember everything?* Available from:

<<https://www.quora.com/Why-can-we-not-remember-everything>>. [15 June 2016].

## Reference

Retailexpress 2013. *Benefits of Retail Inventory Management System*. Available from:

<<http://retailexpress.com.au/blog/inventory/benefits-retail-inventorymanagement-system/>>. [17 June 2016]

Revel 2015. *What is Point of Sale Systems*. Available from:

<<https://revelsystems.com.au/pos-systems-history>>. [10 June 2016].

TrustedPOS 2015. *Bindo POS Review*. Available from:

<<http://trustedpos.com/reviews/bindo-pos-review/>>. [16 June 2016].

TrustedPOS 2015. *LightSpeed OnSite Features LightSpeed POS Review*. Available from:

<<http://trustedpos.com/reviews/lightspeed-pos-review/>>. [11 June 2016].

LightSpeed 2015. *LightSpeed OnSite Features*. Available from:

<<https://www.lightspeedhq.com/products/onsite/features/>>. [19 June 2016].

TrustedPOS 2015. *Vend POS Review*. Available from:

<<http://trustedpos.com/reviews/bindo-pos-review/http://trustedpos.com/reviews/vend-pos-review/>>. [14 July 2016].

Vend 2015. *Inventory, maximize your profits with powerful inventory management software*.

Available from: <<https://www.vendhq.com/tour/inventory-management-software>>.

[15 June 2016].

# Plagiarism Check Summary

## Plagiarism Check Summary

Turnitin - Google Chrome  
Secure | [https://turnitin.com/newreport.asp?lang=en\\_us&oid=789498804&ft=1&bypass\\_cv=1](https://turnitin.com/newreport.asp?lang=en_us&oid=789498804&ft=1&bypass_cv=1)

turnitin Originality Report  
Processed on: 26-Mar-2017 23:06 MYT  
ID: 789498804  
Word Count: 11189  
Submitted: 1

FYP2  
By Weng Kin Wong

Similarity Index: 6%

Similarity by Source:  
Internet Sources: 3%  
Publications: 1%  
Student Papers: 5%

exclude quoted | include bibliography | exclude small matches

Chapter 1 : Introduction 1.1 Motivation Yat Yat Mini Market is my family business, which has been founded and established in Tanjung Malim, Malaysia in 2012. The mini market is selling grocery item such as body shampoo, biscuit and snack to their customer. Currently they are using a desktop base application point of sale to help them to manage the business. However, the application is not user-friendly enough for the mini mart user as they are not familiar with computer. Besides, the application is not able to fulfill their need in term of convenience and functionality. Next, due to the application is only able to work in desktop a lot of things there are not about to do such as unable to perform item checkout without a desktop. Therefore, this project is to develop a web application point of sale to help them to overcome the work that is not able to do in the current application. 1.2 Problem Statements Currently Yat Yat Mini Market do not have a proper inventory management control and they are facing difficulty to manage their storage due to too much of items. The consequences will be wasting time, difficult to stock count and increase expenses due to the item not found or lost. Next, it is difficult to manage many items, as human memory is limited, retailers are difficult to remember which item is been sold or located at which location. According to Paul King (2014) the architecture of the brain is a signaling network, which is not very conducive to perfect storage and recall comparing with a digital computer. Lastly, due to the current economy is not ideal and the mini market is located in a small town, there got a lot of low income household. Hence, the customer may request to credit the payment. As there is a lot of customer request for credit payment, owner is facing the difficulty to remember all the debt from customer. The following are the description of the problem facing by user of the store: 1.2.1 Face difficulty to manage and search stock without shelf management For Yat Yat Mini Market, the owner might own a number of stocks that are storing in the shop. Due to too much of stock, store owner are facing the difficulty to manage and allocate the stock in shelf. Moreover, due to too much of stock, store owner might forget a particular stock is located at which shelf. Consequently this might cause the store owner to spend more time on searching a product. Furthermore, when store owner fail to search the particular item they may claim that the product is missing or been stolen, this may increase the cost for the store owner. 1.2.2 Forget to restock a product As the human memory are quirky, complicated, and unreliable (Thorin Klosowski, 2013), the store owner might forget to restock a product when a product is sold or less than a certain amount. This may cause store owner to face a shortage of products, and decrease the sales due to the product is not available. Thus, shortage cost will be increase and profit will decrease. 1.2.3 Forget debtor detail To maintain the customer loyalty Yat Yat Mini Market is allowed trustable customer to perform separate payment or credit payment. Currently, Yat Yat Mini Market is using paper to record customer who are request for credit payment. As four year past experience, they are losing quite a lot of number of bill, due to the paper that record customer detail are missing and not standardize. The paper that they

- 1% match (student papers from 26-Aug-2016) Submitted to Universiti Tunku Abdul Rahman
- 1% match (Internet from 21-Oct-2011) <http://javasolution.blogspot.com>
- 1% match (publications) High Level Models and Methodologies for Information Systems, 2015.
- < 1% match (Internet from 22-Nov-2016) <https://www.vendhq.com/tour/inventory-management-software>
- < 1% match (student papers from 12-May-2016) Submitted to University of Greenwich
- < 1% match (Internet from 26-Oct-2015) <https://www.hostmerchantservices.com/article-of-sale-system-articles/using-pos-systems-for-inventory-management/>
- < 1% match (Internet from 18-Dec-2015) <http://www.slideshare.net>

Turnitin Document Viewer - Google Chrome  
Secure | [https://turnitin.com/dv?s=1&o=789498804&u=1052983993&student\\_user=1&lang=en\\_us&](https://turnitin.com/dv?s=1&o=789498804&u=1052983993&student_user=1&lang=en_us&)

FYP2017 FYP-II- DUE 30-Mar-2017

Originality GradeMark PeerMark

FYP2  
BY WENG KIN WONG

turnitin 6% SIMILAR OUT OF 8

Match Overview

- Submitted to Universiti ... Student paper 1%
- javasolution.blogspot.c... Internet source 1%
- High Level Models and... Publication 1%
- Submitted to University... Student paper 1%
- www.vendhq.com Internet source <1%
- www.hostmerchantserv... Internet source <1%
- Submitted to Laureate ... Student paper <1%
- www.slideshare.net Internet source <1%

Chapter 1 : Introduction  
1.1 Motivation  
Yat Yat Mini Market is my family business, which has been founded and established in Tanjung Malim, Malaysia in 2012. The mini market is selling grocery item such as body shampoo, biscuit and snack to their customer. Currently they are using a desktop base application point of sale to help them to manage the business. However, the application is not user-friendly enough for the mini mart user as they are not familiar with computer. Besides, the application is not able to fulfill their need in term of convenience and functionality. Next, due to the application is only able to work in desktop a lot of things there are not about to do such as unable to perform item checkout without a desktop. Therefore, this project is to develop a web application point of sale to help them to overcome the work that is not able to do in the current application.

1.2 Problem Statements  
Currently Yat Yat Mini Market do not have a proper inventory management control and they are facing difficulty to manage their storage due to too much of items. The consequences will be wasting time, difficult to stock count and increase expenses due to the item not found or lost. Next, it is difficult to manage many items, as human memory is limited, retailers are difficult to remember which item is been sold or located at which location. According to Paul King (2014) the architecture of the brain is a signaling network, which is not very conducive to perfect storage and recall compare with a digital computer. Lastly, due to the current economy is not

<b>Universiti Tunku Abdul Rahman</b>			
<b>Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)</b>			
Form Number: FM-IAD-005	Rev No.: 0	Effective Date: 01/10/2013	Page No.: 1 of 1



**FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY**

<b>Full Name(s) of Candidate(s)</b>	
<b>ID Number(s)</b>	
<b>Programme / Course</b>	
<b>Title of Final Year Project</b>	

<b>Similarity</b>	<b>Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)</b>
<b>Overall similarity index: _____ %</b> <b>Similarity by source</b> Internet Sources: _____ % Publications: _____ % Student Papers: _____ %	
<b>Number of individual sources listed of more than 3% similarity: _____</b>	
<b>Parameters of originality required and limits approved by UTAR are as Follows:</b> (i) Overall similarity index is 20% and below, and (ii) Matching of individual sources listed must be less than 3% each, and (iii) Matching texts in continuous block must not exceed 8 words <i>Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.</i>	

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

***Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.***

\_\_\_\_\_  
Signature of Supervisor  
  
Name: \_\_\_\_\_  
  
Date: \_\_\_\_\_

\_\_\_\_\_  
Signature of Co-Supervisor  
  
Name: \_\_\_\_\_  
  
Date: \_\_\_\_\_

