AN ON-LINE DECISION SUPPORT SYSTEM FOR RETAIL CHAIN STORE

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2006

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DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER SCIENCE COMPUTER

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Abstract

In recent times, online retail stores have become more popular and the global retailing trend is moving towards chain stores that provide a wider assortment of products and e-service e.g. online purchasing. However, online retail chain stores face many problems and limitations pertaining to the delivery of the online orders and in the management of stores in the retail chain stores. This research suggests a solution for these limitations, whereby an online decision support system for retail chain stores is developed to overcome these problems. The system can be used to help managers by generating reports to help them in making decision on how to manage the stores in a more efficient way. In overcome the problem pertaining to delivery of the online orders by a customers, the system is able to find a near subset of stores, based on the customer's postal/zip code, and make a decision as to which store should deliver the customer's order depending on the lowest cost of delivery. In addition to this, if an item in the customer's order is not available in the selected store, the system will select the next "best" store based on the next lowest cost of delivery to fulfill and deliver the item to the customer. The system is also able to manage the product inventory for each store in the retail chain stores. Furthermore, the system can help customers to purchase items online in a convenient way.

Acknowledgment

I would like to extend my gratitude to my supervisor Ms. Azwina Mohd. Yousof for her continued guidance and support during the dissertation, without her supervision I would not have been able to finish this work. I am grateful to my family for putting up with my absence for two years during the master study. I am also thankful for my faculty members and my friends for their encouragement.

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Chapter 1

Introduction

1.1 Background

Over the last two decades, the term ‘‘e-commerce’’ has grabbed the headlines throughout the world, and has been the subject of intense debate. Electronic commerce, know as e-commerce, is the cutting edge for today’s business, so companies became compelled to adopt e-commerce in order to survive (Dixon, 2002).

In the retail property market, which is facing severe pressure and changes due to the nature of competition, companies are now trying to have their own unique purchasing system to achieve competitive advantage in the market. Online purchasing systems have become more and more popular, and more consumers are using the internet to purchase on-line.

There are two types of organizational structures for retail chain stores, i.e. a centralized organization and a decentralized organization. A centralized organization is defined as one in which store practices are mandated from

corporate headquarters (HQ) or head offices, and the manager of the HQ manages and makes the decisions for the stores. A decentralized organization gives the freedom to the store managers to make the decision for their stores.

This research describes an online decision support system for retail chain stores (ODSS-RCS) that provides empowerment to related stores with the delivery of its customers' orders'. ODSS-RCS serves retail chain stores that have many head offices whereby each head office (HO) has many stores that are related to it as shown in figure 1.1. The head office and its stores may be available in a country, in a state or in a city, and so on. A head office and its stores are independent in terms of its administration, and distribution customers' orders from other head offices and their stores.

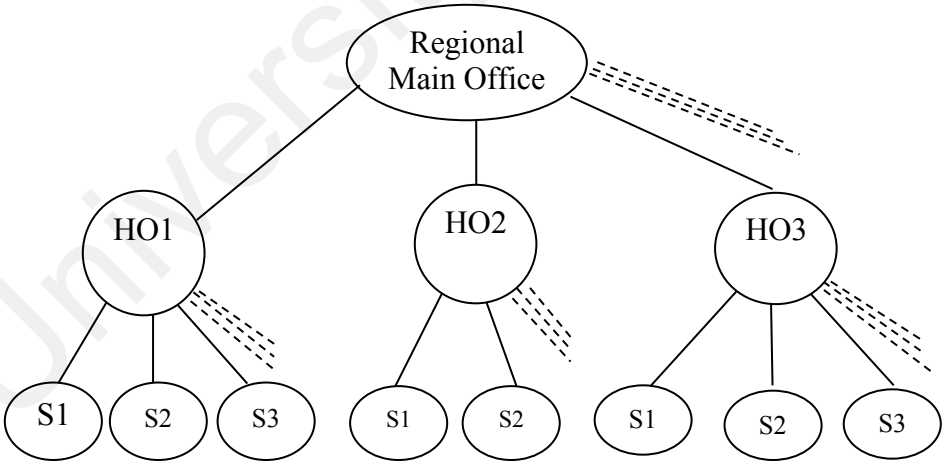


Figure 1.1: Structure of retail chain stores that is supported by ODDS-RCS

The system can help a head office manager and a store manager to generate ad-hoc reports to help them in decision making. A store manager can make a decision depending on the reports generated that are related to the situation and information in his/her store. A Head Office manager can generate reports for the head office itself and also for its stores, but the head office manager can not generate reports for other head offices and their stores, therefore, this system allows the possibility for an organization to implement the concept of a decentralized retail chain store by giving the store managers the responsibility of making decisions which are suitable to their own stores.

The main improvement feature in ODSS-RCS is the ability of the system to make decision on which store should serve a customer. The system is able to find a near subset stores for a customer, based on the customer's postal/zip code input in the order form. Depending on the lowest cost of delivery, the system makes a decision as to which store should deliver the online customer's order. In addition to this, if the selected store does not have a product in the order, the system makes a decision to determine another store which can deliver the order to the customer based on the next lowest cost of order delivery.

The system will only search for another store within the same area of the identified head office and its stores, because in the real world, a head office and its stores may be in one country, state or area. If the product isn't available in these selected stores, the responsibility now lies with the store managers or the head office

manager to overcome this problem by ordering from the supplier. Here, the system also allows the managers to find the nearest suppliers that can supply the required products to the required sores.

1.2 Problem Statement

Currently, there are two types of on-line system provided by retail chain store companies; the first is where a customer selects the on-line store that he/she wants to purchase from, and the second where the system automatically finds the store for the customer based on his/her postal code. Both systems do not take into consideration the cost of delivery. But in reality, customers often care about cost the most as they are ones that are saddled with it. Therefore, a system is needed whereby both the needs of customers and the retail chain store companies are taken into consideration. The system can automatically find the nearest store to a customer that can satisfy the customer's order based on the lowest cost of delivery. The system can also be used to aid the managers in managing their respective stores and in making decisions related to the stores. This research seeks to investigate and develop such system.

1.3 Importance of the study

One of the important issues that have always been taken into consideration by the managers of retail chain stores is how to minimize the cost of delivery of the customers' orders, in order to increase the margin of profit and to get a competitive advantage. So, this research will investigate how the on-line system can help the retail chain stores to decrease the cost of delivery by finding the stores that can deliver the customers orders with the lowest cost of delivery.

Another important issue for retail chain store is customer satisfaction which should be pursued with both caution and determination. If customer is not satisfied with the way of purchasing from the online system, this causes negative impact on on-line retail chain stores. This research investigates how customers can conveniently purchase on-line.

Most of the online retail chain stores try to distribute orders all over the world, therefore a chain store has a huge number of stores and customer orders. Since managers face some problems in managing these stores, one of the important issues of this research is to develop an on-line decision support system for retail chain stores to help the organization in managing customers' orders and to apply the concept of decentralization in decision making.

1.4 Research objectives

The objective of this research is to investigate and build an online decision support system for retail chain stores in order to aid management in decision-making pertaining to customers' orders, sales, procurement of retail products, and inventory management in each stores. In achieving this objective, the research should achieve several goals as follow:-

1) Investigate current on-line retail chain stores, both locally and abroad, to identify the main problems limitation with current system.

2) Provide a solution to the identified problems and limitations of current on-line retail chain stores.

3) Build an online decision support system for retail chain stores that supports decentralized organizational structure, and can generate reports that can help a HO, and store manager in making decisions relating to his/her store that related to him/her store. The system:-

   ⇒ Can support a series of head offices, with each HO supporting a series of stores that belong to it.

⇒ Can find a near subset of stores nearest to the customer, and then from the subset of stores, find the store which can deliver the customer's order depending on the lowest cost of delivery.

⇒ Can find another store nearest to the customer in the case when the selected store does not carry a product in the customer's order. Here, the system with the lowest cost of delivery is chosen.

⇒ Can provide an alternative to customers to purchase products on-line in a convenient way to increase customers' satisfaction.

⇒ Can manage the product inventory for each store and determine which supplier can supply what product for a particular store.

4) Perform testing, including user acceptance testing, to ensure that the system performs each functionality accurately and efficiently.

1.5 Research Scope

The foundation of this research is to develop an online decision support system which helps retail chain stores to deliver online customers' orders from the near store to the customer and depending on the lowest delivery cost

The system manages a series of head offices and its stores. It also considers a head office to be a store that delivers online orders to customers. A manager of a head office can generate reports that support his/her decision making and manages the head office and its stores. But a manager of a store can generate reports and making decision pertaining to his/her store only. This means that the on-line system built applies the concept of decentralized retail chain stores.

1.6 Research methodology

Several approaches are implemented in this research in order to determine the requirements of the system. The strategy to achieve the project's goal involves the following steps:

1. **Conduct Literature Review**

Studied and analyzed, journals related to e-commerce, and decision support system, in addition, to articles related to online decision support system for retail chain stores.

2. Data Gathering and Analysis

In addition to conducting literature review, two questionnaires i.e. one for customers and the other for organizations that have many stores, were carried out. The data from these two surveys were gathered and analyzed in order to aid in coming up with proposed solution to the problems and limitations of current online retail chain stores.

3. System Development

Evolutionary Prototyping was used as the methodology for system development, due to time and requirements factors. The system development life cycle involved the following steps:-

⇒ Capture System Requirements

UML use case diagram was used to captured and identify the requirements of the system.

⇒ Design

The overall system design, structured design and database design were developed to be used later in the implementation phase.

⇒ **System Implementation and Testing**

System implementation translates the design into a computer system. Using ASP as the programming language, interacting with SQL server 2000 to build the database used in the on-line system.

⇒ **System Testing and User Evolutionary**

Testing is performed to validate the implementation and to test if the requirements captured meet the purpose of this research. This is done by showing if the components built comply with requirements specification and design. Then, the system is put to the test using a sample of organizations and customers to evaluate it.

1.7 Research Contribution

The main contribution of this research is in providing an online decision support system for retail chain stores to help managers in decision making and to deliver online orders to customers at the lowest cost. It takes into cost of delivery when determining which store should handle a customer order.

1.8 Outline of the Thesis

This research is organized in the following.

Chapter One gives a background on the research, problem statement, research objective, research scope, research methodology, research contribution and thesis organization.

Chapter Two outlines the definition of e-commerce and studies the type of e-commerce, and gives an analysis on the concept of online purchasing, type of decision support systems, web technologies and decision support systems, relation between online purchasing and decision support systems. This study reviews some related systems to an online decision support system for retail chain stores, describes main properties of these system. This chapter provides the findings of related systems, and provides some requirement which should be in online decision support system for retail chain stores.

Chapter Three is divided into two parts. The first contains the research methodology which describes the approaches that conduct this thesis as research questions, methodology and technique that is used in the research.

The second part describes the system development life cycle that is used in this thesis to develop an online decision support system for retail chain stores.

Chapter Four Contains analysis of questionnaires, and defines system's functional and nonfunctional requirements and makes the use case diagram.

Chapter Five has general models for ODSS-RCS, and how ODSS-RCS finds the near store, and description on the organization structure of retail chain stores that is supported by this research. This chapter further describes the database design and system architecture.

Chapter Six discusses the system development and implementation details. Some security issues are mentioned in this chapter.

Chapter Seven discusses the system testing in the system development life cycle of the system, and presents system testing for each function and overall system testing.

Chapter Eight presents the conclusion for the thesis.

Chapter 1: Introduction

Chapter 2

Background Literature

2.1 Introduction

A literature review is an evaluative chapter of information found in the literature related to the research area and some of the systems which are already there in real world. This review describes, summaries, evaluates, analyses and clarifies some of the studies that are founded in previous and current literature that are related to this area of study. This includes online systems that are related to decision support system for retail chain store which is in existence in the real word.

It gives a theoretical base for the research and helps to determine the nature of the research and what should be done to overcome some of the problems that face the decision support system for retail chain store. E-commerce as a science is a vast area of study. Therefore works which are irrelevant in the research area should be discarded and those which are peripheral should be looked at critically. For this research, the literature review covers the concept of e-commerce, concept of online purchasing, decision support system, web technologies and decision support systems, and finally studies some systems related to online decision support systems for retail chain store (ODSS-RCS).

2.2 E-commerce

Today, e-commerce has become a part of living activity and a turning point in transforming daily transactions from the old style to an electronic style.

2.2.1 Definitions

There are many definitions of e-commerce with many different focuses. Some of the definitions are limited to the exchange of processes over the net, but other definitions extended to the exchange of processes with other business activities and related commerce technologies. The following table gives different definitions of e-commerce.

Table 2.1: List of e-commerce definitions.

Definitions	Focuses
❖ **E-commerce:** The transaction of business electronically rather than via paper. (Petroleum Industry, 2003)	New way to deal with others in business
❖ **Electronic commerce** is the exchange of goods or services via the internet (www.artofthegroove.com)	Exchange of goods and services via the internet
❖ **E-commerce:** The conducting of business communication and transactions over networks and through computers. As	This defines e-commerce as a basic

most restrictively defined, e-commerce is the buying and selling of goods and services, and the transfer of funds, through digital communications. However e-commerce also includes all inter-company and intra-company functions (such as marketing, finance, manufacturing, selling, and negotiation) that enable commerce and the use of e-mail, EDI, file transfer, fax, video conferencing, workflow, or interaction with a remote computer. E-commerce also includes buying and selling over the Web, electronic funds transfer, smart cards, digital cash (eg Mondex), and all other ways of doing. **(**Hooker, 2000)	activity such as buying and selling goods and services through the net, and a way of paying through e-commerce
❖ **E-commerce**: Any on-line transaction of buying and selling where business is done via Electronic Data Interchange (EDI), (World net Daily, www.worldnetdaily.com)	Transaction via Electronic Data Interchange
❖ **E-commerce**: is a business to business (B2B) initiative aimed at communicating business transaction documents on a real time or near real time basis between known trading partners, such as suppliers, customers and increasingly, between a suppliers' supplier or a customers' customer (Viradix, www.viradix.com/terminology.html).	This definition is concern with the activities in a business through a chain between the business and suppliers.

❖ **E-commerce:** Doing business online, including buying and selling online via the Internet, electronic funds transfer, business communications, and using computers to access business information resources (IBM, www.ibm.com).	Buying, selling and finding information electronically
❖ **E-commerce**: is any business transaction whose price or essential terms were negotiated over an online system such as an Internet, Extranet, Electronic Data Interchange network, or electronic mail system. It does not include transactions negotiated via facsimile machine or switched telephone network, or payments made online for transactions whose terms were negotiated offline, (Census Burean, http://help.econ.census.gov)	This definition adds negotiations concept through the web
❖ **E-commerce** refers to all forms of business activities conducted across the internet. This can include E-tailing, B2B, intranets and extranets, online advertising, and simply online presences of any form that are used for some type of communication (customer service for example), (Human-IT, www.human-it.com).	In this definition will see new concept on online advertising and e-tailing
❖ **E-commerce:** A broad term encompassing the remote procurement and payment by businesses or consumers of goods and services through electronic systems such as the Internet. (Retail Payment Systems, 2004)	e- purchasing and e-payment

❖ **Electronic commerce**: or e-commerce consists of the buying, selling, marketing, and servicing of products or services over computer networks. The information technology industry might see it as an electronic business application aimed at commercial transactions, and may also involve the electronic transfer of information between businesses (EDI). (Economic Expert, http://www.economicexpert.com).	Add e-marketing to buying and selling via internet and related it's to EDI

2.2.2 History

The Internet was conceived in 1969, when the Advanced Research Projects Agency (a Department of Defense organization) funded a research on computer networking (http://ecommerce.insightin.com). E-commerce has become a reality since the 1990's, when the internet became a popular and mainstream medium for the dissemination of information (university of Virginia, www.cs.virginia.edu).

The emergence of the internet and subsequent development of e-commerce has become a viable and likely medium to conduct trade. This has occurred only during the past fifteen years and is most likely due to the increasing popularity of the Internet.

Moreover, a drastic drop in computer prices in the last two decades helped to boost e-commerce. Further, operating systems and software have become more powerful and user-friendly to the business market (Chan, 1998).

The development of e-commerce can be categorized under different generations though there are some overlapping between them.

2.2.2.a First Generation

It uses the Internet to reach millions of people anywhere, anytime and provide potential customers with information.

⇒ **Business success**

- Web search services: Yahoo!, AltaVista, Lycos, AOL, Infoseek, etc.
- Information sites: MSNBC, ESPN, Dow Jones, etc.

2.2.2.b Second generation

It use the Internet as a new way to conduct business. And with this emerged the concept of online sales and purchases and merchants and businessmen looked at reduced costs of buying and selling and minimizing the cost of business expansion.

⇒ **Business success**

- Online sales: Amazon.com, Dell Computer, eBay etc.
- Financial trade: E Trade, Charles Schwab, etc.

2.2.2.c Third Generation

Most of the companies recognized a new need to integrate their companies with suppliers and customers in order to create new business opportunities through enhanced supply chain management to increase profits and improve customer services and relationships.

⇒ **Business success**

- Business organizations determined to succeed for survival.

This figure below illustrates the phases of the development of e-commerce through the generation.

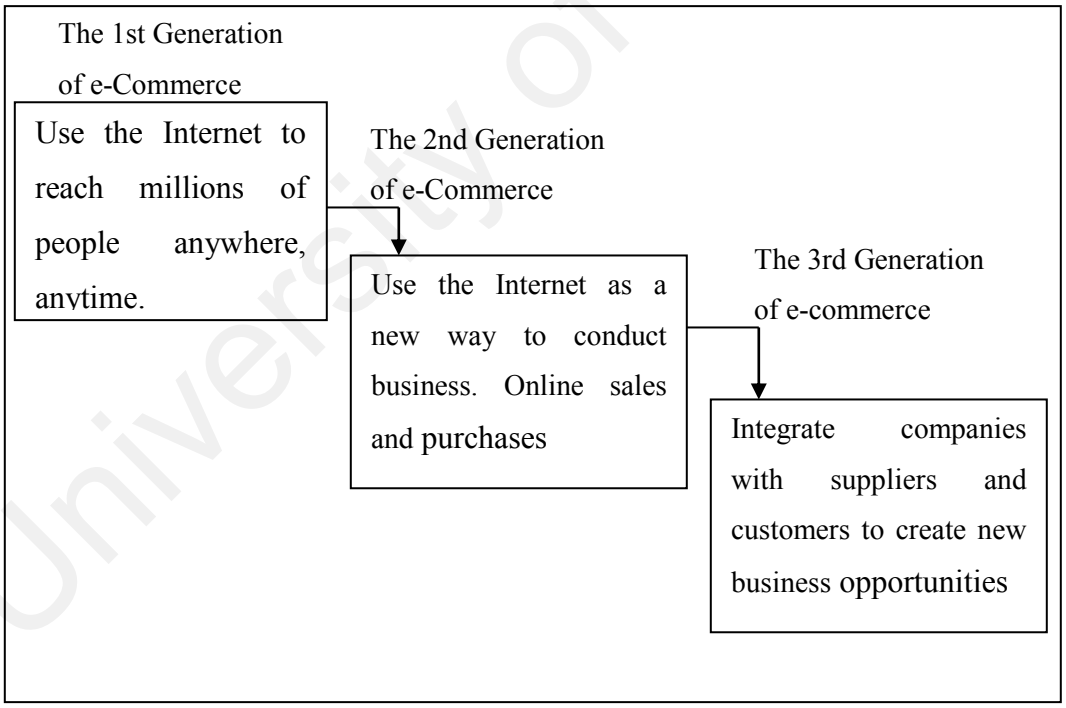


Figure 2.1: Generation of e-commerce development.

2.2.3 Categories of Websites in E-commerce

E-Commerce creates many types of businesses in the Internet. The Internet enables a company to conduct business everywhere and anytime. Wider contacts have led to the concept of e-commerce being done electronically within government and between governments itself (e-government). Figure 2.2 shows the categories of website through the internet (Paulk, 2001).

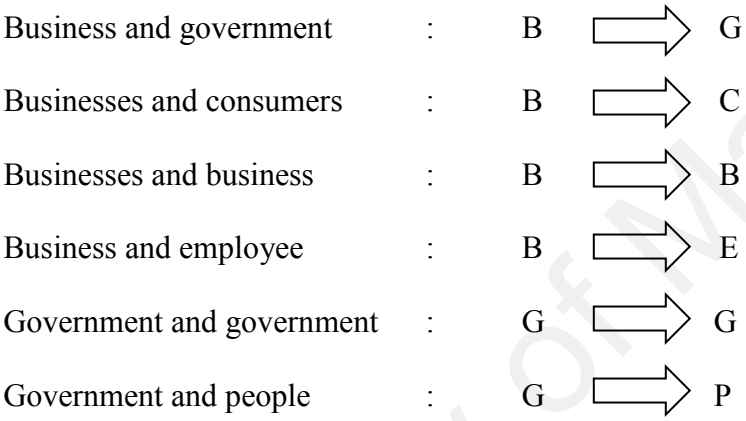


Figure 2. 2: Category of website through business

There are two major types of e-commerce in the business; the first business to consumer (B2C), as a consumer purchase products and services from businesses, and the second business to business (B2B), such as businesses that buy and sell among themselves (Shim & el, 2002).

2.2.3.a Business to Consumer (B2C)

Business to consumer e-commerce consists of two parties; the first side is a business and the second side is a consumer (Chaudhury & Kuilboer, 2001). Here, consumers purchase products and services from businesses such as shopping and other activities such as promotion, ordering and payment. Table 2.2 shows the activities involved in B2C e-commerce.

Table 2.2 Activity in business to consumer e-commerce

Activity	Description
Promotion	Online advertising expanded quickly and this is reflected in the advertisements that appear on portal sites such as Yahoo, and AltaVista.
Ordering	The consumers order the product or services from a site, and can use the web to obtain some information.
Product delivery	Digital products, such as software and music can be downloaded directly from a site after purchasing, but products that need to be transported in some ways are determined by the online company.
After-sales support	The customer service support after a sale is considered the final link in the chain between business and consumers, whereby consumers can use e-mails, search engines, and some company developed knowledge based system to help them to find a

	solution. Data mining tool and customer relationship customer tool are used to build a long relationship with customers.

Model for B2C E-commerce

There are some examples of models for B2C e-commerce, whereby companies have built their websites in order to achieve on objective. These business models describe the basic framework for the business that answers the following questions:-

- Who will access this site; this means market segment?
- What products or services?
- How can it be useful to consumer?

Table 2.3 shows some of the website and the business model for it

Table 2.3: Business model for e-commerce

Site	Business Model
Yahoo.com	Advertisement
EBay.com	Auction-based
Amazon.com	Retail merchants
Toyota.com	Promotion
BN.com	Retail transaction
Fedex.com	Customer support

2.2.3.b Business to Business (B2B)

This model was first started through Electronic Data Interchange (EDI) whereby it is used to enable two companies to achieve a more efficient data and information transfer between them and to improve supply chain management. There are still a lot of companies that do not yet use EDI due to the relatively high costs of implementing and running such systems (Dai & Kauffman, 2001). EDI is considered as the first form of electronic commerce used 20 years ago. Now most of B2B e-commerce is an adaptation to EDI or the concept or principle of EDI (Schneider, 2004].

B2B e-commerce considers opportunities for online transactions. It focuses on systems and processes that support the flow and exchange of information within and between firms, and their suppliers. Business to business e-commerce activities are often related to procurement. Here, businesses buy and sell among themselves.

A number of models for B2B e-commerce have begun to originate that manage the exchange of transactions between buyers and suppliers. Table 2.4 shows the models for B2B (McIvor and Humphreys, 2004).

Table 2.4: Models for B2B.

Model	Features
Established buyer-supplier relationship	• Pre-determined one-to-one relationship between a buyer and supplier. • Companies now become more intensive and have interactive relationships with their suppliers
Supplier-oriented marketplace	• Both organisations and consumers use the supplier-provided marketplace. • Business buyers and individual consumers use the same supplier-provided marketplace.
Buyer-oriented marketplace	• Both organizations and consumers use the supplier-provided marketplace. • Business buyers and individual consumers use the same supplier-provided marketplace.
B2B intermediary	• This model is sometimes referred to as a "hub" or "exchange". • It is established by an electronic intermediary that runs a marketplace where suppliers and buyers have a central point to come together

2.2.4 Concepts Regarding E-commerce

The emergence of the internet has given a tremendous boost to e-commerce and a user can do many tasks such as shown in Table 2.5.

Table 2.5: List of E-task

E-Cash	E-cash is a payment mechanism designed for the Internet. It is electronic money that can be passed along from person to person like cash. It is anonymous like cash, and has immediate value. It's cash, not a promise to pay later. (Petroleum Industry, 2003)
E-Check	The electronic equivalent of a paper check (Student company secretary, 2004).
Electronic Banking	A form of banking in which funds are transferred through an exchange of electronic signals between financial institutions, rather than an exchange of cash, checks or other negotiable instruments (Economic Perspectives, 2001).
Electronic Bill Delivery	A bill delivery system offered by Visa Interactive that allows banks to send consumers their bills through their personal computers or via telephone lines. This system now allows consumers to transfer funds through their bank to the billing agent itself. (NECCC, 2005)
Electronic Bill Payment (E-pay)	An alternative to paper checks for paying bills. Consumers can use PCs, telephones, screen phones or ATMs to send electronic instructions to their bank or bill payment provider to withdraw funds from their accounts and pay merchants. Payments may be made either electronically or

	by a paper check issued by the bill payment provider.
Electronic Bill Presentment (EBP)	The electronic delivery of vendor requests for payment. Vendors send consumers their bills via PCs, telephones or screen phones.
Electronic Cash Register (ECR)	A system which functions most efficiently and effectively for large businesses with many registers in single or multiple locations. Provides a direct, computer-to-computer linkup between the First Data host and the merchant's host.
Electronic Check Acceptance(SM) or ECA	A system that captures banking information off a paper check and converts it into an electronic item processed through the Automated Clearing House network. With ECA, checks are processed similarly to credit cards, and the paper check is returned to the consumer at the point of sale.
Electronic Data Interchange (EDI)	The electronic communication of business transactions; specifically the exchange of trade-related documents, such as purchase orders, invoices and corporate Electronic Funds Transfer (EFTs) in a standard format. With EDI, electronically transmitted data replaces paper documents in the business accounts receivable cycle.
Electronic Draft Capture (EDC) Terminal:	Also referred to as Electronic Data Capture terminal. A point-of-sale device that reads information encoded in the bankcard's magnetic stripe, performs authorization functions, stores transaction data, and batches and transmits

	that data to the acquirer for processing. The stored transactions are used to create settlement files and transaction reports.
Electronic Financial Services (EFS)	Financial services that are provided via electronic delivery channels (e.g. PCs, telephones, screen phones and ATMs). These services may be transaction and/or information oriented and may be provided by bank and non-bank providers.
Electronic Funds Transfer (EFT)	A transfer of funds between accounts by electronic means rather than conventional paper-based payment methods. EFT is any financial transaction originating from a telephone or electronic terminal, or from a computer or magnetic tape.
Electronic Funds Transfer at the Point of Sale:	The technology and practice of making payments for goods and services by means of electronic funds transfer initiated at the point where goods and services are purchased.
Electronic Mail (E-mail)	Messages that are sent from one user to another (or multiple recipients) using particular mail programs and protocols (Schneider, 2004).
Electronic Point of Sale	A point-of-sale merchant with electronic equipment for pricing and recording transactions, but not necessarily incorporating functions for electronic funds transfer.
Electronic	The use of internet technology in a company's purchasing

Procurement	and supply management function (Schneider, 2004).

2.2.5 Why e-commerce?

Today, most companies have a web site and they develop e-commerce web sites for different reasons; such as

- ✓ To reach for new customers
- ✓ Allow on-line purchasing
- ✓ To stay abreast with their competitors
- ✓ To meet their customers expectations and needs
- ✓ To enter new market
- ✓ To lower cost
- ✓ To survive in the market.

2.2.6 Types of E-commerce

Day by day, e-commerce is growing by leaps and bound. Below are main types of e-commerce.

- Online purchasing
- Online marketing

2.3 Online Purchasing

A website allows consumers to order products or services and pay for this online, usually by providing credit card details, and/or other mode of payment, such as e-

cash and etc. Online Purchasing is the technology infrastructure for the exchange of data and the purchase of a product over the Internet. On-line purchasing extends e-commerce through a range of on-line business activities for products and services, such as business-to-business or business-to-consumer, via the Internet.

Therefore the concept of e-commerce can be broken into:

- Concept of online shopping.
- Concept of online purchasing.

2.3.1 Concept of Online Shopping

Refers to the scope of information and activities that provide a customer with the information that he/she needs in order to conduct business, and the knowledge to make informed buying decisions. For example, a consumer who is interested in purchasing a personal computer (PC) through the web may first research on the specification, then the prices and maintenance of PC online.

A company may provide product pictures, logos, technical specifications, and product availability, service, and availability to choose some specification on their site. Online shopping speeds the gathering of information that a customer needs and hence, provide timely access to accurate information.

2.3.2 Concept of Online Purchasing

Online purchasing is defined as the infrastructure that allows the purchase of products or services, through the Internet. For example, if a consumer is interested in buying office supplies, they might go to the Staples web site. There they can shop in the site, choosing products and placing them in their online shopping basket. When they have found all the products they want to purchase, they can choose the Staples' online purchasing form to buy the products they have chosen, (Ready Go, www.readygo.com).

2.3.3 Benefits of Online Purchasing

Some of the benefits of on-line purchasing are given below:-

- ✓ Create efficient purchasing processes through decreasing order costs and increasing buyer availability.
- ✓ Convenient to purchase goods 24 hours a day and 7 days per week. Therefore, there is time efficiency.
- ✓ More speed to accomplish the process due to shorter processing time
- ✓ Most of the processes are automated, therefore increasing the control and consequently reduce error administration (Benjamin, and el, 2002).

2.3.4 Classifying Online Purchasing System

Online purchasing system can be divided into the following three categories, as shown in Table 2.6 (Benjamin).

Table 2.6: Classification of online purchasing system

Number Of Suppliers	Many	Buyer Driven Catalogs & Bidding System.	Third Party Catalogs & Trading Exchanges.
	One		Supplier-Driven Extranets.
		One	Many
		Number of Buyers	

The above categories depend on the number of suppliers and the number of businesses.

2.3.4.a Buyer Driven Catalogs & Bidding System

Here, a company implements an on-line procurement system which enables its suppliers to bid on auctions and upload catalogs. One buyer to many suppliers is used in large company such as Sony as it can attract more than one supplier.

2.3.4.b Third Party Catalogs & Trading Exchanges

Here a third party sets on-line procurement service for buyers and suppliers. But in this category, there are many buyers to many suppliers and this online system may have vertical or horizontal exchange.

Some examples of this type of system are as follows:

- www.wiznet.com.; a buyer can search online based on a huge published buyer catalog.
- www.fastpart.com.; provides an online spot market for new electronic components
- www.partsmart.com.; provides an online market for PC components.

2.3.4.c Supplier-Driven Extranets

In this popular online purchasing system, customers can navigate the supplier website to get product information and then can purchase then according to their needs. In this situation, there are many buyers to one supplier.

Some examples of these systems are as follows:

- www.dell.com (Dell company)
- www.cisco.com (Cisco company)
- www.ibm.com (IBM company)

2.3.5 An Interactive Experiential Web Site

A company's web site plays an important role in furthering the shopping experience. A successful product or web site must be multi-sensory for a great experience. Experiential web sites are interactive sites that stimulate the user through interaction with the interface and product offerings virtually, resulting in a memorable shopping experience. In essence, the customer feels as if they are transported into a virtual environment, such as browsing a cybermall or trying on clothes in a virtual dressing room. This feeling of being transported to a virtual environment is called telepresence. Some examples of experiential web sites that simulate a sensory experience is shown in Table 2.7 Sites (Mahfouz, 2005):

Table 2.7: Interactive Experiential

Web Site	Interactive Experiential Features
Landsend.com	• Customized clothes and virtual models of users • Sense of community via shoping with a friend • Online personal shopper recommending products
Amazon.con	• Personalized greetings • Product suggestions based on purchasing history • Virtual book with the capability of looking inside this book • Community sense: shared shopping experiences
dell.com	• Customizable products • Online community sharing advice & experience
ebay.com	• Sense of exploration • Sense of community

everestgum.com	• Imagery of mountains conveying cool sensations • Sounds mimicking intense winter winds blowing • Animation flashing words like "icy, cold, pure"
reflect.com	• Customized design/naming of products by users • Fresh look of the web page • Community sense: beauty expert, dermatologist

2.4 Decision Support Systems

Any successful business needs information to make business critical decisions relating to sales, purchasing, budgeting, finance, and /or supplies. For decision support systems, you must have data to support it. Databases that contain information support business decisions.

2.4.1 What is Decision Support System

Decision Support System (DSS) is an information system that has the ability to obtain information -also known as knowledge- from data and information stored in computers to specify goals, analyze information and predict the impact of decisions before they are made. Database Management Systems (DBMSs) help user to select data and information for reporting and analysis (Intergraph Solutions Group, http://solutions.intergraph .com).

DSSs are a class of computerized information systems that support decision-making activities. There are 5 types of DSS: communications-driven, data-driven, document-driven, knowledge-driven and model-driven. DSS are interactive computer-based systems intended to help decision makers use communications, data, documents, knowledge and models to identify and solve problems and make decisions.

2.5 Decision Support Systems and Web Technologies

Modern decision support system provides managers a wide range of capability. Computerized systems support decision tasks like information gathering, model building, alternative evaluation and analysis. In addition, decision support is increasingly integrated into business processes and DSS are used for ad hoc analysis. The internet is now the primary enabling technology for delivering DSS, whereby web technology is facilitating it (Bhargava & Power, 2001).

2.5.1 General Approaches for Decision Support Systems

There are a number of approaches in delivering decision support. They are

2.5.1.a Data-Driven DSS.

Data-Driven DSS help managers organize, retrieve, and synthesize large volumes of relevant data using database queries, On-Line Analytical Processing (OLAP) techniques, and data mining tools.

2.5.1.b Model-Driven DSS

Model-Driven DSS use formal representations of decision models and provide analytical support using the tools of decision analysis, optimization, stochastic modeling, simulation, statistics, and logic modeling.

2.5.2 General Approaches for Decision Support Systems with Web

The general approaches have become most widely implemented for delivering decision support due to Web technologies. The approaches that use the web are:-

2.5.2.a Communication-Driven DSS

These rely on electronic communication technologies to link multiple decision makers who might be separated in space or time, or to link decision makers with relevant information and tools. The Web has expanded this technology.

2.5.2.b Knowledge-Driven DSS

This system can suggest or recommend actions to managers. The Web helps deliver this type of DSS to a much broader audience of decision-makers.

2.5.2.c Document-Driven DSS

It integrates a variety of storage and processing technologies to provide managers with document retrieval and analysis (Bhargava & Power, 2001).

2.6 Online purchasing and Decision Support System

There is increasing competition between companies through online purchasing systems and activities that is done on the net, such as online purchasing and marketing and etc. As there is a link between suppliers, retailers and consumers decision support system in e-commerce has become important as it helps managers in managing their business and in making strategic business decisions. DSS also supports the customers in decision making and supports companies and suppliers in achieving their goal. Therefore, companies that incorporate DSS in their e-commerce applications have competitive advantage in the market.

2.6.1 Consumer Decision Making in Online Shopping Environments

With the revolution of e-commerce and the explosive growth of the number of consumers who use interactive media for pre-purchase information search and online shopping, it has become essential for companies to support the consumers to make purchasing decisions.

A unique characteristic of online shopping environments is that they allow vendors to create retail interfaces with highly interactive features. The availability of tools, which we refer to as interactive decision aids for consumers, may lead to a transformation of the way in which shoppers search for product information and make purchasing decisions.

2.6.2 Interactive Decision Aids for Online Shopping

The technology available for implementing machine interactivity in online shopping environments has the potential to provide consumers with unparalleled opportunities to locate and compare product offerings. Such capabilities are particularly valuable given that online stores cannot offer physical contact with products, do not allow face-to-face interaction with a salesperson, and may offer a very large number of alternatives as it lacks the physical constraints with respect to product display.

Interactive decision aids that may be of use to consumers who wish to shop online include a wide variety of software tools, ranging from general-purpose search engines (e.g., www.infoseek.com, www.lycos.com) to sophisticated agent-mediated electronic commerce systems (e.g., compare.net, www.jango.com). A common classification of interactive shopping agents is based on whether a tool is designed to help a consumer determine (1) what to buy or (2) whom to buy from. (Ha¨ubl & Trifts, 2000)

2.6.3 2.6.3 The Support of Online DSS for Online Purchasing

The important issue in on-line retail chain store is getting the correct goods to the right place at the right time, in the right condition with the minimum of cost.

There are some products or services that are delivered more easily than others. When a customer buys online they tend to expect a better standard of service.

Basically, poor delivery of customer orders damages customer loyalty and his/her trust in online purchasing system.

Some improvements in online retail chain stores can be achieved by answering the following questions

- How is the on-line retail chain store going to distribute the goods or services to the customer?
- What are the delivery options?
- What criteria are to be used to define the store which should deliver customer orders?
- How much is the cost of delivery?
- How can retail chain stores improve delivery time?
- Is the online retail chain store smart enough to find which supplier should deliver a product for a store?
- Can the managers a make proper decision based on the information that available in the online system?
- Are customers satisfied with the on-line purchasing system?

So, online decision support system should support the retail chain store to achieve the aims of business.

Solution

- Keep the customer informed – probably via email. This is vitally important and may include: confirming the sale, the expected delivery date and follow-ups to check if the delivery has been completed. Effective communication will help to establish a relationship of trust with the customers.
- Online DSS should support the managers in decision making.
- Online DSS should manage the inventory.
- Online DSS should support the staff in dealing with customers orders.
- Online DSS should help to find new ways of managing retail chain store.
- Online DSS should find effective ways to deliver orders to customers in the right place at the right time, in the right condition with minimum cost.
- Online DSS should let the customer be satisfied with the way of purchasing.
- Online DSS should offer the flexibility of conducting business with a centralization and decentralization management style.

2.7 Review of four Online Purchasing System in the Real Word

Today, users can find many online purchasing sites for companies, products, supermarkets, malls, and so on. Customers can buy online and the company or shop will deliver the orders to the customer based on the given address, whereby most companies depend on the postal /zip code to determine the delivery area. Therefore, in this section, some on-line purchasing systems were reviewed in order to gather the basic steps or procedures in online purchasing.

2.7.1 IBM

IBM, is the leader in the invention, development and manufacture of the industry's most advanced information technologies including computer systems, software, storage systems and microelectronics (IBM, ibm.com/ibm/us). Figure 2.6 shows the IBM main web site.

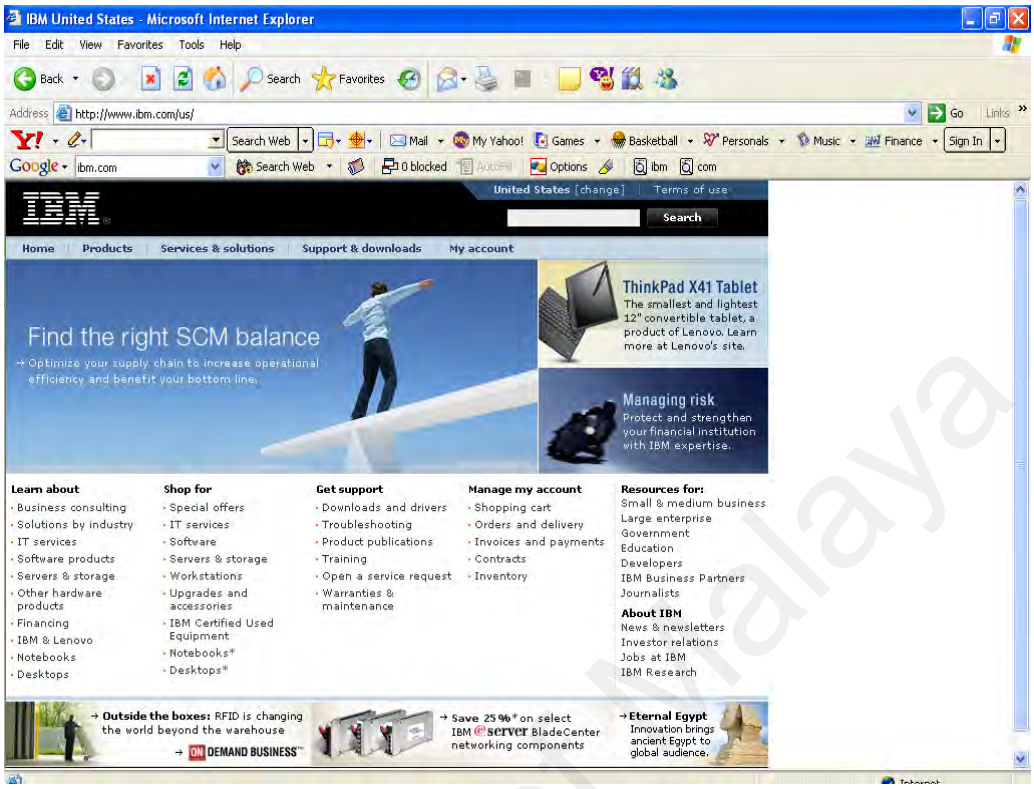


Figure 2.3: IBM web Site

For reviewing the IBM web-site, the main characteristics identified are:-

- Customized site; the customer can see the catalogue, that includes the purchasing rules to help customer.
- Pricing and shopping cart options; to allow customers to view the price of each item and to add to their shopping carts, if necessary.
- Detailed product specifications; can be viewed by click of a button.
- Actual inventory states in real time; in order to ensure whether the products needed are available.
- Ability to manage customer order.

- Order status and tracking, and 60-day history. For the customers to track their purchasing order.
- Advanced search on category, subcategory, keywords and price, for customers to refine their search, if and when necessary.
- Access to IBM's portfolio of hardware, software and services.

IBM allows customers to also control their purchasing activities using the business Access web site's Orders Management tool. Here, customer can get details information on their quotes and orders at their convenience, (IBM business access, 2004). The main processes involved are:-

- Save customer's cart as quote
- Convert quote to order
- E-mail and print customer's quote
- Detailed order status & tracking
- Detailed order/quote history.

2.7.2 Wal-Mart Site

Wal-Mart has become the world's number one retailer. It sells furniture, décor, toys, electronic, sport tools, and etc… Figure 2.4: shows Wal-Mart web Site

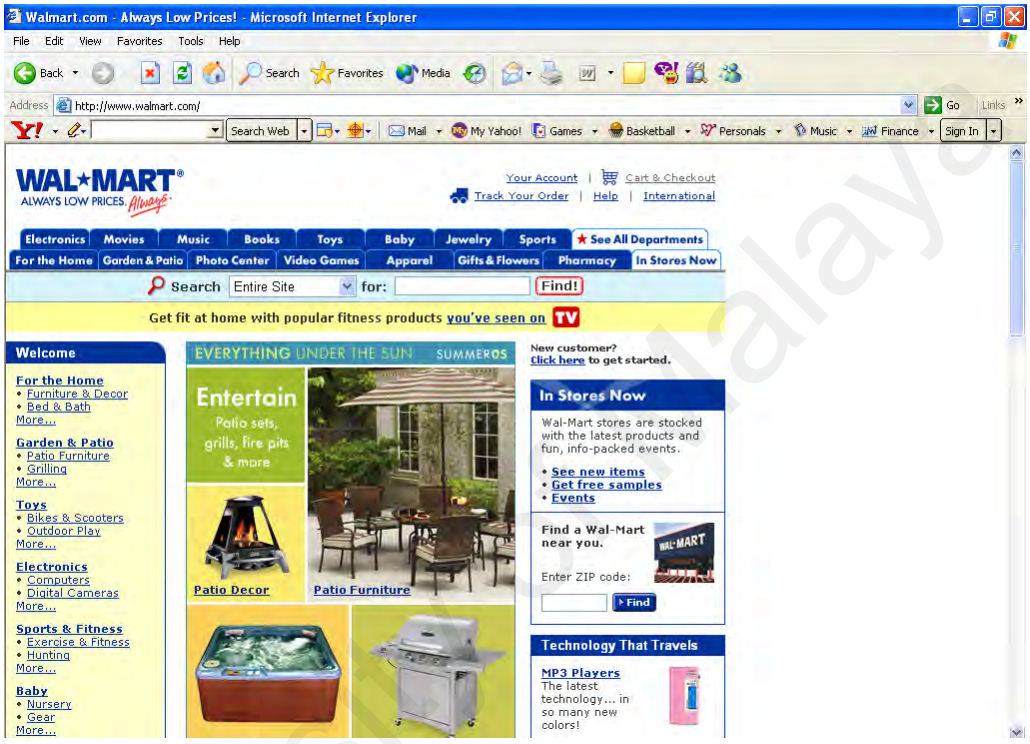


Figure 2. 4: Wal-Mart web Site

Though wal-mart allows for convenient on-line shopping, it has several drawbacks, such as

- Does not accept checks, money orders or credit cards issued by foreign (non-U.S.) banks.
- Does not verify the postcode. Entered by the customer.

2.7.3 Amazon.com

Amazon.com is considered one of the leaders that sell via internet as retail merchants use online purchasing system, and it has a 1-Click Patent.

❖ **Amazon.com and the 1-Click Patent**

According to Amazon.com CEO Jeff Bezos in United State "We spent thousands of hours to develop our 1-Click process, and the reasons we have a patent system in this country is to encourage people to take these kinds of risks." (Jarvenpaa & Tiller, 2002).

Amazon.com enables customers to find and purchase products such as books, music, videos, and other items over the World Wide Web. Because of the increasing the competition between companies through online purchasing system amazon.com pursued a strategy of innovation to distinguish its shopping experience from other competition, and made investments to build customer relationships during the early growth phase of e-commerce. Reinforcement of the user interface creating easy-to-use and easy-to-learn application has become amazon's strategy.

In September 1997, Amazon.com implemented the idea to enable Amazon.com customers to purchase items with a single-click of a computer mouse button. That idea resulted in a system in which a consumer can complete a purchase order for an item via the Internet using only a single click, once information identifying the

item was displayed to the consumer. This system is applicable in situations where a retailer already has, in its files, various information about the purchaser (such as the purchaser's address and credit card number) and where the purchaser's client system (e.g., a personal computer) has been provided with an identifier – or "cookie" -- that enables the retailer's server system to identify the purchaser. Technologically, the 1-Click was an order fulfillment component of a server system that took the information provided by the databases of user information and inventory, combined those into a shipment order, and then notifies the customer that the order was ready for shipment. (Jarvenpaa & Tiller, 2002), From the analysis and from the information that is available on Amazon.com site we can find out some concepts that is related to 1–click, which are:-

i) 1-Click Default Address for Amazon

A list of shipping addresses will appear beneath the "Buy now with 1-Click" button on every product information page. The addresses that appear at the top of this list is the customer's 1-Click default address. A customer can change the default address if he /she wishes. The customer can also change its 1-Click settings after he/she signs in (Amazon, www.amazon.com)

ii) 1-Click Settings

1-Click allows its customers to place orders to any or all of the addresses commonly used. Customer 1-Click settings include customer's preferred shipping method and credit card for every shipping address in the customer's address book [Amazon, www.amazon.com).

2.7.4 Sainsbury's

It is an on-line shopping in British, they deliver an ever improving quality shopping experience for customers with great product, it aims to exceed customer expectations for healthy, safe, fresh and tasty food making their lives easier every day.

The specifications for the Sainsbury website are as follows:-

- Before an account is created, the system will let the customer check the customer's area in the delivery section.
- It offers one address for one customer
- If a product is out of stock on the day of customer delivery, the customer will get a substitute, selected by the Sainsbury's shopper in the customer local centre as a close alternative to the customer's original choice. Customer can accept or decline this substitute at the customer doorstep. The price of the substitute will be included in the final bill, so that a refund will be arranged by the company the customer should not wish to accept it.
- The customer can pay using Switch, Maestro, Visa Credit, Visa Debit, MasterCard, American Express, Style and Electron.
- Passwords or payment details are delivered using 128 bit Secure Socket Layer encryption (Sainsbury, www.sainsburystoyou.com].

A summary of the main features of the reviewed application is given it table 2.8.

Table 2.8: main features of reviewed applications

Main Features / Application	IBM	Wal-Mart	Amazon	Sainsbury
Customer chooses which store to shop from	√	√	x	√
System automatically chooses which store to deliver products to customer	√	√	√	x
If product is not available 1. System will deliver error message	x	√	√	√
2. System will automatically choose another store to deliver the product	√	√	√	x
3. System will replace the products with another similar to it.	x	√	x	√
One- click purchasing experience	x	x	√	x
e-mail notification sent automatically after customer has completed his/her purchase	√	√	√	√
Allow more than one delivery address	√	√	√	x
The Choose the nearest store which will deliver the order, depending on lowest cost of delivery	x	x	x	x

2.7.5 An on-line Purchasing and Decision Support System for Distributed Retail Chain Stores

In the real world, a lot has been written about subjects relating to online purchasing and decision support system from different perspectives. One such study was done by (M. Yusof, 2005) whereby the study looked into how integrating on-line purchasing with inventory management system for distributed retail chain stores can automate and aid the process of decision-making in relation to on-line product sales and distribution. M. Yusof's study aims to allow on-demand and automatic communication between the retail chain store's head office and point-of-sale (POS) outlets, and on-line purchasing for home users. Product transactions are at different geographical locations.

The system facilitates transaction between the head office and (POS) outlets and it aids top-level management to make the right business decisions. i.e. to find the right products at the right location, at the right time and to ensure that products ordered by users are sent by the right POS outlet.

2.8 Summary

This chapter has looked into the literature review for related researches and studies. The topics in this field of study were read and analysed, such as definition

of e-commerce, category, and model of e-commerce. The concept of online purchasing and its categories studied. Moreover, the decision supports system and its approaches, and the relationship between DSS and web technology have been studied. Finally, some real world systems that are related to the research area were examined such as Amazon, IBM, Sainsbury, and Wal-Mart to understand the proprieties of those systems.

Chapter 1: Introduction

Chapter 2: Background Literature

Chapter 3

Research Methodology

3.1 Introduction

Methodology refers to the analysis of the methods used appropriate to a field of study. It is a systematic way of accomplishing certain tasks and is defined as a collection of procedures, techniques, tools and documentation aids that helps a software developer to speed up and simplify the software development process (Pressman, 2001).

In this research, a combination of methodologies was used. This chapter describes the methodology for this dissertation and the methodology that is used for system development.

3.2 Research Methodology

The purpose of the research methodology is to provide a view of the methods that was applied into this research. In addition, it defines the system development life cycle (SDLC) for developing the system.

The Research methodology defined here is based on the methods used to collect information on the real world problem pertaining to on-line retail chain stores and to define system requirements. From the analysis study, understanding of the literature reviewed and analysis of questionnaires, will lead the initial requirements for the system. Evolutionary prototype is used as methodology for SDLC. Once the initial requirements are ready, the next step is to design the system, followed by coding and testing.

3.2.1 Research Questions and Methodology

In this research, the researcher seeks to solve the following research question related to online purchasing and decision support system:-

1. Is the system able to determine which stores should distribute customers' order based on the lowest cost of order's delivery?
2. Is the system able to determine another store nearest to the customer to deliver a product in the customers' order based on the second lowest cost, if this product isn't available in the first selected stores?
3. Can the system help management apply the concept of decentralization in decision making?
4. Is the system flexible in managing a variable number of head offices and stores?
5. Is the system able to manage product inventory for each store and define which product has reached to the reorder point?

6. Is the system able to find which supplier should supply a product for a store?
7. Are the customers able to buy from the online shop in a convenient way?

Therefore, this research covers to two types of e-commerce, B2C and B2B e-commerce.

3.3 Research Technique

There are many techniques used to collect data. The techniques used to collect data for this research are as follows:

- Literature review.
- Survey (questionnaire).
- Brainstorming.
- E-mail, i.e. send email to a manager in retail chain stores.

3.3.1 Literature Review

As was mentioned in chapter 2, four on-line purchasing systems were reviewed in order to determine similar features and functionalities. The features of the four systems have been summarized and can be seen in the table 2.6.

3.3.2 Research survey

Survey questionnaires are used to obtain quantitative descriptions of what business and customers have and what they need. The structures of the questionnaires are designed to capture data about companies that have online purchasing system, and customers who buy from an online shop. Two sets of questionnaire were designed.

The first set is for companies who have online purchasing system that allows customers to purchase online. This questionnaire is used to capture data about the status of available systems, and invites suggestions on system improvement. (See Appendix A)

The second set was designed for customers and was used to capture data about customers' behaviors when they are online, such as how they could buy, and what customers look for when they are shopping online. (See Appendix B)

Customer's questionnaire was sent to a random sample of 217 customers while the company's questionnaire was sent to a random sample of 22 company addresses. The result of the questionnaires will be discussed in detail in the next chapter.

3.3.3 E-mail

It is used to communicate with persons who works in companies have on-line purchasing system and decision support system to ask them about system. Because

physical meetings conducted is so difficult because some of them out of Malaysia or he hasn't enough time to manage a meeting, so the communicated through e-mails more easily. Actually, the questions that are asked about the features and drawback in current system and what the new features required in new system. In addition, asked questions about the main feature in this thesis.

3.4 System Development Life Cycle

Like a traditional software development, the process of e-commerce development can also be divided into different life cycle steps. This can be done through methodology that will be adopted into the research.

The system development life cycle (SDLC) is the entire process of formal, logical steps taken to develop a software product. There are many life cycle models that exist to develop the system, and the researcher is at liberty to chose a model that fit this project, time and constraint. The phases of SDLC can vary somewhat but generally include the following: Requirements specification, software design, coding, testing, and delivery.

3.5 SDLC for developing the On-line decision Support System for Retail Chain Store (ODSS-RCS)

Due the circumstance surrounding this research, in particular time constraint, the SDLC that was chosen for system development is Evolutionary Prototyping.

The goals of prototyping vary from system to system, and different prototyping strategies may be adopted, depending on the problem domain.

3.5.1 What is Evolutionary Prototyping (EP)?

Evolutionary prototyping uses multiple iterations of requirements gathering, analysis, design, development, and testing of prototype. After completion of each iteration, the result is analyzed by the researcher. Their response creates the next level of requirements and defines the next iteration. And this goes on until the operational system is ready (http://www.doc.mmu.ac.uk).

Advantages

- Suits rapidly changing or poorly understood requirements, so it suits a project in which the development areas are not well known to the developers
- Provides the end-user with clear signs of progress
- Gives the end-user a sense of control over the project's progress

Disadvantages

- Very hard to set deadlines and make time estimates. In the real world developing a prototype may extend the schedule but the prototyping time may be recovered because rework is avoided.

Evolutionary prototyping focuses on gathering a correct and consistent set of requirements. This lends forward the building of quality software by means of ongoing clarification of real requirements be it clarification of existing requirements and/or the discovery of previously missing or unknown requirements (Carter & et al, 2001).

Building (ODSS-RCS) is a challenging activity. When the thesis stared, the problem domain and the system requirements are often not clearly understood. In order to maximize the likelihood of on-time delivery and to minimize cost and time, it can be useful to construct an initial prototype system. A prototype can help in identifying the system requirements and in minimizing uncertainty or missing requirements. Building prototypes is a good way to SDLC. (Eric H. Nyberg, 2004)

3.5.2 Justification for Using the Evolutionary Prototyping in SDLS for (ODSS-RCS)

1. **Clarifies the requirements needed in a system.**

Evolutionary prototyping helps to alleviate changing opinions and vague specification by embodying the requirements in a tangible form. So potential users

and supervisor can see their requirements in the prototyped systems, and therefore can validate the requirements reflected in the prototype. By the iterative nature of the prototype's evolution, a software developer has the opportunity to accept, or change a requirement.

2. Find out unknown requirements.

When a researcher starts a project, he /she does not have a clear picture of what should be developed. Based on the objectives, the researcher may find additional functions that the prototype must provide. "The key is that prototypes are an excellent means of eliciting correct, consistent, and complete specifications of requirements" (Davis, 1992).

3. Requirements Analysis and Design by view

Requirements analysis and design for online systems have two main challenges for a software. First, it is generally difficult to provide a detailed specification for the interface and the visual components of a web site suck as graphics, layout, etc. Second, there exist functional requirements which customers may take for granted, therefore EP can help a developer to get rid of these challenges.

4. Flexible to change research assumptions.

Evolutionary prototyping is beneficial to the researcher to shift (update) his assumptions and requirements. Some of these assumptions will be discussed with the supervisor and some written in documentation. Evolutionary development models allow these effects and changes.

5. Provides a method to communicate about Systems.

Evolutionary prototyping is facilitating communication between the researcher and his supervisor. So when researcher has a new idea, the prototype helps him to explain what has been done and if there are any suggestion from supervisor he can easily incorporate the suggestion into the prototype. There is less argument about what a prototype does, and reduce the misinterpretations from vagueness and equivocalness in natural language specifications.

6. Reduce development schedule and minimize cost

Prototyping minimize development costs and, development schedules, if there is any change in project, the researcher can do that in early phase and this will require less time and effort. If there is a wrong in SDLC, the researcher will change in documentation, design and models. "Many stakeholders are also less intimidated by the presentation of a prototype than by the paper avalanche of specifications, designs, screen layouts, and diagrams found too often in methods such as the Waterfall model" (Antón & Carter & Earp & Williams**,** 2001).

7. Build knowledge from experiment

Evolutionary prototyping helps to build knowledge base for researcher from what he did and if any mistake happens wrong in any phase the researcher will acquire new knowledge and try to avoid this in the next phase. “Evolutionary models of prototyping take advantage of knowledge acquired as development progresses" (Antón & Carter & Earp & Williams, 2001).

3.5.3 Evolutionary Prototyping (EP) for ODSS-RCS

EP for ODSS-RCS has six development phases which are in Requirements analysis/Gathering/Integration, System Design, Implementation (Build Prototype), System Debugging / Testing, User Evaluation, and Deliver to user. As shown in figure 3.1, in the real word, each phase overlaps and repeats the phases until the system is built. Each phase of EP for ODSS-RCS is explained in detail below.

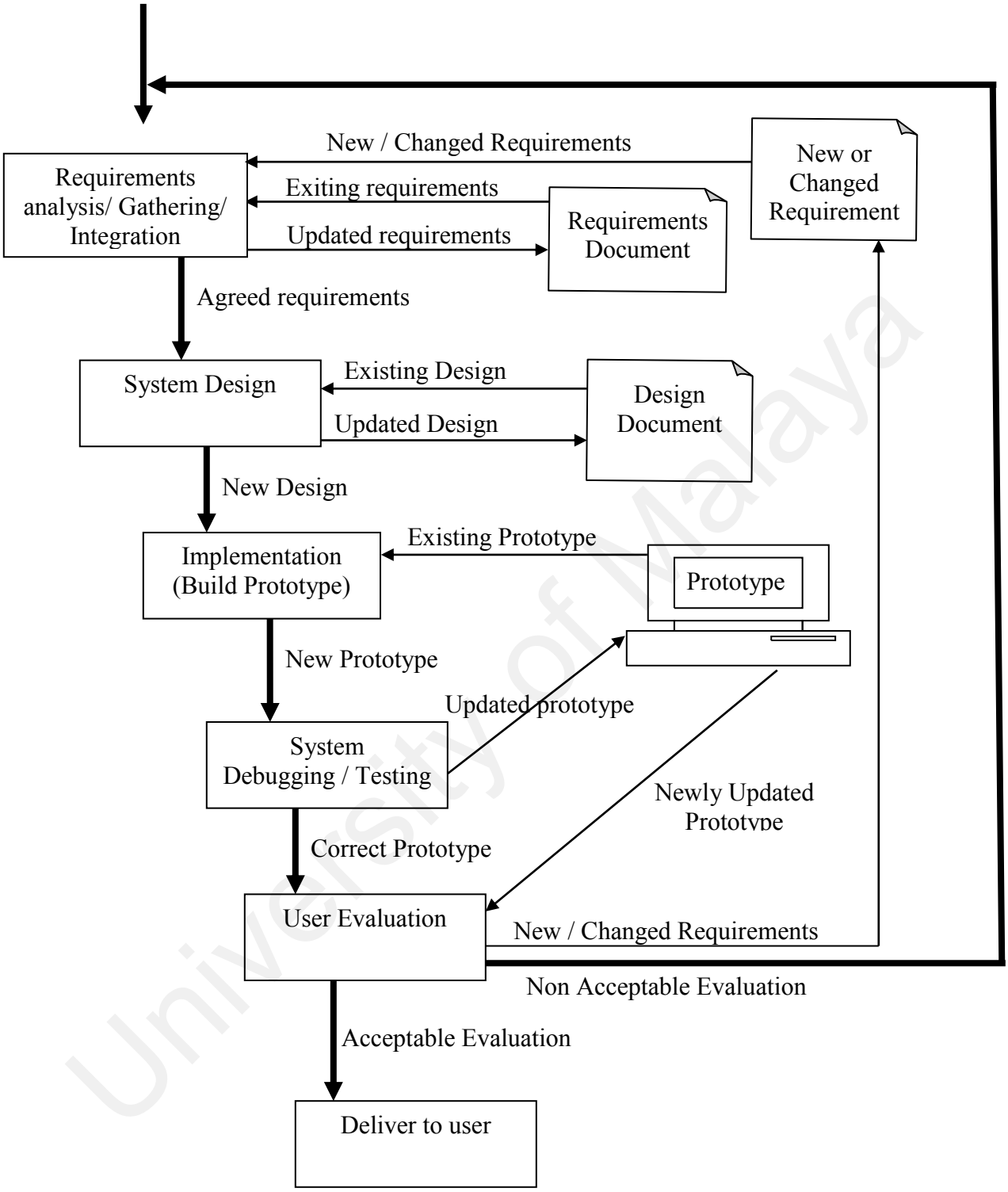


Figure 3.1: The evolutionary prototyping for an online decision support system for retail chain stores (EP for ODSS-RCS)

3.5.3.a Requirements analysis / Gathering and Integration

Requirements definition is the most crucial part of this project. A requirement is a description of what a system should do, (Lutz & Woodhouse,1997). Figure 3.2 shows the process of gathering the initial set of requirements from the study of literature review, discussion with potential users, and reviewing other similar software systems**,** so as to contribute to the understanding on what the system must do.

The initial requirements are documented in the initial requirements document template. New requirements are agreed during the analysis and negotiation processes with potential users, whereby, the agreed requirements are then added to the exiting requirements. As in most software processes, the design of a new prototype release occurs as the designers decide how the new sets of requirements will be incorporated into the revised prototypes. Initial requirement set is documented using the initial requirements document and this continues until the final requirements document is completed.

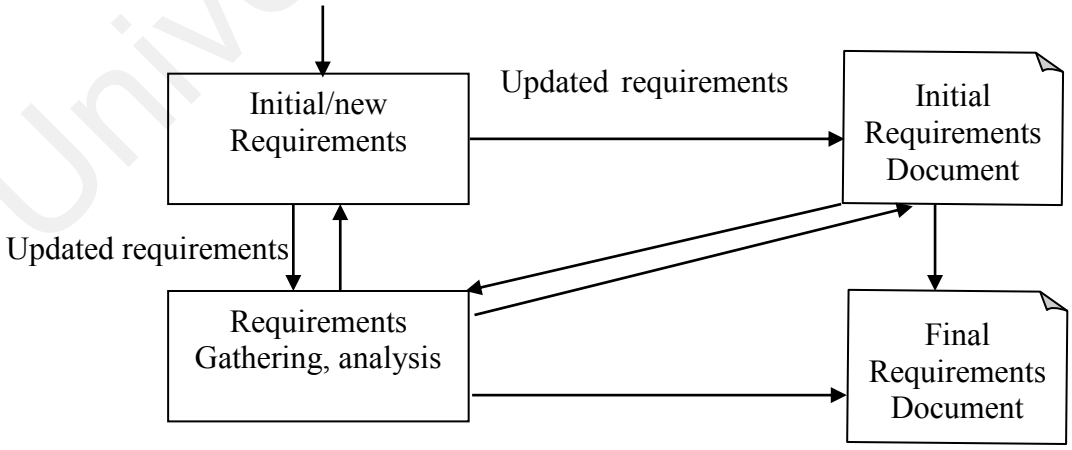


Figure 3.2: Requirements analysis and gathering model's through EP

3.5.3.b System Design:

Initial system design begins by using the partial Design Document from the initial requirement document. This is repeated until the software process design of the new prototype release occurs as the designers decide on how the new sets of requirements will be incorporated into the revised prototypes. The architectural design, subsystem and module specification, and interface design are revised and minimally documented as necessary to ensure a design and prototype structure. The system design is considered as the connecting link or bridge between the existing set of requirements and the prototype implementation. as shown in Figure 3.3

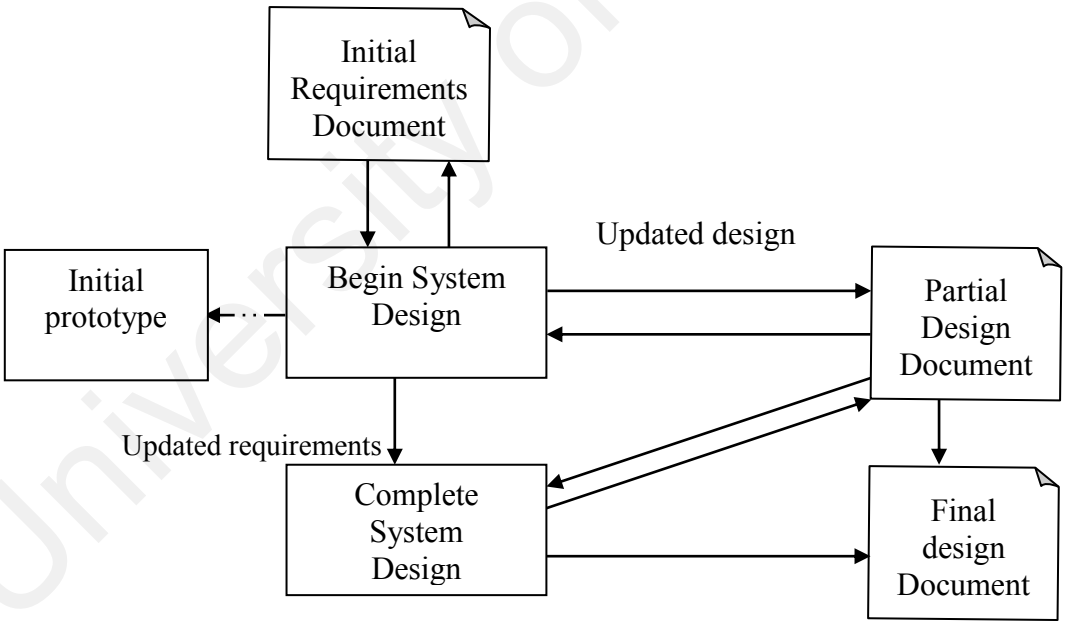


Figure 3.3: System design model's through EP

3.5.3.c Implementation (Build Prototype)

Once new requirements are agreed, and the initial design or a change in the design of a new requirement is done, then the researcher will begin developing a prototype or the revised prototypes. The prototype is iteratively modified to respond to initial design for new requirements. Figure 3.4 shows the implementation. At the end of each prototyping cycle, the researcher starts to develop tested prototype.

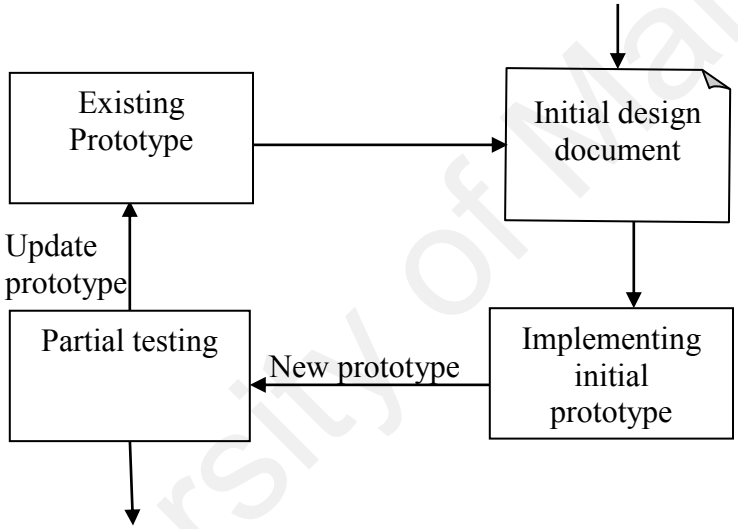


Figure 3.4: Implementing prototype model's through EP

3.5.3.d System Debugging / Testing

When the prototyping phase and the tested prototype phase is done the researcher and the potential users may judge whether or not the prototype meets their expectations. If the result from partial test isn't satisfactory, then a change in the requirements, design and revised prototypes are carried out. But if everything is satisfactory, then we enter a new iteration for new requirement and this is shown in

Figure 3.5. Programming and debugging is still performed until the requirements are met and the design is fulfilled at the conclusion of system implementation.

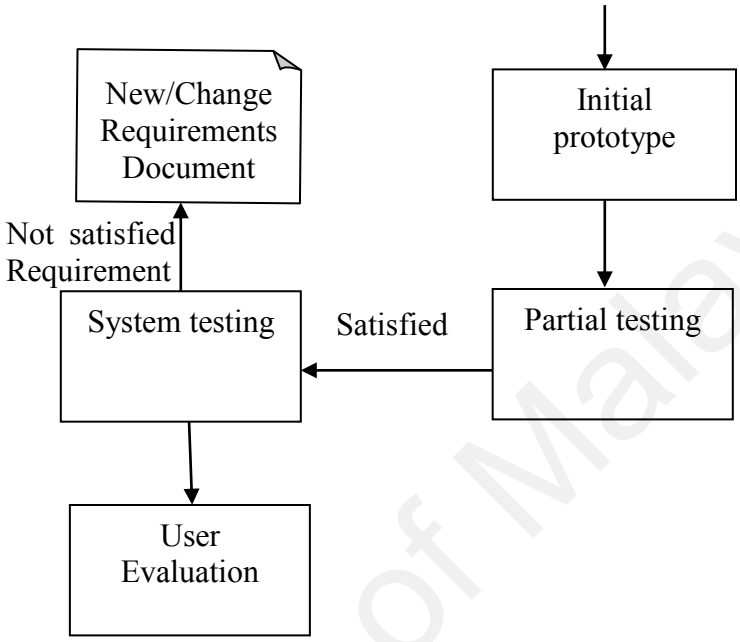


Figure 3.5: System debugging and testing model's through EP

3.5.3.e User Evaluation

Figure 3.6 shows the user evaluation model for the system. When implementation prototyping for the system is done, the final prototype goes through extensive testing. At the end of the testing if the researcher and the potential users feel that the system is not satisfactory, then new requirements and modifications are carried out, but if it is satisfactory this means that the system is complete. After that, the system is tested by two categories of users, i.e. first the online company and second the customers. If the feedback from the users are good and there are no

new requirements to add, the system is complete, and is ready to be delivered. Or else, a new iteration of the prototype will be implemented in order to incorporate the new requirements.

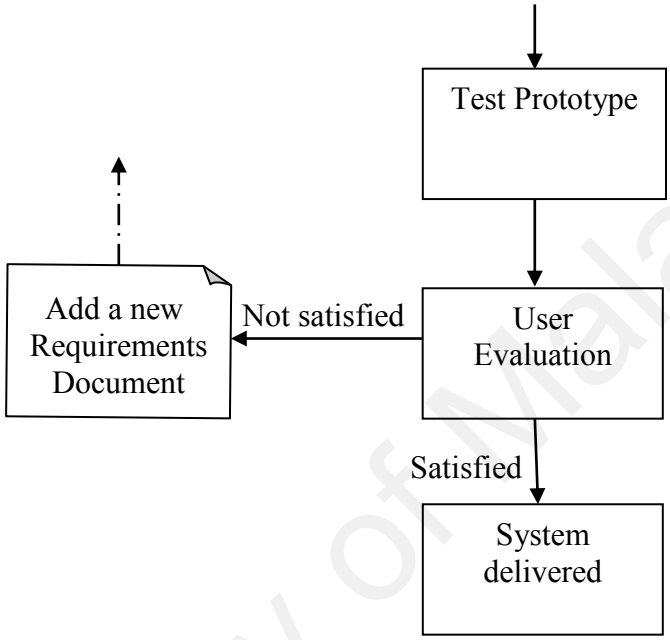


Figure 3. 6: User Evaluation Model for System through EP

3.5.3.f Deliver the system

Figure 3.7 shows the process when the system is ready to be delivered. The delivered system should encompass the needed functionality and the approved system qualities as dictated by the users.

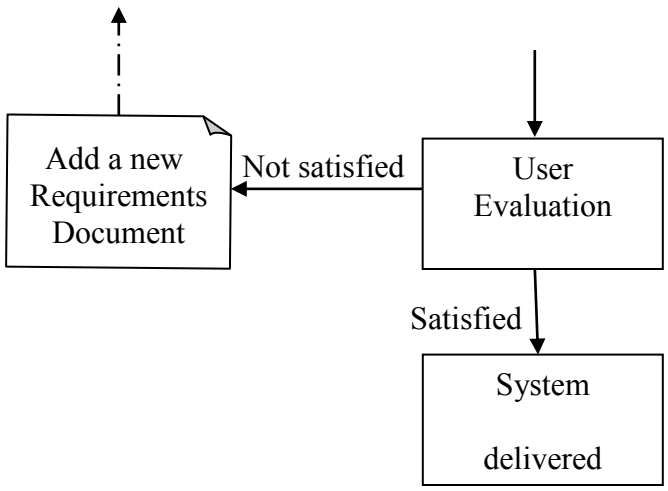


Figure 3. 7: Model's Deliver System

3.6 Summary

This chapter has looked into the research methodology which was used in this dissertation. The techniques used to collect the related information from potential users were surveyed and e-mail address. The literature review is used to study the current system and the related research previously done. The evolutionary prototype method was used in the system development life cycle of ODSS-RCS.

Chapter 3:Research Methodology

Chapter 4

System Analysis

4.1 Introduction

The aim of system analysis is to find out the role of the proposed system and the identification of the requirements that it should meet. It is a systematic investigation of the proposed system to determine the functions of the system and how they relate to each other.

One method that is used to capture the requirements as mentioned in chapter three is the use of questionnaires which are analyzed in this chapter. The functional requirement of the proposed system is defined by using UML use case diagram. Each use case is defined and described, and finally a use case diagram is produced.

4.2 Analysis of Survey

As was mentioned in Chapter 3, two sets of questionnaires were designed and distributed. The first is for companies who have an online purchasing system that

allows customers to purchase online, and the second set was designed for customers who use online purchasing systems.

4.2.1 Companies' Survey Analysis

The questionnaire was distributed to 22 companies and 18 completed and returned the questionnaire. Out of the 18 returned and completed questionnaire, 17 was analysed while one was discarded. The one that had to be discarded was because it was incompleted.

Tables 4.1 to 4.9 show the responses to the questions posed in the questionnaire.

Table 4.1: Q1: Does your company have online purchasing system?

The Answers	Number
Yes	17
No	0

Table 4.2 : Q2. Does your company have stores to deliver online orders?

The Answers	Number
Yes	17
No	0

From table 4.1 and 4.2, it can be seen that the questionnaire that were analyzed and filled are from companies that work in the target research study, i.e the companies have an on-line purchasing system and own stores that deliver on-line orders.

Table 4.3 shows the result from question 3 to 12 in to questionnaire.

Table 4.3 The answers to questions from 3-12

Q #	Questions	Percentage				
		Never	Seldom	Sometimes	Frequently	Always
3.	Does your company respond to specific questions from customers that are received through e-mail?	0	1	3	7	6
4.	Does your company have time-delay in delivering on-line orders?	3	7	6	1	0
5.	Has your company not completely deliver an order that is purchased online?	0	5	11	1	0
6.	Does your company apply the concept of decentralization in decision making that is related to its stores?	2	3	5	5	2
7.	Can a store manager generate reports that help in decision making that are related to his/her store?	1	3	8	3	2
8.	Can a Head office (headquarter) manager generate reports that are related to its stores)?	1	1	3	7	5
9.	Do you plan to improve your current system to help store manager in decision making?	0	1	8	5	3
10.	Does your online purchasing system deliver the online order from the nearest store to the customer	0	1	4	8	4
11.	Is the delivered online orders accomplished with minimum cost?	0	1	10	6	0
12.	Is your company satisfied with the cost of delivering an online order?	1	2	7	5	2

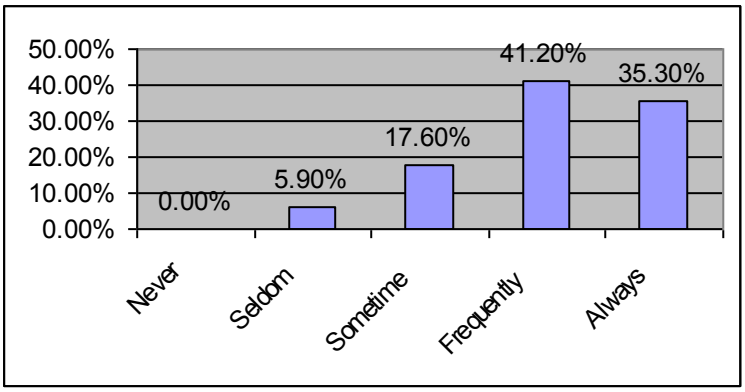


Figure 4.1: Percentage of companies that respond to customer's question received through e-mail?

From table 4.3 it can be concluded that:-

i. 5.9% of companies seldom respond to customers' questions, 17.6% sometime respond to customers' questions', 41.2% frequently respond to customers' questions, and 35.3% always respond to customers' questions that were asked through e-mail, as can be seen in figure 4.1.

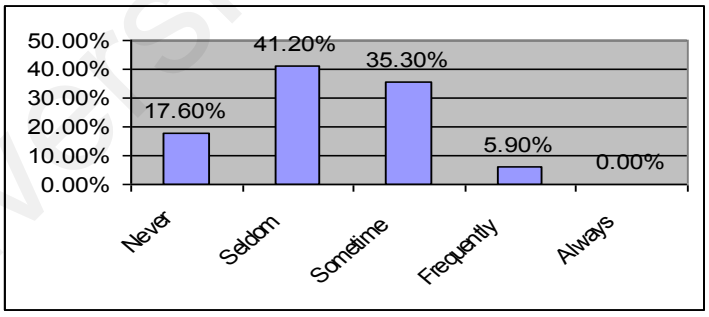


Figure 4.2: Companies that have time-delay in delivering online orders.

ii. 82.4% of companies have a time-delay in delivering online customer orders as shown in figure 4.2. This means the system that is used in some companies is not efficient in managing the online orders.

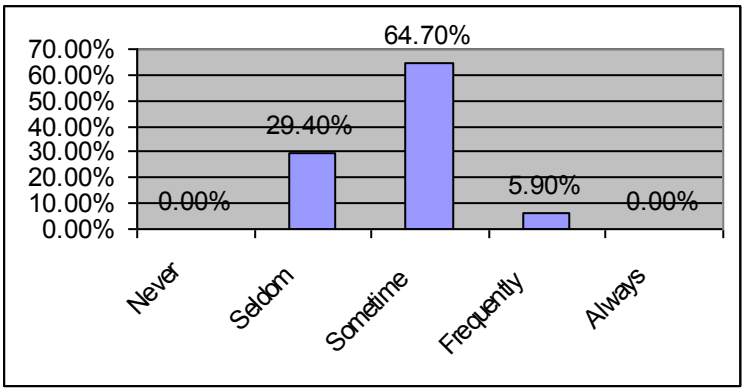


Figure 4.3: Percentage of companies that does not completely deliver the order that is ordered online.

iii. 64.7% of companies sometime have problems in delivering orders, as can be seen in figure 4.3. This means that some companies have problem in managing the products in their store. There may also be some problems with the system in managing the orders.

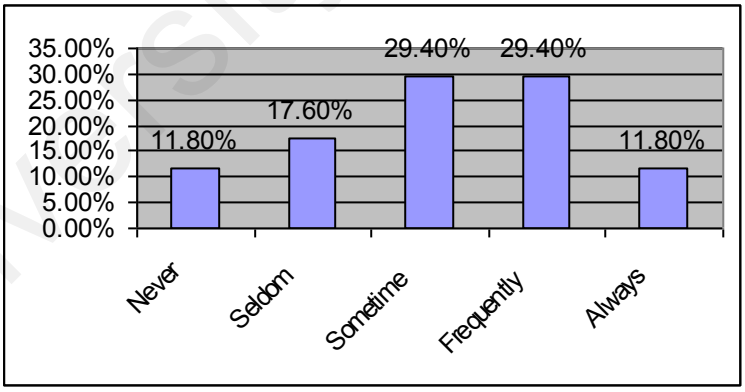


Figure 4.4: Percentage of companies that apply the concept of decentralization in decision making in relation to their stores.

iv. 11.8% of companies are already applying the concept of decentralized in decision making, whereas some companies are trying to apply decentralization in decision making, as can be seen in figure 4.4. This means that there are some companies that stille have hesitation in applying this concept, so they need a system to help them in applying it by giving the store managers the ability to make decision, and by allowing higher management to oversee and control them.

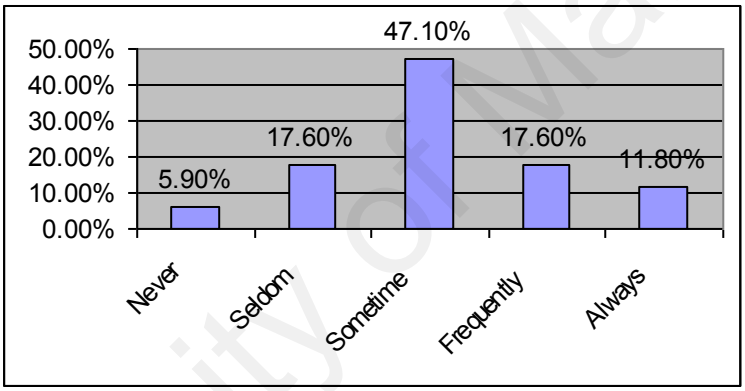


Figure 4.5: Percentage of store managers who can generate reports.

v. As shown in figure 4.5, 47.10% of the companies have a system which sometimes generates reports that help managers in decision making. This means that sometime the manager can generate the proper reports that are needed for decision making.

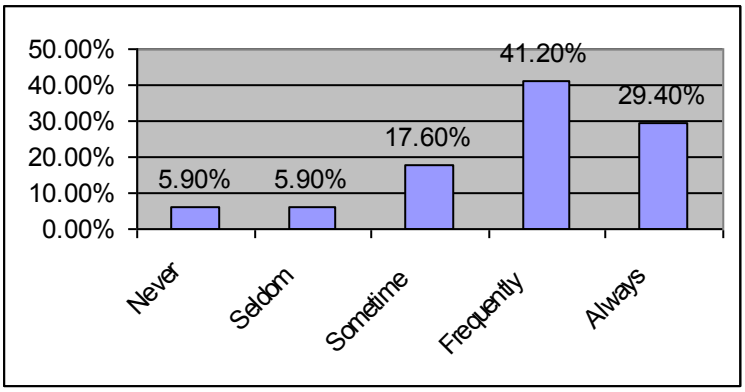


Figure 4.6: Percentage of Head office managers who can generate reports.

vi. 41.2% of the HO managers frequently generate report for their stores, whereas only 29.4% always generate reports. This means that most of the current systems used in retail stores help the HO manager in decision making.

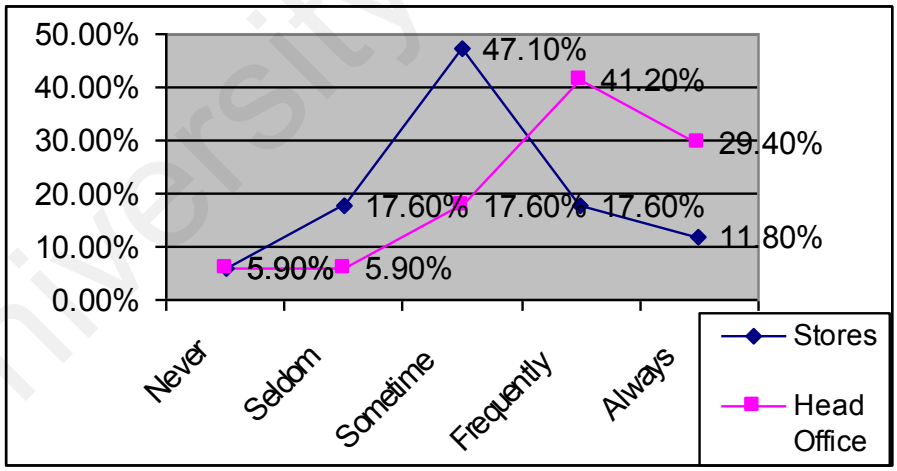


Figure 4.7: Percentage of managers of stores and head offices that can generate reports.

vii. As show in Figure 4.11, the percentage of both store and head office managers that can generating reports that can help them in decision making are 41.20% frequently and 29.4% always for head office manager, while 17.6% frequently and 11.8% always for stores managers. This means that the system used in most companies help the head office manager in generating report more than store managers.

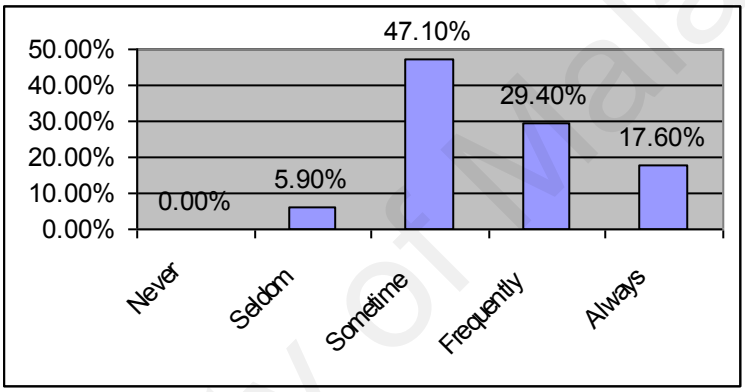


Figure 4.8: the percentage of companies that are planning to improve their current system.

viii. As shown in Figure 4.8, most companies' surveyed plan to improve their current system, which implies that the current systems don't satisfy some of their business needs.

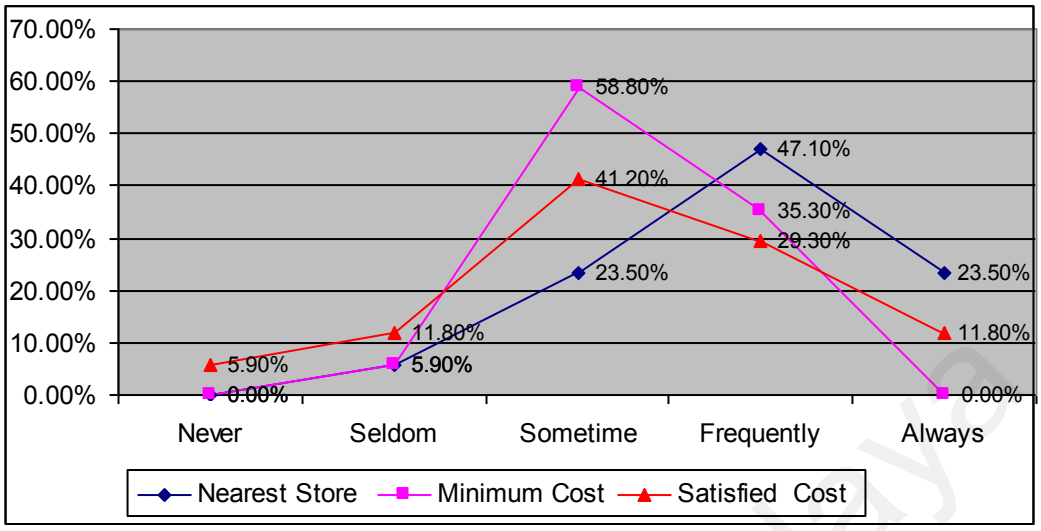


Figure 4.9: Percentages of the way of deliver order and degree of satisfaction.

ix. 47.10% and 23.50% of companies frequently and always successfully deliver orders from the nearest store, while 35.30% of the companies frequently deliver orders at a minimum cost. From figure 4.9, it can be seen no company always deliver the orders at a minimum cost. In addition, 29.30% and 11.80% of companies are frequently and always satisfied with the cost of delivery. This means that the companies deliver the order from the nearest store, regardless of the cost of delivery and that companies are not satisfied with the cost of delivering customers' orders.

Tables 4.6 shows the results of the yes / no questions of the survey, i.e. questions 13-19, wile figure 4.10 show the same result but in terms of percentages.

Table 4 4: Answer for question from 13-19

Q#	Questions	Percentage	
		Yes	No
13.	Would you like to increase the efficiency of your distributed orders?	12	5
14.	Does your online purchasing system depend on postcode to deliver orders that is ordered online?	15	2
15.	In case, the nearest store for customer hasn't an item in customer's order, does the system find another nearest store to deliver the item?	4	13
16.	Does one product have different re-order points in each company store?	7	10
17.	Does the system define different suppliers for the same product in different stores?	6	11
18.	Does the system define the shortage in inventory in the store?	17	0
19.	Can the head office (headquarter) staff know the shortage in inventory at stores through the system (without order from stores)?	10	7

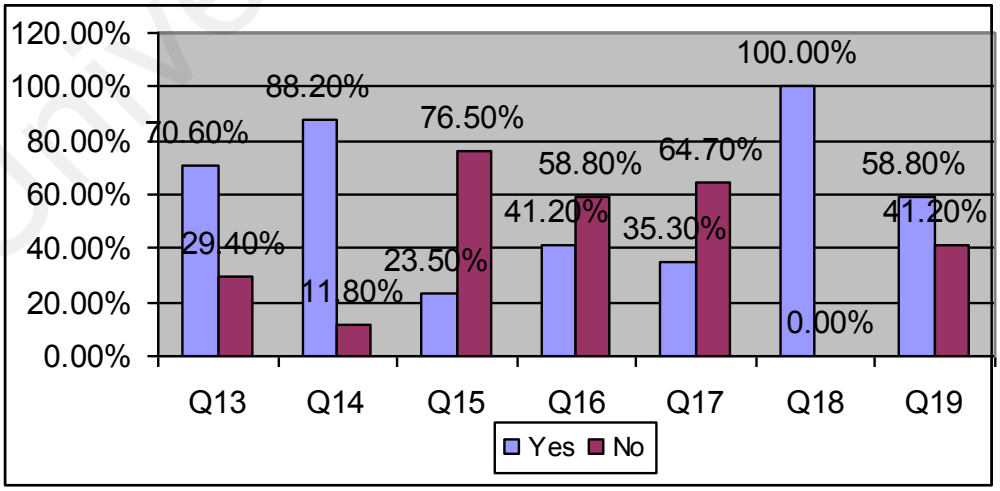


Figure 4. 10: Percentage of answers for Yes / No questions.

The result from figure 4.10 shows that

⇒ 70.60% of companies would like to increase the efficiency of their distributed orders, which means that the managers need a new way to increase the efficiency of delivering the products.

⇒ 88.20% of companies depend on postal / zip code for online order. This means that the postal / zip code define a customer's area, and then the system identifies the nearest store to the customer.

⇒ Only 23.50% of companies have systems which find another "nearest" store to the customer in the case where the first selected store does not have a product in the customer's order. This means the most of the companies do not have this feature in their system.

⇒ 41.20% of companies have different re-order points for a product in each different store. This illustrate that the companies are trying to improve their inventory management.

⇒ 35.50% of companies have systems that define different suppliers for the same product but for different stores. This is to increase the efficiency of supplying products for the companies' stores.

⇒ 100% of the companies' system defines the shortage of inventory in each store.

⇒ 58.80% of companies' system the allow head office staff to know a shortage in inventory stores. So that appropriate action can taken.

Table 4.5: Q20. How long does it take to deliver an on-line order to a customer?

The answers	Percentage
Less than six hours	5.9%
From six – 12 hours	11.8%
From 12 – 24 hours	17.6%
Two days	52.9%
More than two days	11.8%

Table 4.7 shows that most companies need at least two days to deliver a customer's order. In reality, this time may be efficient for some product but may not be efficient in some cases.

Table 4.6: Q21. Do the customers have the ability to fill the on-line order form correctly?

The answers	Percentage
Less than 25%	11.8%
From 26% - 50%	35.3%
From 51% - 75%	29.4%
From 76% -90 %	17.6%
More than 90%	5.9%

The above table shows that the customers have some problem in filling the online order form. It may be because the customers are still having some problems with the concept of the online shop or the online store's system interface and purchasing process need to be improved.

Table 4.7: Q22. In your opinion in term of percentage, is your online purchasing system easy to use and convenient for a customer to complete the purchasing process?

The answers	Percentage
Less than 25%	0.0%
From 26% - 50%	5.9%
From 51% - 75%	35.3%
From 76% -90 %	52.9%
More than 90%	5.9%

Table 4.7 shows that only 52.9% of managers feel that their companies on-line system is convenient to the customers. While 35.3% of manager consider the system as is convenient. This means that the managers are thinking of improving their system to be more convenient to the customers.

Table 4.8: Q23. Which address do the customers like to receive the order? (Can choose more than one answer)

The answers	Percentage
Home	76.5%
Work place	52.9%
Family or friends home	29.4%
Others places	17.6%
I don't know	29.4%

As shown in Table 4.8, customers want the option of receiving to orders in different places each time they buy from an online shop.

Table 4.9: Q24. What is your level of satisfaction about your online purchasing system?

The answers	Percentage
Less than 25%	0.0%
From 26% - 50%	11.8%
From 51% - 75%	23.5%
From 76% -90 %	47.1%
More than 90%	17.6%

The above table shows that 47.1% of managers are 76%-90% satisfied with their current system, while 23.5% of managers are just 51%-75% satisfied with their

system. This means that most managers are looking for improvement in the system to achieve competitive advantage.

4.2.2 Customers' Survey Analysis

The questionnaire was distributed to 240 customers, in which 217 answer was successfully collected. Out of 217 returned questionnaires, 22 had to be discarded because the respondents have never purchasing on-line.

The tables 4.10- 4.12 show the answers to general questions posed to the customers, such as their gender, age, marital status and etc.

Table 4.10 :Q1. Your gender is

The answers	Percentage
Male	54.9%
Female	45.1%

Table 4.11: Q2. Your age is

The answers	Percentage
Under 20	4.1%
From 20 – 29	65.6%
From 30 – 39	21.0%
From 40 – 49	8.2%
Over 50	1.0%

Table 4.12 : Q3. Your current marital status is

The Answers	Percentage
Single	22.6%
Married	67.7%
Divorced/Separated	8.7%
Widowed	1.0%
Other	0.0%

Table 4.13: Q5. Please indicate your current household income per month?

The Answers	Percentage
Under RM1,000	7.2%
RM 1,000 - RM 2,000	14.4%
RM 2,001 - RM 3,000	45.1%
RM 3,001 - RM 4,000	28.2%
Over RM 4,000	5.1%

From the four tables, it can be concluded that the respondent are male and female, between the age of 20-39, married and with an income of RM 2,001 to RM 2,999.

Table 4.14: Q6 How many times have you purchased things by using the online purchasing system in a month?

The Answers	Percentage
Didn't buy	0.0%
one time per month	68.2%
From 2 – 4 times	24.6%
From 5 – 7	5.6%
More than 7 times.	1.5%

As can be seen in table 4.14, 68.2% of customers purchase once per month from online shop, and 2.6% buy about 2-4 times per week. This means that the majority of customers buy at least once from online shop.

Table 4.15: Q7, What percentage of your income are you using on online purchasing to buy goods or food?

The Answers	Percentage
Less than 10%	90.8%
From 11% – 25%	8.7%
From 26% - 50%	0.5%
More than 51%	0.0%

The above table shows that the majority of customers only use leas than 10% of their income on on-line purchasing.

Table 4. 16: Q8, Where would you most like to receive the product which is bought through the Internet? (Can choose more than one answer)

The Answers	Percentage
Home	69.2%
Work place	55.4%
Family home	14.4%
Friend's places	5.1%

Table 4.16 shows the location where customers would like to receive their online orders. The majority of customers would like to receive their online orders at home and/or at work. A small number of customers would like to receive the online orders at other address. This means that the customers are using more than one delivery address when shopping on-line.

Table 4. 17: Q9. How many online shops have you used to buy product(s)?

The Answers	Percentage
Less than 2 online shopping	58%
From 3 to 6 online shopping	40.5%
From 7 to 10 online shopping	1.0%
More than 10 online shopping	0.5%

Table 4.17 shows that 58% of customers buy from maximum 2 online shops, while 40.5% buy from 3 to 6 shops.

Table 4.18: Q10. On the average, how long do you always spend on a site when you want to buy a product?

The Answers	Percentage
Less than 5 minutes	12.8%
From 6 – 10 minutes	40.0%
From 10 – 15 minutes	12.8%
From 16 – 20 minutes	20.0%
More than 21 minutes	14.4%

The above table shows that 40 % of customers spend 6 -10 minutes to buy from online shop, 12.8% of customers spend 10-15 minutes, and 20% of customers spend 16 - 20 minutes to buy from online shop. This means that customers relatively spend a lot of time when they buy a product from online shops.

Table 4.19: Q11, What is the percentage of your satisfaction when you shop online?

The Answers	Percentage
Less than 25%	22.6%
From 26% - 50%	29.7%
From 51% - 75%	43.6%
From 76% -90 %	3.6%
More than 90%	0.5%

This table shows that 29.7% of customers fall into the 26% - 50% range in relation to satisfaction with online shop, while 43.6% have from 51% - 75% satisfaction with online shopping. This means that much can be done to improve customers' experience when they shop on-line.

Table 4.20: Q12. How long does it take to fill up personal information when you want to buy a product online?

The Answers	Percentage
Less than 2 minute	4.1%
From 2 – 4 minutes	14.9%
From 5 – 8 minutes	73.3%
From 8 – 10 minutes	7.7%

Table 4.20 shows that 73.3% of customers need from 5 - 8 minutes to fill in their personal information when they buy online.

Table 4.21: Q13. Do you use user name and password on online shops?

The Answers	Percentage
Yes	96.4%
No	3.6%

Table 4.21 shows that 96.4% of customers have on account in online shop.

Table 4.22: Q14. If yes, how long does it take to checkout when you want to buy a product?

The Answers	Percentage
Less than 1 minute	2.9%
From 2 – 4 minutes	35.4%
From 5 – 7 minutes	60.0%
From 8 – 10 minutes	1.7%

The above table shows that 35.4% of customers need 2 - 4 minutes to checkout when they want to buy, while 60% of customers need 5 - 7 minutes to checkout. This means that customers relatively need a long time to checkout their on-line orders.

Table 4.23: Q15. Which method of payment do you use when you buy online? (Could choose more than one answer)

The Answers	Percentage
Cash when you receive the order	8.7%
Transfer though bank	30.3%
Credit card	84.6%
Others type of card	1.0%

The above table shows that 84.3% of customers usually use credit card as a mode of payment when they buy online, while 30.3% use bank transfer as a form of

payment. This means that the customers prefer to have the freedom in choosing the way of payment with regards to online purchasing.

Table 4.24: Q16. How long does it take for you to get the ordered product?

The Answers	Percentage
Less than six hours	2.1%
From six – 12 hours	6.2%
From 12 hours - 24 hours	33.3%
Two days	40.5%
More than two days	17.9%

Table 4.23 shows that 33.3% of customers receive their order from seller within 12 - 24 hours, while 40.5% within two days, and 17.9% of customers received online order after more that two days.

Table 4.25 : Q17. What duration of time would satisfy you to obtain the online ordered product?

The Answers	Percentage
Less than six hours	12.3%
From six – 12 hours	19.5%
From 12 – 24 hours	41.5%
Two days	25.1%
More than two days	1.5%

Table 4.25 shows the duration of time that would satisfy a customer in obtaining an ordered product, whereby 19.5% of customers will be satisfied to receive online order within 6 - 12 hour, while 41.5% between 12–24 hour, and 25.1% will be satisfied within two days.

Figure 4.11 shows the comparison of the time that customers received their online orders versus the time that they would like to receive them. The first column shows the actually time and the second column shows the satisfied time.

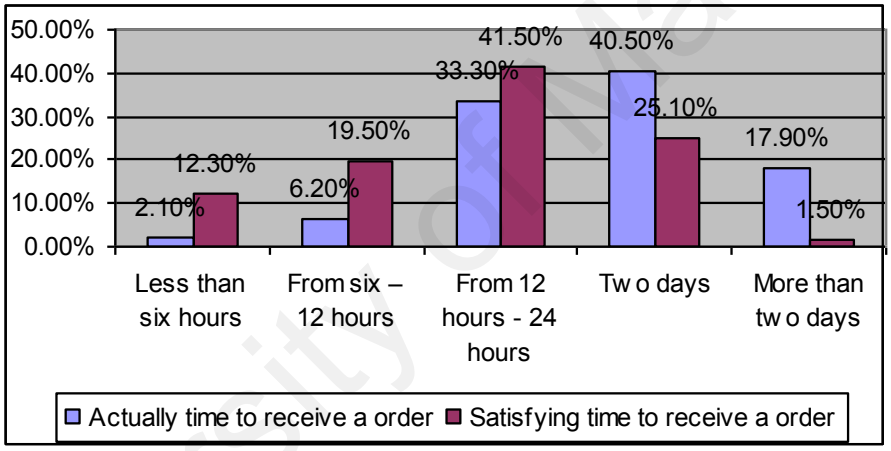


Figure 4.11: Percentage of the actual time of customers to get orders and satisfy orders.

From the figure, it can be seen that most customers are unsatisfied with the time that it takes for them to receive their on-line orders. They want to get it as soon as possible.

Table 4.26 :Responses to questions 18-25 shown in percentage. Of the questionnaires

Q #	Questions	Percentage				
		Never	Seldom	Some times	Frequently	Always
18.	Are you using different types of credit card to buy from the same online shop?	8.7%	31.3%	41.0%	17.4%	1.5%
19.	Is it easy to purchase from an online shop?	1.5%	9.2%	23.1%	38.5%	27.7%
20.	I enter my personal information when I buy through online purchasing	2.6%	19.5%	45.1%	21.5%	11.3%
21.	While you are surfing an online shop, are you aware of what you are doing?	1.0%	3.1%	9.2%	57.9%	28.7%
22.	Do you feel comfortable (user friendly) with an online shop.	1.5%	2.6%	14.4%	62.1%	19.5%
23.	Do you send a note by email about your feelings and opinions about on line shop?	5.1%	23.1%	54.9%	12.3%	4.6%
24.	Do you feel confused while buying a product in an online shop?	1.5%	47.7%	34.4%	10.8%	5.6%
25.	Do the online shops that you always buy from have the ability to send the orders completely?	1.0%	4.1%	23.1%	53.8%	17.9%

The result from table 4.26 is summarized as following:

⇒ Most of the customers use different types of credit card to buy from the same online company.

⇒ 23.1% of customers sometime consider buying from an online shop easy, while 38.5 % frequently consider it easy.

⇒ Most of the customers fill some personal details when they buy from an online shop.

⇒ Most of the customers are aware of what they are doing while shopping on-line.

⇒ Most of the customers consider themselves frequently familiar with online shopping, while 18.5% aren't familiar

⇒ Most of the customers sometime send e-mail about their opinions on online shops.

⇒ 34%.4 of the customers feel confused while buying from an online shop.

⇒ 17.9% of the customers receive their online order completely, 53.8% frequently receive it completely, while 23.1% sometime receive it completely.

4.2.3 Conclusion of the survey / questionnaires

From the survey that was conducted on both the customers and the companies that have on-line shops, it can be concluded that:-

i. All companies surveyed have on-line shops, therefore there's a need for companies, especially one dealing with retail stores, to have their own on-line purchasing web-site.

ii. Some companies manage to deliver their products ordered on-line completely, but with a time delay of less than 2 days. There other companies deliver not complete order.

iii. Most companies practice the concept of decentralization in managing their retail stores. Whereby they want to improve a system to support store managers in make decision that related to them stores.

iv. Most of HO managers generate ad-hoc reports.

v. Most of companies plan to improve on their current system, whereby they want to improve on the efficiency in delivering the products.

vi. Most companies use postal code / zip code in delivering the nearest store to the customer.

vii. Only a small quantity of companies have the option of finding the next nearest store, if the first selected store does not carry an item in the order.

viii. Not many companies allow for different suppliers to supply a product to different store location.

ix. Majority of customers want an on-line system that is easy to use and efficient in handing their orders, i.e shorter delay in sending their products and ability to send all of the ordered products

x. Most customers want the option of having different addresses to receive the on-line product, with different mode of payment.

xi. Most of the companies not satisfied with the cost of delivery order.

4.3 System Requirement

System requirement defines what the system is required to do and the circumstances under which it is required to operate (Kotonya et. al 1998). The system requirements for the proposed online decision support system for retail chain stores (ODSS-RCS) are categorized into functional and non-functional requirements. To define the system requirements for this system (ODSS-RCS), UML use case diagram is used.

4.3.1 Functional Requirement

Functional requirement is defined as the "requirement that specifies a part of functionality required by the user" (Bennett et. al, 2002). Functional requirements capture the intended behavior of the system. This behavior is expressed as services, tasks, and functions that the system is required to perform (http://www.bredemeyer.com).

An e-commerce system brings together content and functionality on several levels. So in order to define and understand the overall functions of ODSS-RCS, the use case analysis is used to identify the different users (actors) of the system (i.e. customer, staff, store manager, HO Manager, and Administrator). The initial prototype include a skeletal implementation of the interfaces and functionality for each user (actor) role, (Nyberg, 2004). Following the construction of the prototype, a requirements review is conducted to determine whether the current understanding of the requirements is complete and correct.

4.3.1.a System Requirement list

The requirement list includes the system requirements and use case for these requirements. Table 4.27 shows which use case provides the functionality for a requirement. The last five requirements are non-functional requirements and so they do not have use cases that define their requirements.

There general requirements in the system are built into the ODSS-RCS. The system supports an organization that distributes orders to customers that are bought online. It is used that there are many main head offices (HO) for retail chain store and every one has many stores to distribute orders to customer; One HO has many stores and they are independent from other HO and it's stores, i.e. one HO and it's stores in Kuala Lumpur (HO in KL central, and stores for example in Bangsar, Ampang and in Bukit Bintang) and another HO and it's stores are in Ipoh, one in Melaka, etc.

The postal code of the place of delivery for an online customer order will determine the near subset of stores to the customer. Depending on the lower cost of delivery, the system finds which store should deliver an online order to the customer from the identified subset of stores. In addition, depending on the next lowest cost, the system will find another store close by to the customer if the selected store does not have a product in the customer's order.

The online decision support system manages the inventory for each store and decides which supplier will supply which product for its store. The same product can possibly be delivered to different stores from different suppliers.

Besides the general requirements a customer is also able to purchase in a convenient way. The system requests the customer to create an account. Once this is done, the customer can login into the system by using his /her user name and

password. After adding products to the shopping cart, and once the customer clicks to buy, a new page with two options will appears. The first option button asks the customer where he/she wants to receive the product (i.e. home or at work), while the second one deals with the mode of payment. When this is done, the customer clicks the submit button to submit his / her on-line order.

Table 4.27: System Requirement List and Use Case.

NO	Requirement	Use case	Actor
1	Add product to cart.	Add Item to Cart	customer
2	Surf the online shop	Browse the Site	customer
3	Review content of the cart.	Review Contents of Cart	customer
4	Remove, or add item to cart.	Update Cart	customer
5	Create a new account.	Create Customer account	customer
6.	Login to his / her account.	Login Customer	customer
7	Buy content of cart.	Checkout	customer
8	Change password.	Change Customer PW	customer

9	Change personal information.	Update Customer Information	customer
10	Update home address.	Update Customer Home Address	customer
11	Update work address.	Update Customer Work Address	
12	Update credit card information.	Update customer's credit card information	customer
13	Add a new address (other than home or office).	Fill New address	customer
14	Review history orders.	Check History Order	customer
15	Login to his /her account.	Login Staff	Staff
16	View Re-order point for each product in store.	View re-order Point	Staff
17	Define Re-order point for each product in store.	Define Re-order Point	Staff

18	View inventory status in a store.	View Inventory	Staff
19	Adjust inventory status in a store.	Adjust Inventory	Staff
20	View the state of the orders.	View Order Status	Staff
21	Update the state of orders.	Update Order Status	Staff
22	Add note to an order.	Add note	Staff
23	Change password.	Change password	Staff
24	Change personal information.	Update Personal information	Staff
25	Generate reports that help managers in decision making.	Generate report	Staff
26	View customers' orders that need to be delivered by the store at any time (can view all orders, by date, by order ID, customer ID.	View Customers' Orders	Staff
27	Print invoice for customer.	Print Customer's Invoice	Staff
28	Generate report of store needs from the inventory.	Print inventory needed	Manager

29	Generate report of inventory status in a store.	Print Inventory Status	Manager
30	Generate report of suppliers who provide specific product in specific stores.	Print Product's Supplier	Manager
31	Generate report to know actual stock with re-order point	Print Stock VS. Re-order Point	Manager
32	Generate report for know the performance of product in a store.	Print Sales Performance	Manager
33.	Log in to account	Login Administrator	Administrator
34.	Add product's category.	Add Category	Administrator
35.	Update product's category.	Update Category	Administrator
36	Delete product's category.	Delete Category	Administrator
37.	Add product to shop.	Add Product	Administrator
38.	View a product details.	Edit Product	Administrator
39	Update a product.	Update Product	Administrator
40.	Delete product from online shop.	Delete Product	Administrator
41	Add employee to store.	Add Employee	Administrator
42	Update employee in a store.	Update Employee	Administrator
43	Delete employee from store.	Delete	Administrator

		Employee	
44	Assign product to each store and which supplier will provide this product for this store.	Assign product to Store	Administrator
45	Delete a product from a store.	Delete Store's product	Administrator
46	Add new head office.	Add Head Office	Administrator
47	Add new store for a head office.	Add Store	Administrator
48	Add new postcode for a store.	Add Postcode	Administrator
49	Add another administrator.	Add Administrator	Administrator
50	Add new supplier.	Add Supplier	Administrator
51	Print list of suppliers.	Print Supplier List	Administrator
52	Edit supplier information.	Edit Supplier	Administrator
53.	Delete supplier.	Delete Supplier	Administrator
54	Change password for employee (if employee forgets it).	Change Employee Password	Administrator
55	The system will automatically determine the nearest store for customer based on lowest	Determine Nearest store	system

	cost of delivery. (System must find it in customer area).		
56	In case, the nearest store does not have a product in the customer's order, the system will automatically find the second nearest store that has the product(s) depending on the lowest cost.	Find Another Nearest Store	system
57	The system will send an e-mail automatically to a customer after purchasing.	Send e-mail Automatically	system
58	Each HO and its stores are independent in relation to the order.		
59	Set multiple user access level (administrator, customer, store manager, Head Office Manager, and staff).		
60	Session security.		
61	Encryption of information between client and server.		
62	Encryption of some information in the database.		

4.3.1.b Clarification of Use Case

The system requirement list in Table 4.27 needs more clarification on what each use case represents. Use case clarification is done for each requirement in order to understand and build a clear picture of the system requirements. Appendix C has a table showing the use case description. It gives a more detailed explanation about each requirement. This style of clarification is adopted by (Bennett & all, 2002).

4.3.1.c Use Case Descriptions

Each use case description is a textual document, written to be understood by stakeholders. Descriptions of use case can be written in any of a dozen styles, some more appropriate than others. In this report, the style adopted is the one used by (Bennett et. al, 2002), as shown in Appendix D.

The purpose of writing these descriptions is to enable the stakeholders to understand the requirements and what each use case means, show how the actor will interact with the system, what is the input and output, and what each use case will do, in order to complete the process with success. This is the goal of the use case, and every use case has at least one goal that it is intended to achieve.

4.3.1.d Use Cases Diagrams

Use cases are descriptions of the functionality of a system from the user's perspective. Use case diagrams are used to show the functionality that the system will provide and to show which users will communicate with the system in some way to use that functionality. (Bennett et. al, 2002)

A use case diagram describes system functionality as a set of tasks that the system must carry out and actors who interact with the system to complete these tasks (http://www.visualcase.com). Use Case diagrams show the associated roles and accesses available to actors and other systems external to the system. They show how users can interact with the system while avoiding the complications of diagramming the internal workings of the system.

In building the proposed system, five actors have been identified, i.e. a customer, staff, store manager, administrator, and system. Actually, there is another actor is called HO Manager. The HO manager is the manager for the head office; he/she can manage, and generate reports for all stores that are under its head office in the same way store manager manages and generates reports about his/her store. Therefore, this actor has the same functionality as the Store Manager, but the HO Manager can selects the name of store when he/she wants to do a function, or generate reports about a store that relates to his/her HO. Thus, there is no need to draw the same use case for HO manager.

The use cases that relate to customer is depicted in Figure 4.12. This figure shows what a customer can do and how he / she interacts with ODSS-RCS.

Figure 4.13 shows the functions that two actors i.e. the Store Manager and Staff can perform, F 4.14 show the function that can be performed by the store manager, while Figure 4.15 and 4.16 show the function that can be performed by the Administrator.

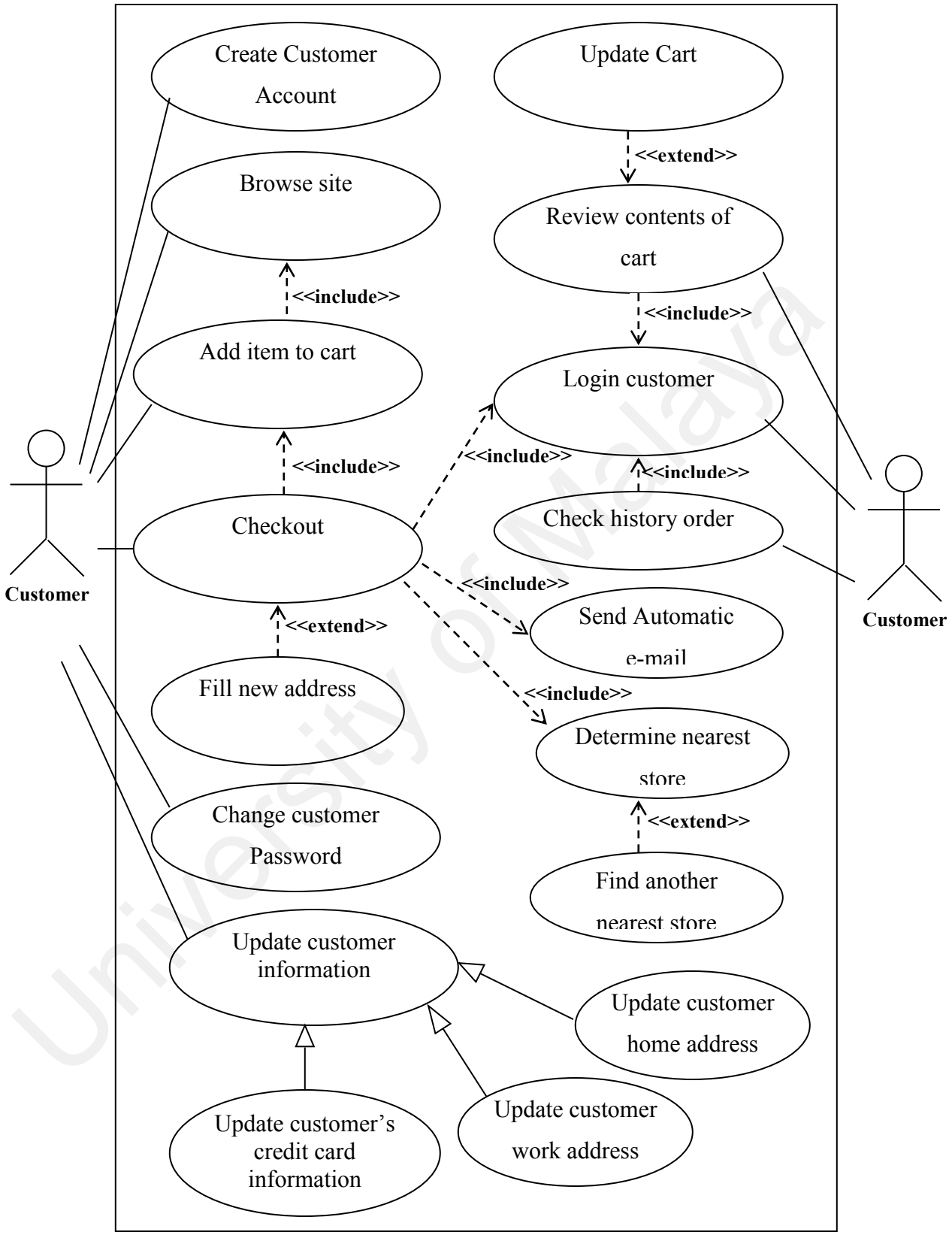


Figure 4.12: Customer use case diagram

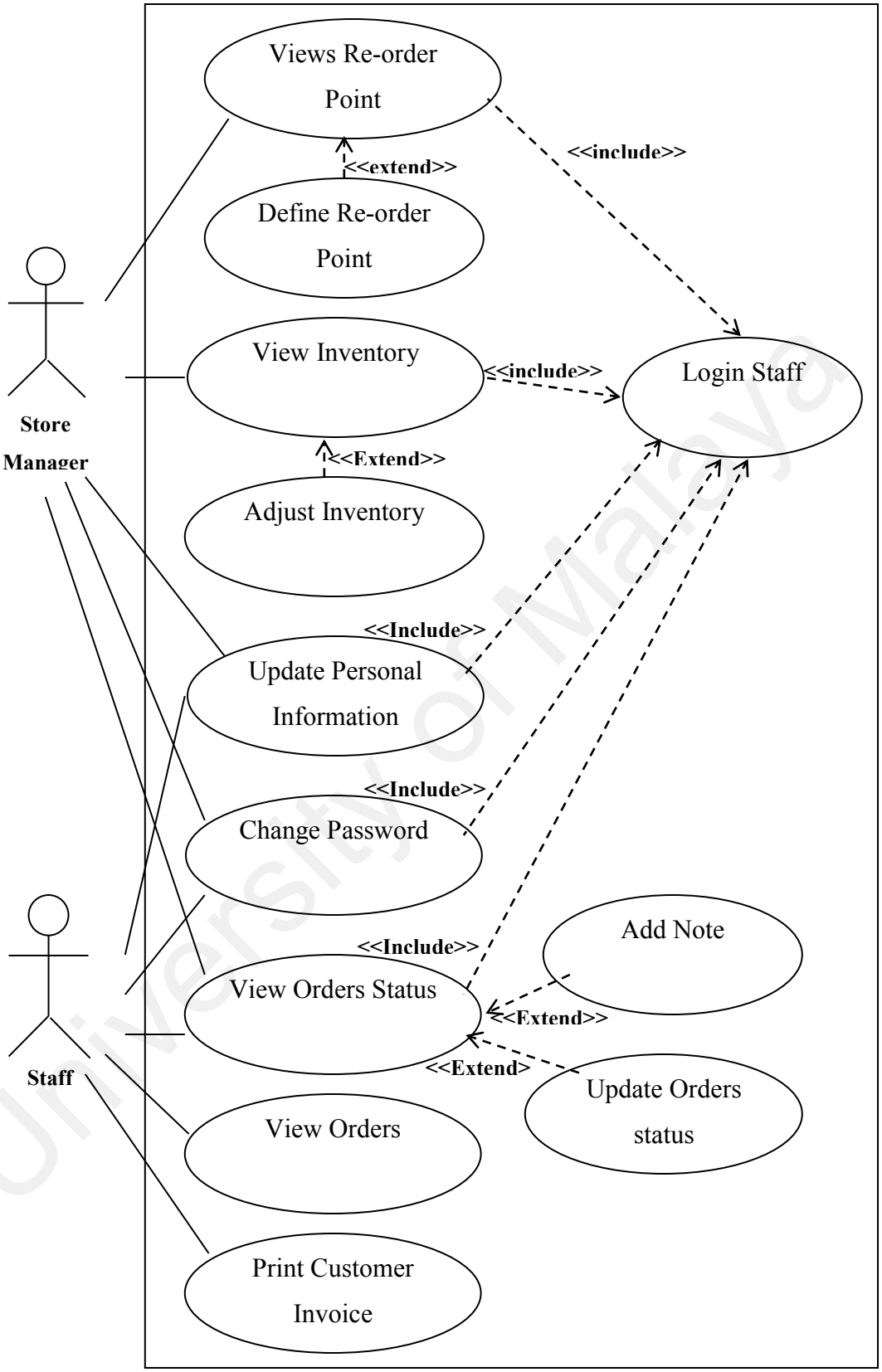


Figure 4.13: Store Manager and Staff Use Case Diagram

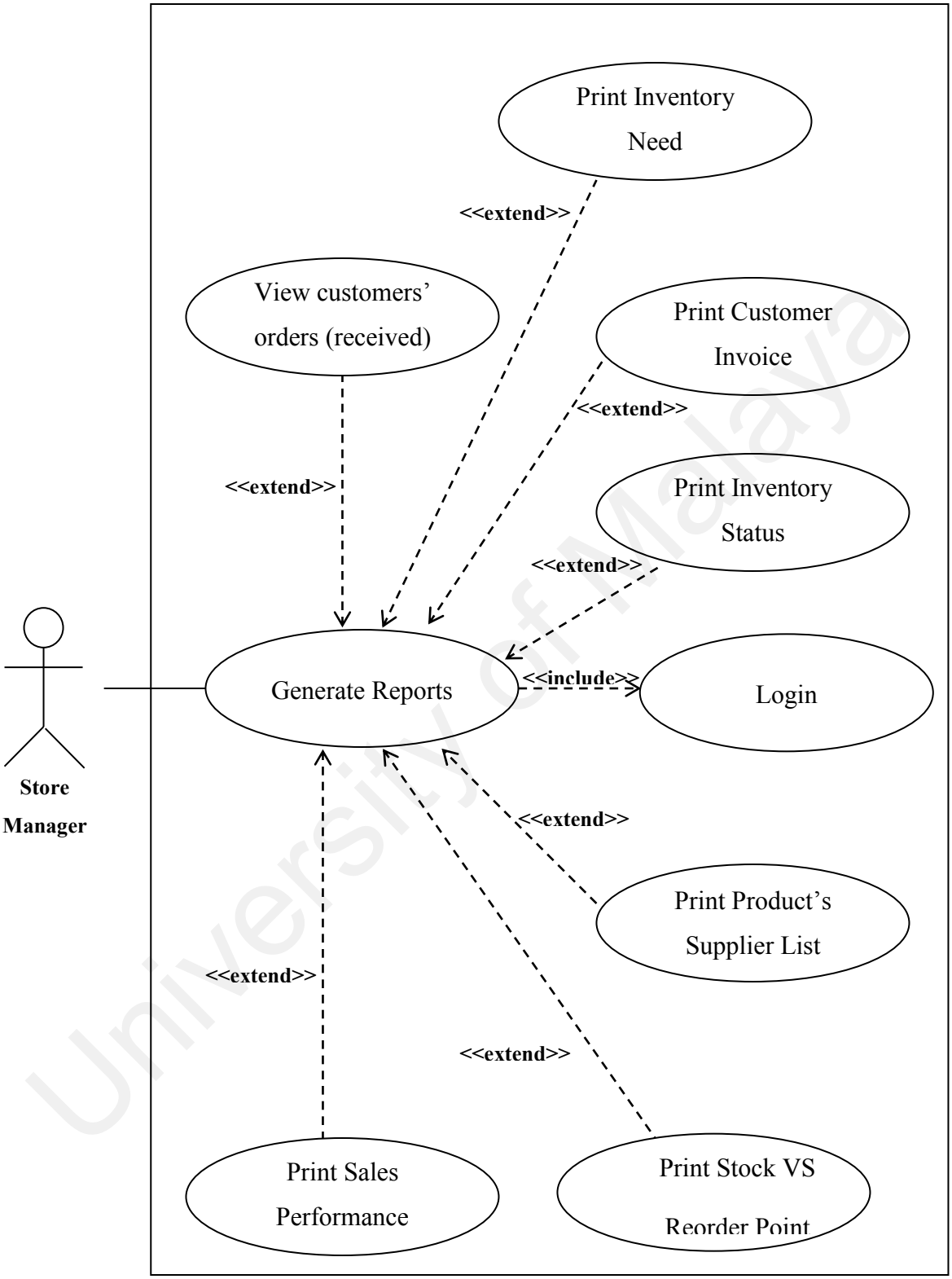


Figure 4.14: Store Manager Use Case Diagram

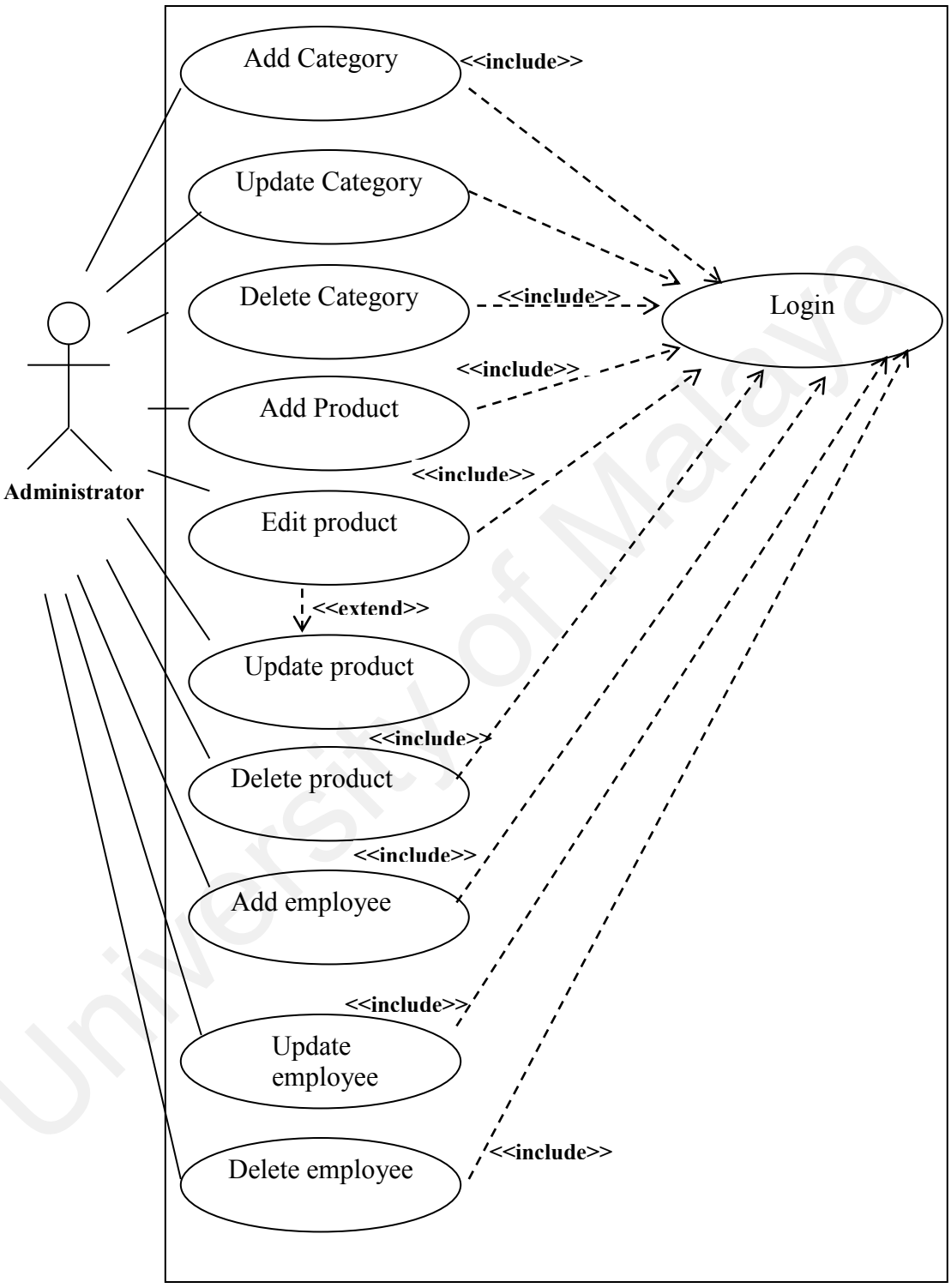


Figure 4.15: Store Manager Use Case Diagram

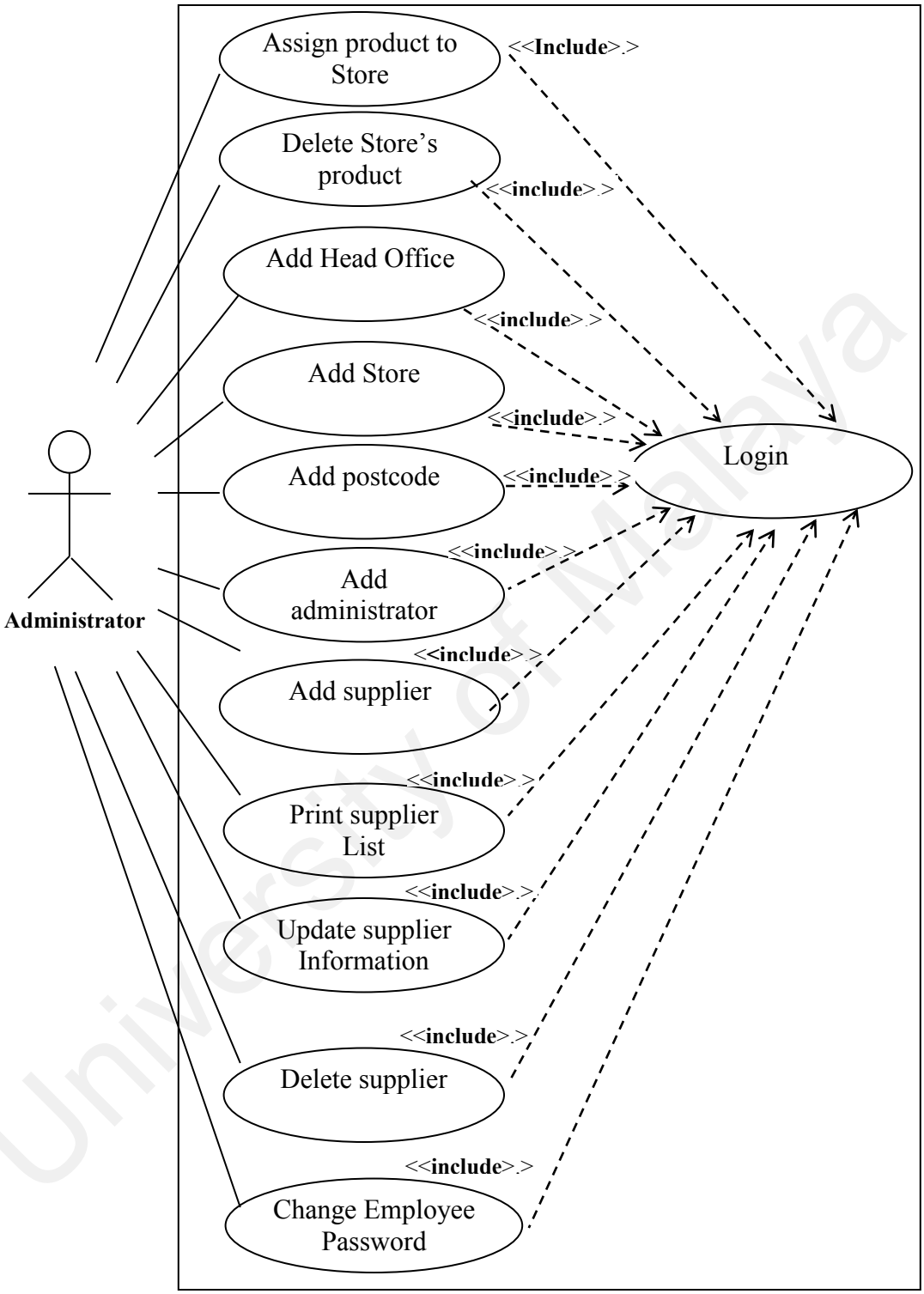


Figure 4.16: Store Manager Use Case Diagram

4.3.2 Nonfunctional Requirement

Non-functional requirement refer to a requirement that relates to system features such as performance, user friendly, and etc.

In the case of ODSS-RCS, the non-functional requirements identified are:-

- Each HO and its store has independence in relation to the order.

- Multiple user access level (administrator, customer, store manager, Head Office Manager and staff).

- **Security issues,**

Because the system is an online system, there are some security requirements that are implemented in the system in order to be more secure, such as.

1. **Session**.
    i. A specific visit to the system should end when the user has taken no further action after a given period of time.
    ii. If a user copies the Address bar when he/she logs-in into his/her account then paste it in other page, it doesn't open.
2. **Encryption**:
    i. Encrypt all transfer data between client and server.
    ii. Encrypt all passwords, credit card number and any important data in database.

- **User-friendly**
    i. Easy-to-use
    ii. Simple interface.

- **Reliability**
    i. Automatic e-mail sent to customer

4.4 Summary

This chapter discusses the analysis of the surveys given to customers and related companies as a type of potential users, after which the functional and non-functional requirements were listed. UML use case diagram was used to define the requirements and the interaction with the actor.

Chapter 4: System Analysis

Chapter 5

System Design

5.1 Introduction

System Design covers the activities of determining detailed requirements, design of data/information flow, design of database, physical design, and design of hardware/software configuration.

In system design the researcher uses more than one model for development to define the relationships between the requirements, involving functional design, software architecture, business process or workflow design, user accessibility and database design. This chapter shows some of these designs.

5.2 The General Process Flow of ODSS-RCS

The online decision support system for retail chain stores (ODSS-RCS) depends on a customer's address postcode to define a customer area. In addition, it depends on the lowest cost of delivery to determine which store should deliver an order for a customer. Figure 5.1 shows the general process for ODSS-RCS.

A customer must have a user name and password before he/she can purchase on-line, therefore when a customer wants to create his/her account, three categories of information should be entered. First the address must be entered; the customer can enter one, two, or three addresses. This should essentially include the home or work place address, so the customer must enter the postcode for each of the address. In a second category, the customer should fill in the mode of payment. The customer has the choice of choosing for mode of payment i.e. by using a credit card, bank transfer, or cash on delivery. In the third category, the personal particulars are entered.

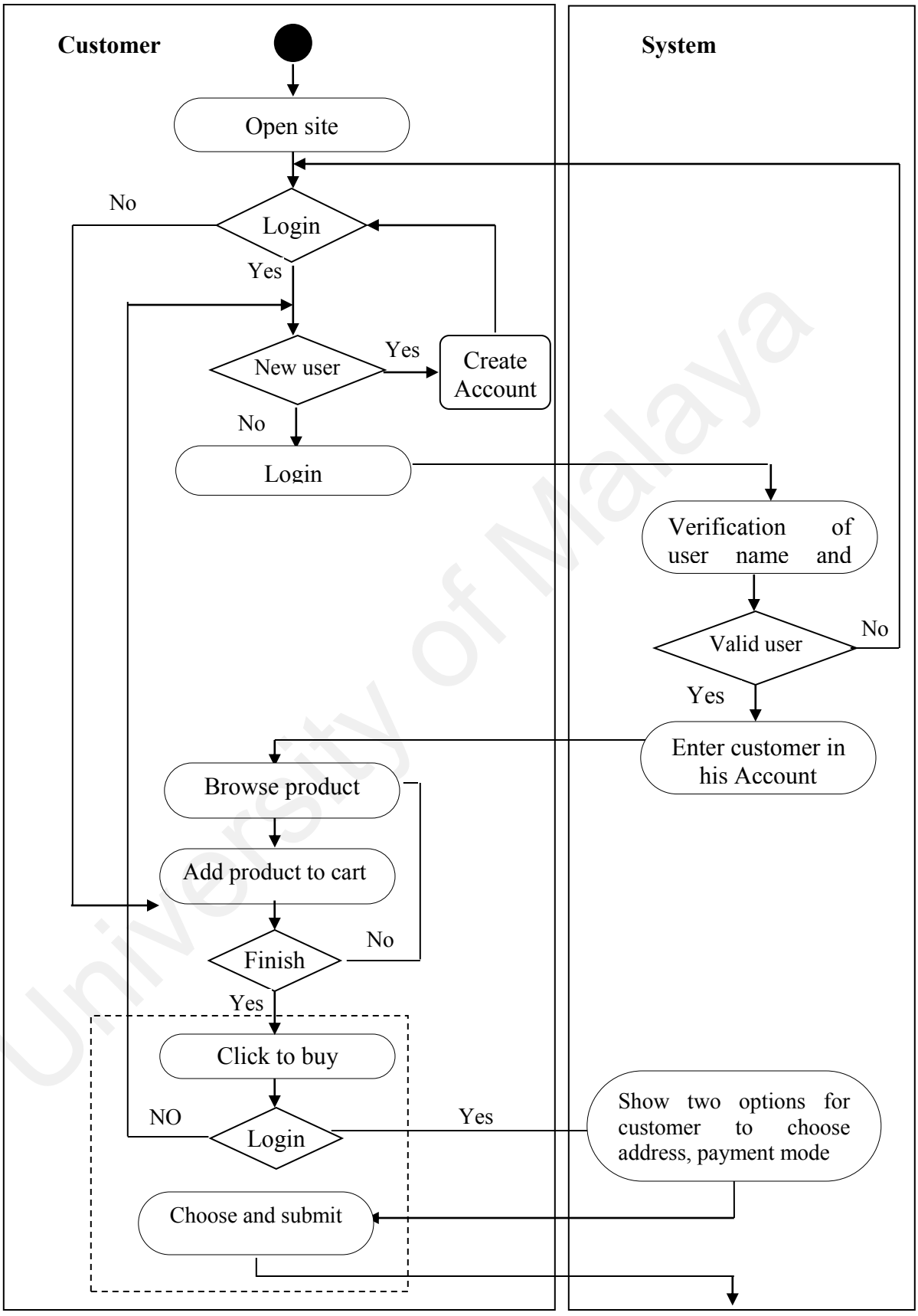
The consumer enters the online shop and can surf and roam in the shop and then add product(s) to his/her shopping cart before/after login to the system. The customer has the option of removing product(s) that had been added to the cart. The system updates the shopping list with the new total amount and the new contents of the cart, and he/she can review the contents of the cart. If the consumer decides to buy a product, he/she must first login into his/her account if he/she has not login yet.

Next, when he/she clicks to buy the content of cart (checkout), the system opens a page which has two options. The first option is to choose where the customer wants to receive the order, and the second is to choose the mode of payment. The customer would then click to submit what he/she has chosen. The system displays a message to the customer showing that the purchasing order is complete.

Subsequently, the ODSS-RCS will find the nearest store depending on the lowest cost of delivery, and then the system will reserve the product in the selected store. The process is complete when an automated e-mail is generated and sent to the customer informing the customer of his/her order and requesting for confirmation. The staff would then process the order by checking the mode of payment, issue an invoice and later deliver the product to the customer.

5.3 Structure of Organization for ODSS-RCS

When developing the system, a broad understanding of the organizational structure for retail chain stores that will be supported by the system is needed, such as the organization head offices (HO) and its stores, and the relationship between them. This is because ODSS-RCS depends on postcode and the lowest cost of delivery to deliver an on-line order, therefore a picture of the structure of the organization, and how it relates the head office with its stores is required.



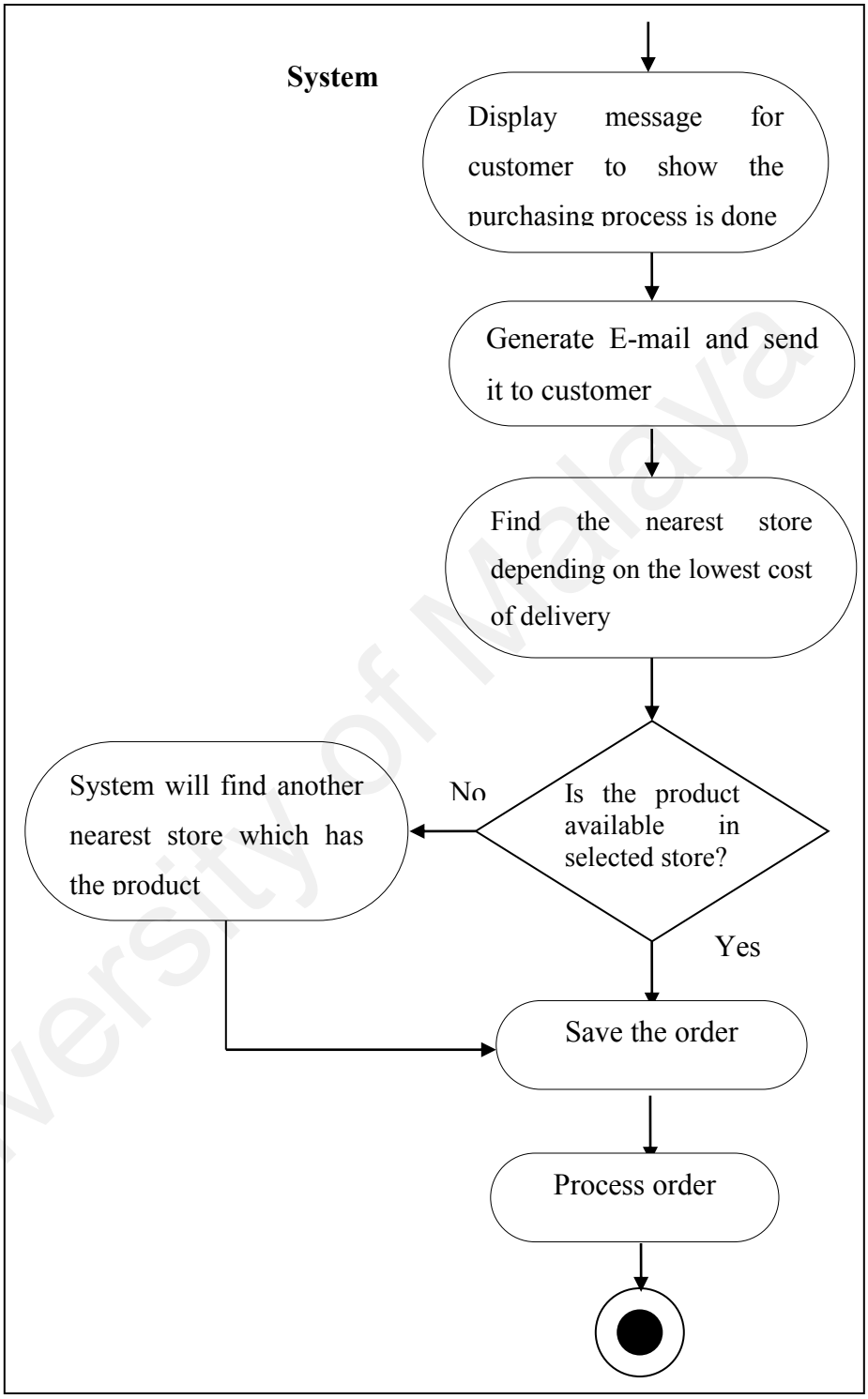


Figure 5. 1: General model for OPS-DSS

Figure 5.2 shows the structure of the organization which will be supported by the system; it shows the head offices and stores and the relationships between the stores and the HO. It consists of a root that represents the regional main office (Mother Company), and a set of rectangles representing the head offices and a set of oval nodes representing the stores. All of them are going to distribute products except the root which is considered the managerial office (regional office). It is assumed that each HO and its stores are within a country, city or area and are independent of other HOs and their stores pertaining to delivery orders, inventory management, and others process related to orders.

Whenever a store doesn't have an ordered product, then the system finds the next nearest store which has the product that can be delivered at a minimal cost. The system will search for the nearest store in the domain area (nearest subset stores) from the customers' address in the order.

Another issue that is considered during system design is that the nearest store to a customer's home address may be different from the nearest store to a customer's work address and so on, but there is the possibility that both are in the same area, therefore the order should be delivered by a store within same area. There is also the possibility that the customer's home address is in a different area than the customer's work address or other addresses, therefore the HO and the stores that will deliver and manipulate the customer orders for the home address is different

from the HO and its stores that handles the order for the work address, or other addresses.

Note: The discrete lines in Figure 5.2 shows that the ODSS-RCS can serve another head offices and stores by adding a new head offices and/or adding new stores to the system.

5.3.1 Justification for Decentralization from Head Office

A decentralized structure for retail chain stores can be a powerful engine for improving store efficiency for an organization by giving store managers the power to make decision. The disadvantage of giving too much power for managers is that a bad decision taken may erode the efficiency of the organization. So to increase the efficiency of organization and solve such a problem, a system which supports this structure of decentralized organization is built. The system allows office managers in the head offices as well as the office managers in the stores to generate report about the stores that relate to his/her head office in order, to improve the decision making process, and also support the decisions that had been taken. Good decision taken can act as good practice for the head office and its stores to emulate.

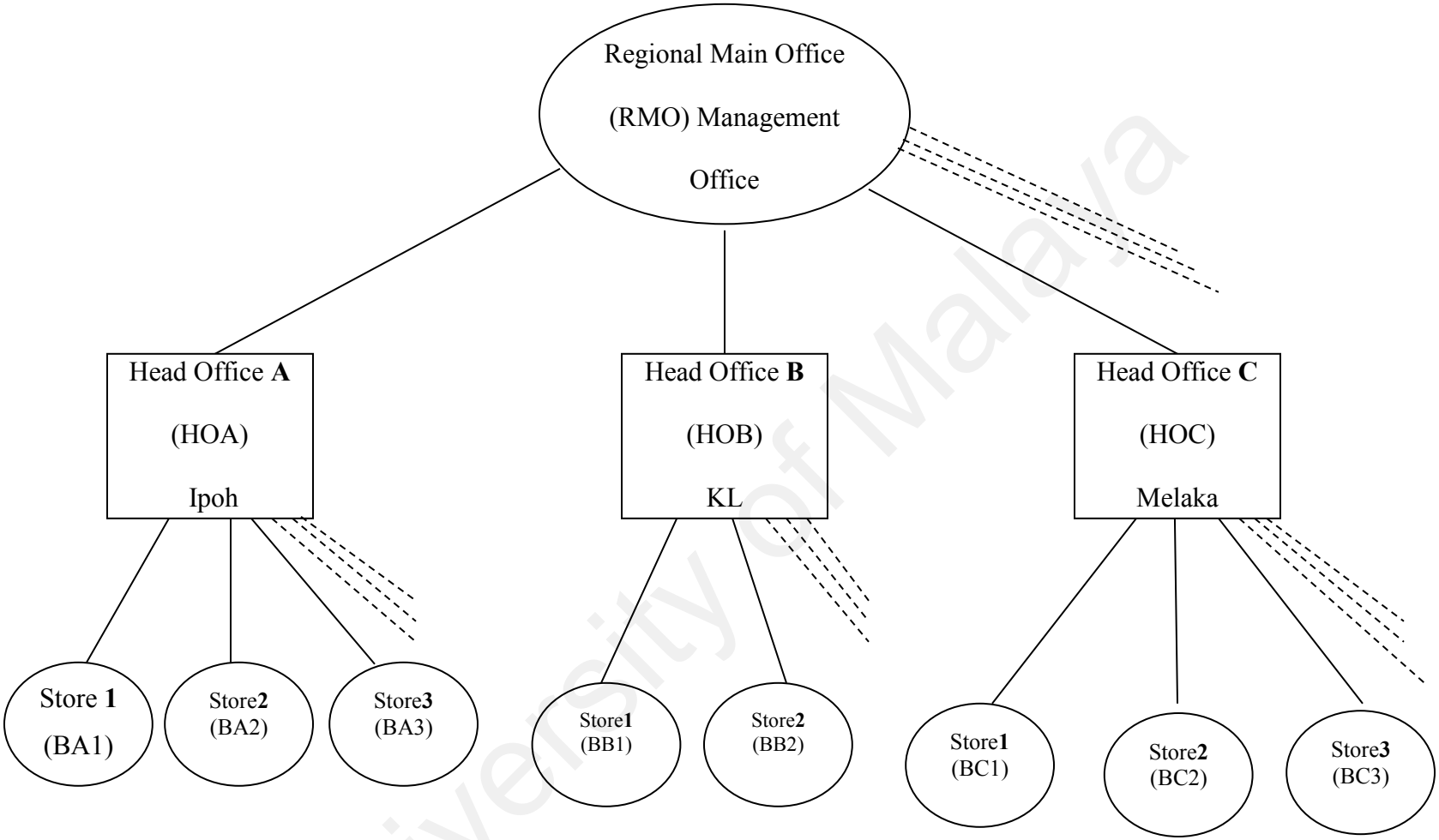


Figure 5.2: Organization structure that is supported by ODDS-RCS

5.4 How ODSS-RCS Finds the Nearest Store & Reserves Product

Based on a customer's postcode that was saved in the database, the system determines the nearest subset stores to the customer, and then depending on the lowest cost of delivery, the system selects the nearest store to the customer that has the product in the customer's order, and directs the company to deliver the product(s) to his/her given address. Figure 5.3 shows how the system determines the nearest store and how it reserves orders in the selected store depending on the postcode, and the cost of delivery.

In the event that the selected store does not have all or some of the products, then ODSS-RCS will reserve the available product in the selected store and then find another nearest store, depending on the lowest cost of delivery, to complete the customer's order.

In the case that the HO and all of its stores (nearest subset stores) do not have a product that is in the customer's order, then ODSS-RCS will register this order in the HO, and then the management will make a decision about this order, i.e. they may direct the supplier to supply the product, and then deliver the customer's order. This means ODSS-RCS does not check another HO and its stores because it is assumed the other HO are in different areas or states.

Note: In the case where the first selected store does not carry a product in a customer's order and a second store is selected to deliver that product, the system will attach a note in the customer's order form of the first store stating the name of the second store selected to deliver the product.

5.4.1 Find the Lowest Cost Stores of Delivery

ODSS-RCS finds the nearest subset stores to a customer, and then from the subset of stores, finds the store which can deliver the customer's order with the lowest cost of delivery. Depending on the lowest cost of delivery, ODSS-RCS will find another nearest store to the customer in the case that the selected store does not have a product in the customer's order this subset of stores represents one HO and its stores.

When a customer buys from ODSS-RCS, the system will determine the customer's area from the customer's postcode in the shopping address of the order. Then, the system will check if the products in the customer's order are available in the selected store depending on the lowest cost of delivery. If the store has the products, the system will reserve them in the store and stops searching other stores. But if the product does not exist in the first selected store, the system will find another store with the next lowest cost of delivery. This process will continue until either all products in the order have been reserved or when all stores in the HO area have been searched. In the case that the system does not find a product in the subset of stores, the system will register the product in HO.

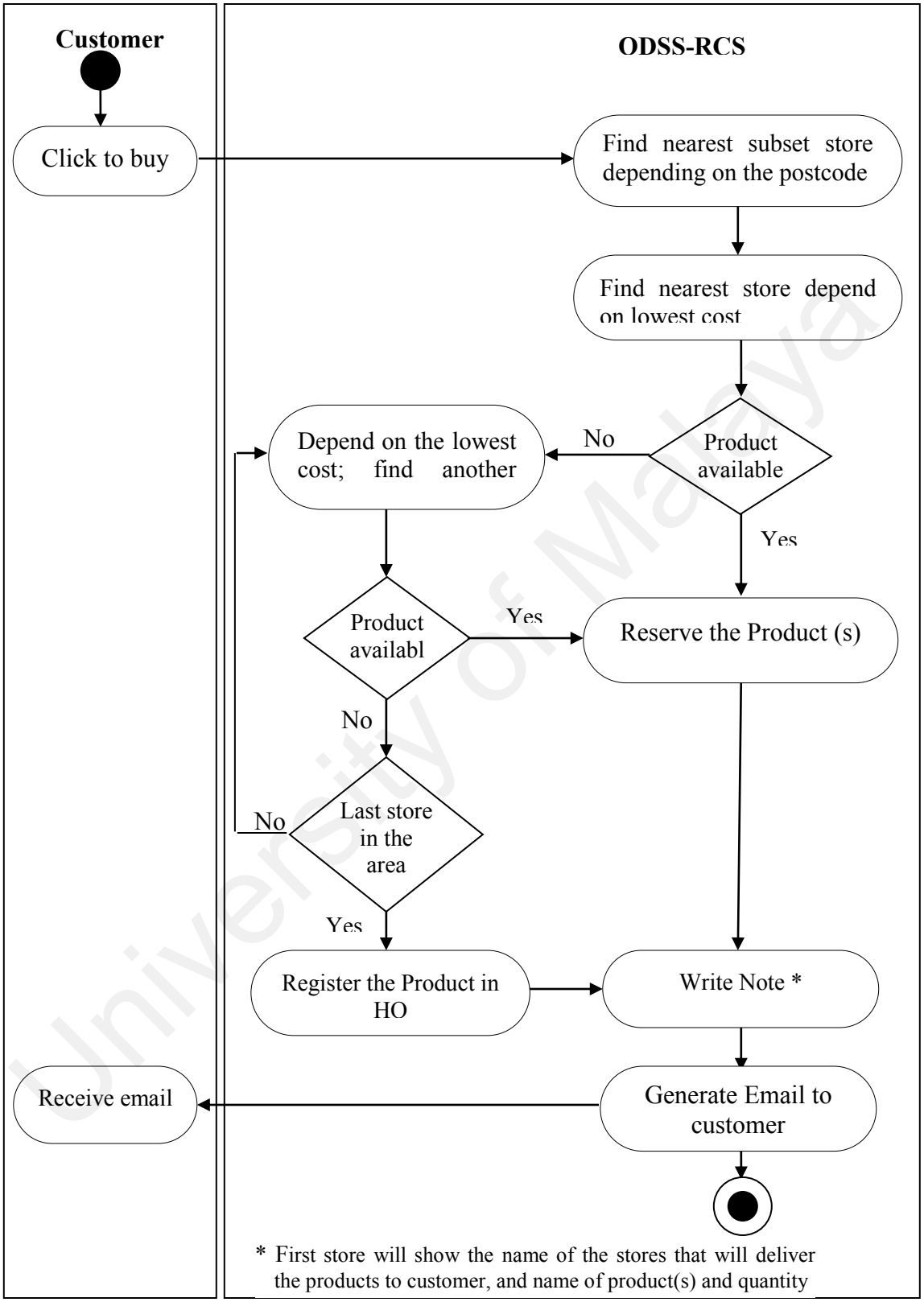


Figure 5.3: Activity model shows how the system finds the nearest store(s) that has the customer's product

Figure 5.4 shows a graph that represents a subset of stores areas, and a customer' area. A node represents the store area, and the numbers on the lines represent the cost of delivery for an order between two areas.

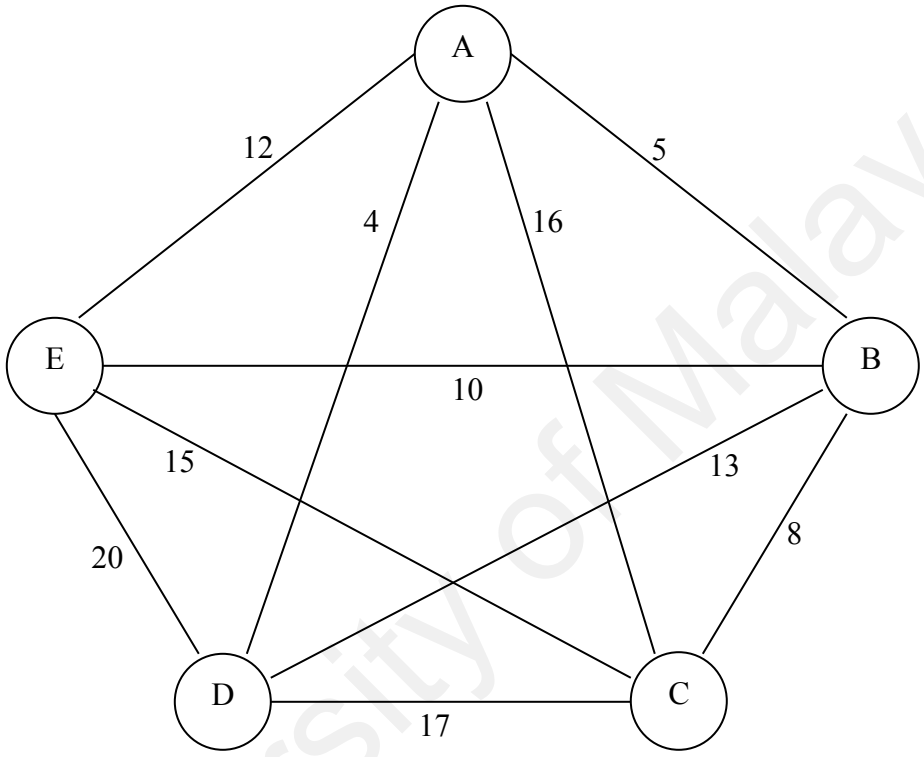


Figure 5.4: Represents a subset of store areas and the cost of delivery between them

According to Figure 5.4, the system will keep finding stores and check for a product in the customer's order until either all products in the order have been reserved or when all stores in the HO area have been searched. The process is shown below:-

❖ If the customer is in **area A** the system will check the stores as follows:-

A $\xrightarrow{\text{Then}}$ D $\xrightarrow{\text{Then}}$ B $\xrightarrow{\text{Then}}$ E $\xrightarrow{\text{Then}}$ C

This is because the system will always refer to customer area, as it is the customer's area. Therefore, the lowest cost of delivery for each store always refers to area A.

❖ If the customer is in **area B,** the system will check the stores as follow

B $\xrightarrow{\text{Then}}$ A $\xrightarrow{\text{Then}}$ C $\xrightarrow{\text{Then}}$ E $\xrightarrow{\text{Then}}$ D

The lowest cost of delivery for each store always refers to area B.

❖ If the customer is in **area C** the system will check the stores as follow

C $\xrightarrow{\text{Then}}$ B $\xrightarrow{\text{Then}}$ E $\xrightarrow{\text{Then}}$ A $\xrightarrow{\text{Then}}$ D

The lowest cost of delivery for each store always refers to area C.

❖ If the customer is in **area D** the system will check the stores as follow

D $\xrightarrow{\text{Then}}$ A $\xrightarrow{\text{Then}}$ B $\xrightarrow{\text{Then}}$ C $\xrightarrow{\text{Then}}$ E

The lowest cost of delivery for each store always refers to area D.

❖ If the customer is in **area E** the system will check the stores as follow

E $\xrightarrow{\text{Then}}$ B $\xrightarrow{\text{Then}}$ A $\xrightarrow{\text{Then}}$ $\xrightarrow{\text{Then}}$ D

The lowest cost of delivery for each store always refers to area E.

5.5 Customer can purchase in a Convenient Way

Customers can buy in a convenient way through ODSS-RCS and this can increase customer's satisfaction. The customer can add, and update the cart before or after logging-in to his account. When the customer decides to buy the content of the cart, he/she clicks the "buy" button; if he/she has yet to login into the system, the log-in page is displayed, but if he/she has login, the system opens a new page that offers two choices i.e. to choose the address and the mode of payment. Figure 5.5 shows how a customer purchases products on-line after login.

First, choosing an address implies where the customer wants to receive the order. He/she may probably wants to receive the order at home, or at work and any other address determined by him/her. The customer already has at least one address saved in the system. The customer can choose an address which has been already saved in the system, or choose a new address.

Second, in determining the mode of payment either by credit card, or bank transfer, or by cash on delivery, the customer once again chooses an option that has earlier been entered into the systems. Once this is done, the customer clicks the submit button. Then, the system can generate a message confirming that the purchasing order transaction is now complete. In addition the system generates an email which has the order details, and send it to the customer.

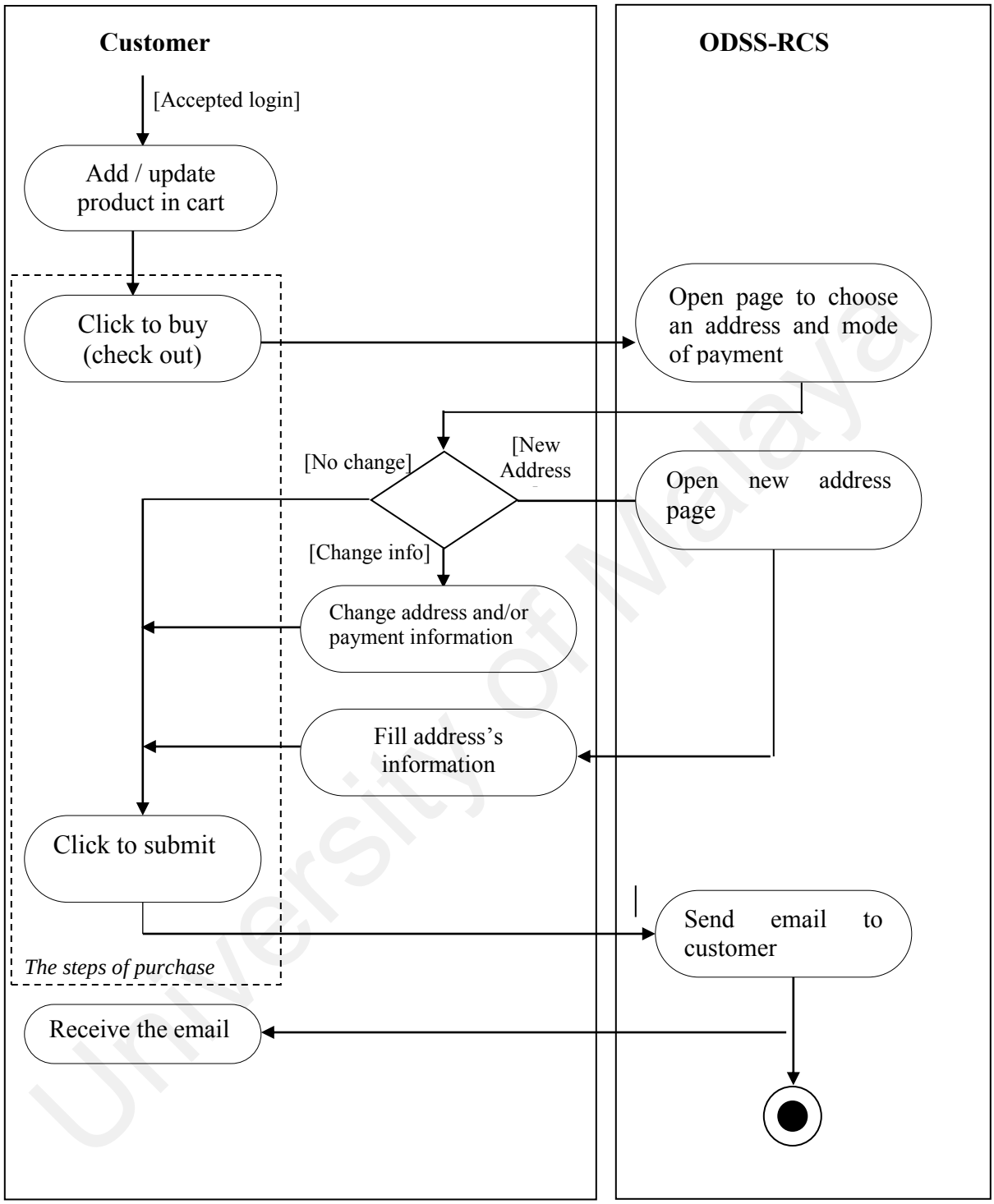


Figure 5.5: Activity model shows how customers buy (check out) from the online shop.

5.6 Database Design

When conceptualizing the database design for ODSS-RCS, several issues need to be taken into consideration. The organization structure that will be supported by ODSS-RCS consists of several head offices and each one has several stores under it. A head office and a store may have different amount of products, and different suppliers. In addition, each HO and stores have deferent type of staff and each one has different responsibility. Therefore, there is a need to determine what is the data related to each store and etc.

Also, a customer has more than one address to choose from when purchasing goods online. The database design of ODSS-RCS should allow customer to access data pertaining to personal information, payment, and address information such as home address and work address. Each address is important as it has different postcodes whereby, consequently different orders may be served from different stores.

The database should be designed in a proper way that avoids any possibility of a problem and whereby data can be manipulated easily. Figure 5.4 shows the tables and the relationships between them in the database for ODSS-RCS. The description of DB tables description shown in Appendix G.

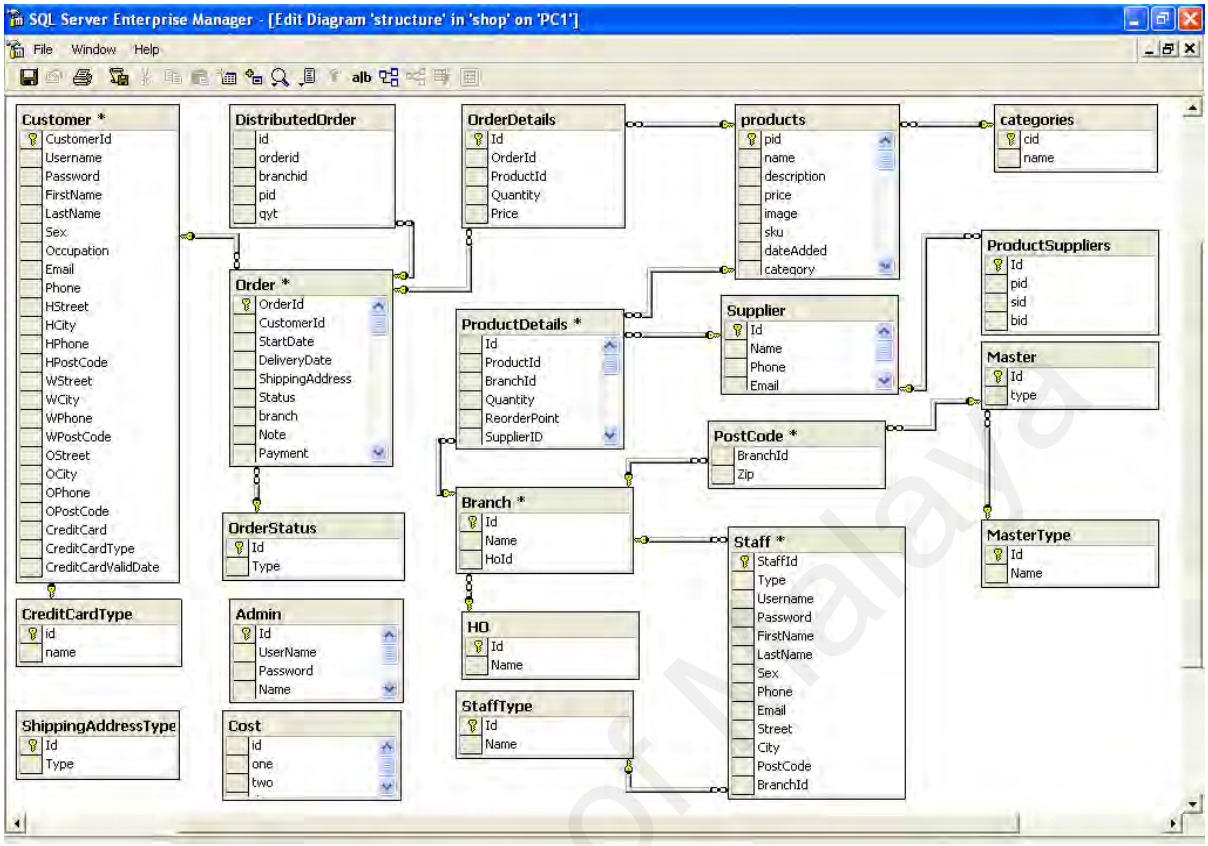


Figure 5.6: Database of ODSS-RCS

5.7 System Architecture

The selection of architecture or a development approach can be critical in ensuring that a system will meet the changing demands of an organization structure. Therefore, scalability and the total cost are important factors which should be considered here (Davis, 2005). Thus, software architectures play a major role in determining the quality, reliability and maintainability of a system (Wasserman, 2005). Web-based applications are multi-tier applications, which sometimes are

referred to as n-tier applications. Multi-tier applications divide functionality into separate parts; it shows how application functions transmit or share information, and connections that show how the various program operations are activated. Although tiers can be located in the same computer, the tiers of Web-based applications typically reside on separate computers (DEITEL, 2004).

5.7.1 ODSS-RCS Architecture

Figure 5.7 represents the basic structure of ODSS-RCS, which is a three-tier architecture. The information tier maintains data pertaining to the system. So in the system, these tiers will store data in a relational database management system (RDBMS) using a Structured Query Language (SQL) 2000 server. The researcher uses the ODBC to store and retrieve data from the SQL 2000 server database, and use ASP in developing the system.

The database contains customers information, such as user names, home addresses, work addresses with post code for each address and credit-card numbers. The same database has information about stores and head office (e.g. stuff, product information, quantities of stock, and reorder point for each product in each store), and supplier information. So information tier can consists of databases, which together contain the data needed for ODSS-RCS. This is the main reason for putting the database in one server as it will be more efficient.

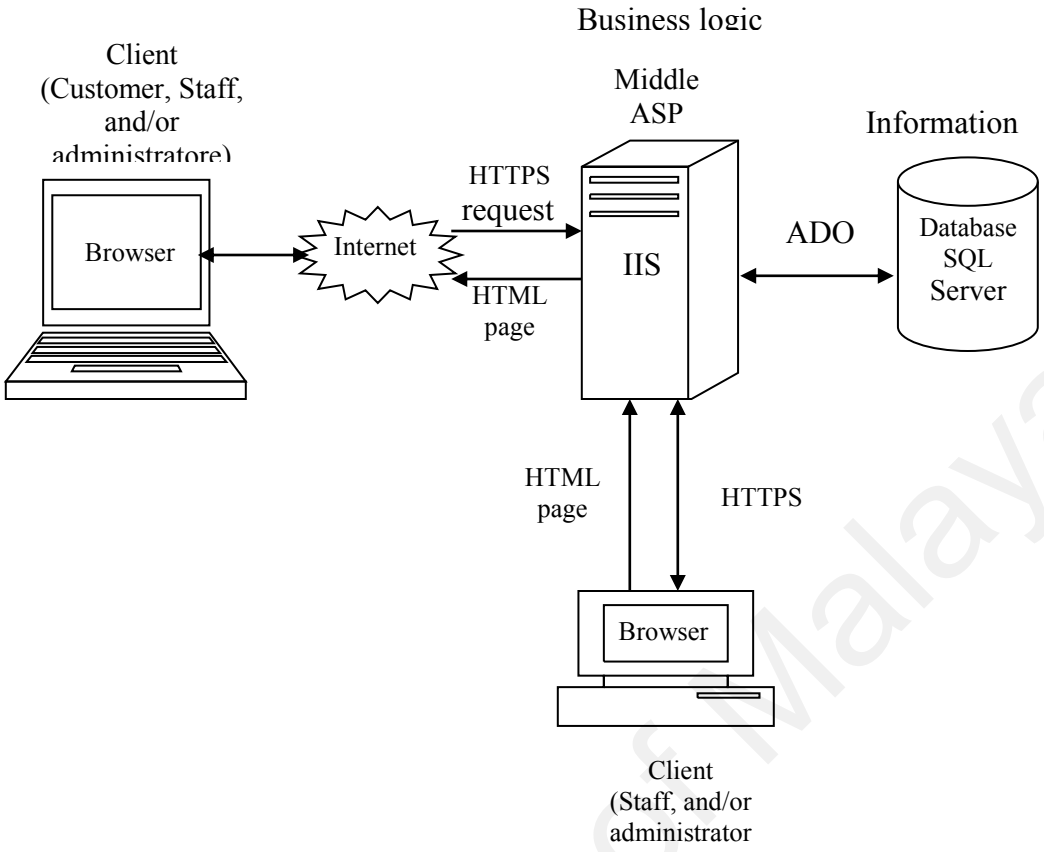


Figure 5. 7: ODSS-RCS Architecture

The client tier is the application's user interface, which is a web browser. Users interact directly with the application through the user interface (e.g. Customers interact with the main online shop pages, staff interacts with staff area pages, and administrator interacts with admin pages). The client tier interacts with the middle tier to make requests and to retrieve data from the information tier. The client tier then displays to the user the data retrieved from the middle tier. This will depend on user's authentication.

The middle tier implements ODSS-RCS (i.e. business, controller, and presentation logic) to control interactions between application clients and application data. The middle tier acts as an intermediary between data in the information tier and the application's clients. The middle-tier controller logic processes client requests such as requests to view personal information and retrieves data from the database and this depends on user authentication. Business logic in the middle tier enforces business rules and ensures that the data are reliable before the server application updates the database or presents data to users. Business rules dictate how clients can and cannot access application data and how applications process data (e.g. manager store can generate report that staff can't generate).

5.8 User Responsibility & Authentication

To increase the efficiency and effectiveness of ODSS-RCS, it is important to determine that only authenticated users can access the modules that are authorized for them to use. The users of ODSS-RCS can be categorized into:

i. **General users**, i.e. the on-line customers.

ii. **The retail chain store staff.** In general, they are responsible for managing the retail chain stores. The staff can be further categorized into:

1. **Manager of head office.** The managers are responsible for managing the head office store, so a manager of HO can generate reports of his store and all the stores that are under his HO, but he can not generate reports of other HO.

2. **Manager of Store.** Refers to the staff in charge of managing the store, generate reports, pertaining to his/her store and managing inventory in his store. The manager for a store can not manage or generate reports for another store.

3. **Staff.** Refers to the normal staff of a head office or of a store, whereby they manage the customers' orders and the daily activities that are related to their stores. They can not manage customers' orders of another stores.

iii. **Administrator** refers to the staff in charge of maintaining the system, and he/she can create, delete, and update information of an employee, a product, a HO, a store, and a supplier.

Each of the users identified above has access over certain modules and sub-modules of ODSS-RCS, as shown in Tables 5.22 - 5.24.

Table 5.1: Staff authenticated for inventory control and order in ODSS-RCS

	Inventory Control								Orders							
	Stock Adjusting				Determine Min quantity of product				View/ Update Order Status				Add Note			
	HO	S1	S2	S3	HO	S1	S2	S3	HO	S1	S2	S3	HO	S1	S2	S3
Administrator																
Manager of HO	✓	V	V	V	✓	V	V	V	✓	V	V	V	✓			
Staff of HO									✓				✓			
Manager of S1		✓				✓				✓				✓		
Manager of S2			✓				✓				✓				✓	
Manager of S3				✓				✓				✓				✓
Staff of S1										✓				✓		
Staff of S2											✓				✓	
Staff of S3												✓				✓

Note: 1) **V** in the table means that the head office Manager can view the module.

2) S1, S2, and S3 mean stores under a head office.

Table 5. 2: Staff Authentication for Generate Reports in ODSS-RCS

	Reports																											
	View Orders				Issue of Invoice				Print Inventory Needed				Print Inventory Status				Print supplier List				Stock vs. Reorder Point				Sales Performance			
	HO	S1	S2	S3	HO	S1	S2	S3	HO	S1	S2	S3	HO	S1	S2	S3	HO	S1	S2	S3	HO	S1	S2	S3	HO	S1	S2	S3
administrator																	✓	✓	✓	✓								
Manager of HO	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
staff of HO	✓				✓				✓																			
Manager of S1		✓				✓				✓				✓				✓				✓				✓		
Manager of S2			✓				✓				✓				✓				✓				✓				✓	
Manager of S3				✓				✓				✓				✓				✓				✓				✓
Staff of S1		✓				✓				✓																		
Staff of S2			✓				✓				✓																	
Staff of S3				✓				✓				✓																

Table 5. 3: Authentication users in ODSS-RCS

	Product Categories			Maintenance of products					Managing Employees						Manage the Suppliers			Stores		Online Purchasing		
	Add Category	Edit Category	Delete Category	Maintenance of products	Edit Product	Delete Product	Assign Product for Store	Delete Product from Store	Add New Employee	Update personal info	Change Employee position and/or store	Delete Employee	Change Password	Forget Password	Add New Supplier	Edit Supplier	Delete Suppliers	Add New Head Office	Add New Stores	Check out	Shopping Cart	Order history for customer
administrator	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Head Office Manager										✓			✓									✓
Store Manager										✓			✓									✓
staff										✓			✓									✓
customer										✓			✓							✓	✓	✓

5.9 Summary

This chapter describes the system design, i.e. the general model, purchasing model, and the find nearest-nearest store model used in ODSS-RCS. The database design and the system architecture were also described. In addition, the user-access authentications through the ODSS-RCS were also shown.

Chapter 5: System Design

Chapter 6

Implementation

6.1 Introduction

This chapter describes the tools that have been used in programming and the security issues that are implemented in the system. It basically shows the implementation of the proposed online decision support system for retail chain stores.

6.2 Development Tools Used

This section discusses the programming language along with the development tools used to develop ODSS-RCS as well as the web server, relational database management system and operating system employed during the development of ODSS-RCS.

6.2.1 System Development

The ODSS-RCS is developed using ASP 3, with VB script as the core programming language. In addition, it used JScript to support the checking of forms validation.

The relation database management system used to build the database for ODSS-RCS is Microsoft SQL server 2000, while Open Database Connectivity ODBC is used as the access method to access the data from the database management system (DBMS).

6.3 System Implementation

This section mostly shows the interface of each module, in each part of the system; i.e. in the customer area, staff area, and administration area.

6.3.1 On-line shopping site for customer

The online shopping site is considered the interface site for the customers. In this page, there are topics and areas for the customer to browse. Here, the customer can create an account, login, browse new products, create personal account, review customer account, review shopping cart and check out when he/she has decided to buy.

6.3.1.a Main Page

From the main page, a customer can do online shopping by adding a product to the shopping card. Besides this, the page displays the different products on sale, organized in different categories such as computers, laptop, mobile, printer, PDA, phone, and etc. Figure 6.1 shows the main site for the retail chain store. In addition there is another page called new product that has new products, so customer can see the new arrivals to the retail chain store. From the main page, a customer can browse many pages, i.e. new product, my account, shopping cart, checkout, and FAQ pages.

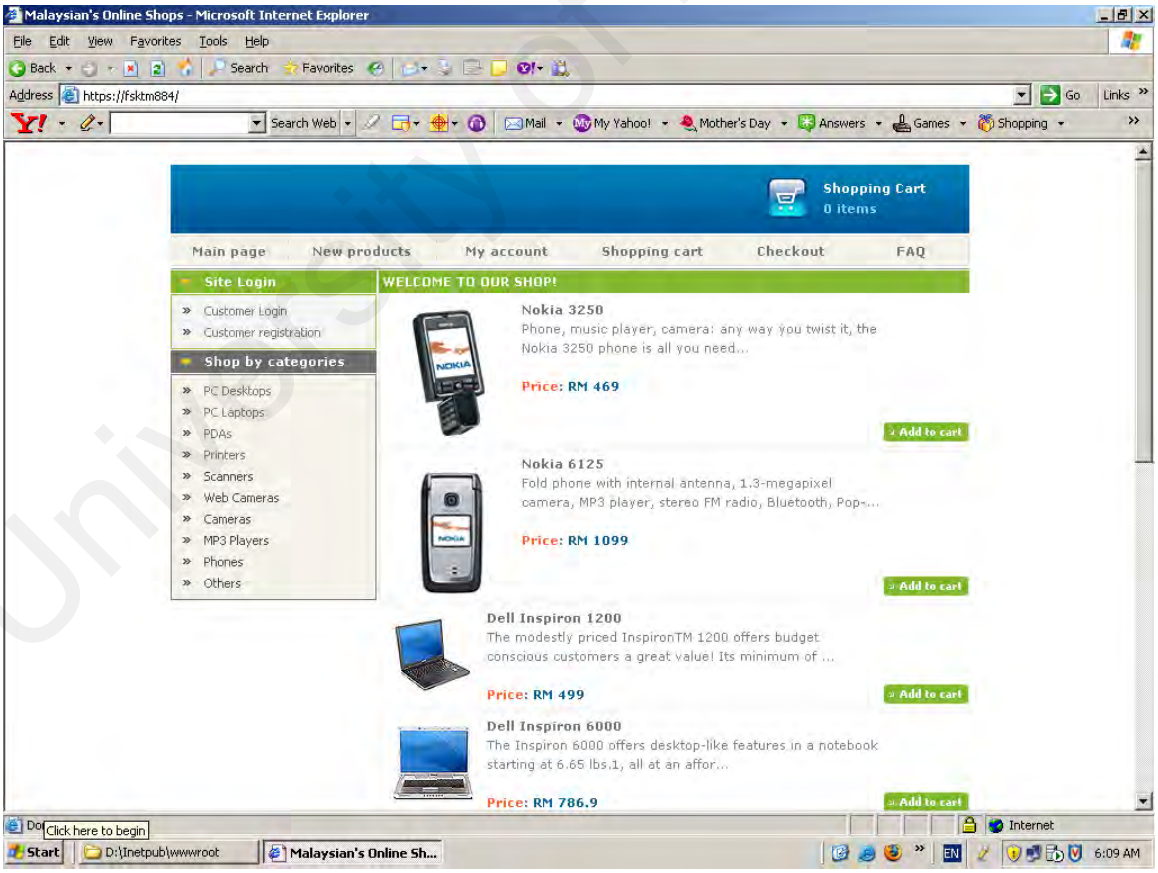


Figure 6.1: ODSS-RCS main shop interface

6.3.1.b Customer Account

A customer can create an account to get a user name and password so that he/she can buy in a convenient way instead of entering personal information each time. ODSS-RCS depends on the postcode to determine the customer's area, so it is compulsory for customer to enter at least one address with postcode, in addition to entering payment information such as credit card information. Figure 6.2 shows the page to create a new account, where a customer can enter his/her personal, information, mode of payment, and address information.

The customer must fill the field that have asterisk, such as user name, password, at least one address, credit card information, etc. when the customer clicks the submit button and there is unfilled fields, the system will show an error message. Figure 6.3 shows a message that instructs the customer to fill the important fields.

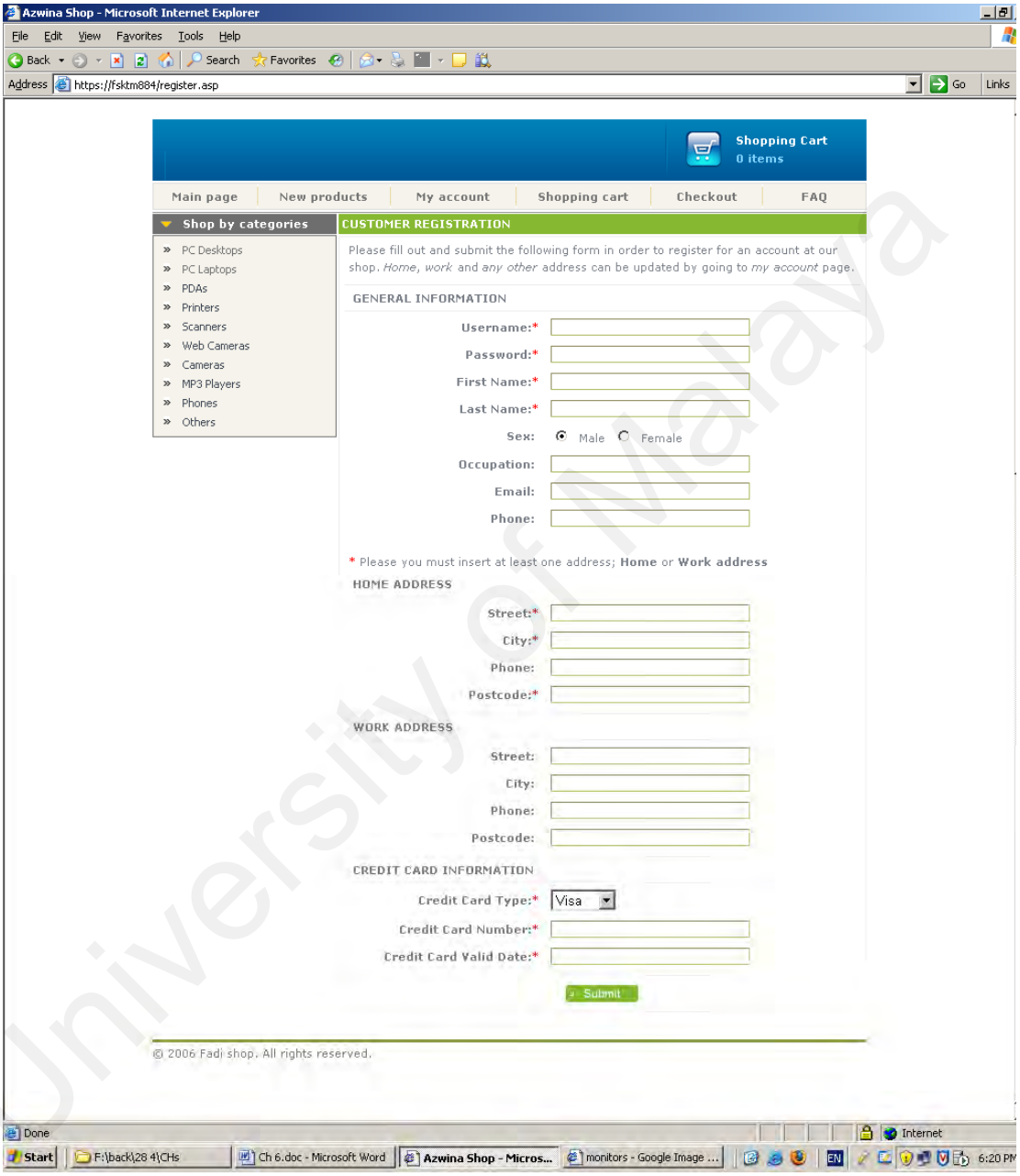


Figure 6.2: the web pages to create a customer account in ODSS-RCS.

Figure 6.3: the error message that will appear to instruct customers to fill an important field in registration form.

6.3.1.c Customer Login

Figure 6.4 shows the login page for customers in ODSS-RCS, a customer need to have his/her user name and password, and enter them correctly to login into his/her account.

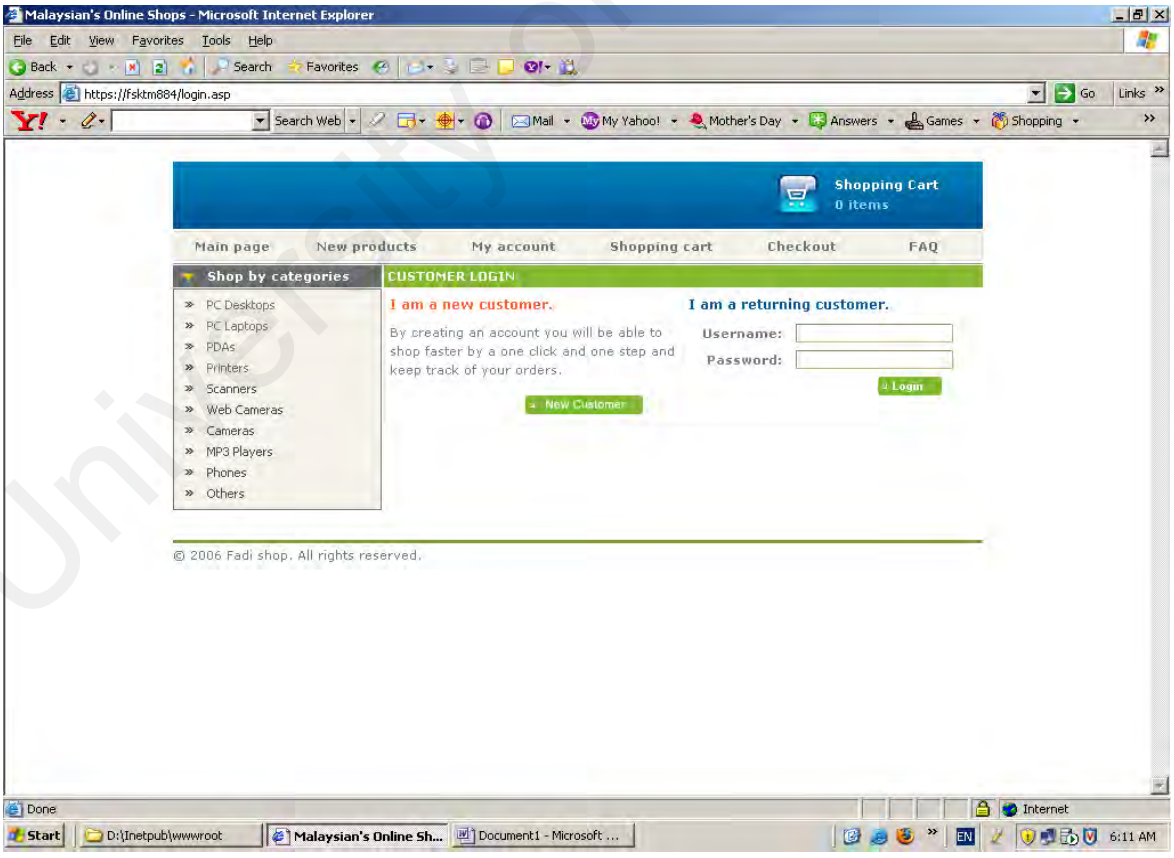


Figure 6.4: Customer login page.

6.3.1.d History data of Customer's Orders

ODSS-RCS allows customers to review their accounts; In this section a customer can review the history of past orders that he/she has bought from the online retail chain shop, e.g. review all orders, review specific orders, or review an order between two periods. Figure 6.5 shows the interface for the option to check order history. In addition to this, customers can change password, personal information, and/or any one of his/her addresses.

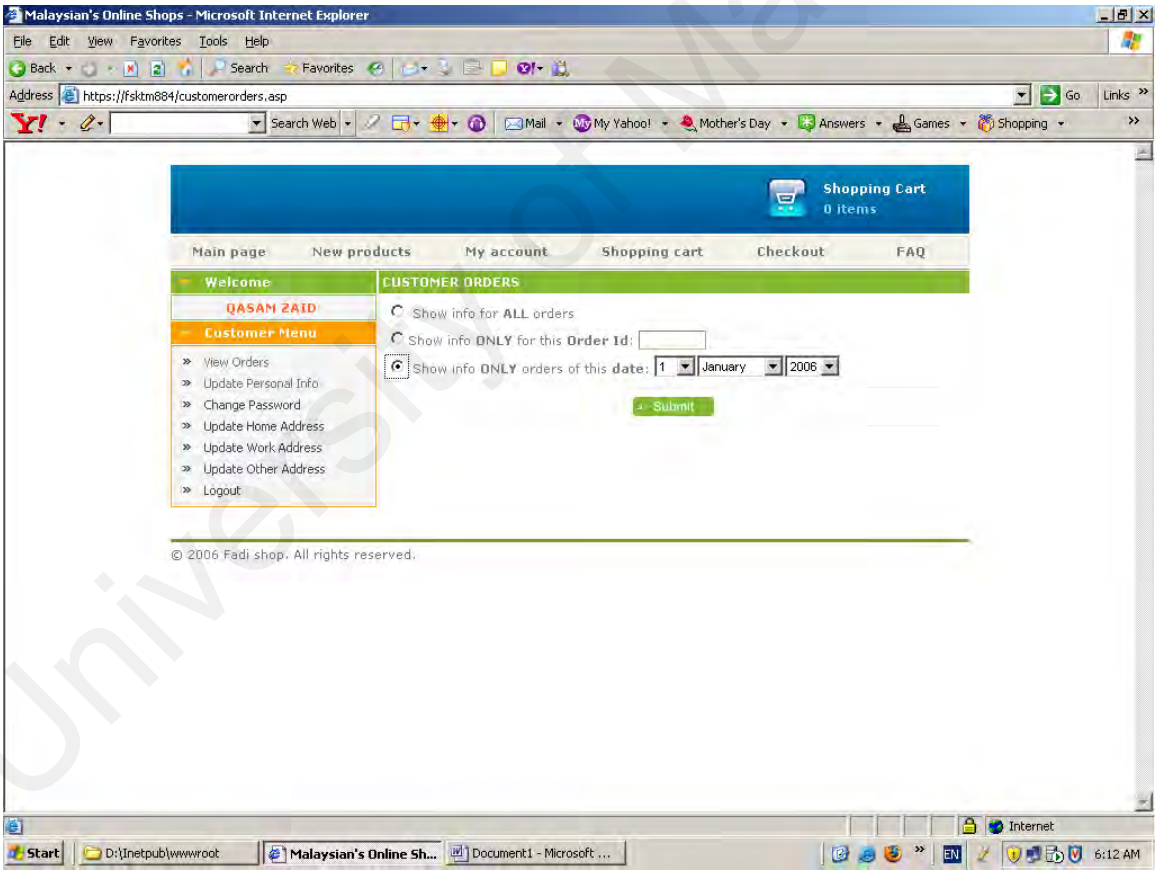


Figure 6.5: Customer views history of orders in ODSS-RCS

6.3.1.e Shopping Cart

Customer can add products to their shopping cart. Before a customer confirms the purchase, he/she can review, and/or delete, and add new product to it. Figure 6.6 shows how a customer can review his/her shopping cart. It also displays the price of each product.

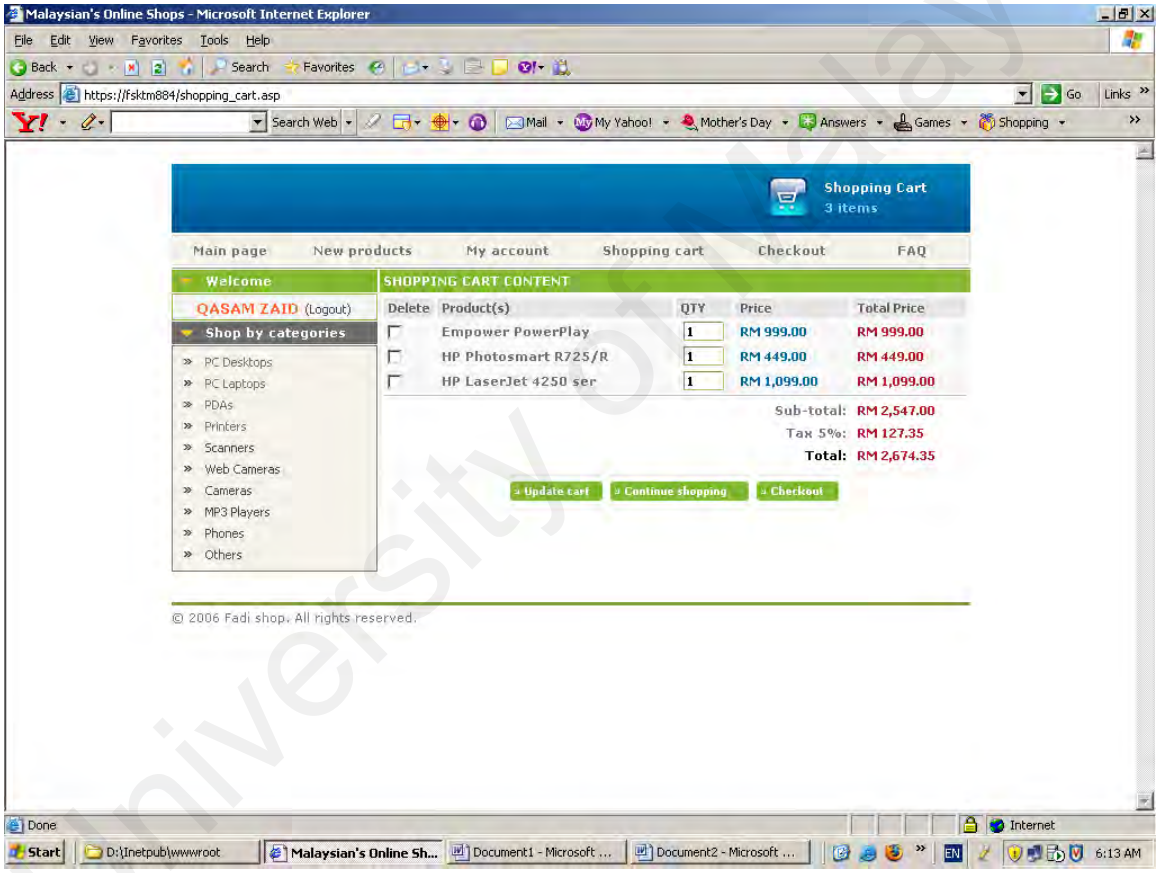


Figure 6.6: Customer review of shopping cart in ODSS-RCS

6.3.1.f Checkout

In ODSS-RCS, customers can buy in a convenient way. When a customer clicks to buy (checkout), and he/she has been logged in into his/her account, the system will open a page to enable the customer to choose the shopping address and the mode of payment, and submit it. Figure 6.7 shows the page where the customer selects an address and the mode of payment. In addition to this, the customer in this page can update an address, or/and payment information. Furthermore, the customer can fill in a new address if he/she selects another address. The customer can not select an address which he/she did not provide its information, so the combo box for this address will be disabled.

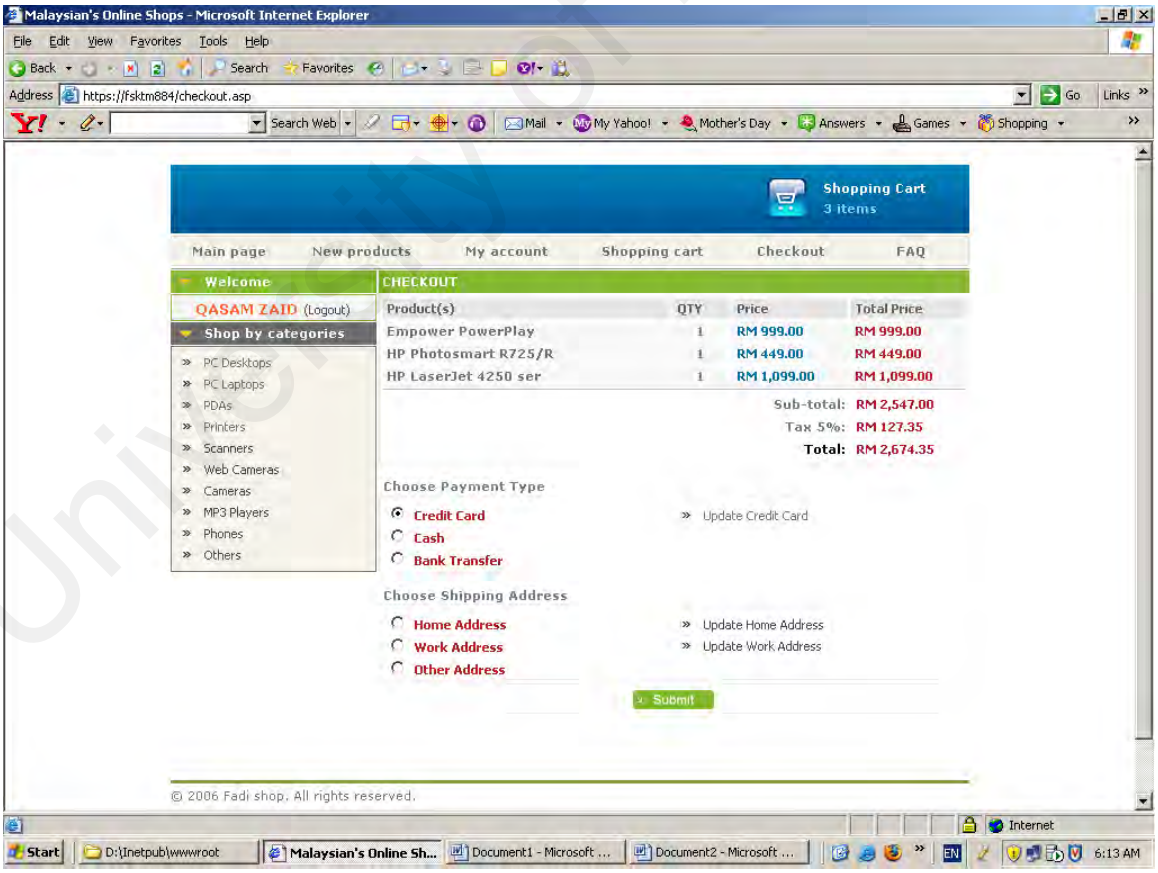


Figure 6.7: Interface for checkout page in ODSS-RCS

6.3.2 Staff Area

The second page is the staff area, whereby the staff can manage the stores from this page. When a staff logs in, the system can determine which store or head office the staff belongs to, and the type of staff, i.e. Store Manager, HO Manager, and normal staff. Figure 6.8 shows the staff login page. In addition, the system is able to provide information to a staff that is authorized to it. However, the staff is unable to see information pertaining to others. i.e. a staff belonging to Store (A) can not see information that is related to store (B), and so on. The head office manager has the right to see and generate reports on his/her HO and the stores that belong to this HO, but at the same time the HO manager can not see or generate reports for stores that does not belong to them.

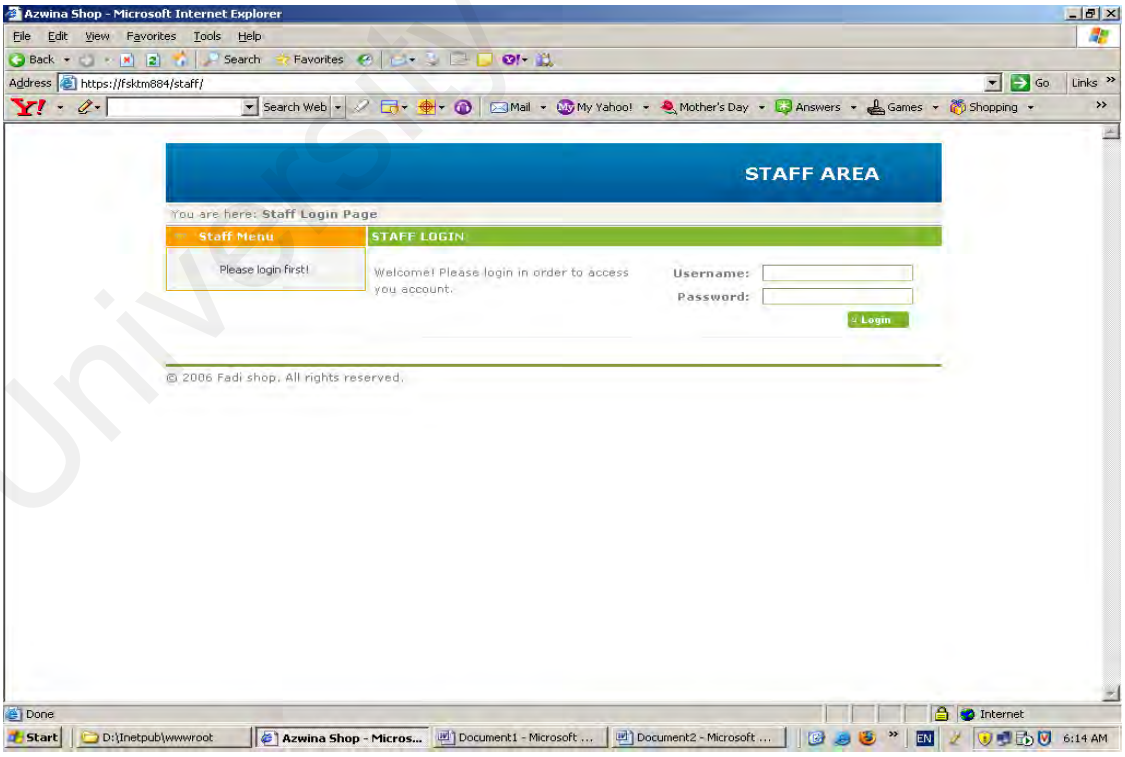


Figure 6.8: Interface of staff login page in ODSS-RCS

6.3.2.a Inventory Adjustment

Retail chain store has many types of products; ODSS-RCS is able to manage product inventory in each store. ODSS-RCS is makes automatic update for the stock in each store after purchases by customers. When a store receives a stock of product, the store manager can update the inventory in it. Figure 6.9 shows an example of the quantity and reorder point for several products in a store. The manager can click on the "adjust" link to enter a new quantity of a product in the store.

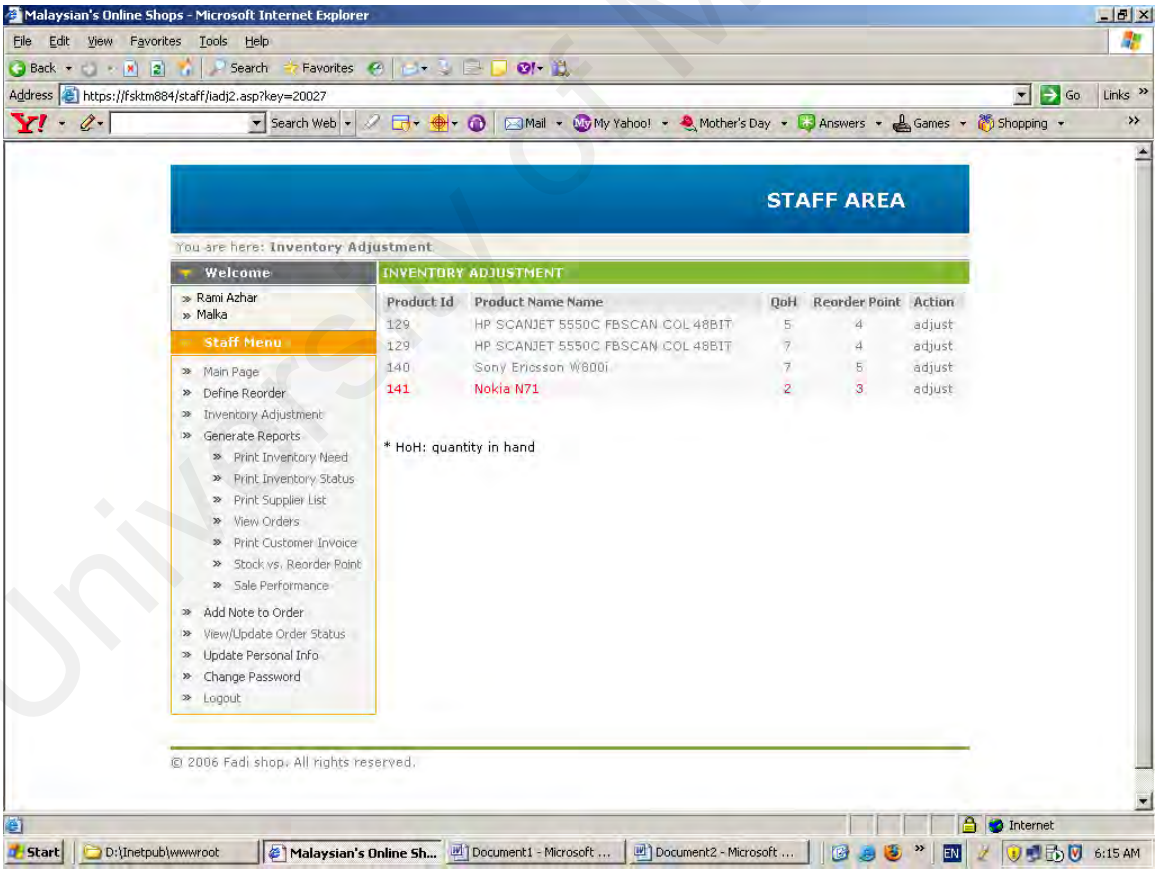


Figure 6.9: Interface for updating the inventory in ODSS-RCS by a store manager.

6.3.2.b Defining the Re-order Point

Depending on the sales index of a product, a manager of a store can define/redefine the re-order point of a product that is available in his/her store. This will help to keep a minimum quantity of product on hand in the store at all times. Figure 6.10 shows the interface for defining the re-order point for a product in a store.

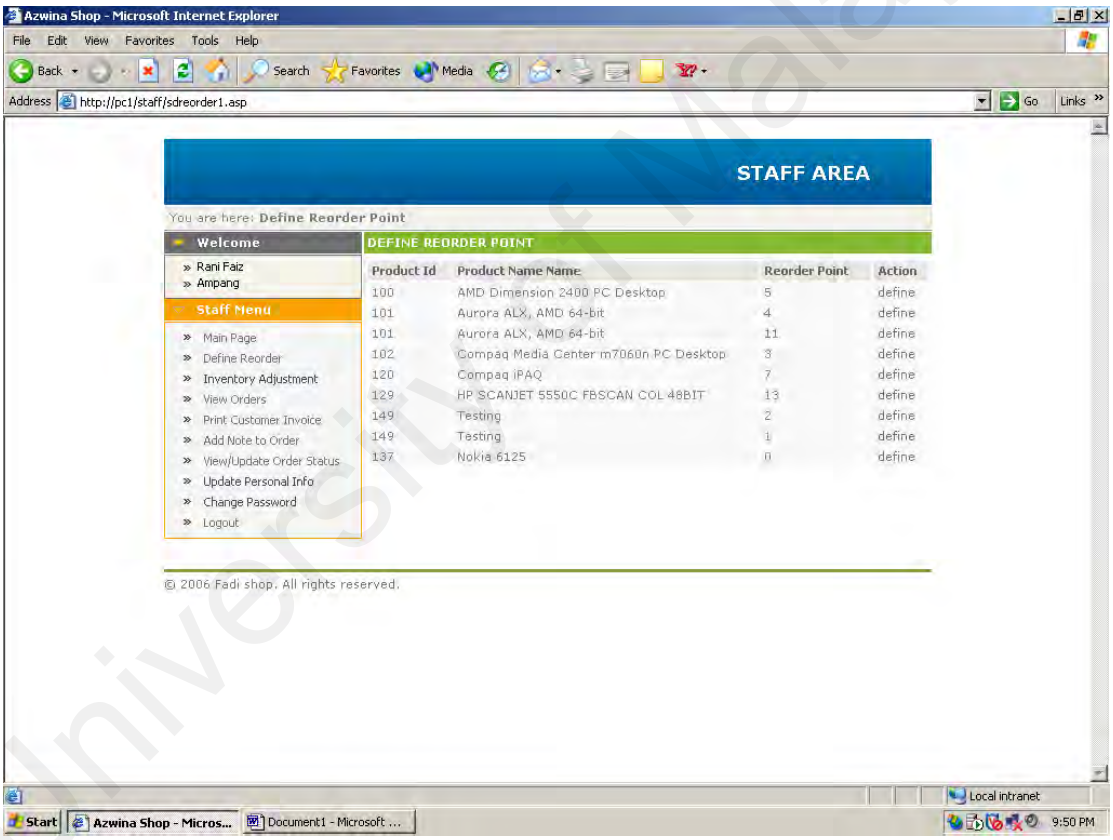


Figure 6.10: the interface for defining the re-order point for a product in a store.

6.3.2.c Generate Reports

ODSS-RCS helps managers to make a proper decision by generating reports on the stores that belong to them. This section describes the implementation of such reports. Head office managers can generate report for the stores that belong to their HO, but store managers can only generate reports to pertaining to their stores only. Figure 6.11 shows the list of stores that belong to a HO. The HO manager can select which store would generate the report, and then generate the report. But this option is not available to the store manager because he/she can generate reports pertaining to his/her store only.

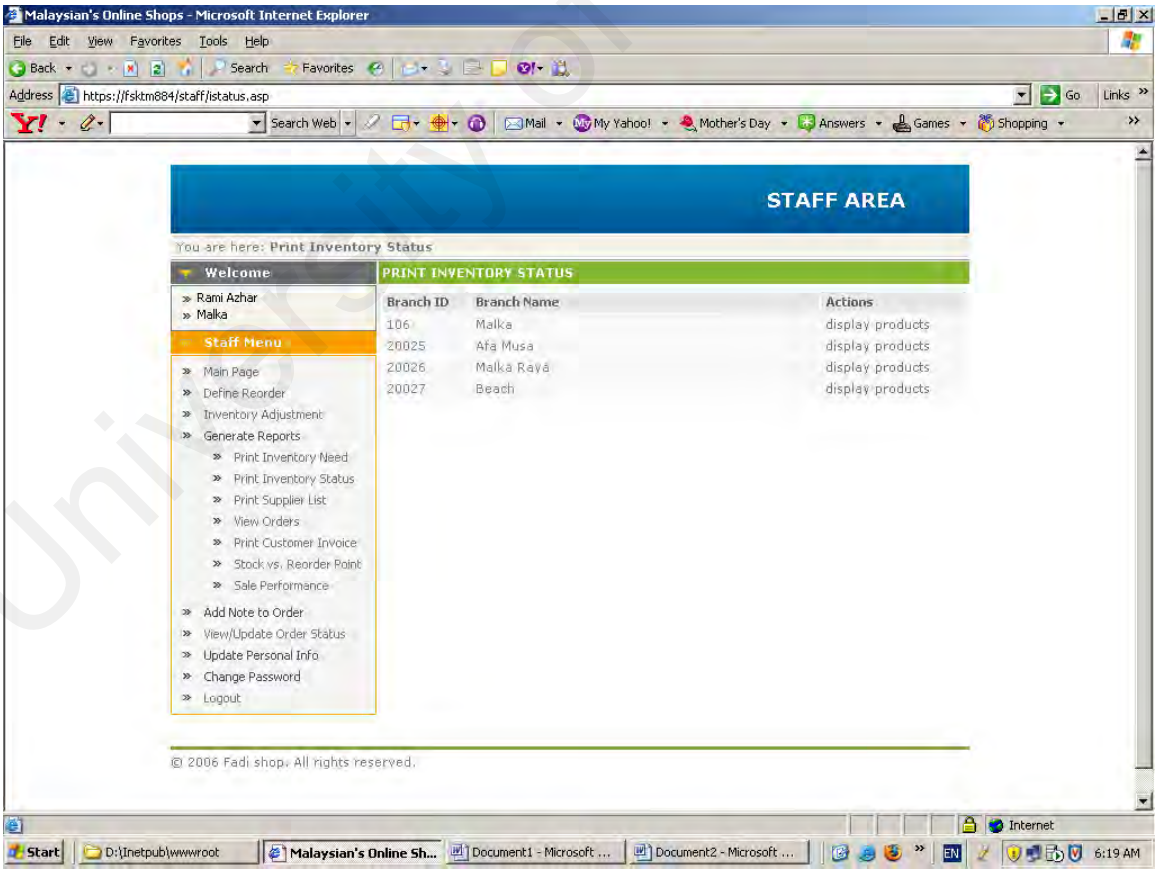


Figure 6.11: Interface of list of stores that belong to a head office.

➢ **Generate Report of Inventory Status**

A store manager can generate a report on the stock in his/her store. Figure 6.12 shows the inventory of products in a store.

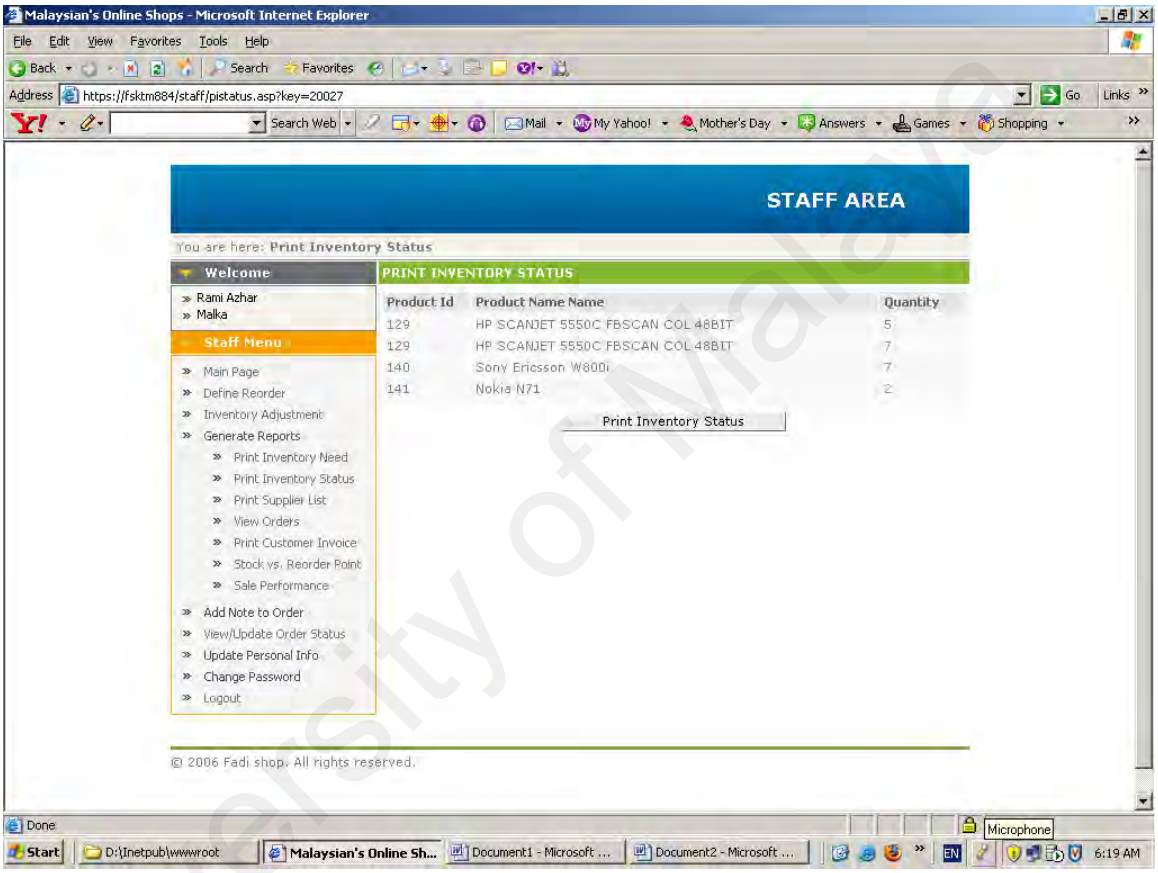


Figure 6.12: List of product inventory in a store.

➢ **Generate Report of Stores' Inventory Needs**

Actually, the head office is also a retail store that may deliver a product for its stores, so the manager of a HO can generate report on the stores' needs without asking from the store manager. Figure 6.13 shows the interface of the list of products that has shortage of stock in a store. A HO manager can select any store under it to generate this report as shown in Figure 6.11, but store manager can only generate reports for his/her store.

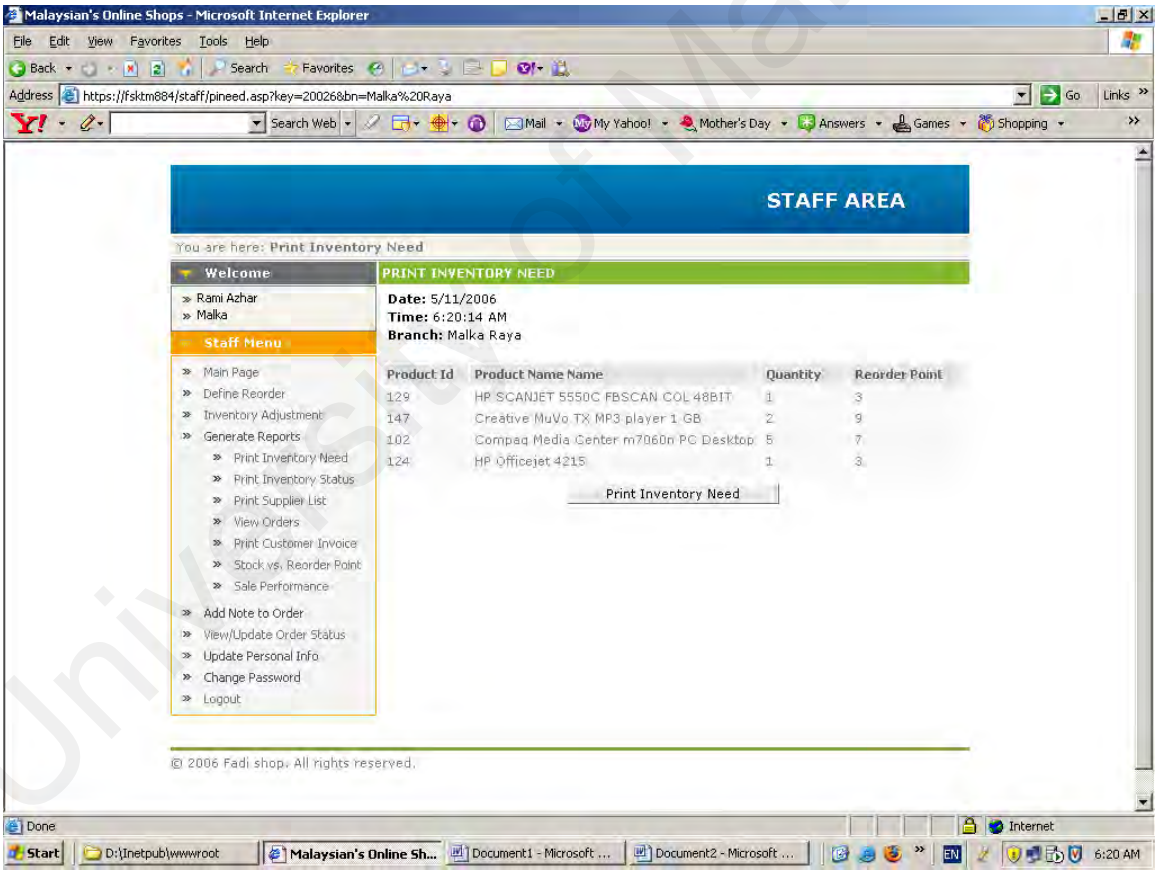


Figure 6.13: the interface of the list of products that have shortage of stock in a store.

➢ **View Orders**

A staff of a store can view the orders that will be delivered, from his/her store. The generation of a report could be done in many ways, i.e. all orders, by order ID, by customer ID, or show orders between two periods. Figure 6.14 shows the interface of ODSS-RCS options in viewing customers' orders.

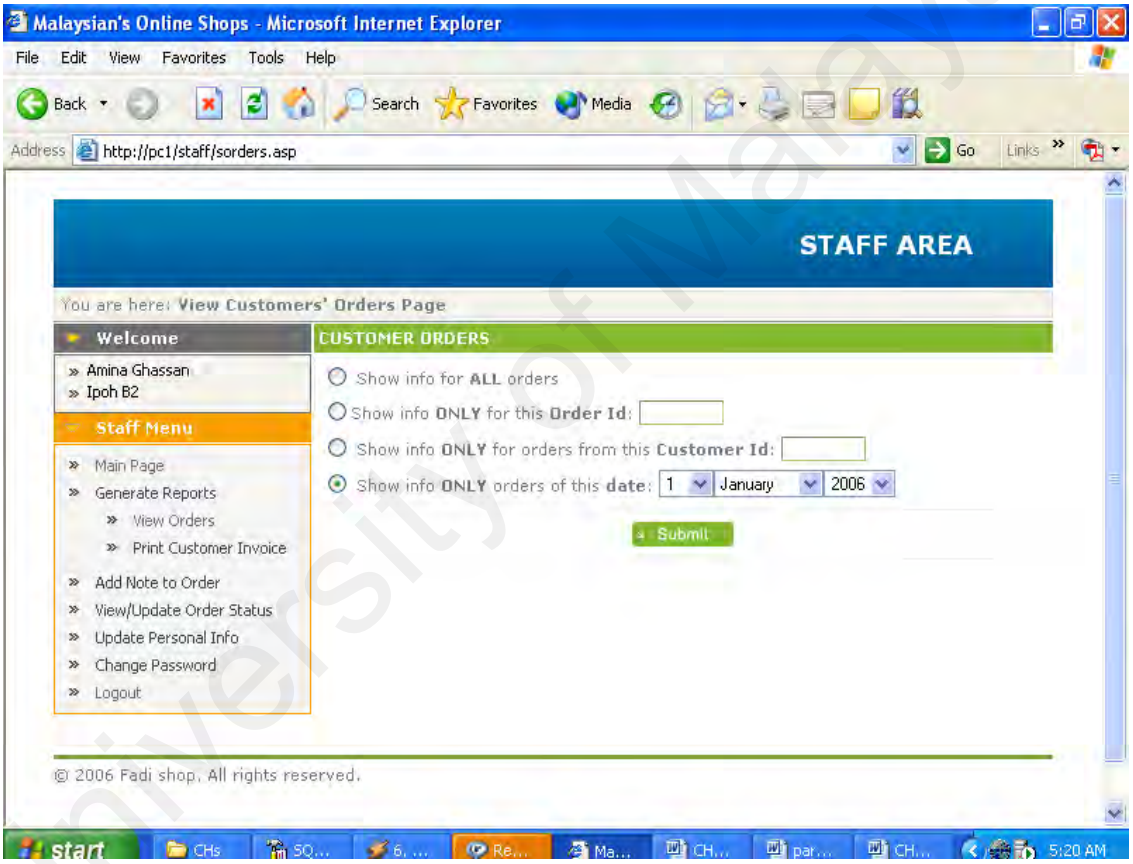


Figure 6.14: The interface of ODSS-RCS options to view customers' orders.

Now, the staff can manipulate the customers' orders so that they can view the order information. Figure 6.15 shows the view of an order.

In the case where the selected store nearest to a customer does not have the product(s) required in the customer's order, depending on lowest cost, the system will find another store that has that product(s). The system will then display a note in the customer's order showing the stores that will deliver the item in their order.

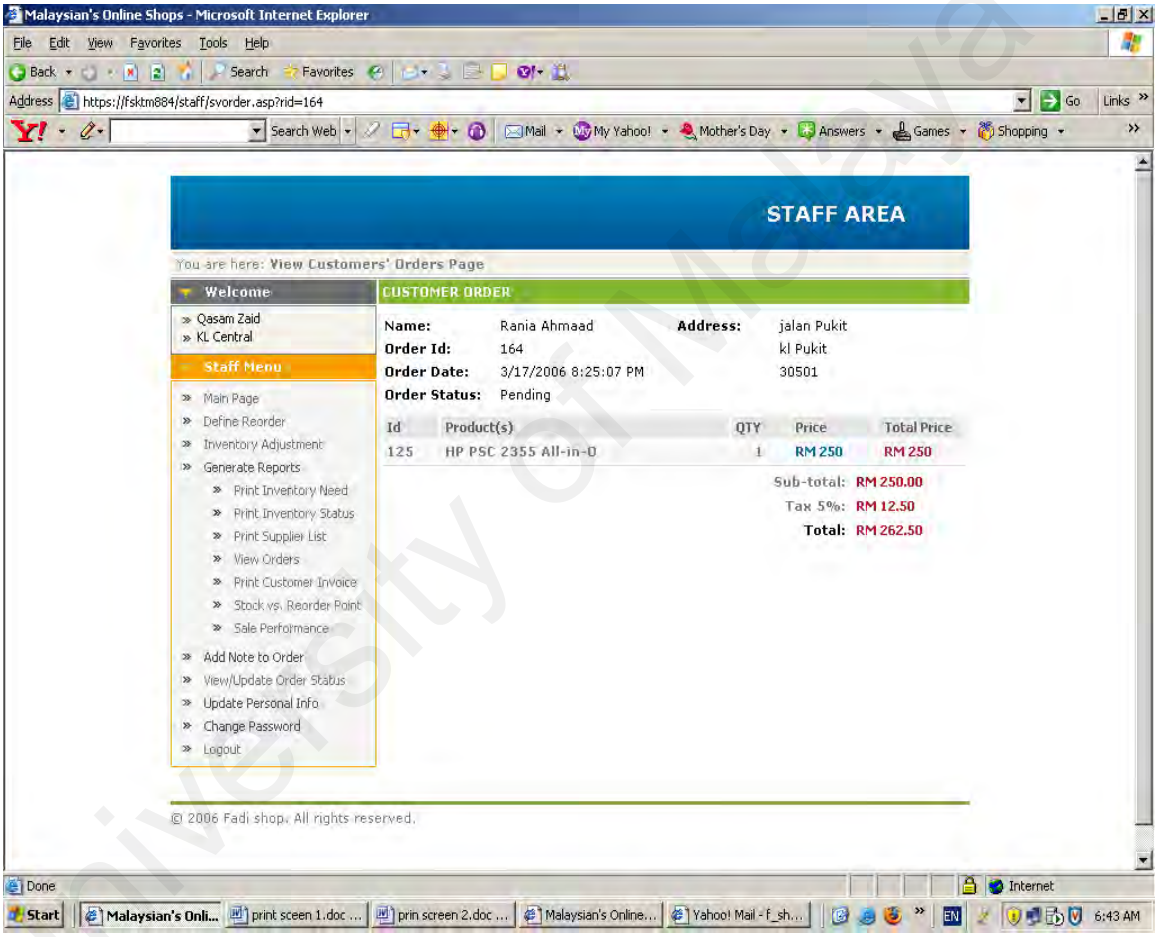


Figure 6.15: the interface of the view customers' orders module in ODSS-RCS

Figure 6.16 shows the interface of a customer order, the mentioning the name of the store that is/are delivering the order, product's name, and quantity of product that will be delivered to the customer.

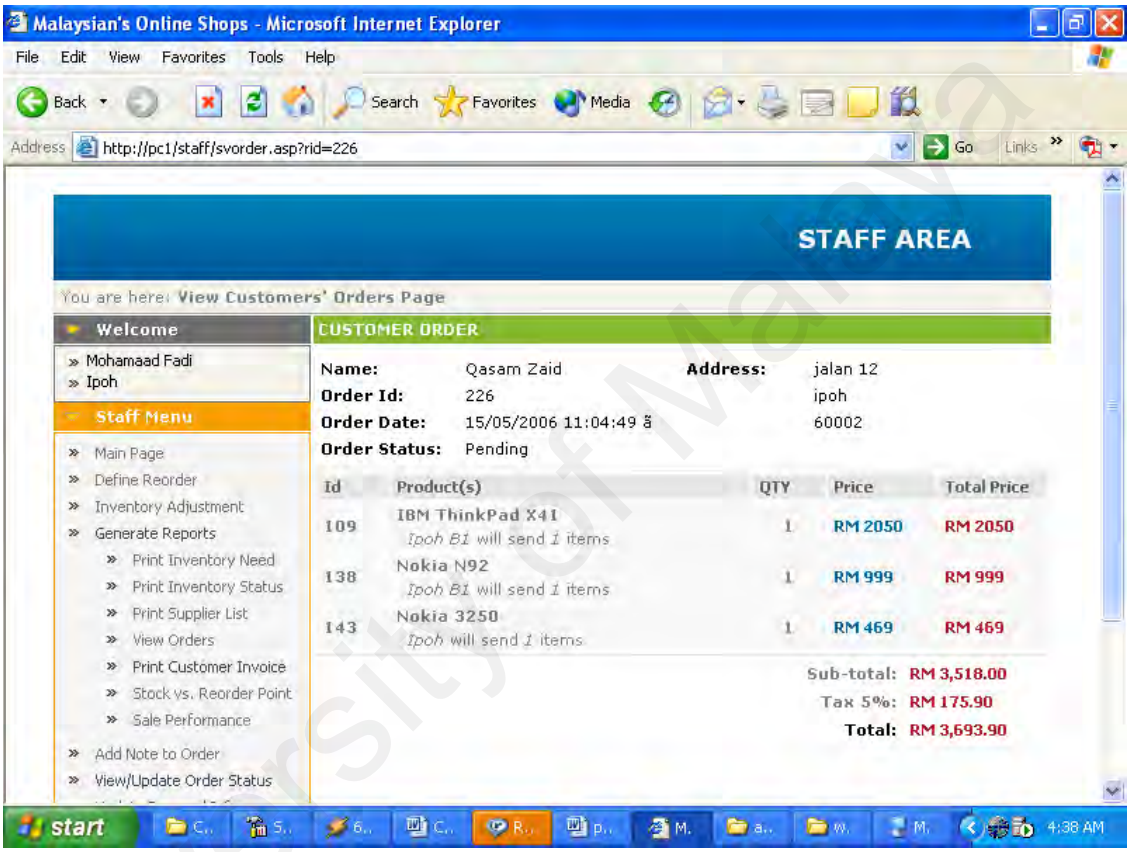


Figure 6.16: The interface of the customers' orders in ODSS-RCS, which displays the list of products that will be sent to the customer from more than one store.

➢ **Print Invoice**

For each order, the staff can print an invoice for the customer. Figure 6.17 shows the interface of such invoice that will be printed and sent to customer. The invoice has the description for the order, price, tax, and the total.

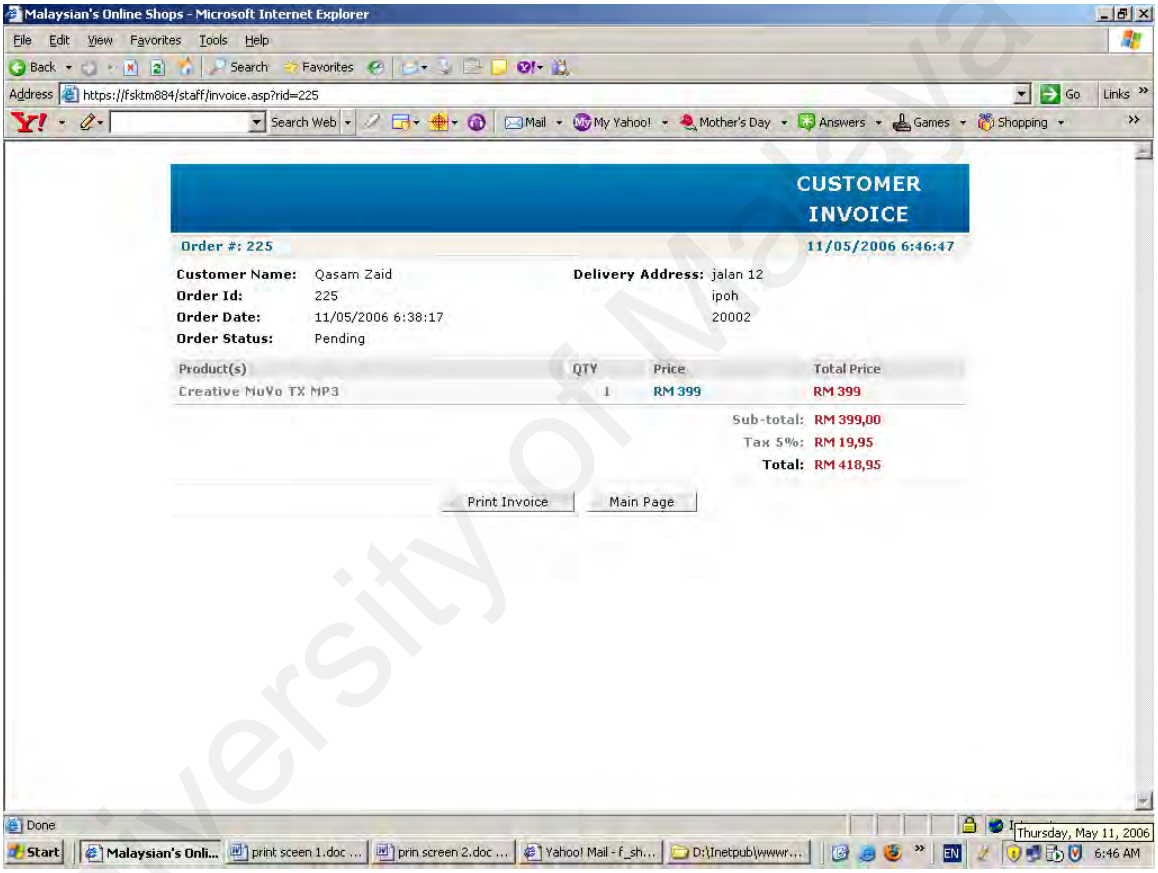


Figure 6.17: The interface of an invoice for a customer's order.

➢ **Generate Report of Suppliers**

A product in a store can be supplied from different suppliers; therefore the manager can generate a report of the suppliers' name that provides a product for the store. Figure 6.18 shows the interface of how to view products' suppliers in a store.

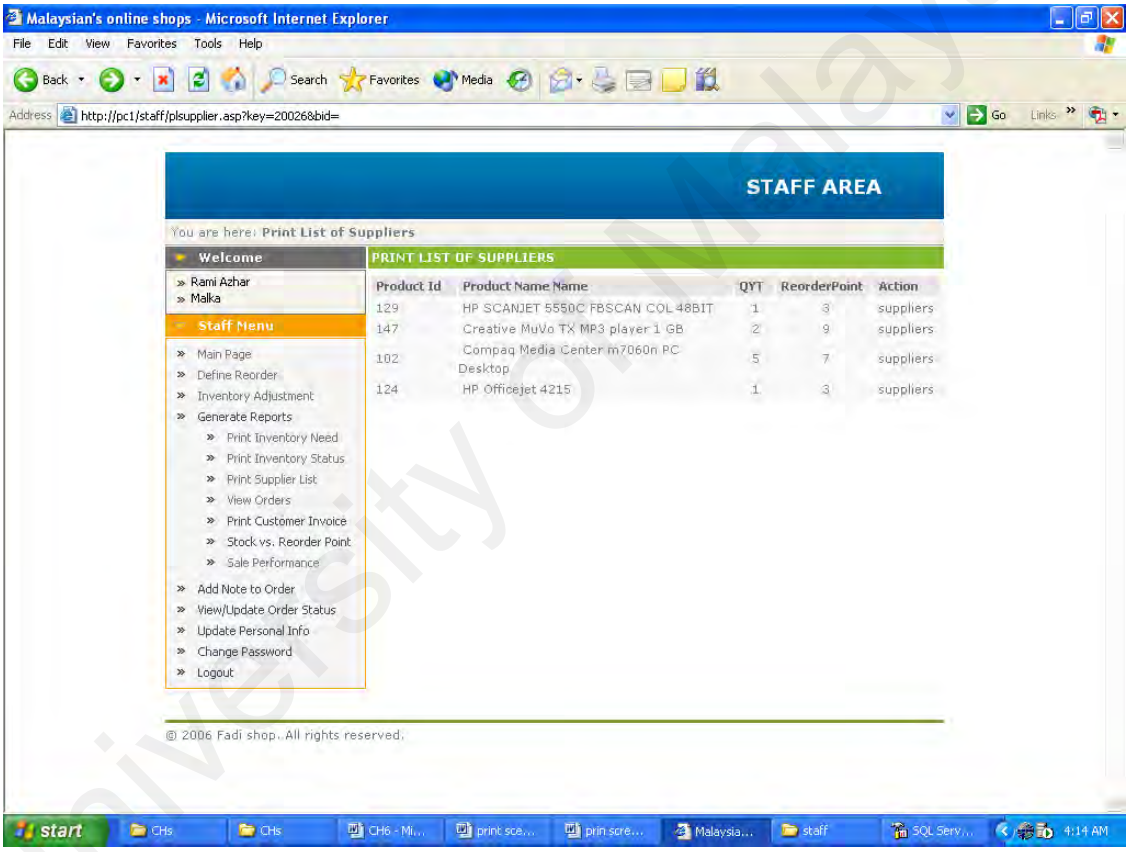


Figure 6.18: the interface for viewing the products' suppliers in a store in ODSS-RCS

➢ **Generate Report of Stock & Reorder Point**

A manager can also generate a report of stock and re-order point in stores, for a product or for a category. Figure 6.19 shows the interface for generating a report of stock vs. re-order point for a HO manager. When a HO manager logs in, the system will show a list to choose regarding the store which he/she wants to generate a report for. Figure 6.20 shows the interface for generate report of stock vs. re-order report for a store manager.

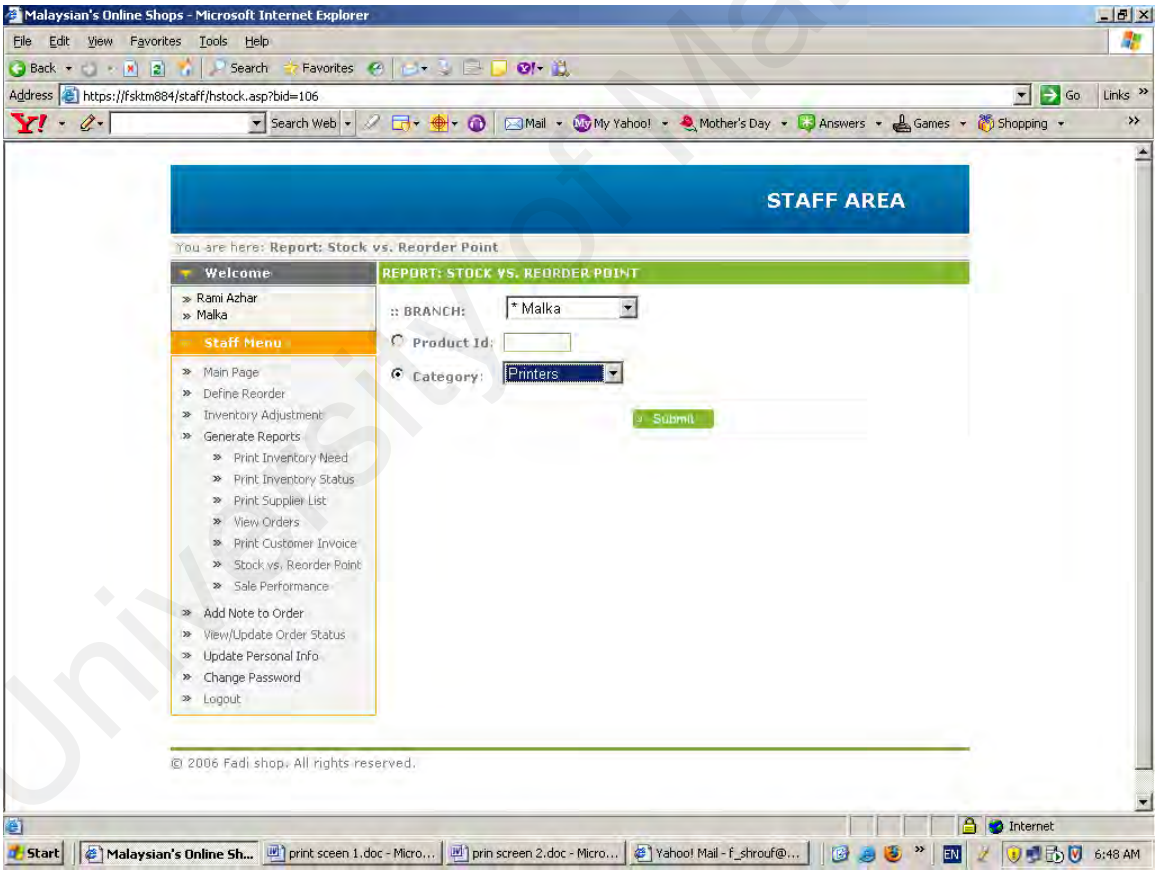


Figure 6.19: The interface for generating a report of stock vs. re-order point by HO manager.

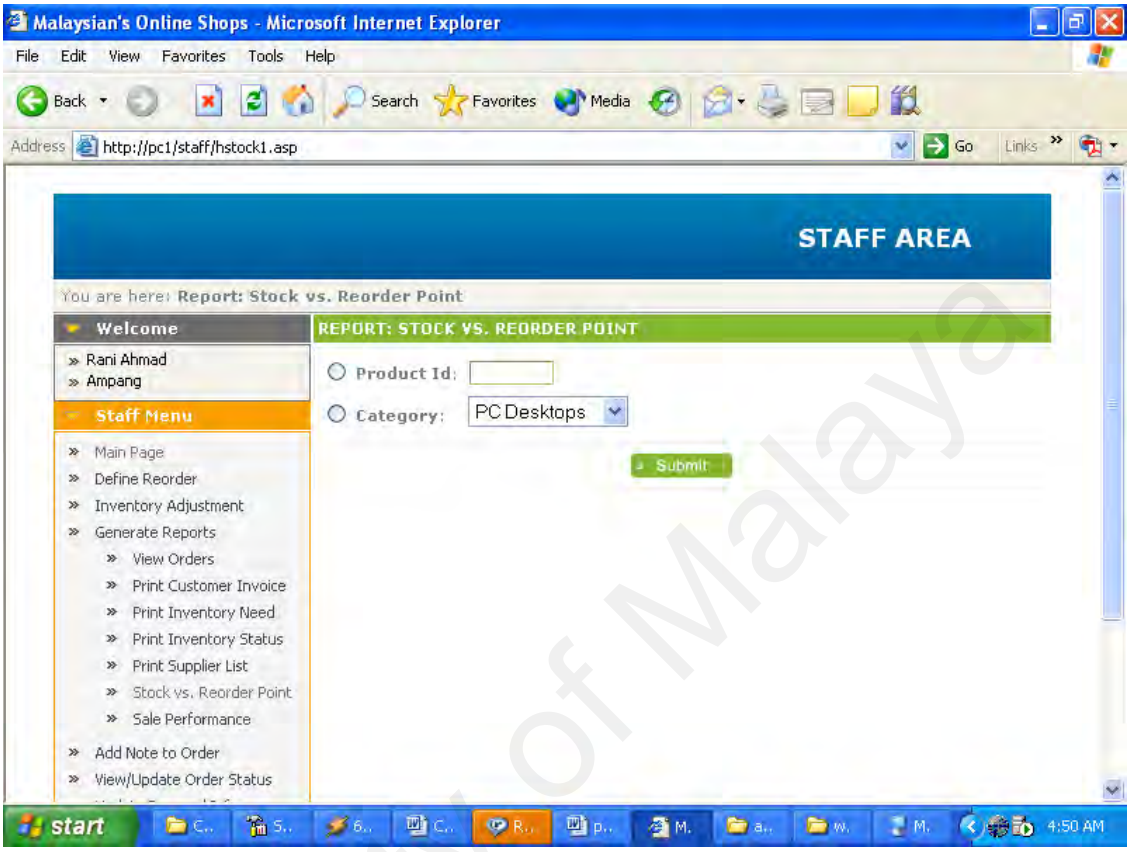


Figure 6.20: the interface of stock vs. re-order point report. (for store manager)

- **Generate Reports for Sales Performance**

HO managers can also generate reports to show the sales performance of the products in the stores. Figure 6.21 shows the interface to generate sales performance report by a HO manager. A HO manager selects which store he/she wants to generate a report for. The report is able to measure the sales product performance for a particular date or for a period of time. In addition, the report measures the sales performance of a product or category. Figure 6.22 shows the interface for the sales performance report.

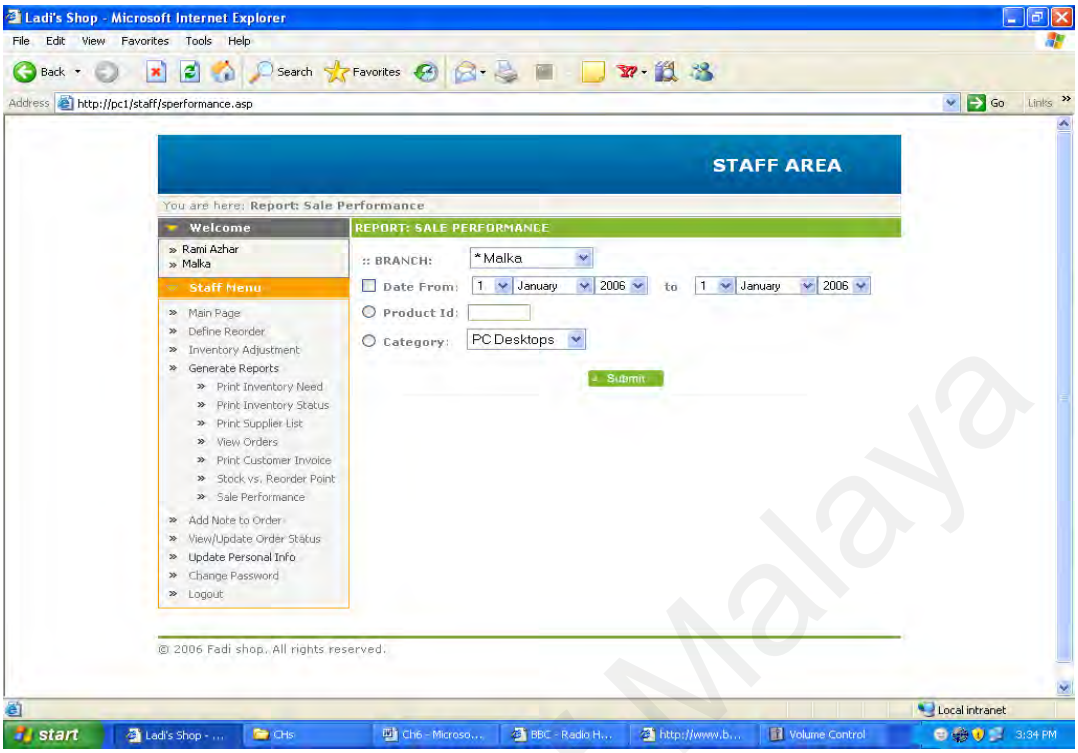


Figure 6.21: The interface to generate performance sales report by HO managers

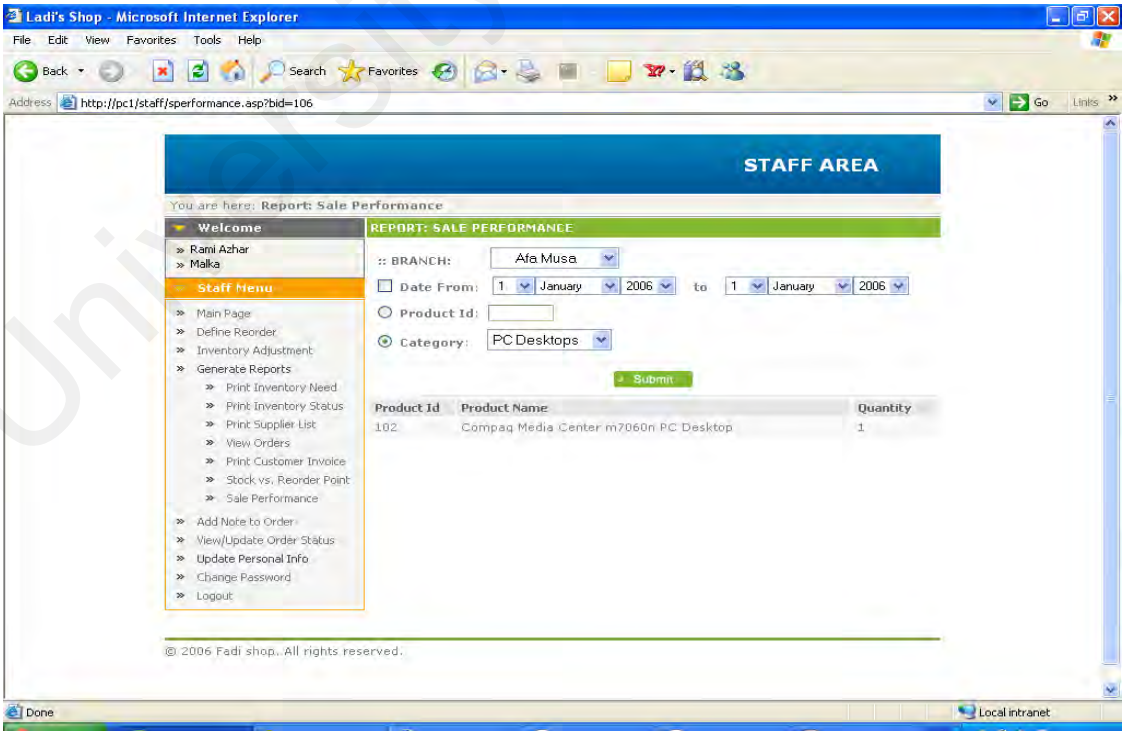


Figure 6.22: the interface to generate performance sales report.

6.3.2.d View/Update Order Status

The staff can also update the status of an order which is pending to be delivered. In addition, they can add a note for an order. Figure 6.23 shows the view of orders status. The staff can determine which order he/she wants to view and the click the update link to change the order status.

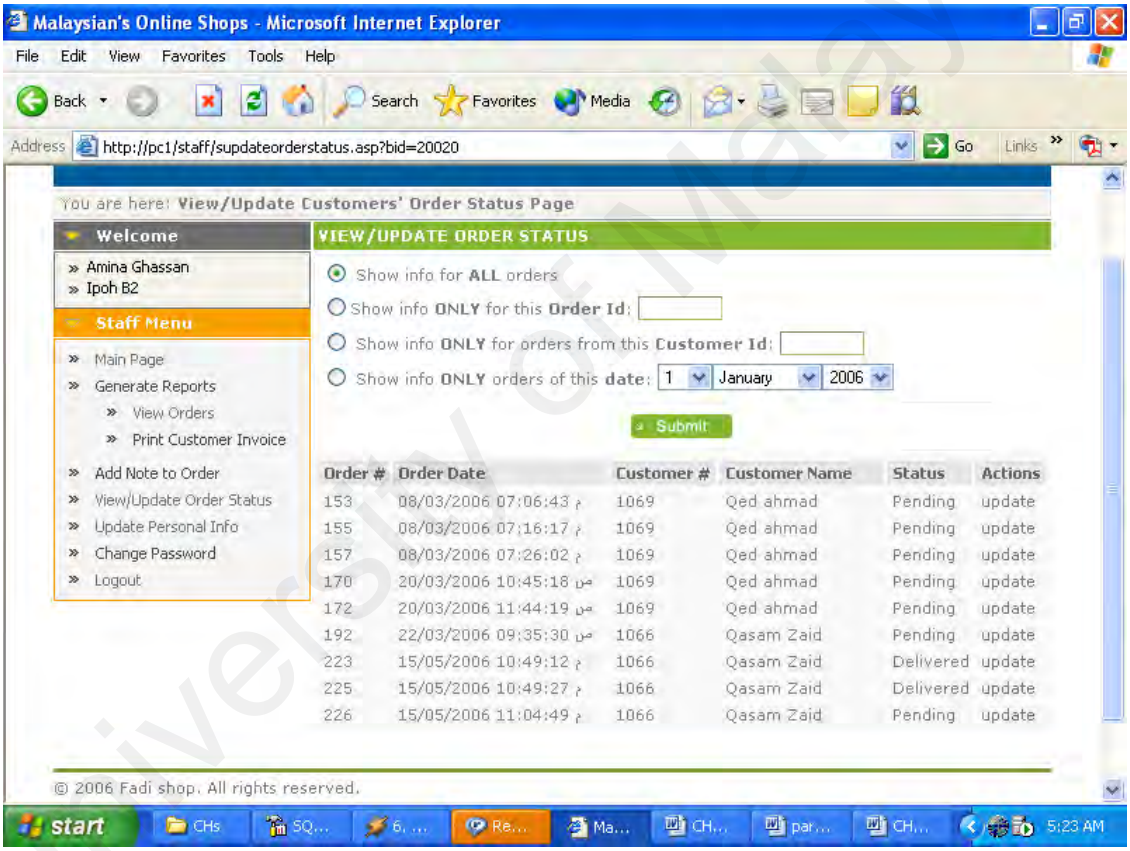


Figure 6.23: The interface for view orders status

6.3.2.e Update Staff Information

In this page, a staff can just update his/her personal information. Figure 6.24 shows the interface of the update personal information for a staff module. The staff can not change his/her store or type of staff (i.e. staff, Store manager, or HO Manager) in this page, as it is only the responsibility of the administrator to do so.

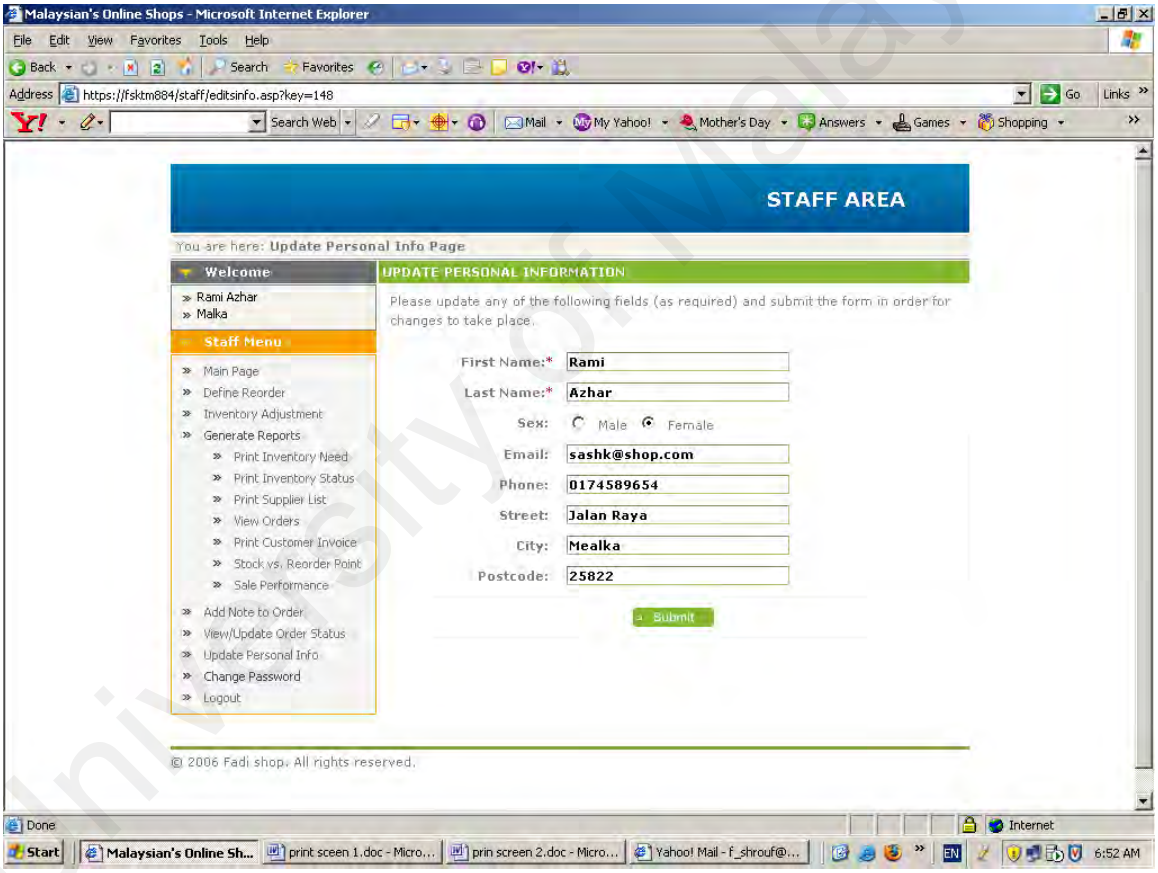


Figure 6.24: The interface showing the update of personal staff information through ODSS-RCS

6.3.2.f Change staff Password

A staff can change his/her password. Figure 6.25 shows the interface of the change staff password module.

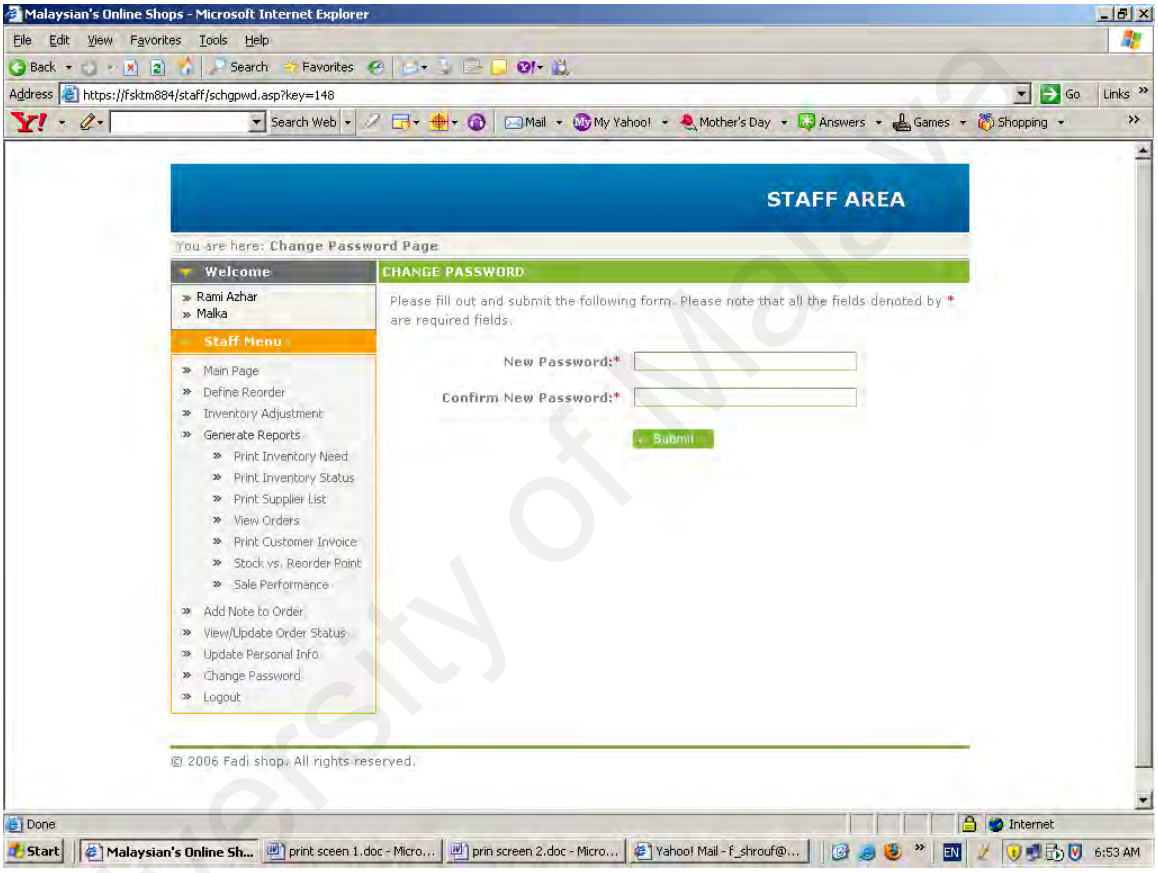


Figure 6.25: The interface for change staff password module.

6.3.3 Administrator Module

An administrator is responsible for managing the ODSS-RCS, i.e. responsible is adding /editing / deleting a product, category, employee, and supplier, in addition to assigning a product to a store, delete a product from a store, adding a new store and HO, and etc. Figure 6.26 shows the log in page for the administrator.

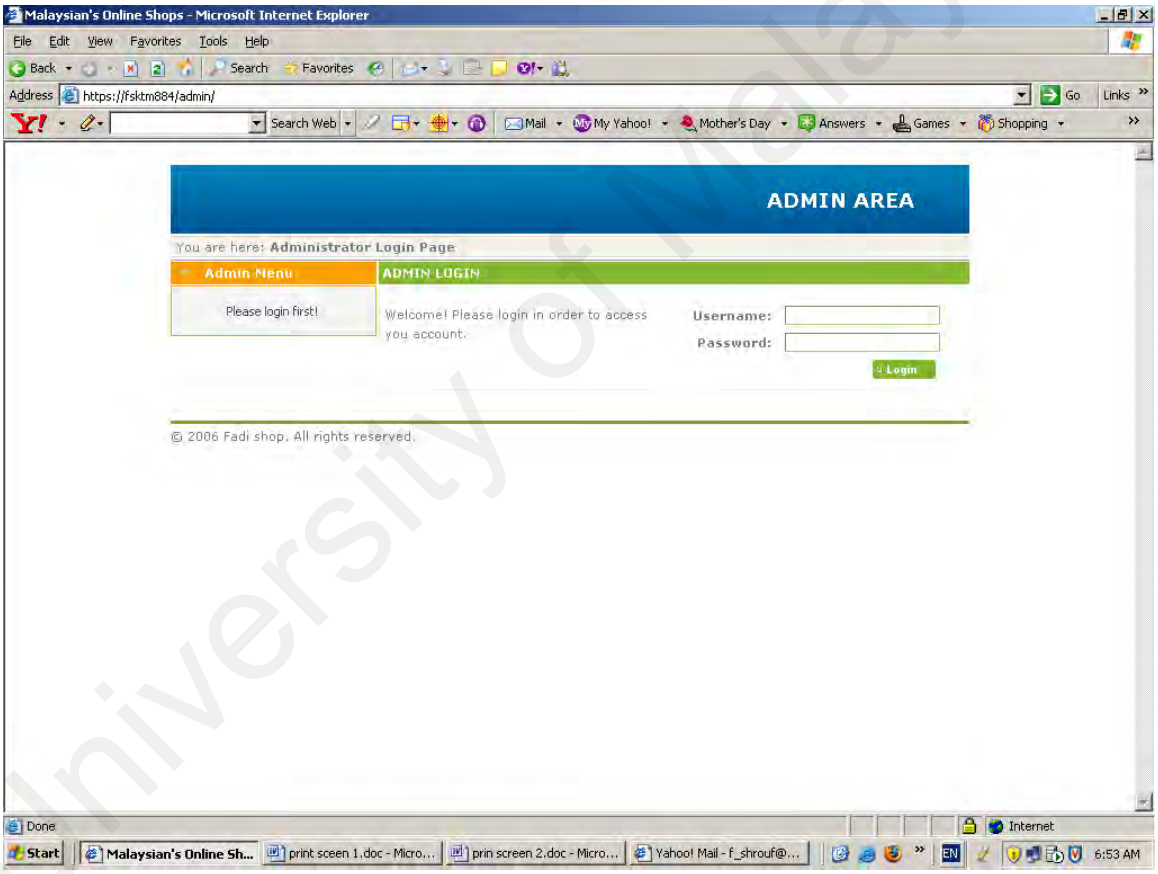


Figure 6.26: The Interface for the login page for the administrator

6.3.3.a Add/Edit/ Delete a Product

When a product is put on an online shop, it is the administrator who has the right to add that product. Figure 6.27 shows the interface on how to add a product to the online shop. In addition to product info, picture, description, and price, the administrator can choose the category in which the product is to be classified under, i.e. if the product is a computer, it will be put the under category of personal computer, and so on.

Figure 6.27: The interface for adding a new product to the online shop site.

The administrator can delete a product from the online shop by selecting a product category. Figure 6.28 shows the interface of the product categories in the system. The administrator selects the product from its category, and then deletes it. Further the administrator can edit the product information in the online shop. Figure 6.29 shows the interface for deleting a product from the online shop of ODSS-RCS.

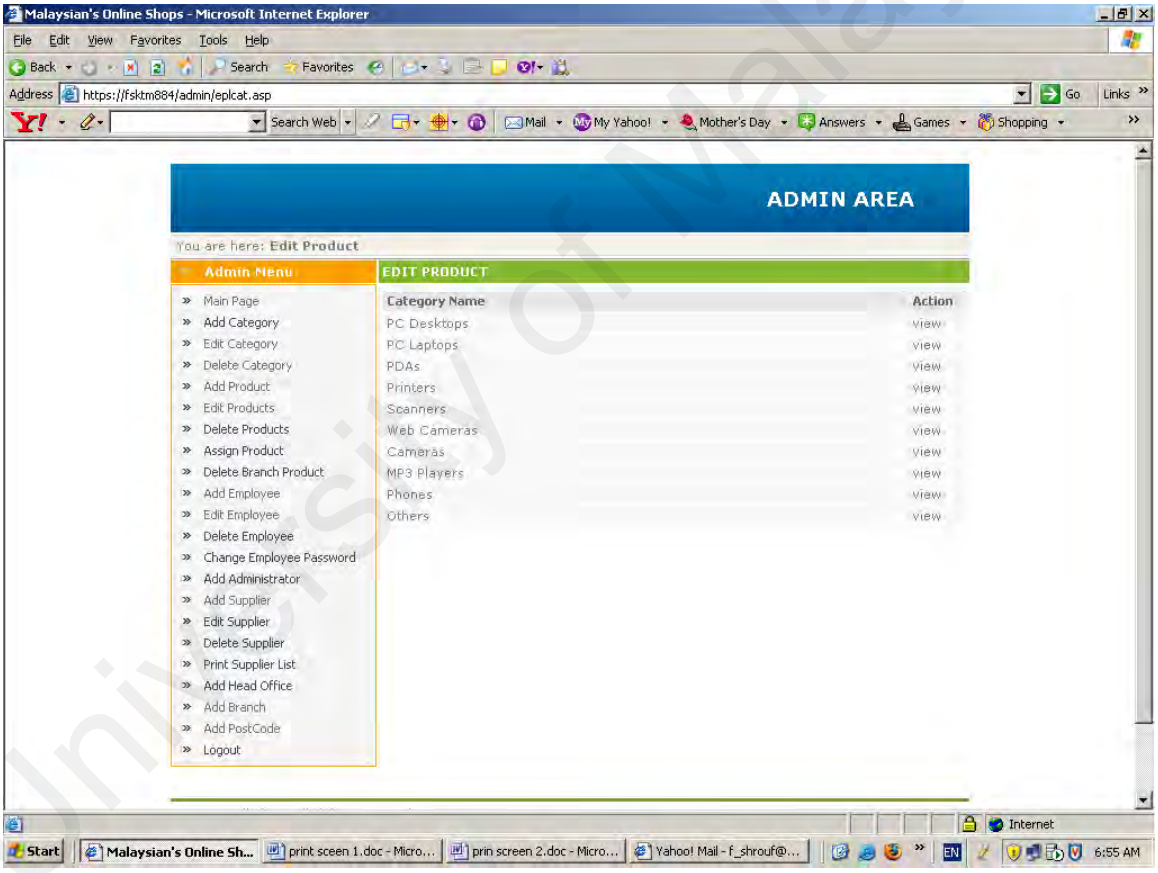


Figure 6.28: the interface for the list of products' categories in ODSS-RCS

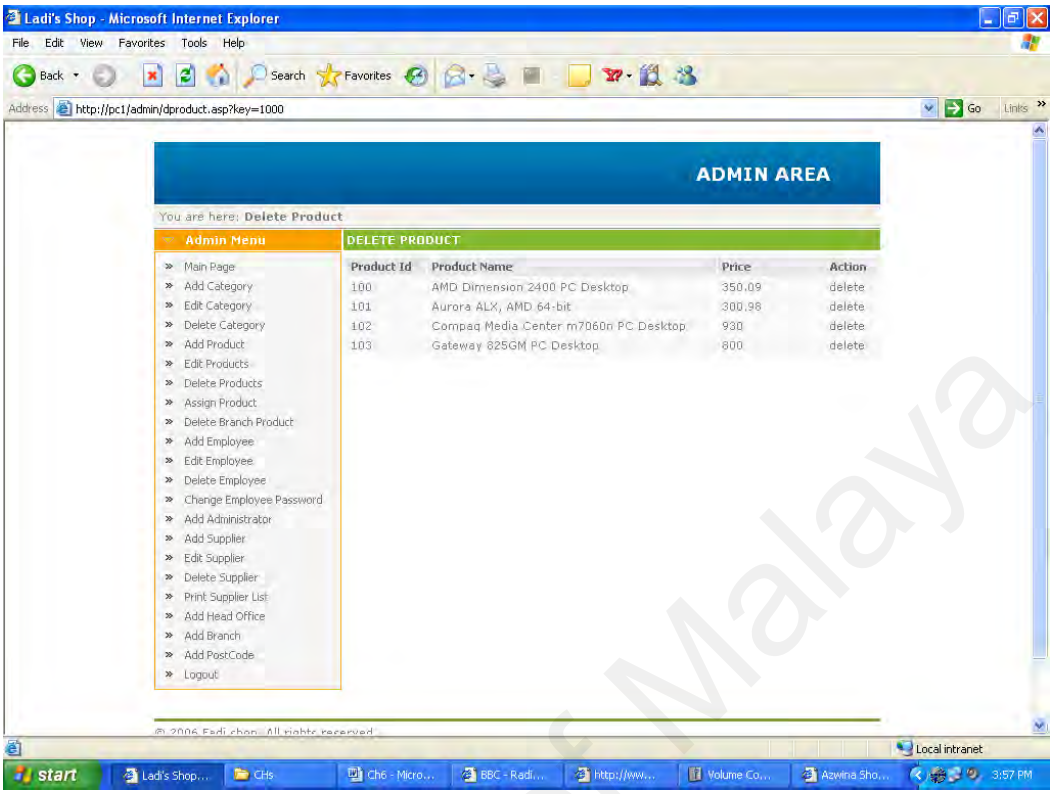


Figure 6.29: The interface for deleting a product from ODSS-RCS.

6.3.3.b Assign / Delete a Product to a Store

Assigning products to a store is considered as one of the important tasks that is performed by an administrator. This way, each product is available in a store to which it is assigned to. Figure 6.30 shows the interface for assigning a product to a store. In the first step, administrator selects the product, and then selects the store which he/she store wants to add this product to, and lastly, choose the supplier who will provide this product for the store. In addition he/she can enter the initial quantity of a product in the store, and the reorder point for it.

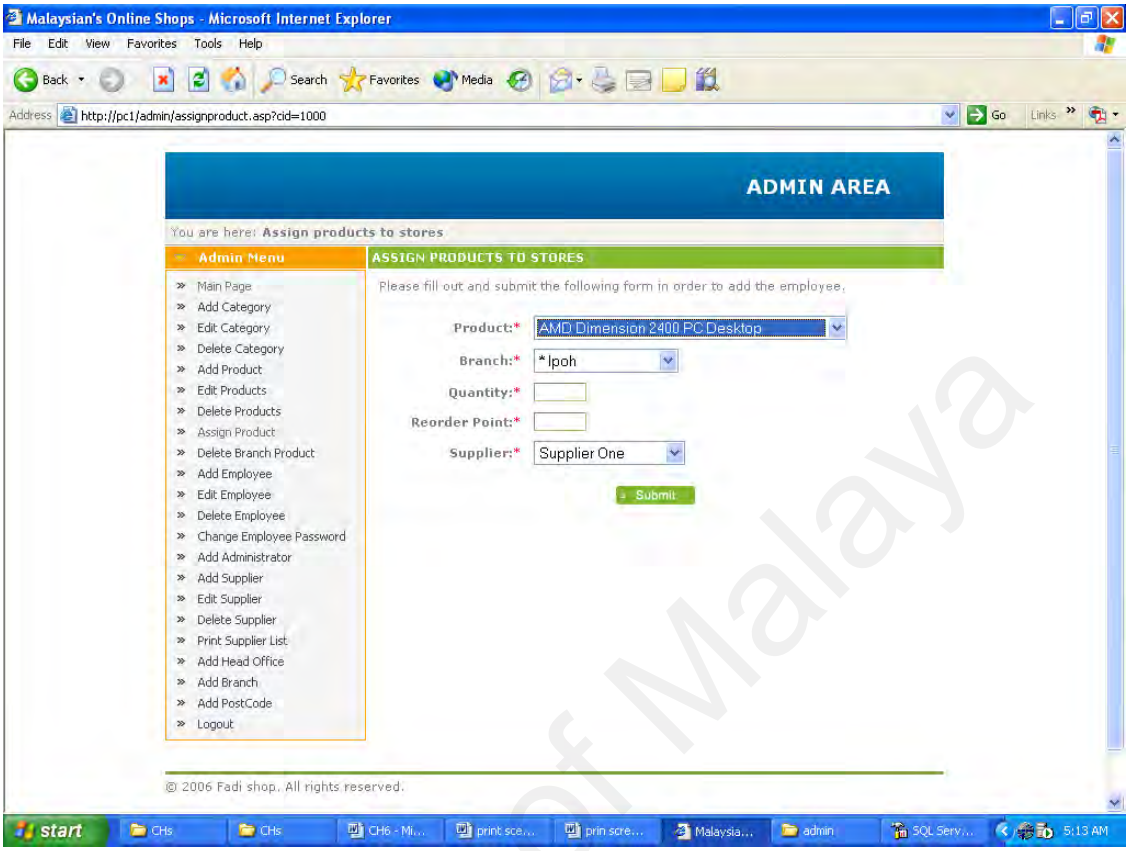


Figure 6.30: The interface for assigning a product to a store in ODSS-RCS

Deleting a product from a store is done by clicking the delete store product button. The system then opens a page to select the name of the store that the administrator wants to delete the product from. Figure 6.31 shows the interface that displays a list of stores in the system that an administrator may choose to delete a product from. After selecting the store, the system will show the category of product, to which the administrator with select the category. After selecting the category, the system will display the products in that category. The administrator will then select the name of product and then delete it.

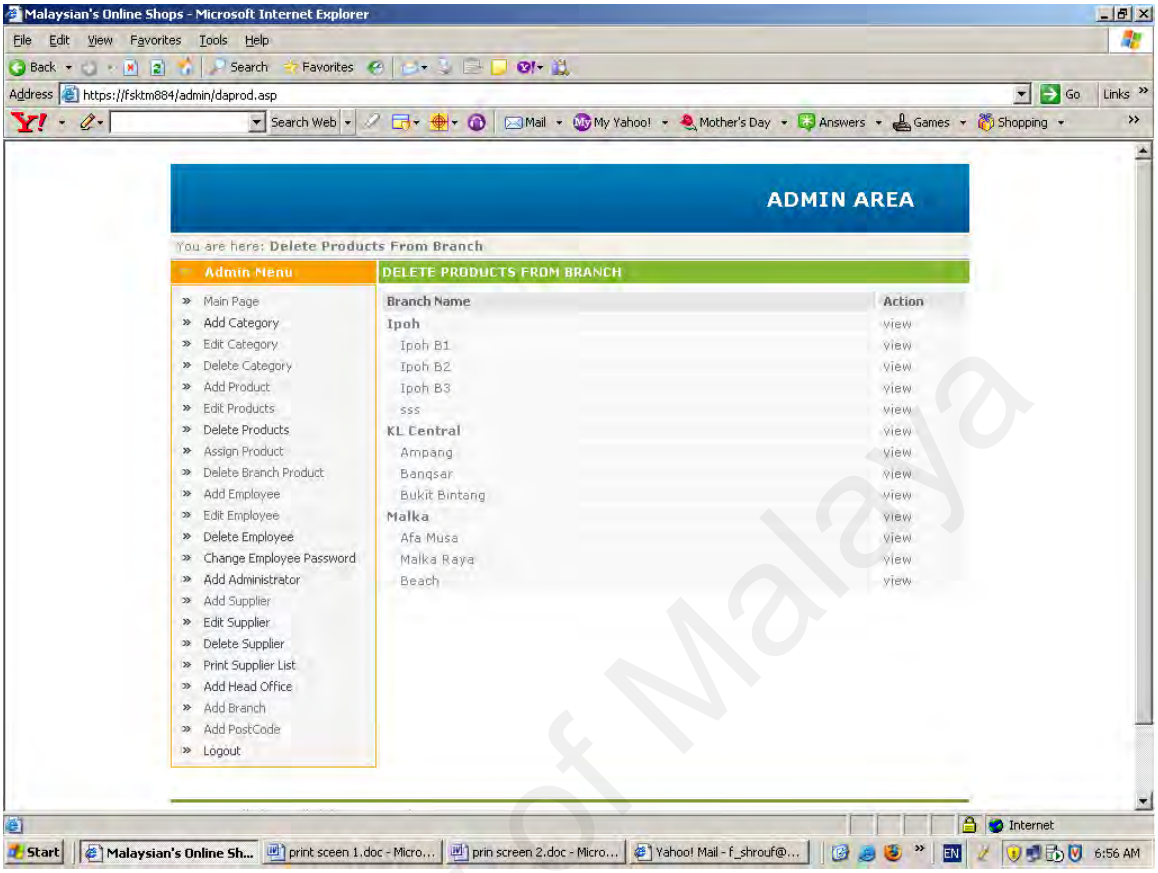


Figure 6.31: The interface for selecting a store in ODSS-RCS to delete a product from.

Figure 6.32 shows the interface for the list of products that are available in a store under a category.

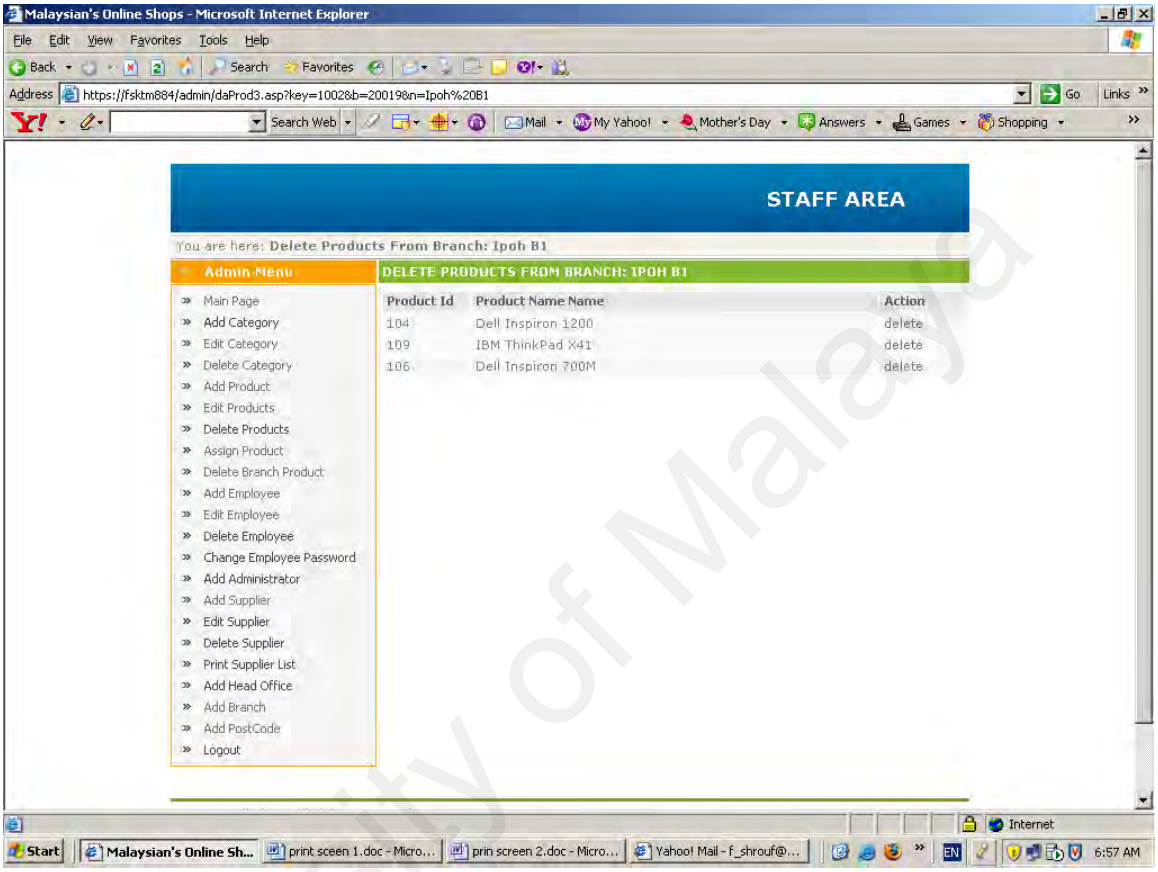


Figure 6.32: The interface for deleting a product from a store in ODSS-RCS

6.3.3.c Add/ Edit/ Delete Employee

Adding a new employee means creating a user name and password for a staff in ODSS-RCS. Figure 6.33 shows the interface on how to add new an employee to ODSS-RCS. In addition to entering the user name, password and personal information for the new employee, the administrator must also choose the type of staff, i.e. a normal staff, store manager or head office manager. Next, the administrator selects the store in which the new employee will be added to.

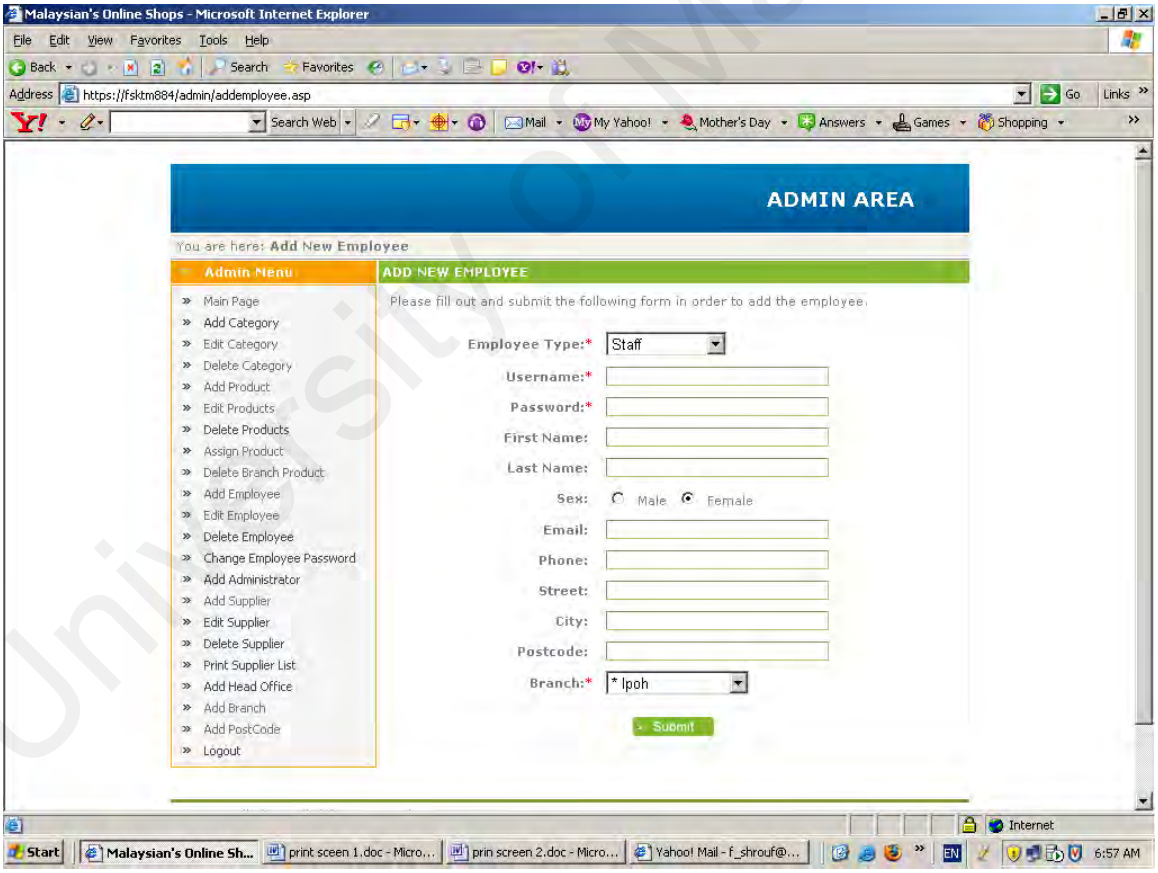


Figure 6.33: The interface on how to add a new employee in ODSS-RCS.

The Administrator can also delete and edit an employee in the ODSS-RCS. Editing means to change the position, and/or move an employee from a store or HO to another store or HO in the retail chain store. Figure 6.34 shows the interface for editing an employee in ODSS-RCS.

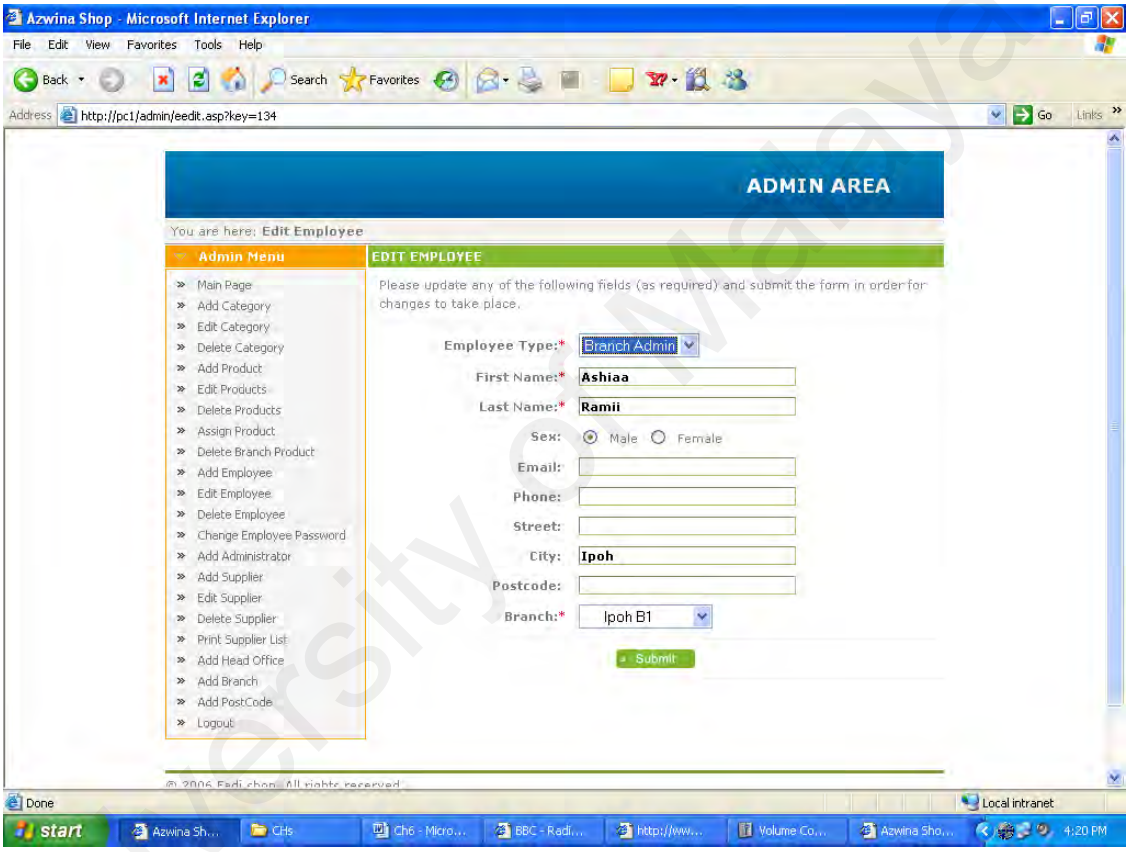


Figure 6.34: The interface for editing an employee information in ODSS-RCS

6.3.3.d Add Store

The management of the retail chain stores can add a new HO and stores for the HO. Figure 6.35 shows how an administrator can add a new store to the head office, and hence the ODSS-RCS will open a new page to fill-in the cost of delivery.

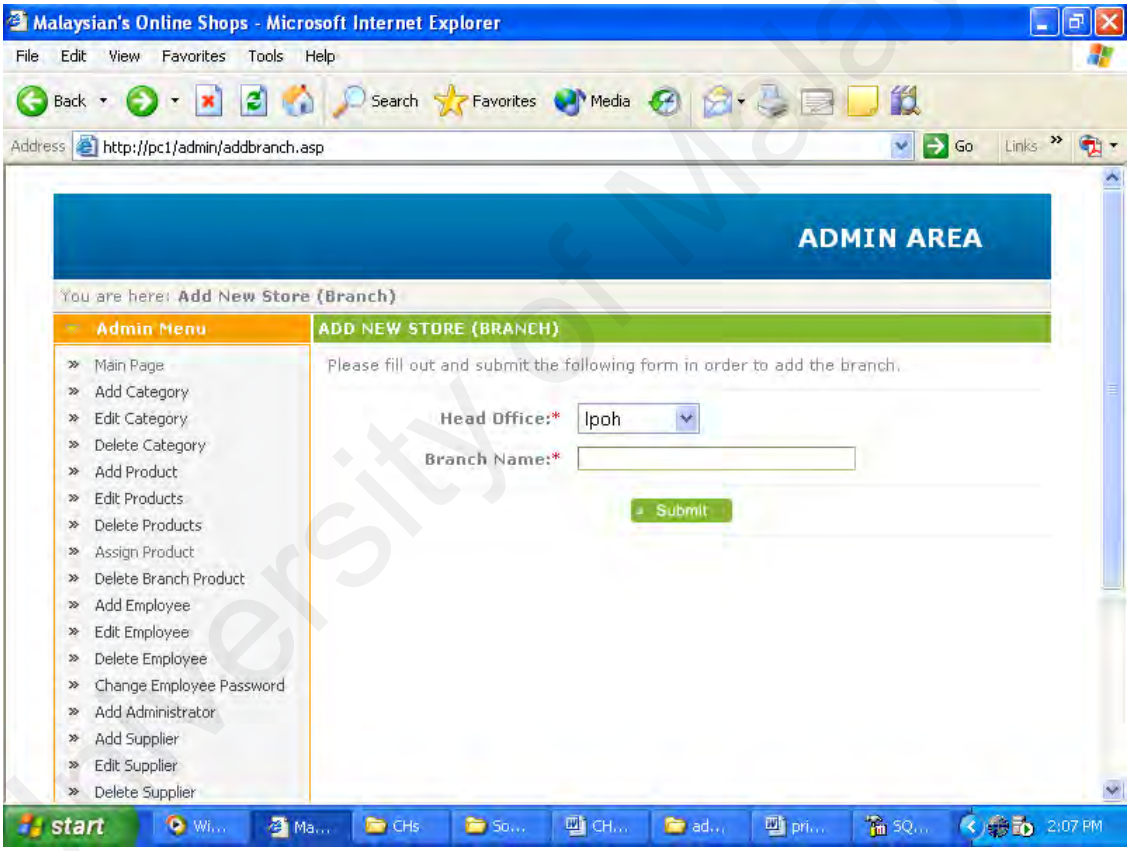


Figure 6.35: The interface for adding a store to a head office in ODSS-RCS

Figure 6.36 shows the interface on how to enter the cost of delivery between areas. This page will be a dynamic page; therefore the number of node will depend on the number of stores that belongs to the HO.

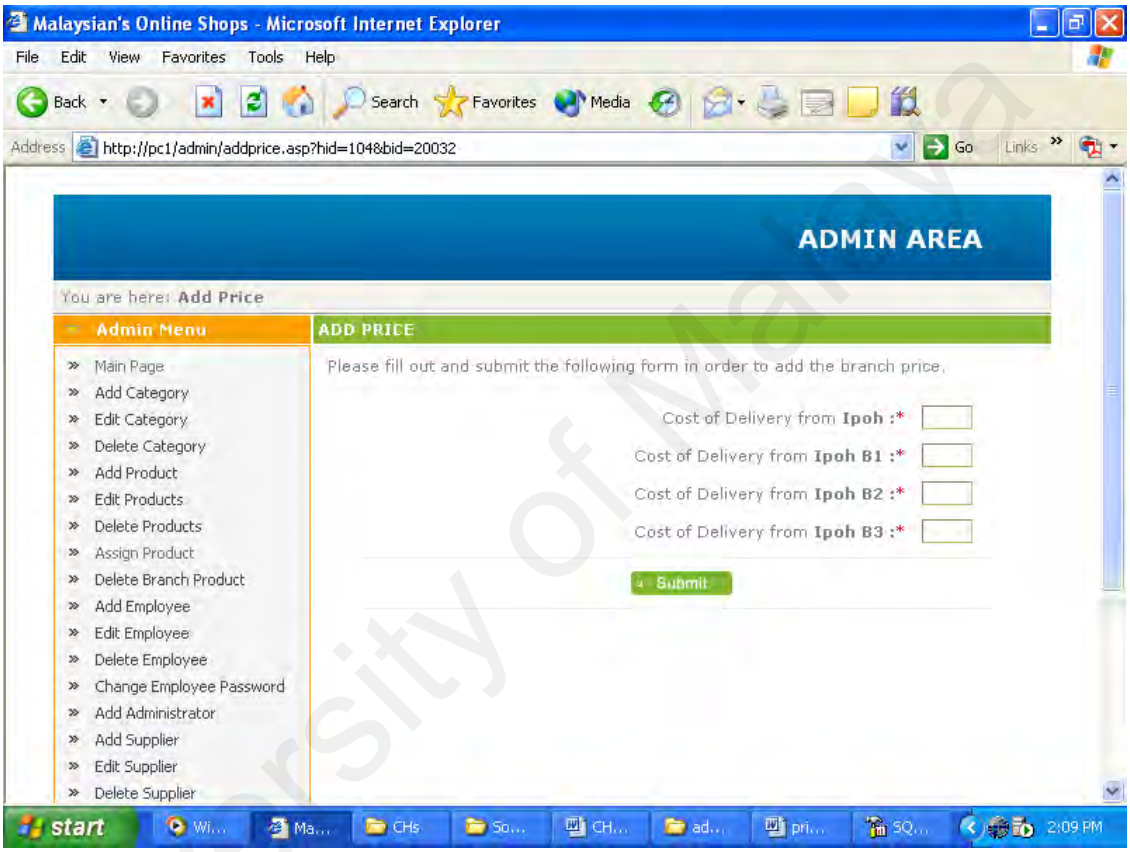


Figure 6.36: The interface for entering the cost of delivery for a store in ODSS-RCS.

6.4 Security Implementation

This section shows that security is embedded and implemented in ODSS-RCS, in the form of session security, data encryption in the database, and the Secure Sockets Layer (SSL) for selected web-pages in the ODSS-RCS.

6.4.1 Session

The server creates a new session object for each new user, and destroys the session object when the session expires. A session ends if a user has not requested or refreshed a page in the system application for more than 20 minutes.

In addition, if a user copies the address bar when he/she logins in his/her account then paste it in other page, a new page does not open.

6.4.2 Data Encryption in the Database

In ensuring that important data stored in the data base such as password, credit card numbers and etc, are protected, they are encrypted using CR4 algorithm.

6.4.3 Using SSL

Secure Sockets Layer (SSL) is a protocol for transmitting private documents via the Internet. SSL is the standard security technology for establishing an encrypted link between a web server and a browser. This link ensures that all data passed

between the web server and browsers remain private and integral. SSL uses a cryptographic system that uses two keys to encrypt data − a public key known to everyone and a private or secret key known only to the recipient of the message. SSL is an industry standard and is used by millions of websites in the protection of their online transactions with their customers.

To be able to create an SSL connection a web server requires an SSL Certificate. Since win server 2003 has this certificate, it was used to configure SSL in ODSS-RCS. Figure 6.37 shows the summary of the information when the researcher configures the SSL in the system.

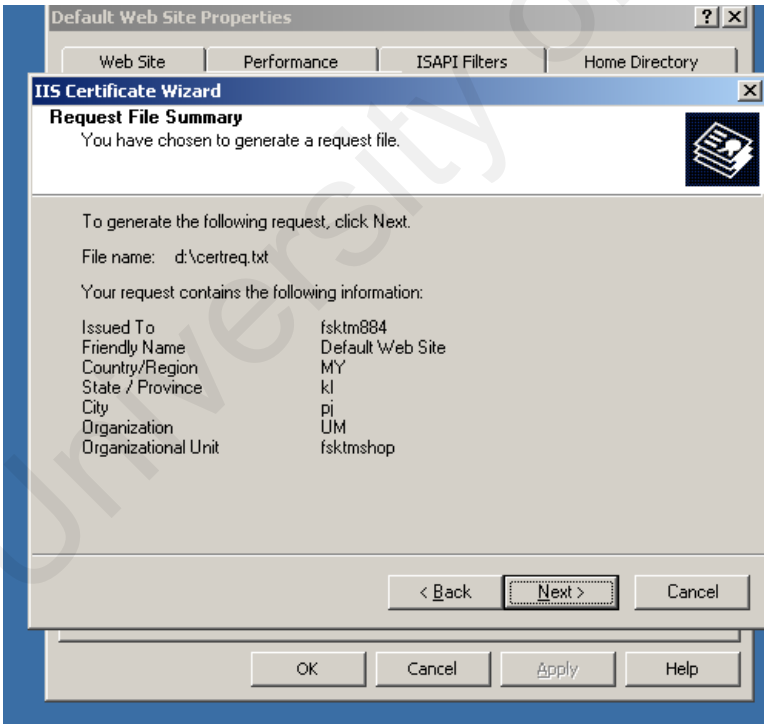


Figure 6.37: Print screen for the request file summary for SSL in ODDS-RCS.

6.5 Summary

This chapter has looked into the implementation phase of developing ODSS-RCS. It described the implementation tools that have been used. The system implementation has been done through the integration of the customer module, staff module, and administration module. Then, the implementation of security issues were describe.

Chapter 7

Testing

7.1 Introduction

Testing is a critical phase of software quality assurance in the system development life cycle. This chapter discusses system testing in the software development life cycle of the ODSS-RCS. The objective is to execute the system with the intention to discover errors, and to determine whether it compiles according to its requirement and functional specification. Each module in the system was tested after each phase of development through the evolutionary prototype method that is used as the for system development life cycle in this project.

A comprehensive testing for ODSS-RCS also performed after finishing the whole implementation. Finally, a user acceptance testing was performed on the system with customers and companies that relate to retail chain stores, whereby a questionnaire was distributed to the selected parties.

7.2 Testing methodology

In this testing phase of this project, the following types of testing were used:-

1. Unit testing
2. Integration testing
3. Comprehensive testing

4. Security testing
5. Users testing and questionnaires for evaluation.

7.3 Unit testing

Unite testing is conducted to ensure that proper functionality and code have been achieved during the coding of each system modules. This stage of testing verifies that each module is working correctly and meets the requirement.

7.4 Integration testing

The integration testing of the ODSS-RCS can be viewed from an incremental perspective, whereby the testing was conducted from three main pages of the system, and then integrate the three main pages together. It starts from the main page and related modules that is considered as the customer's area, and then proceeds to the administration area and related modules, which was then integrated with the customer's area module. This is followed by testing the staff area and its modules. Finally, the customer, administrator, and staff area are tested together for a smooth integration.

7.4.1 Testing the Customer module

Table 7.1 shows the test cases for the requirements in the customer area, where it shows the actual output versus the expected output from the testing phase.

Table 7. 1: Testing the functions (modules) of customer module

Num.	Test case.	Expected result.	Actual result.
1.	Log in customer account.	Log in.	Logged in.
2.	Create account without an address.	The system should ask to enter an address.	The system gives message to enter it.
3.	Enter new address with missing information.	Message shows you should enter the information.	Done.
4.	Create customer account.	Create it.	Done.
5.	Add product to customer cart.	The cart will have the product.	Done.
6.	Update the cart by increasing the number of a product in the cart.	Update the cart and update the total price.	Done.
7.	Click to continue shopping from “view the cart” page.	Going back to shopping page.	Done.
8.	Click for check out.	Open the page to choose address, and mode of payment.	Done.
9.	Submit the information to buy.	Show message confirming the purchase. In addition, the system will generate an email, which has the order information to confirm it.	Done, and received an email with the details of the order.
10.	Try to select an order address that the system does not have the information on.	Combo box will be disabled	Can't select this address.

11.	Add a new address without post code.	Give message to fill in required field.	Done.
12.	Click to update customer information.	Open page to update.	The page is opened.
13.	Select a new address to deliver the order.	Open page to enter the address information.	Opened it.
14.	Buy the content of the cart and select the new address to receive the order.	Confirm the purchase.	Done.
15.	Click to view the history order between two dates.	Show the list of orders which was bought between this period	Done
16.	update personal information	password changed and shows message to confirm it.	Done.
17.	Customer change password.	Change it and shows message to confirm it.	Done.
18.	The same user name Logs with new password.	Log in the account.	Done.
19.	Browse the new product page	Show the new products page on the online shop.	Done.

7.4.2 Testing the Administration module

After testing the customer module, the administration module was tested next. In this step, the admin module was integrated with the customer module and with some part of the staff module. Table 7.2 shows the test results for this module.

Table 7. 2: Testing the modules in administration module.

Num.	Test case	Expected result	Actual result
1.	Add new category.	The category was added, and a message to confirm it was shown.	Done.
2.	Change the name of category.	The name of the category was changed, and a message to confirm it was shown.	Done.
3.	Delete a category	Delete it, and show message to confirm it.	Done.
4.	Add new product.	Add it, show message to confirm it, and the product will be on a new product site.	Done, and the product is in a new product page.
5.	Shift a product from a category to another.	The product will be in the new category.	The product is in the new category.
6.	Update product information.	Update it, show message to confirm it, and the new information will show on the	Done.

		online shop.	
7.	Delete a product from the shop.	Delete it from its category and remove it from the online shop, and show message to confirm it.	Done.
8.	Assign a product to a store	The product will be added to the store's inventory, and show message to confirm it.	The message is displayed and the product is in the store's inventory.
9.	Delete a product from a store.	Delete it from the store's inventory, and show message to confirm it.	Done
10.	Add new employee to a store.	Add the employee to the store, and the system show a message to confirm that the employee is added successfully.	Done.
11.	Transfer a staff from one store to other store.	Transfer the staff to the new store and the system should show a message to confirm that.	Done.
12.	Log in the staff who has transferred to a new store.	The staff is logged in to his/her account in the new store.	Done.
13.	Change the type of staff from store staff to store manager	The staff is changed to a store manager, and the system shows a message to confirm that.	Done.
14.	Log in the staff who had changed	Staff log in as a store manager.	Staff logged as

	his/her type in the previous case.		store manager
15.	Change the type of staff from store manager to store staff	The staff should now be store staff.	Staff is a store staff
16.	Change the staff from store manager to head office manager	The staff should be head office manager.	Staff is a head office manager
17.	Delete staff	Delete the staff and the system should show a message to confirm this.	Done
18.	Change staff password	Change the password and system should show a message to confirm this.	Done
19.	Add new head office.	The system should add new head office.	The system added a new head office.
20.	Add a new store under the new head office	The system will create a store under the head office, and open a page to enter the cost of delivery.	Done.
21.	Add postcode for a store	Added the postcode and system shows a message to confirm this.	Done
22.	Add a new administrator	Create a new administrator.	Done.
23.	Add a new supplier to the whole organization	The system will add the new supplier and the system shows a message to confirm this.	Done

24.	Update supplier information	Information updated and the system shows a message to confirm this.	Done
25.	Delete supplier	Delete the supplier and the system shows a message to confirm this.	Done
26.	Print supplier list for all organization	Print out list of supplier names	Done

7.4.3 Testing the Staff modules

Testing of the staff module is an important part of testing. Therefore, in this testing integration will be between the customer, staff, and administration modules. Table 7.3 shows the test result for the staff module.

Table 7.3: Testing of staff module

Num	Test case	Expected result	Actual result
1.	A staff tries to log in with a wrong user name and password in the staff module.	Don't log in to the account.	Don’t log in to the account.
2.	A staff of a store tries to log in with the right user name and password in the staff module.	Logged in staff and can reach his/her store only, depending on his/her right.	Done.
3.	A store manager tries to log in with the right user name and	Log in staff and can reach his/her store only, depending on	Done.

	password in staff module.	his/her right.	
4.	A HO manager tries to log in with the right user name and password in the staff module.	Log in to staff area and can reach his/her HO and its stores depending on his/her right.	Done.
5.	A staff (not administrator) tries to log in the administration module by using his/her user name and password.	Can't log in to admin module.	Can't log in to admin area.
6.	Define the re-order point for a product.	Save the new re-order point for the product, the system will show a message to confirm this.	Done.
7.	Update the stock for a product in the store	Update the stock, the system will show a message to confirm this.	Done.
8.	Generate a report of inventory needed for a store manage.	Print the list of products that have shortage in stock in the store.	Done.
9.	generate report of inventory needed for a store which belong to a HO	Print the list of products that have shortage in stock in the store.	Done.
10.	Manager generate a report of the inventory status for a store	Print the list of products with their quantities in the store.	Done.
11.	Generate report by the manager for product inventory in a store	Show the product quantity and reorder point for this product in the store	Done.

12.	Manager generates a report of the inventory status for a category in a store	Print the list of all products in this category for the store	Done.
13.	Manager generates a report for the suppliers who supply product to specific store.	Print the list of suppliers who supply the product to stores.	Done.
14	Generate a report by manager of the sales performance for a product in a store within a period of time	List of product names and the quantities sold in this period is displayed.	Done.
15	Generate report by manager of the sales performance for a product category in a store within a period of time	List of product in the category, and the quantity of product which have been sold in the specific period is displayed.	Done.
16	View all customers order for a store	List of all customers orders from this store	Done.
17	View customers' orders in a store between two dates.	List of customers' orders for this store in this period is displayed.	Done.
18	View a customer order by order ID	View the order only.	View the order only.
19	View customer orders by customer ID	List of all orders which is ordered by the customer	Done.
20	Print invoice for a customer	Print the invoice	Done.

21	Update the status for an order pending to be delivered.	Status of the order that will be delivered is displayed.	Done.
22.	A staff add notes to an order	Add notes, and show message that confirm that the note has been added	Done.
23.	A staff changes his password	Password changed. The system shows a message to confirm that the password had been changed	Done.
24	A staff update his/her personal information	Update the personal information. The system shows a message that confirms this.	Done.
25	A staff tries to change his/her store	Can not reach this feature	Can not reach to this feature.

Notes on staff area testing

- A staff (staff or manager store) can not view any information of another store. This was tested and was done correctly.

- A head office manager can view and generate reports on his/her store and all stores under its head office, but can not view information or generate a report for stores under another head office. This was tested and was done correctly.

- A staff (except administrator) can not create a new account for a staff. Furthermore, he can not change his store. This was tested and was done correctly.

7.5 Testing Scenario

One of the important reasons for performing a testing scenario is to test how the system manages a customer's order by defining which store should deliver an order, and whether the selected store has all the products in the customer's order. Furthermore, it is to test all of the components of ODSS-RCS.

Figure 7.1 shows a sample of the data that was entered is ODSS-RCS for testing purposes. It has administration ID, the name of the head office (HO) stores, HO Manager ID, a staff ID in a HO, three stores under a HO, a store Manager ID, a staff ID in each store, and additional samples of postcode for each HO and each store.

For more illustration of the scenario and to be clearer, some names from different areas and city in Malaysia were used. Note that the cost of delivery between stores are for testing purposes only.

Administrator ID	**admin fadi**								
Name of HO	**Ipoh**			**KL central**			**Melaka**		
HO Manager ID	mohd			amar			rami		
HO staff ID	ahmad			azmi			alia		
Sample of postcode that will serve from HO	50000	50004	50008	10000	10004	10008	70000	70006	70024
	50001	50005	50009	10001	10005	10009	70001	70020	70025
	50002	50006	50010	10002	10006	10010	70002	70021	70026
	50003	50007		10003	10007		70003	70022	70027
							70004	70023	70028
Name of stores	**Ipoh S2**	**Ipoh S3**	**Ipoh S4**	**Ampang**	**Bangsar**	**Bukit Bintang**	**Beach**	**Melaka Raia**	**A'Famusa**
Store Manager ID	ashia	omar	hatem	rani	laith	musa	kamrol	zdinki	abd
stores staff ID	ali	amina	read	reem	Sali	salm	hafz	nasr	mus
Sample of postcode that will serve from stores	55000	60000	65000	20000	30000	30500	75000	85000	80001
	55001	60001	65001	20001	30001	30501	75001	85001	80003
	55002	60002	65002	20002	30002	30502	75002	85002	80004
	55003	60003	65003	20003	30003	30503	75003	85003	80005
	55004	60004	65004	20004	30004	30504	75004	85004	80006
	55006	60005	65005	20005	30005	30505	75005	85005	80007
	55007	60006	65006	20006	30006	30506	75006	85006	80009
	55008	60007	65007	20007	30007		75007	85007	
	55009	60008	65008	20008	30008		75008	85008	
	55010		65009	20009	30009		75009	85009	

Figure 7. 1: A sample of the data that was entered in` ODSS-RCS for testing

Figures 7.2 - 7.4 show the cost of delivery in one area that consists of the head office and its stores. Figure 7.2 shows a sample of the cost between the stores in one area called KL. Figure 7.3 shows a sample of the cost between the stores in other areas such as Melaka. Figure 7.4 shows a sample of the cost between the stores in Ipoh.

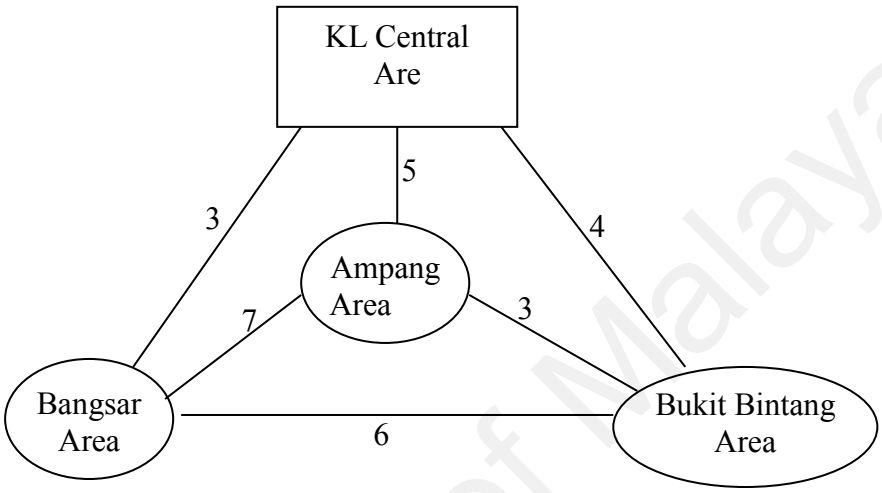


Figure 7. 2: a sample of the cost of deliver between stores in KL areas.

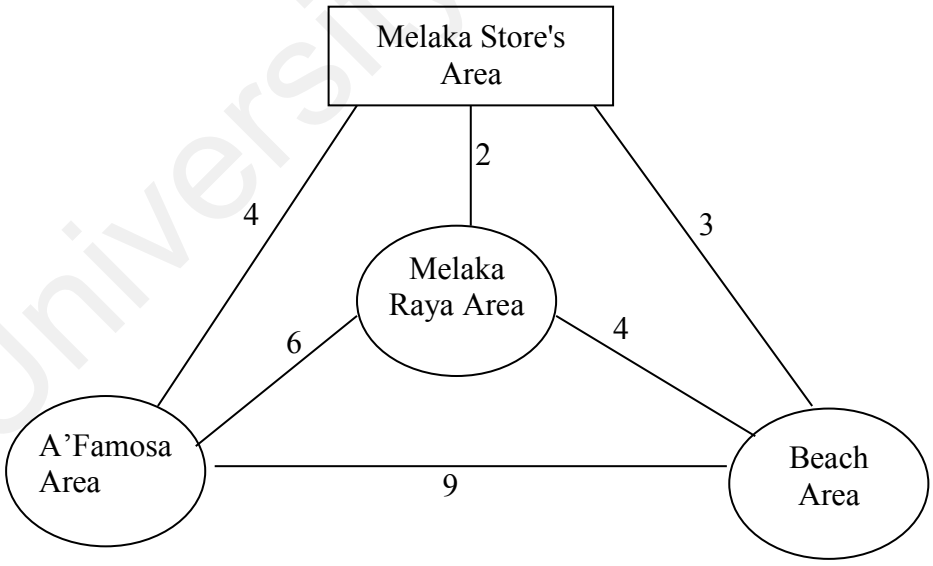


Figure 7.3: A sample of cost of delivery between stores in Melaka areas.

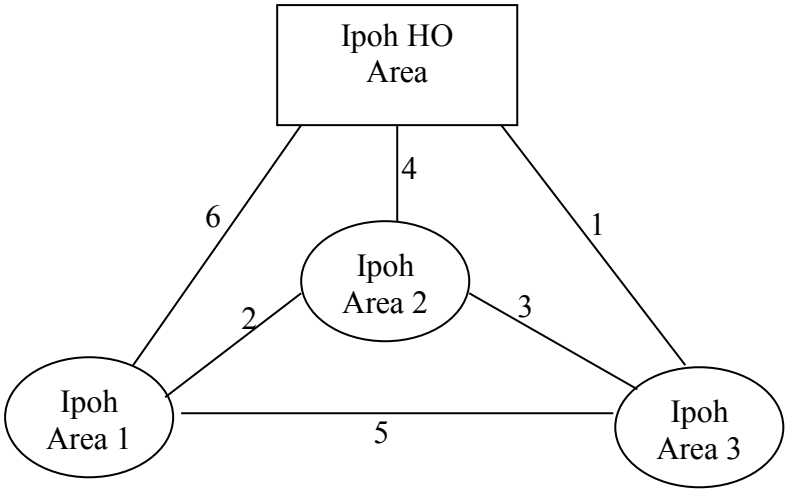


Figure 7.4: A sample of the cost of delivery between stores in Ipoh areas.

To complete the testing scenario, some customers need to test the scenario. Table 7.4 shows some customer ID and the postcode of their addresses that was used in testing.

Table 7. 4: A sample of customer ID used in testing the system

Customer ID	Home Postcode	Work Postcode	Other address
Qaz	55001	60002	
	---	----	
Qasm	60001	65002	
Fad	85002	----	
Ream	30504	50009	
Dadi	60003	----	
Ahmad	70003	80003	
Rosli	20009	10004	
Rna	80002	70002	30500
Azah	65001	20002	

After creating the customers ID account as in Table 7.4 and creating the stores and their staff and defining all related information as in Figures 7.1- 7.4 the scenarios for testing is started by customers loging-in into their account by using their customer ID, and then buying from the online shop. Next, the researcher will check which store(s)

has the product(s) in the customers' order and which should deliver the order to the customer.

The scenarios that are tested are summarized in Table 7.5, which shows the scenario number, customer ID, postcode for delivery of the order, products in the order, the store that should deliver the order depending on the lowest cost of delivery, the store which will deliver a product in case the nearest store does not have the product(s) in the customer's order, explains why the system chose a store to deliver a product in the order, mention of figures that shows the cost of delivery from each store, and finally the Figure number that displays the screen when the staff view the orders that should be delivered from his/her store.

Table 7. 5 Shows scenarios of customers' order from online shop, and which store will deliver the product.

Scenario number	Customer ID	Postcode of order	Product in the order	Store with the Lowest cost of delivery	Store that will deliver	Reason/s	Figure	System output
1	qaz	55001	❖ HP Photosmart	Ipoh 1	Ipoh HO	No store in the area has the product, so the system will save the order in HO to solve the problem	7.4	7.5 7.6
2	qwe	60003	❖ Camera Small ❖ IBM ThinkPad X41	Ipoh 2 Ipoh 2	Ipoh 2 Ipoh 1	The nearest store to the customer has the first product but not the second, so the system finds another store nearest to the customer that has the product, depending on lower cost.	7.4	7.7 7.8
3	qwe	60003	❖ Nokia N71	Ipoh 2	Ipoh1	Ipoh 2 store does not have the product, therefore the system finds the product at Ipoh 1, after considering the next nearest store to the customer depending on the lowest cost of delivery.	7.4	7.9 7.10
4	rania	30501	❖ Empower PowerPlay	Bukit Bintang	Bukit Bintang	The near store is Bukit Bintang , and it has one	7.2	7.11

			❖ HP PSC 2355 All-in-O ❖ HP LaserJet 4250 ser ❖ Dell Inspiron 6000.		Ampang Bangsar KL Central	product, and the other nearest store is Ampang and it has just the second product in customer order, Bangsar has the other product, and KL central store has the last product		7.12 7.13 7.14
5	rna	70002	❖ Creative MuVo TX MP3	Melaka HO	Melaka Raya	The Head office store does not have the product, so depending on the lowest cost of delivery, the system finds the product at Melaka Raya store	7.3	7.15 7.16
6	rna	80003	Compaq Media Center	Afa Musa	Melaka Raya	The nearest store does not have the product and the next nearest store also does not have the product, so the system find the product at the third nearest store	7.3	7.17 7.18
7.	rna	30501	Nokia 6125	Bukit Bintang	KL central	This address is in KL area, so depending on the lowest cost of delivery, the system finds the product at the KL central store	7.2	7.19 7.20

The following print screen shows when the staff views of the order that should be delivered from his/her store.

Scenario 1

The nearest store does not have the order, so the system attaches a note to the staff displaying which store will deliver the order. Figure 7.5 shows the order information and the note when the staff views the order.

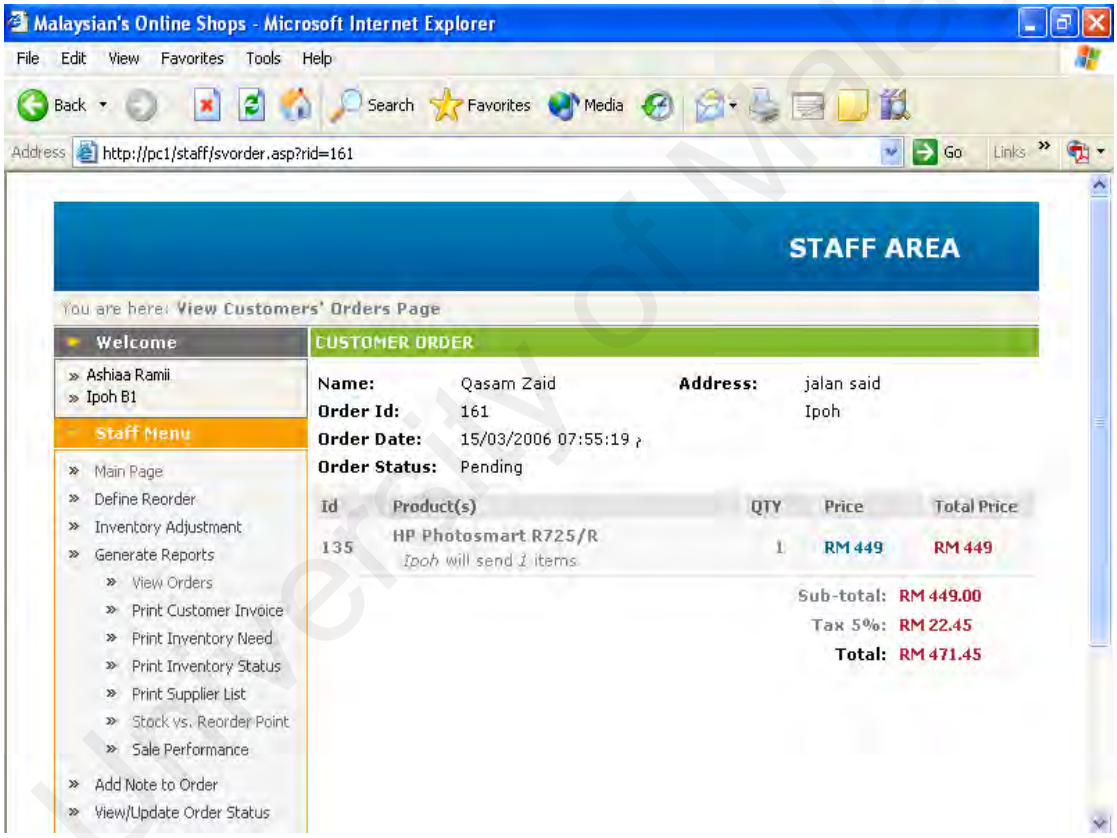


Figure 7.5: Customer's order when a staff of the nearest store in Ipoh 1 views the order in scenario 1.

When the nearest store does not have a product in the order, the system will find a store which has the product depend on the lowest cost of delivery. Figure 7.6 shows the details of a customer order. Actually the nearest store for this postcode is Ipoh 1 store, but neither this store nor the next nearest store has this product, so Ipoh HO will deliver the order.

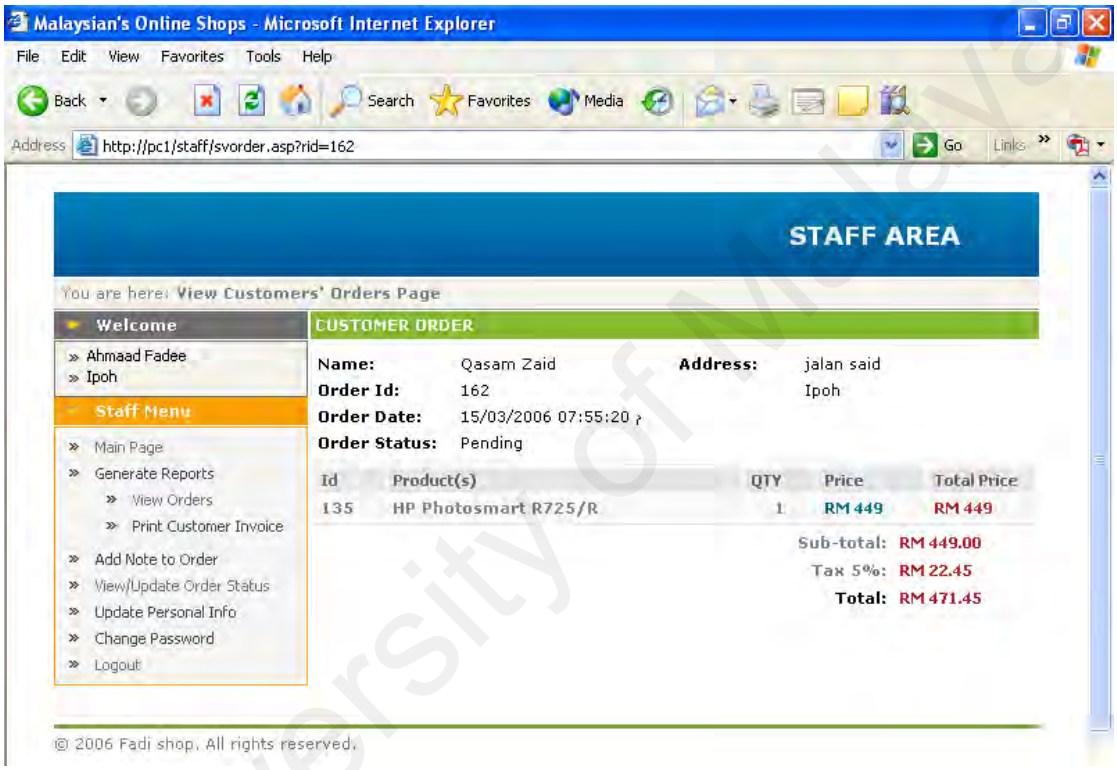


Figure 7.6: Customer's order when a staff of Ipoh HO views the order in scenario 1.

Scenario 2

The customer orders two products, but the nearest store has only one of the product. So, the system finds the next nearest store that has the product depending on the lowest cost of delivery.

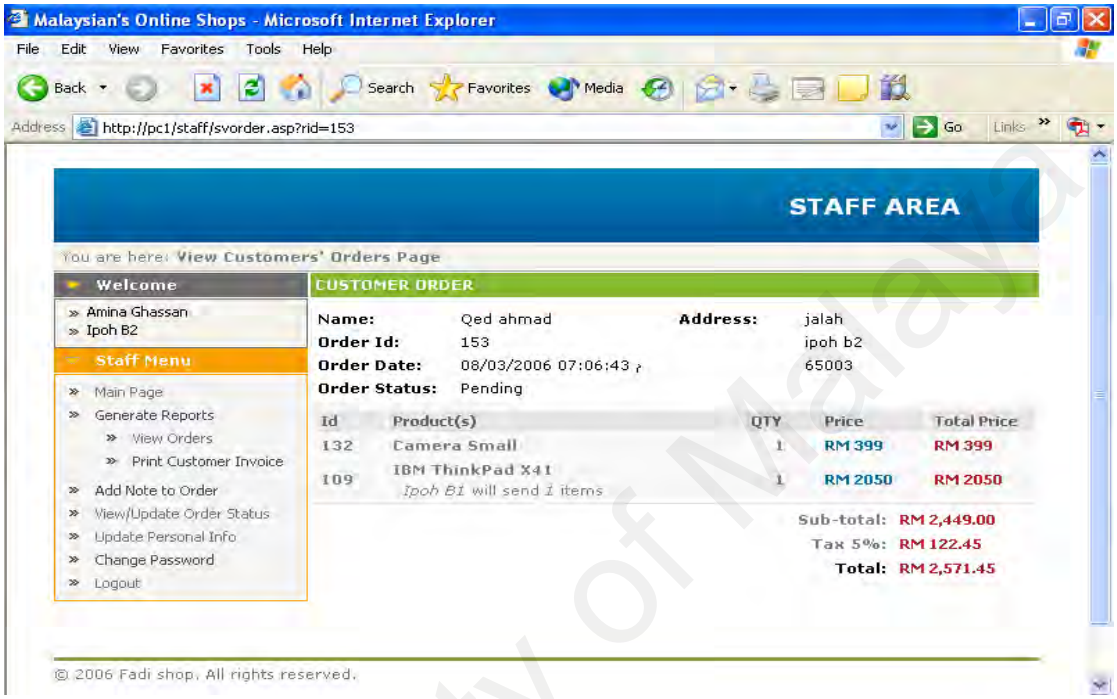


Figure 7. 7: the customer's order when a staff of the Ipoh 2 store views the order in scenario 2.

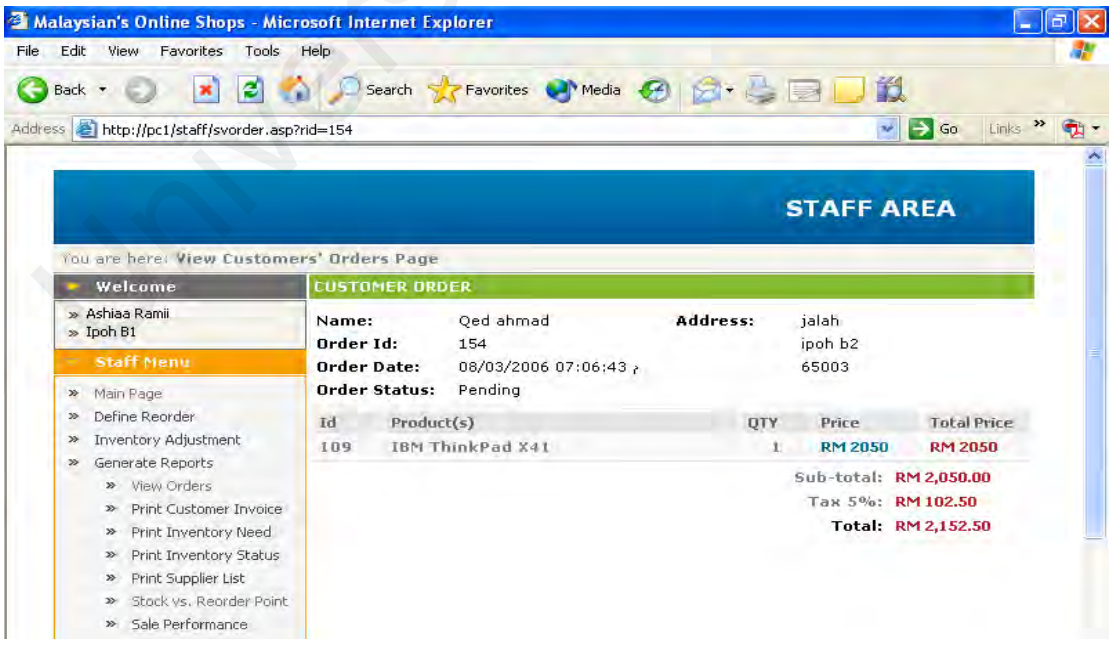


Figure 7. 8: The customer's order when a staff of Ipoh 1 store views the order in scenario 2.

Scenario 3

The customer orders one product, but the nearest store does not have the product, so depending on the lowest cost, the system find, the next neatest stores to deliver the order.

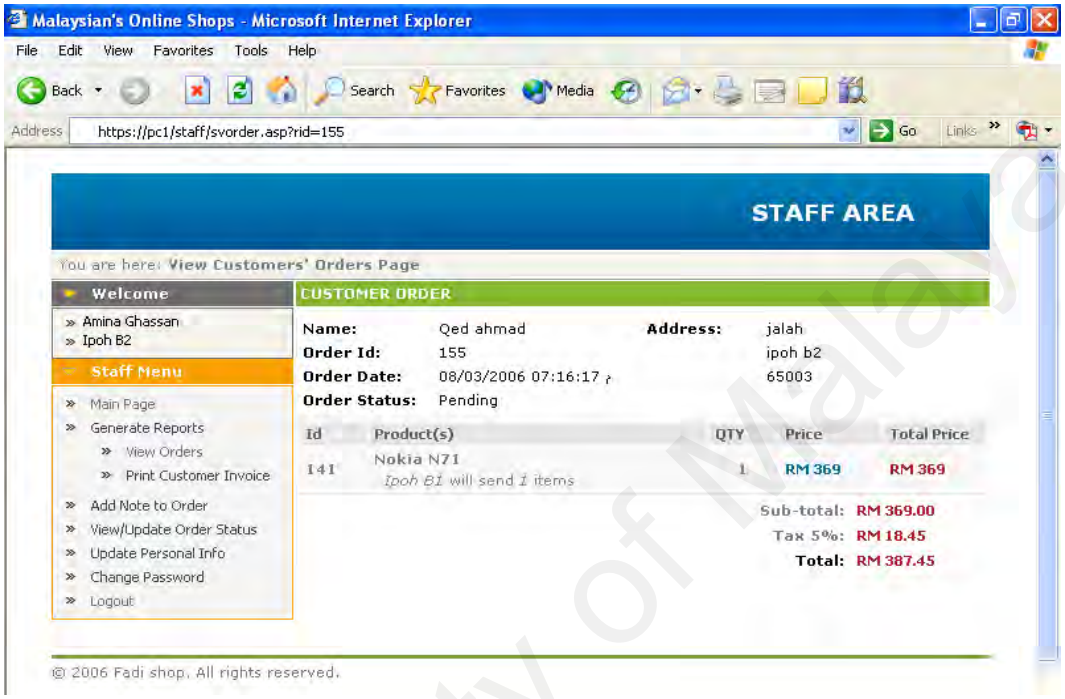


Figure 7. 9: Customer's order when a staff of Ipoh 2 store views the order in scenario 3.

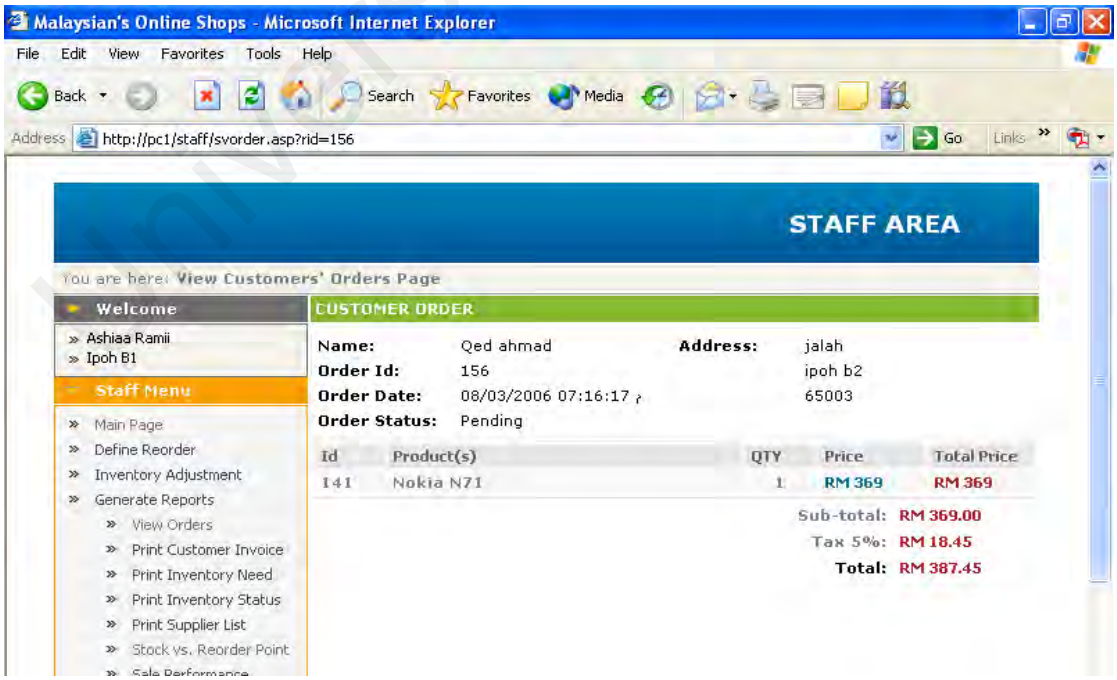


Figure 7. 10: Customer's order when a staff of Ipoh 1 store views the order in scenario 3.

Scenario 4

The customer bought four products. The postcode of the delivery address is 30501. The system found the nearest store is Bukit Bintang, and this store only has one product, i.e. Empower PowerPlay, but do not have the other products, as shown in Figure 7.2. The system finds the stores to deliver the other products to the customer depending on the lowest cost of deliver. Therfore Ampang store will deliver HP PSC 2355 All-in-O, Bangsar will deliver HP LaserJet 4250 ser, and the KL Central store will deliver Dell Inspiron 6000.

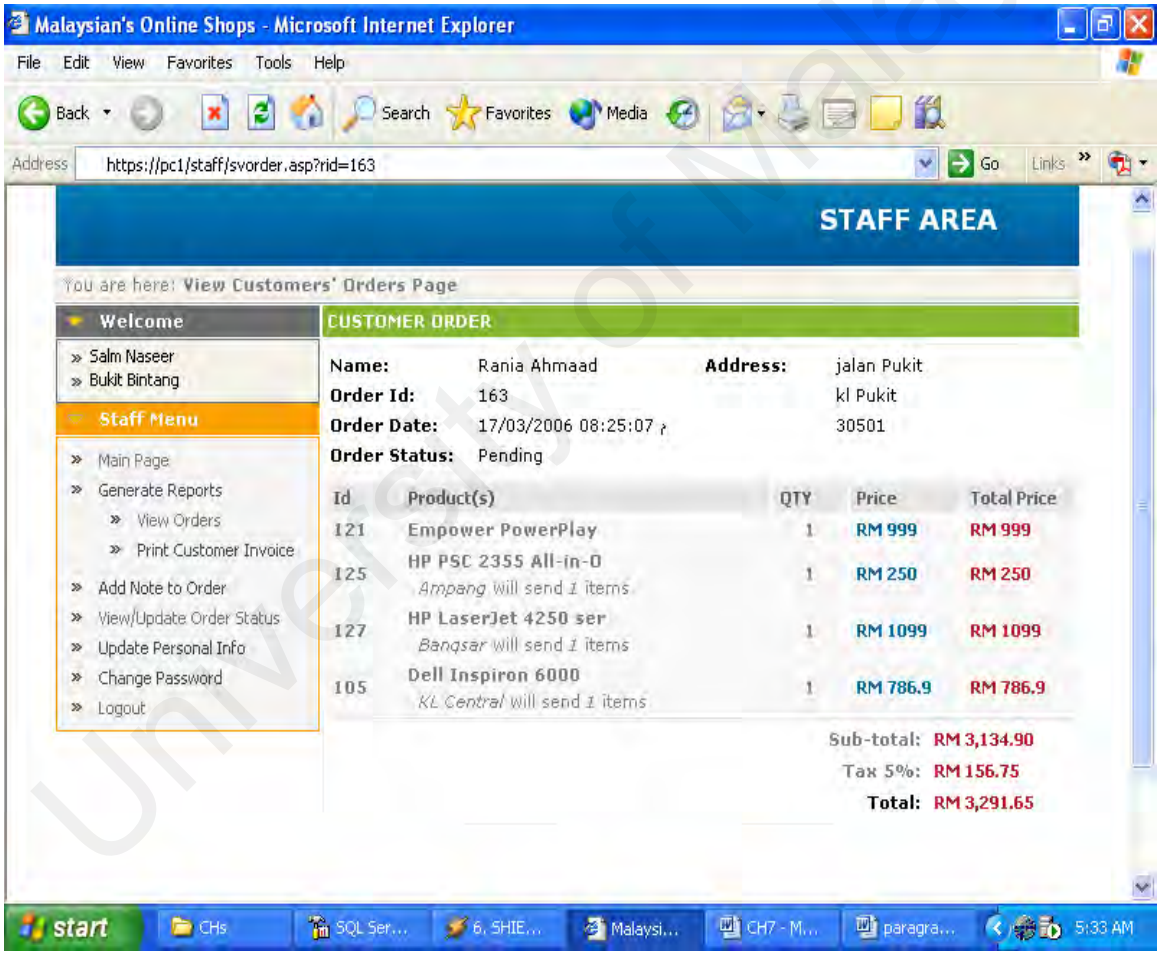


Figure 7.11: Customer's order when a staff of Bukit Bintang store views the order in scenario 4.

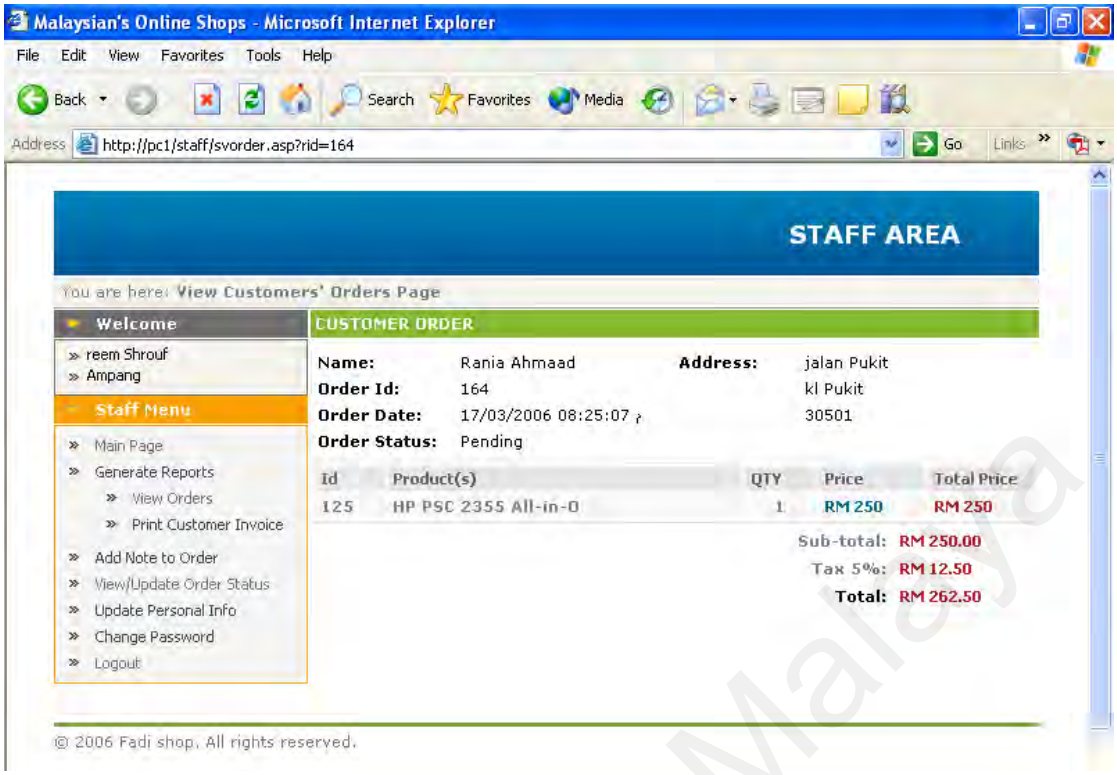


Figure 7. 12 The customer's order when a staff of the Ampang store views the order in scenario 4.

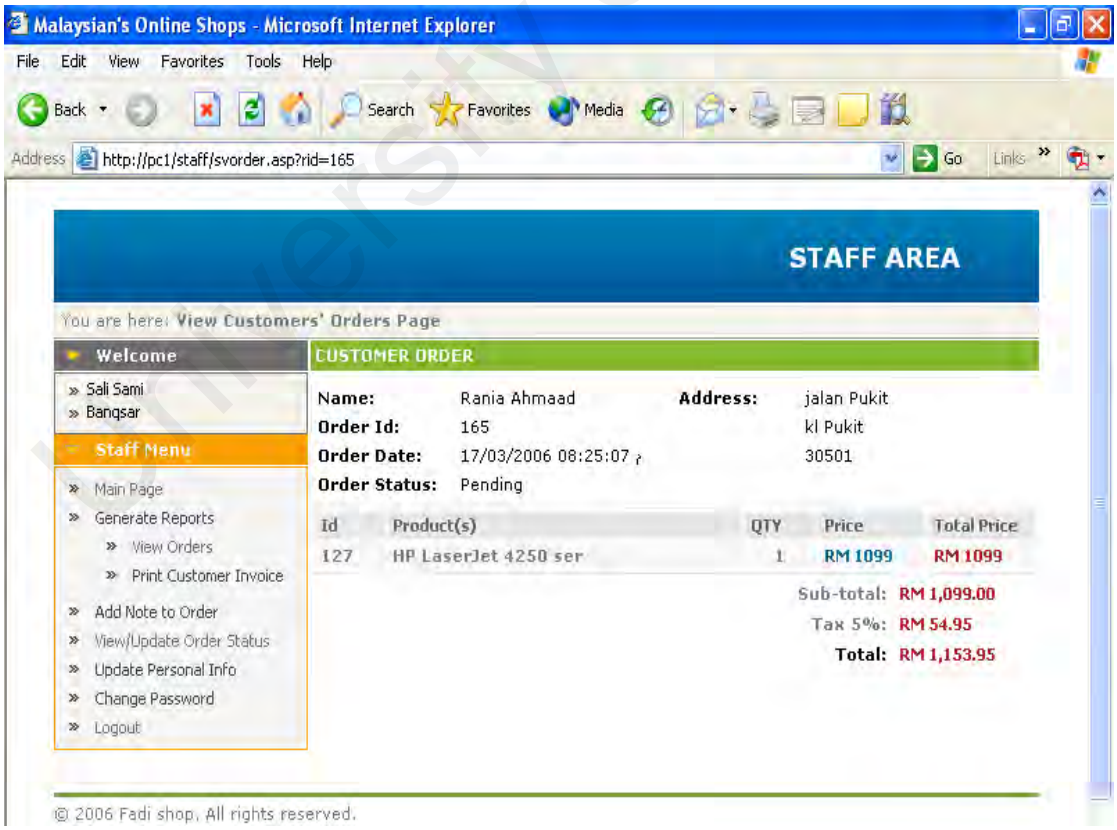


Figure 7.13: The customer's order when a staff of the Bangsar store views the order in scenario 4

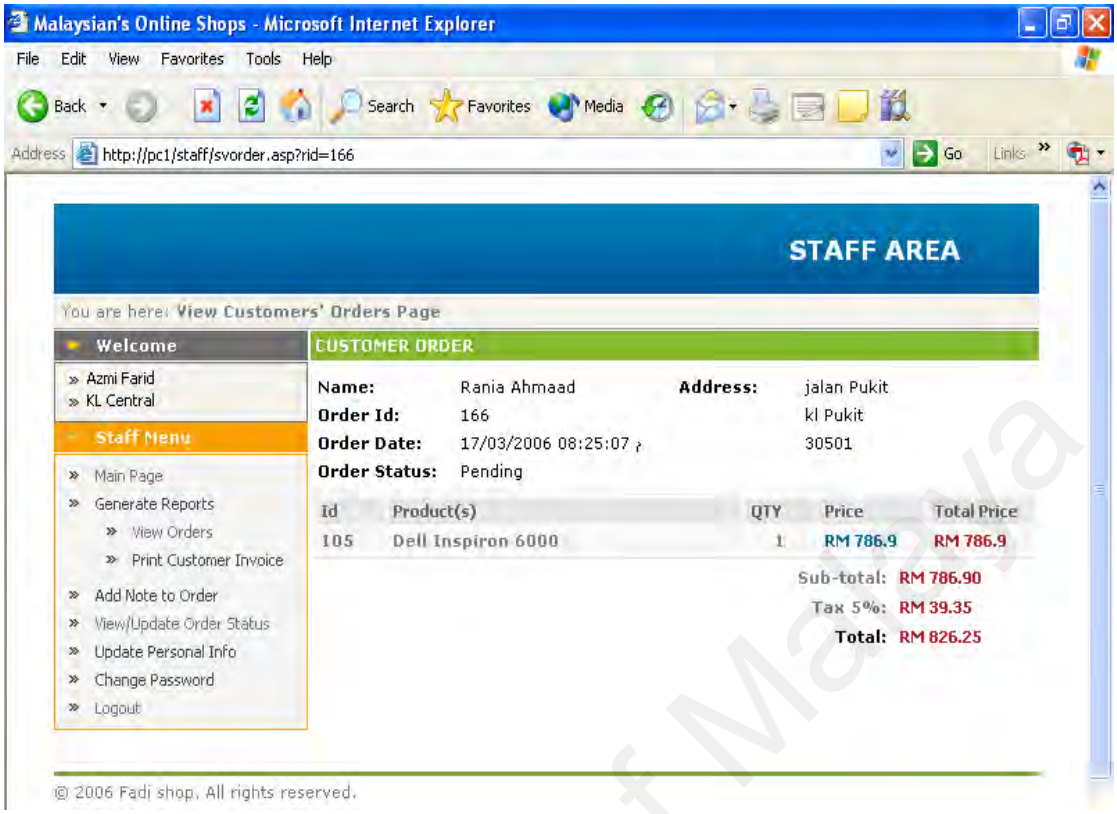


Figure 7. 14: The customer's order when a staff of the KL central store views the order in scenario 4.

Scenario 5

The customer bought Creative MuVo TX MP3. The nearest store for him/her is Melaka HO, but this HO does not have this product. So, the system, depending on the lowest cost, finds another store which has the product. The system displays a note that states which store will deliver the order.

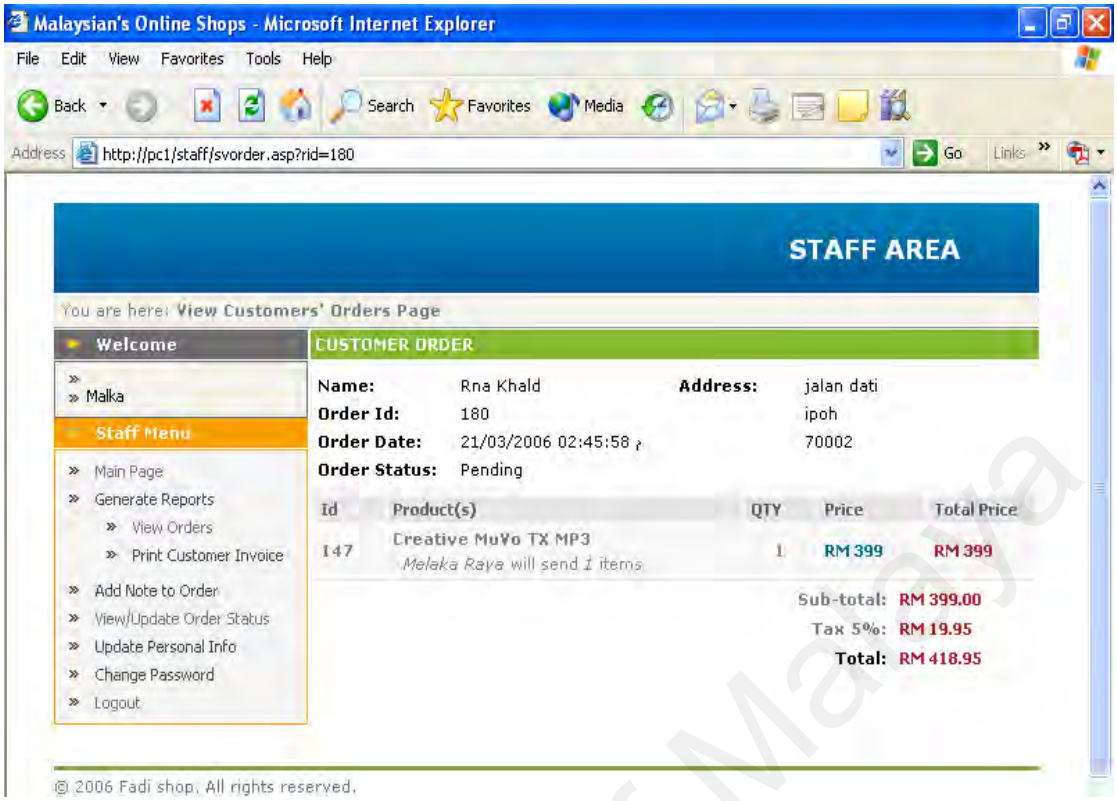


Figure 7.15 The customer's order when a staff of the Melaka HO store views the order in scenario 5.

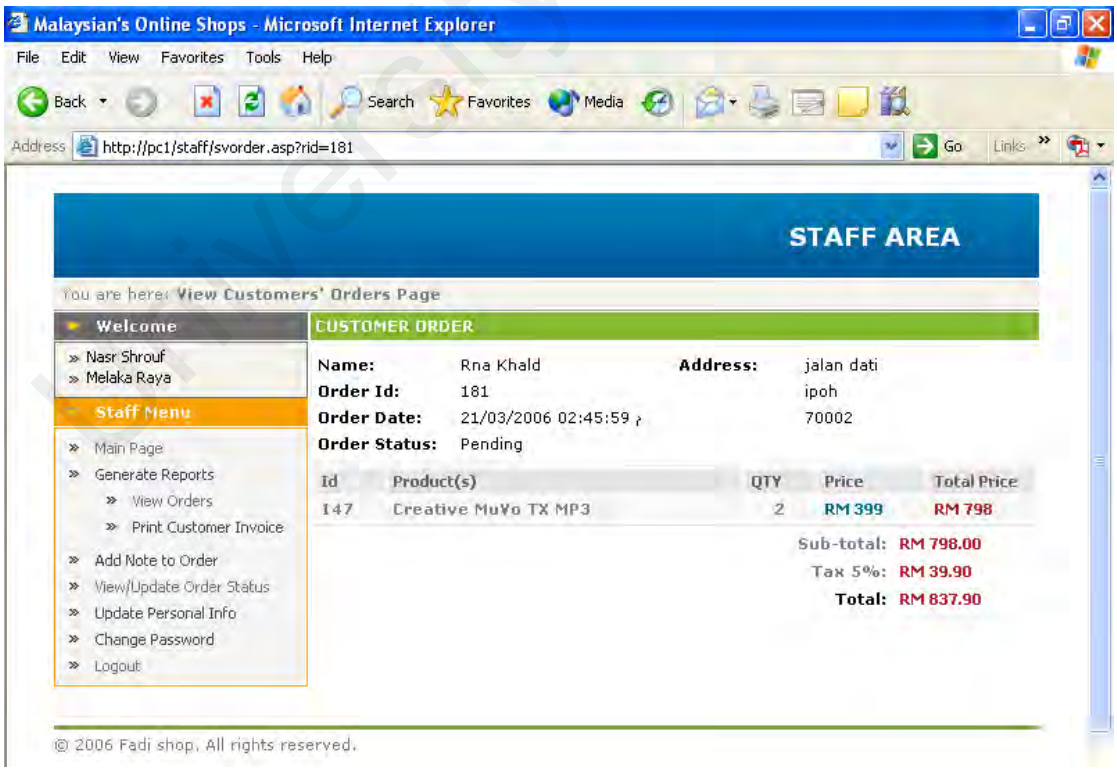


Figure 7. 16 The customer's order when a staff of the Melaka Raya store views the order in scenario 5.

Scenario 6

The customer bought a product, whereby the nearest store is A'Famosa, but this store does not have the product and the next nearest store which is Melaka HO also does not have the product. Therefore, the system finds the product at the third nearest store.

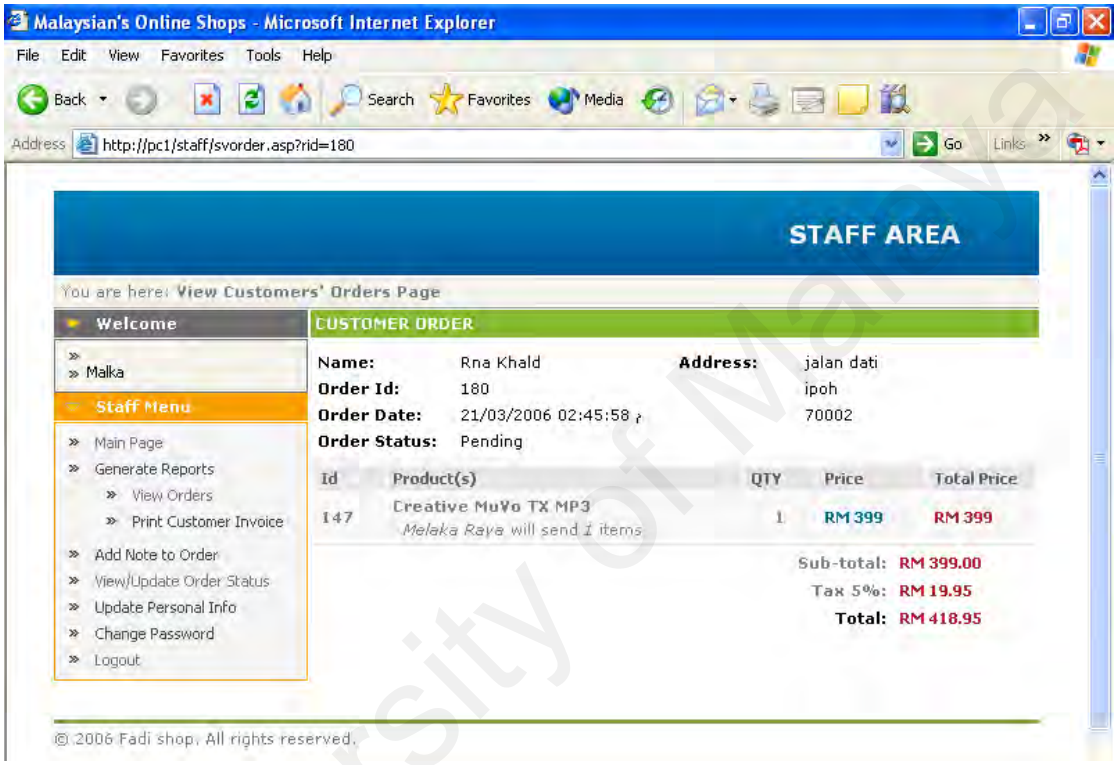


Figure 7. 17: The customer's order when a staff at the A'Famosa store views the order in scenario 6.

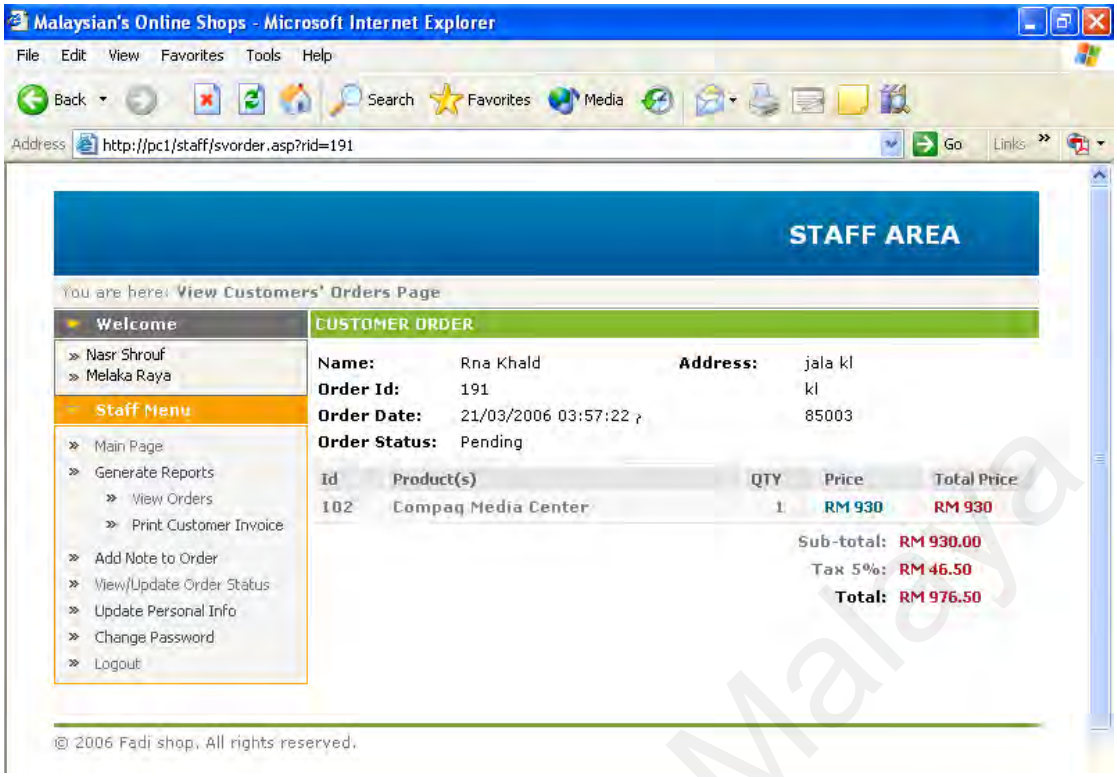


Figure 7.18: Customer's order when a Melaka Raya store views the order in scenario 6.

Scenario 7

The customer has many addresses to deliver the products to, some of them are in one area and some in another area, (HO and its stores). Figure 7.19 shows an order in the KL area. The nearest store does not have the product, so the system finds the next nearest store that has the product in the same area depending on the lowest cost of delivering the order. So the KL central store will send the order to the customer, as shown in Figures 7.19 – 7.20.

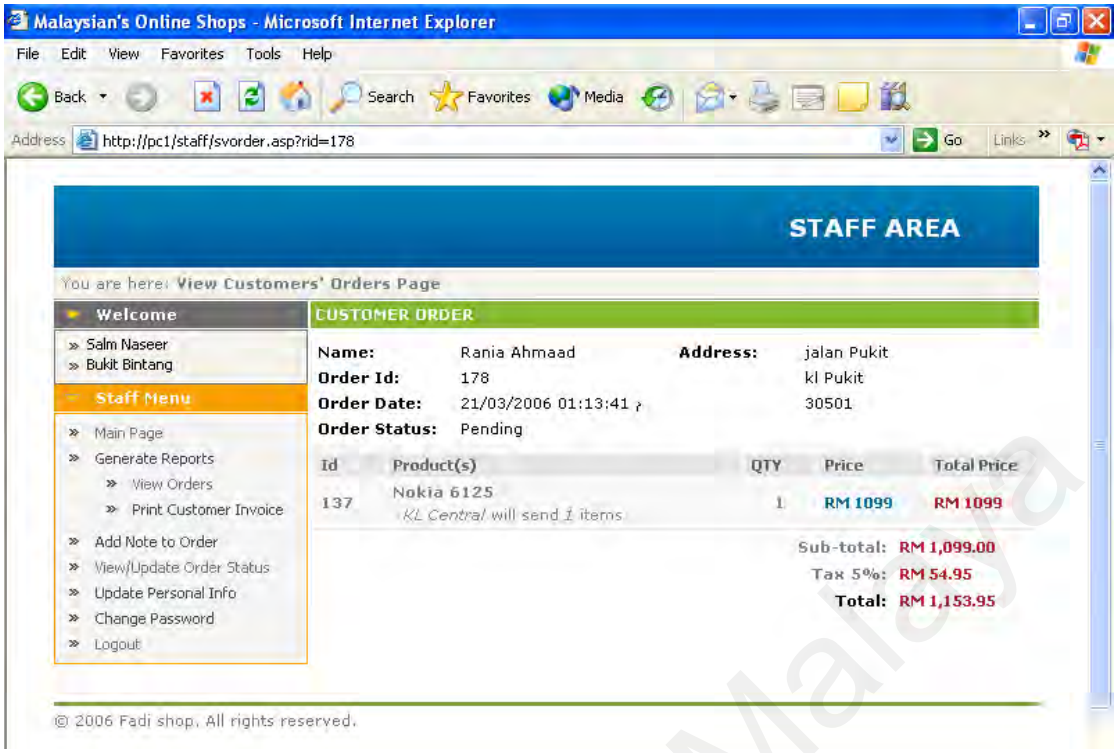


Figure 7. 19: the Customer's order when a Bukit Pintang store views the order in scenario 7.

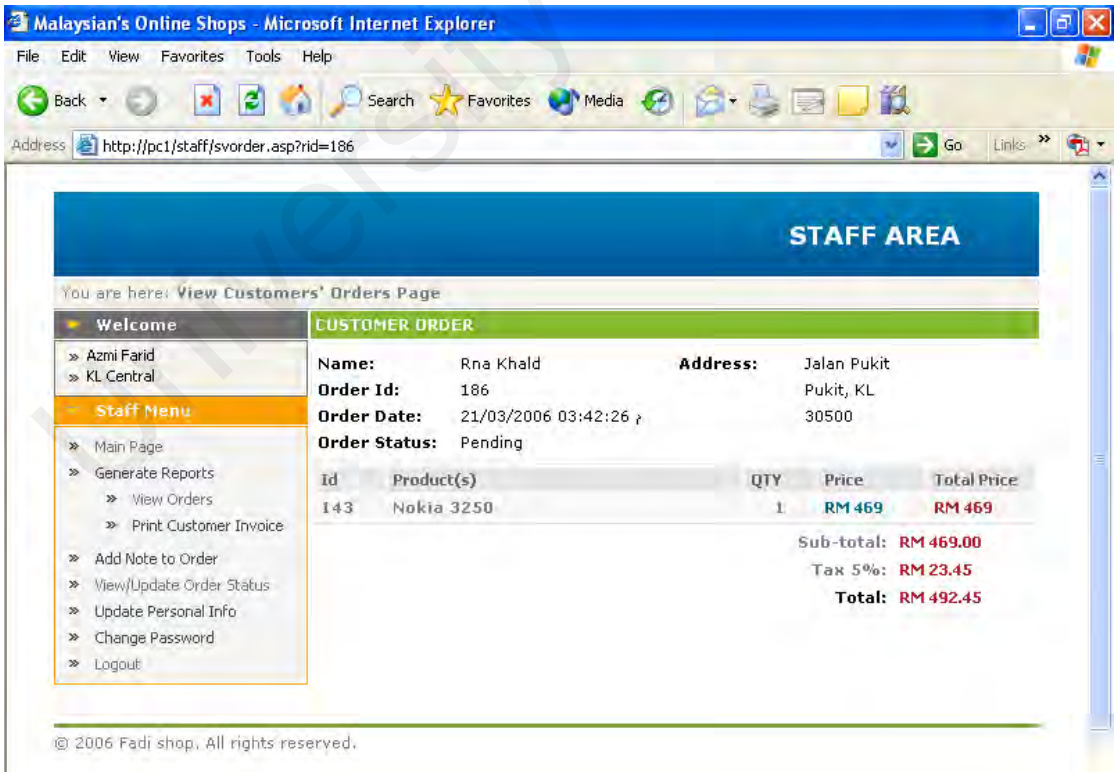


Figure 7.20: the customer's order when a KL central store views the order in scenario 7.

7.6 Security issues

Testing of the security that is implemented in ODSS-RCS is considered an important part in the testing phase. In this section, the final testing for the system, i.e. session, DB encryption, and SSL testing, were done.

7.6.1 Session

The testing for a session has been for all type of users, customer, staff, store manager, HO manager, and administrator. The results of session testing are as follows:-

- A session will destroy a logged account after 20 seconds if it isn't used.

- After logging out, if a user tries to go back into the account, the system asks the user to login and again.

- When the customer logged in into his/her account and copy the address URL and pastes it in a new window, the system does not log in the same address, but will open the log-in page to enter user name and password.

7.6.2 DB encryption

The database is encrypted using the CR4 algorithm, and the testing was done by viewing the encrypted dada in the DB. So if it is correctly encrypted, it will be in the

form of numbers. The following is a print screen for some of the encrypted data in the database.

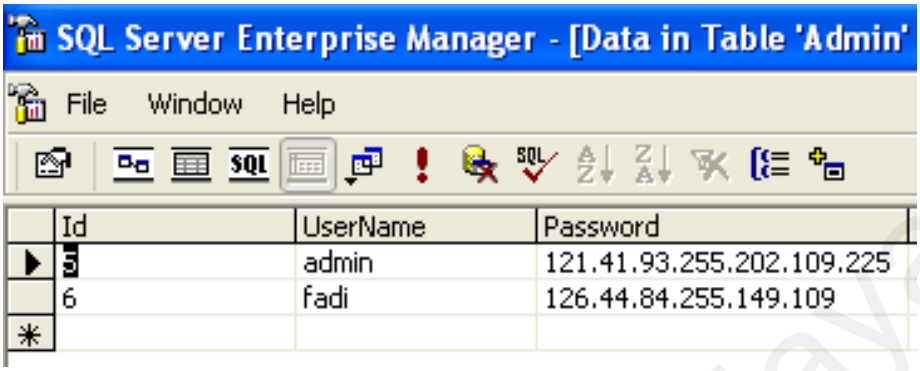


Figure 7.21: Encrypted passwords for the administrator in the database

The above print screen shows that the administrator password is in numerical form, which means it has been encrypted correctly.

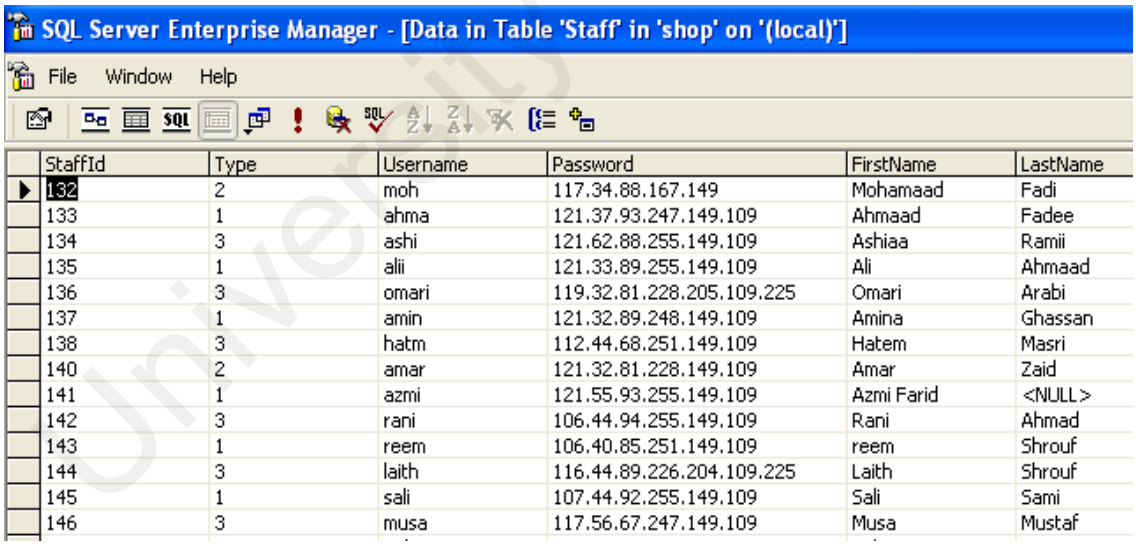
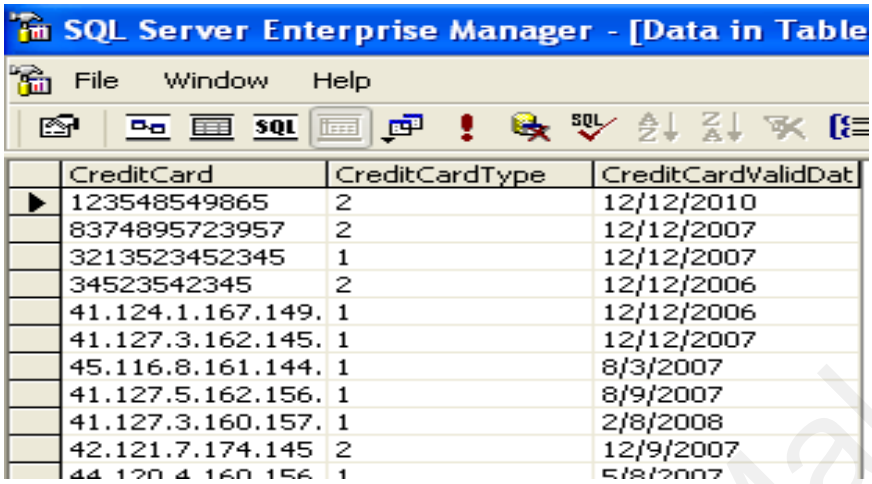


Figure 7.22 Encrypted passwords for staff in the database

Figure 7.22 shows a print screen for a part of the staff table. As can be seen in the figure, the staff passwords are in numerical form, which means that they were encrypted correctly.

Figure 7.23 shows a print screen for the credit card numbers that are stored in the database in an encrypted fomat.



	CreditCard	CreditCardType	CreditCardValidDat
▶	123548549865	2	12/12/2010
	8374895723957	2	12/12/2007
	3213523452345	1	12/12/2007
	34523542345	2	12/12/2006
	41.124.1.167.149.	1	12/12/2006
	41.127.3.162.145.	1	12/12/2007
	45.116.8.161.144.	1	8/3/2007
	41.127.5.162.156.	1	8/9/2007
	41.127.3.160.157.	1	2/8/2008
	42.121.7.174.145	2	12/9/2007
	44.120.4.160.156	1	5/8/2007

Figure 7. 23: Encrypted credit card number in the database.

7.6.3 SSL

To verify that ODSS-RCS is using SSL try must find a small yellow lock icon on the browser lower right corner, , is displayed in addition, the URL used HTTPS instead of HTTP. Figure 7.24 shows that ODSS-RCS implements SSL.

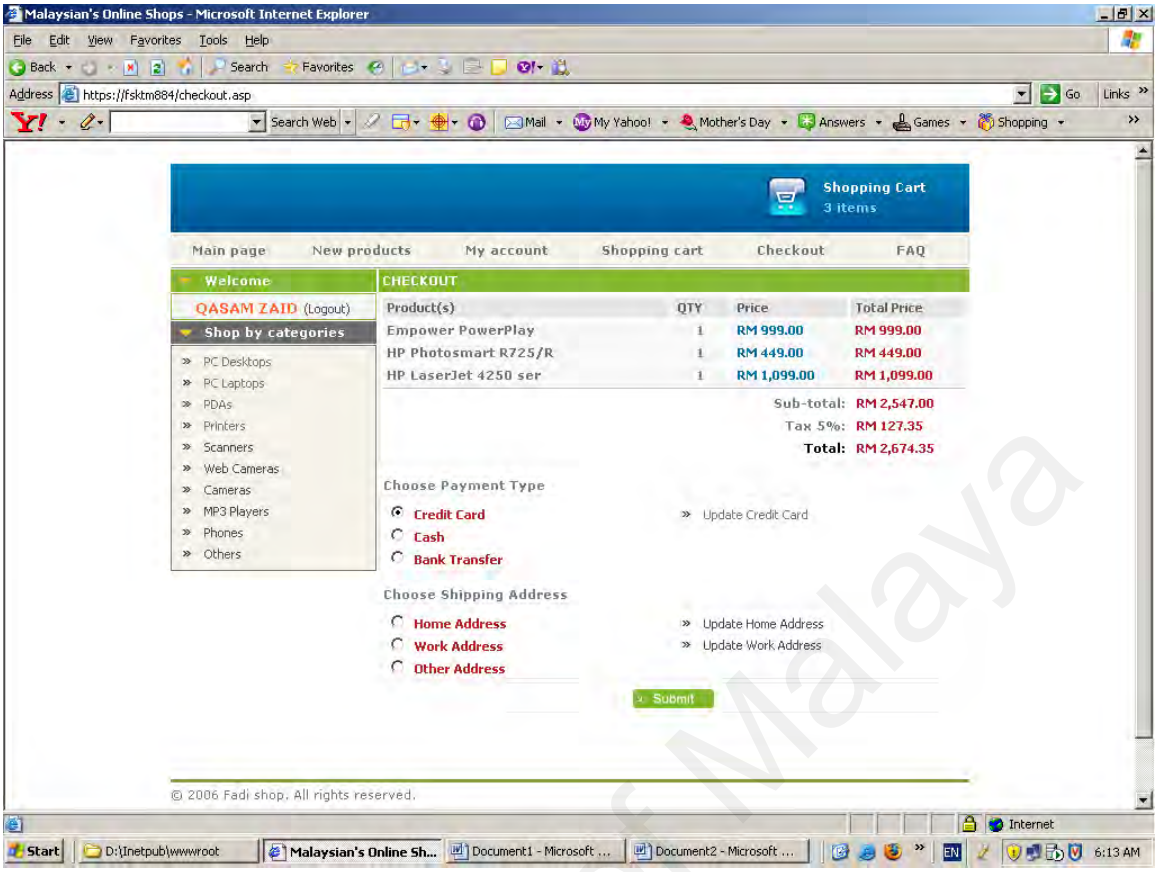


Figure 7.24: A print screen shows that ODSS-RCS implementing SSL

7.7 User Acceptance Testing

After the previous phases of testing were successful, the system was tested with potential users, i.e. the customers and companies. Questionnaires were distributed to each of them to evaluate the system.

7.7.1 Companies Testing and Analysis of the Questionnaires

For company testing of the system, 9 companies were asked to try out ODSS-RCS. The company questionnaire used for user acceptance testing is appended in appendix (E). The purpose of the questionnaire is to know the feedback from the test.

The analysis of part one of the questionnaire is depicted in Table 7.6

Table 7.6: Analysis of the answer to the questions in companies questionnaires.

Q #	Questions	Percentage				
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	The use of the system is easy	0.0%	0.0%	0.0%	33.3%	66.7%
2.	Support of many head offices and many stores bring efficiency for the organization.	0.0%	0.0%	0.0%	44.4%	55.6%
3.	The system can help the organization to implement the concept of decentralization in decision making.	0.0%	0.0%	0.0%	55.6%	44.4%
4.	The implementation of the system will increase the efficiency in delivering the online orders.	0.0%	0.0%	0.0%	33.3%	66.7%
5.	The system can manage the inventory of each store in the organization.	0.0%	0.0%	0.0%	22.2%	77.8%
6.	The empowerment given to the stores' staff in managing customers' order increases the efficiency of the organization.	0.0%	0.0%	22.2%	55.6%	22.2%
7.	Do you agree with the system finding the minimal delivery cost for the store that will deliver the order to a customer?	0.0%	0.0%	11.1%	33.3%	55.6%
8.	Do you agree that the minimal delivery cost implemented by the system would bring greater efficiency?	0.0%	0.0%	11.1%	33.3%	55.6%
9.	The system is able to find another store that can deliver the product based on the lowest cost, in case the nearest store does not have a product in customer order.	0.0%	0.0%	0.0%	11.1%	88.9%
10.	Generating reports by the store manager	0.0%	0.0%	11.1%	55.6%	33.3%

	will increase the efficiency of the daily management of the organization.					
11.	Generating reports by the head office manager will increase the efficiency of managing the organization.	0.0%	0.0%	0.0%	55.6%	44.4%
12.	Generating reports by the stores managers can increase the efficiency of decision making taken by them.	0.0%	0.0%	0.0%	44.4%	55.6%
13.	This system supports for your organization stores (branches).	0.0%	0.0%	22.2%	44.5%	33.3%
14.	Do you agree to use this system in your organization?	0.0%	0.0%	11.1%	55.6%	33.3%

As can be seen in the above table, most of the answers are either strongly agree, or agree. This means that system is proven efficient and effective for companies to use.

Figure 7.25: shows the average of all answers in the questionnaires from the companies that tested the system.

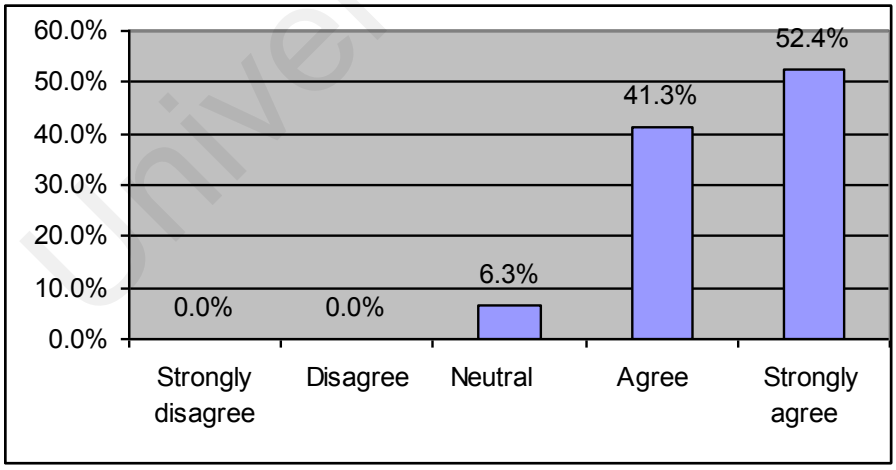


Figure 7. 25: the average of companies' answers that tested ODSS-RCS

Table 7. 7: Available features in the system from the companies' viewpoint

Number	Statement	Percentage
1.	The system finds the nearest store to a customer to deliver the online order	78%
2.	Able to create an account for a staff.	100%
3.	Normal staff of a store can login to his/her store only.	100%
4.	Support many levels of employee authority	89%
5.	View the details of the customer history orders	100%
6.	View specific order for a customer	100%
7.	View orders by date	100%
8.	Manager of HO can generate a report on stores that need inventory.	89%
9.	Store Managers can define the reorder point for a product	100%
10.	Store Managers can generate a report for sales performance for a product	100%
11.	Store Manager could generate a report of the supplier list that supply the stores with a specific product	89%
12.	The system gives an alert when the inventory becomes less than the re-order point.	100%
13.	Issue an invoice to a customer	100%
14.	Assign a product to a store	100%
15.	Add a new head office	100%
16.	Add a new store	100%
17.	Add a new product	100%

Table 7.7 shows the percentage of the available features in the system from the viewpoint of the companies that tested the system.

7.7.2 Customer Testing and Analysis of the Questionnaires

ODSS-RCS was also tested by 25 potential customers. After the users finished testing the system, filled in a "customers acceptance questionnaire" as enclosed in Appendix (F). The purpose of this questionnaire is to gather feedback from the customers about the system. The analysis of the feedback from the customer questionnaire is as follows:-

Table 7. 8: Analysis of the answers of the customers who tested ODSS-RCS

Q #	Questions	Percentage				
		Not very easy	Not easy	Easy	Very easy	Extremely easy
1.	The site interface of online shop is:	0.0%	0.0%	12.0%	52.0%	36.0%
2.	The checkout of the online shop is:	0.0%	0.0%	16.0%	52.0%	32.0%
3.	Filling the customer information is:	0.0%	0.0%	12.0%	56.0%	20.0%
4.	Updating the shopping cart is:	0.0%	0.0%	20.0%	56.0%	24.0%
5.	Updating personal information is:	0.0%	0.0%	16.0%	36.0%	48.0%
6.	Viewing the details of the customer history order is:	0.0%	0.0%	20.0%	48.0%	32.0%
7.	Finding the new products in the online shop is	0.0%	0.0%	24.0%	32.0%	36.0%

As can be seen in Table 7.8 most of the answers given are strongly easy, very easy, and extremely very easy. This means that the system is proven convenient to use by the customers.

Table 7.9: Available features in the system from the customers' viewpoint.

Number	Statement	Available
1.	Create user name	100%
2.	Use the product category for shopping	100%
3.	Use many addresses to order delivery	100%
4.	Update customer information when checkout	96%
5.	View specific history order	100%
6.	View history order by date	88%
7.	View history order by order ID	96%
8.	Customer able to find a new product easily	80%
9.	Delete product from the shopping cart	92%
10.	Add product to the shopping cart	100%
11.	Customer receive automatic email after purchasing from the online shop to confirm order information	100%
12.	It is compulsory to enter a postcode for a address	96%

The above table shows the percentage of the available features in the system from the viewpoint of the customers that have tested the system.

7.8 Summary

In this chapter, the testing phase of ODSS-RCS was discussed at great length. The testing techniques that were used are unit testing, integration testing, scenario testing, security testing and user acceptance testing. For each testing technique, the results have been scrutinized and analysed to better improve the system. The user-acceptance testing that was conducted on two types of users, i.e. potential customers and retail chain store companies, has proven that ODSS-RCS is easy to use and is efficient in handling each of the functionality offered.

Chapter 8

Conclusion

8.1 Introduction

This research was conducted to increase the efficiency and effectiveness of a retail chain store, by developing an online decision support system for retail chain stores (ODSS-RCS which supports the managers in managing chains of stores. ODSS-RCS mainly) manages customers' orders delivery by finding the nearest store which has the products in the customer's order to deliver them to the customer depending on the lowest cost of delivery.

ODSS-RCS is able to define which stores will deliver a customer's order depending on the lowest cost of delivery. In addition, it helps the managers to manage the chains by generating ad-hoc reports on the stores.

This chapter summarizes the dissertation by determining how ODDS-RCS has fulfilled the objectives as identified in Chapter 1.

8.2 Fulfillment of the objectives

Chapter one identified the main objective of this research project. In addition, it identifies four goals that support the main objective.

❖ **The main objective**

The objective of this research is to investigate and build an online decision support system for retail chain stores in order to aid management in decision-making pertaining to customers' orders, sales, procurement of retail products, and inventory management in each stores. In achieving this objective, the research should achieve some goals as follow:-

Result: The main objective is fulfilled by developing the ODSS-RCS successfully. The system can manage customers' orders, sales, procurement of retail products, and manage inventory at stores. Furthermore, it can aid management in decision-making.

❖ **The goals of the research**

In achieving the main objective, four goals were done and completed.

- **Goal 1**

  Investigate current retail chain stores, both locally and abroad, to identify the main problems limitation with current system.

  Result: The first goal was completed.

  Fulfillment: The current system for retail chain stores were investigated, and the problems and limitations were indentified.

- **Goal 2**

  Provide a solution to the identified problems and limitations of current on-line retail chain stores.

  Result: The Second goal was completed.

  Fulfillment: The solutions that can overcome on the problems and limitations in current on-line retail chain stores have been proposed, i.e. identifying the nearest store to a customer based on the lowest cost, and incorporating the decentralization concept and delivering a complete on-line system that provides both features & more.

- **Goal 3**

  Build an online decision support system for retail chain stores that supports decentralized organizational structure, and can generate reports that can help a HO, and store manager in making decisions relating to his/her store that related to him/her store.

Result: The third goal was completed**.**

Fulfillment: The system can generate reports for each store in the chains of stores. These reports give the manager of the store the ability to make a proper decision that relates to his/her store. In addition, the HO manager can generate reports pertaining to his/her HO and its stores. This feature helps the top management to apply the concept of decentralization in decision making pertaining to each store in the chain. Furthermore, the system helps the management to increase the efficiency and effectiveness of decision making by allowing the HO manager to generate the reports for its subset of stores.

The system:-

⇒ Can support a series of head offices, with each HO supporting a series of stores that belongs to it.

Result this goal was completed.

Fulfillment: The system can support chains from head offices and stores to manage the retail chain store in an efficient and effective way.

⇒ Can find a near subset of stores nearest to the customer, and then from the subset of stores, find the store which can deliver the customer's order depending on the lowest cost of delivery.

Result: This goal was completed.

Fulfillment: This goal was fulfilled by the system's ability to find a store which can deliver a customer's order from a subset of stores nearest to the customer and which will decrease the cost of delivery, as shown in Chapter 7.

⇒ Can find another store nearest to the customer in the case when the selected store does not carry a product in the customer's order. Here, the system with the lowest cost of delivery is chosen.

Result: This goal was completed.

Fulfillment: This goal was fulfilled by ODSS-RCS as shown in Chapter 7. The system will find the next nearest store to the customer to deliver the order depending on the lowest cost, in the case that the selected store does not have

a product in the customer's order. This feature increases the competitive advantages for companies by decreasing the cost of delivering the order in case a store can not deliver a product to the customer.

⇒ Can provide an alternative to customers to purchase products on-line in a convenient way to increase customers' satisfaction.

Result: This goal was completed.

Fulfillment: This goal has been fulfilled by ODSS-RCS. Customers can surf and checkouts from the online shop in a convenient way, so this increases the customers' satisfaction, and achieves competitive advantage for the companies. This was problem in the test result in section 7.7.

⇒ Can manage the product inventory for each store and determine which supplier can supply what product for a particular store.

Result this goal was completed.

Fulfillment: This goal has been fulfilled by ODSS-RCS to increase the efficiency and effectiveness in the daily operation.

- **Goal 4**

  Perform testing, including user acceptance testing, to ensure that the system performs each functionality accurately and efficiently.

  Result: The fourth goal was completed.

  Fulfillment This goal has been fulfilled by testing the system from potential users and gathering feedback from them that demonstrated that the system has achieved its intended objectives and goals

Conclusion

The thesis achieved the main objective that it is supported by there four goals.

8.3 Main Advantage of ODSS-RCS

Some of the main advantages of the online system are given below:-

- Support and encourage the goal of the retail chain stores
- The cost of delivery is used to define the store which can deliver the customer's order.
- The system can find other stores to deliver a product in case the selected store does not have a product in the customer's order.
- The customer can buy by is convenient way

- ❖ The system helps the management to implement the concept decentralization in managing the retail chain store.
- ❖ The system can support series of HO with each HO supporting a series of store.
- ❖ the system can manage the daily work for the stores

8.4 Disadvantage / Limitation of the system

The disadvantage of

- ❖ Does not support new trend that is pushing towards mobile shopping via multimedia message service (MMS).

8.5 Future Enhancement

- ❖ Extendable features to support mobile shopping via MMS.

Multimedia Messaging Service (MMS) is a communications technology developed by Third-Generation Partnership Project that allows users to exchange multimedia communications between capable mobile phones and other devices.

Supporting the system via MMS (support ODSS-RCS by m-commerce) means, that the customer can use mobile technology to purchase through the ODSS-

RCS by sending a message to the on-line system and receive a message that confirms its order. In addition, customers can use MMS to know the information related to his/her account / order. It also lets the system send messages to inform the staff about the customer order.

- Incorporate "shopping assistance" via an agent to help customers that are new to online shopping.

Online support services (on-line help) to provide help to the customers when they need it. ODSS-RCS will be able to interact with customers through the agent. In addition, ODSS-RCS will give suggestions to the customer if he/she faces a problem related to the system. It also lets the system help customers regarding the purchasing process, the creation of accounts, and the checkout procedure, etc.

Chapter 8: Conclusion

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