Abstract

Digital Computer Centre (DCC) is a hardware pricing system. The principle of the DCC web application is to provide information to the public. There are no online transactions provided and the information is totally free. Users can gain access to the system in any time, at any where, as long as the Internet service is available. There are user login will be requested to retrieve information from the system.

A lot of literature review has been studied to understand the system and most of the relevant information has been documented into the report. The research includes the performance of development platform, web server and technologies compatibility, powerful development tools and database management system.

The methodology that is used to develop the system is The Unified Process, which is based on the object-oriented concept. This methodology will be applied all the way until the end of the software development life cycle. The brief description of the methodology is stated in the report.

Extensive research has been carried on during the system analysis and design. This has to be done to ensure a good modelling of the system requirements, as well as the accuracy in the design phase. Since the analysis and design process is take advantage of the UML, it is easier to model the behaviour of the objects and also the database design.

It is hope that this documentation will provide useful information to other people regarding to the system being developed.

Acknowledgements

First and foremost, I would like to forward my highest gratitude to my supervisor, Mr. Chiew Thiam Kian who has been so patient in giving his invaluable advices and assistances throughout the project development.

Secondly, I would like to send my special thank you to my moderator, A.P. Dr. Siti Salwah Salim. Thank you for her kindness in freeing a time to attend my VIVA presentation. Thank you for your advices to improve the system.

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CHAPTER 1
Introduction

Chapter 1: Introduction

1.1 Project Definition

Digital Computer Centre (DCC) is a web-based application focusing on hardware pricing. It acts as an electronic shop that stores various computer accessories. However, DCC is not a business-based web application, at least in this moment. Therefore, the DCC doesn't involve with any on-line transactions; there are no products and services booking, buying or selling using CREDIT CARD. Consequently, there is also no confirmation via computer networks. Perhaps, in the future, DCC could be enhanced in providing commercial capability and helps companies to form relationships with customers; besides, expand their business through a virtual market.

DCC is an open system builds on the Internet related technologies. The system exploits the Internet as the core communication medium to distribute information. The web site is available to public regarding to their interests. All the information presented on the pages is stored in a centralized database which is collected from Malaysian market. Therefore, the majority visitors should be Malaysian especially those who are living around the capital, Kuala Lumpur. There is no login ID required for users to enter the web site but the database is protected to administrator only for maintenances and updating. Security is very important to prevent unauthorized access into the database. There are separated tables to store data in the database, such as hardware products, administrator information or comments written by visitors. Products are categorized into different groups according to their functionality. The design certainly will help users to browse through the web contents. Besides the products information, users also can compare

the prices (Ringgit Malaysia). The system somehow capable in calculates the total prices of each item selected by users through a module called "add-to cart". A new idea of image processing has been provided where a toolbar appear on certain location within an image to enable users save or print. However, it is an optional value in helping users to estimate their budget. The price should be around the value but vary with different suppliers.

DCC also provides an "intelligent" module to help users, who are leak of hardware knowledge, setup/configure their own personal computer. The system will interact with users; provide a step-by-step guide to analyze users' needs, and then generates a few options to help users in making decision. It is not an expert system, but the idea is there. It just needs some enhancement to become more artificial intelligent and this will a future research.

In this system, the public users will be the winners. DCC benefits the users by eliminates unnecessary waste of time and efforts. Users can write their comments to the web master regarding the system design and future enhancement. Therefore, DCC provides this facility to meet the public requirements.

1.2 Project Motivation

Most of the computer shops in Malaysia have computerized their management system to cater daily operations, as well as to ease the heavy working burden. This is a good approach in managing business consistently and effectively. But, as a customers view, the system only focus on the internal operation rather than so called "customer service-oriented".

Also, as we can see, many of them promote their products through mass media, such as newspapers, magazines or leaflets. This is not cost effective since it uses a lot of man-works to dispense papers that may not read by people. What a waste! Some of them are smart enough to advertise their company through Internet. However, this kind of information-based advertisement in terms of company profile and services provided are not so valuable to users.

There are lots of problems currently faced by users and sellers. Some of them are:

⇒ time and money wasted on journey.

⇒ difficulty in comparing the quality and price.

⇒ difficulty in locating and identify products.

The DCC, even though, is not perfect web application but can be served as a platform whereby users could simplify and make their "window-shopping" more relaxing and trouble less. Users could save their money and invaluable time visiting a physical shops. DCC has makes the life so easy and convenient where users can access many information from the site, with the capability of on-line browsing compare to traditional way. Users can compare the products prices and a full text description of the products. There will no more time wasting for being caught in a traffic and having difficulty looking for parking lot, while you find nothing at all and get disappointed. Don't it will be better when you find something first before you take action?

As a seller, DCC could make their works paperless and save storage for place. With a well design database, the information management will become easy and accurate. In addition, DCC also could help seller in providing a more efficient and useful service to customers.

1.3 Objective

The objectives of the project are as below:

- Study the techniques to publish and disseminate information on the Internet environment.
- Provide information in a paperless environment – to reduce the office storage and physical works in managing documents.
- Provide relevant and latest computer technology information. For instance, the up-to-date products information and prices.
- Provide a reliable web store with a reasonable respond time.
- Provide user-friendly interfaces with tables or graphical images to attract users, instead of text description.
- Access information from any location at any time, as long as the Internet service is available, without physically visits the shops.

1.4 Project Scope

Generally, the project scopes are:

- Develop to serve local residents especially those living around the capital, Kuala Lumpur.
- Implement a web-based interface to serve as the primary mode to distribute information to the public.
- Develop a secure database to store and organize computer accessories.

The project scopes could also be the functionally of the system itself. Therefore, the scopes also include the following parameters:

i) Administrator Module –

- Provide a login function to validate administrator ID.
- Perform database maintenance and data updating.
- Provide administrator registration.

ii) Customer Module –

- Provide current computer technology (hardware products) information using table form.
- Auto ranking of products through a single click.
- Provide a shopping cart facility for calculation.
- Allow users to give their comments or suggestions on the web site.
- Provide a step-by-step guide/clue to help users configure their personal computer.

1.5 Project Limitation

There is nothing perfect in the world. DCC also has its limitations which are out of the system capability. The limitation might be overcome in the future but there will be another problems encounter soon.

* The system, DCC could not be functioning without the Internet.
* The system only displays latest computer hardware products which are in the Malaysian market.
* The system will not incorporate with any on-line transaction, such as on-line payment or products ordering.
* Store management will only be done on-line.
* English will be the only language using in the system and there will not have other foreign currency, other than Ringgit Malaysia, provided in the system.

1.6 Project Schedule

Project planning is a very important process. It helps in managing time and cost of the entire project. A good project schedule, of because will assure the system carry out within a development cycle. Below is the project schedule for the whole system:

Table 1.1: Project Schedule

	2002							2003	
Key Activities	Jun	July	Aus	Sep	Oct	Nov	Dec	Jan	Feb
Research and Reading									
Literature Review									
System Analysis									
System Design									
Coding									
Testing									
System Integration & Testing									
Report Documentation									

1.7 Project Overview

Generally there are eight chapters in this report:

i) Chapter 1: Introduction

An overview of the entire project; descript about the project definition, motivation, objectives, scopes, limitation and the project development planning. A project schedule is used to indicate the development phases.

ii) Chapter 2: Literature Review

The study conducted regarding the issues and existing systems that are similar to the system being developed. It gives a brief description about the technologies and software that might be used in the project.

iii) Chapter 3: Methodology

A discussion on what kind of methodologies and models are going to use to develop the system.

iv) Chapter 4: System Analysis

This chapter discuss all the technology, deployment software, platform, as well as the hardware are chosen in this project. All the functional and non-functional requirement will also be listed clearly.

v) **Chapter 5: System Design**

This chapter will focus on the entire system where all the module with certain functionality, will be link together. Dummy interfaces will be created in this design phase. A Data Flow Diagram (DFD) is built to represent the information flow within the system.

vi) **Chapter 6: System Implementation**

Description about the implementation of the system's modules and algorithms into a executed forms by using certain programming or scripting language, such as VB Script, Java Script, JAVA, VB.NET and so on.

vii) **Chapter 7: System Testing**

A continues testing process to ensure the whole system executes correctly as what has been specified during the requirement analysis.

viii) **Chapter 8: Conclusion**

A section that encapsulates the problems encountered and the solutions to overcome it. The system strength and weaknesses will also be discussed here. Lastly, the overall conclusion of the project paper.

CHAPTER 2
Literature Review

Chapter 2: Literature Review

2.1 Background Survey

The rapid evolution of computer technologies has made the Internet as a virtual global community centre, distributing different types of information all over the world. Therefore, Internet becomes the major tool in providing information to public or expanding business market worldwide. By using any search engine, there are hundred or thousand e-commerce's linkages available for public references. Also, there are others resources, which are not commercial related. Studying these web sites certainly will give some useful inspirations to design the look and feel of the current developing web site. Here are some of the systems that have been analyzed:

a) Alfa Advanced Computer (URL: http://www.aac.com.my)

Alfa Advanced Computer is doing computer business in local market. In general, the system consists of four main options:

- Computer Package
- DIY (Do-it-yourself) – own customisation
- KWSP_PC – buying computing using KWSP Scheme
- Laptops

Weaknesses:

i) ***Lack of Legal Documentations:*** There is no any terms and conditions specification posed in the web site. This is a serious issue and could bring to any legal issues. Users should force to accept certain rules to protect the company itself. Comprehensible documents will confident users to submit their requests.

ii) ***Unattractive and Inconsistent Interface:*** There are no any images/pictures about particular products provided to let users have a review. Besides, choosing two colour schemes that are merely same could cause confusion to the users. Consistency is a very important issue to help users learning and use the system. Therefore, the entire background image should be parallel. Another issue regarding to web site is the arrangement of the form is quite messy. All the textboxes and labels should align in a vertical axis to increase readability.

iii) ***Lack of Online Help:*** There is no any help text or guide provided to the users to get instructions while they are shopping. Users will feel inconvenient if there is any uncertainty arises.

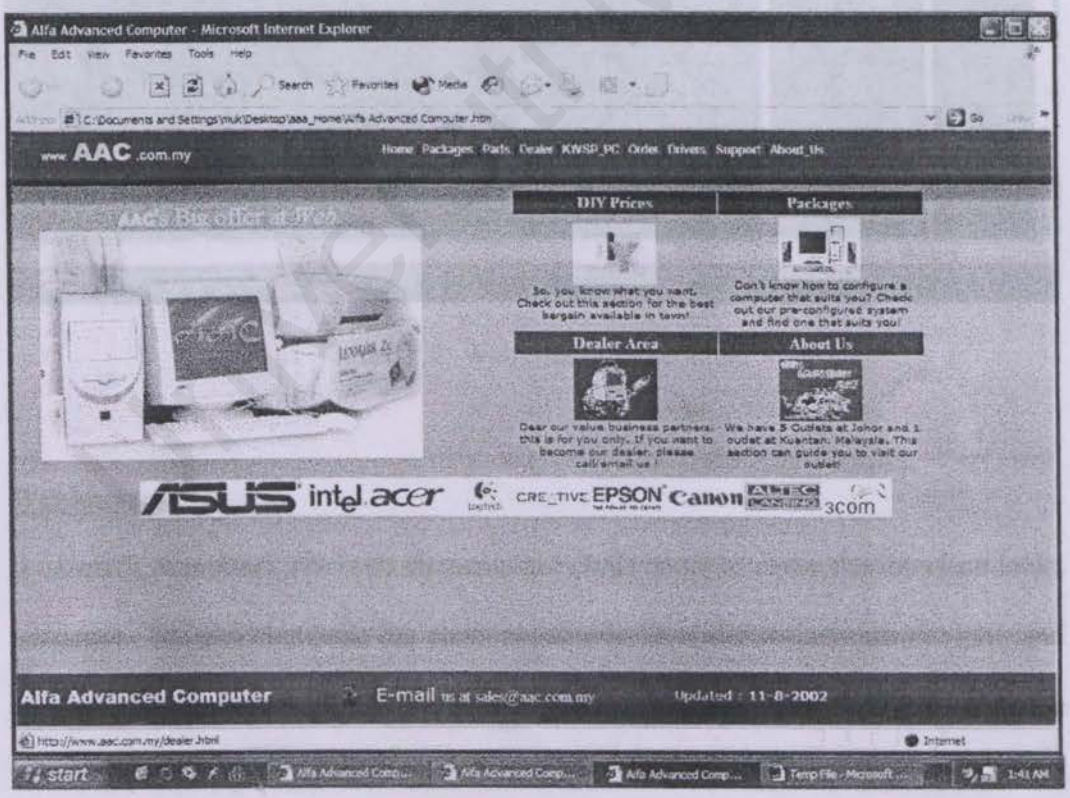


Figure 2.1: Web site of AAC Company — a local computer shop in Malaysia.

b) http://www.pc.com.sg

This a web site contributed by the Singapore computer retailer. There is nothing more than just to display computer accessories information which are sold in Sim Ming Plaza, Singapore. Hence, there is no on-line transaction provided. A list of retailer is provided as a link to the retailer's home page.

Figure 2.2: Web Site of PC.com.sg

Weaknesses

i) ***Untidy Interface:*** The web elements are close enough, make the interface looks dense. The gaps between the elements should be wider to increase the look and feel of the interface. The Home menu on the left hand side makes users confuse whether it is a link/button or just a normal text display.

ii) ***Lack of Features:*** There are too many links provided on this web site. The options such as search engine, useful link, resources, antivirus, software, games and etc, are actually a link too other web sites. The system itself doesn't provide any extra or unique functions.

iii) ***Flicker Object:*** The sparkle effect in fact is not a good design because it makes users feel inconvenient. The repeated picture flashes too frequently until users get frustrated.

c) http://www.hkrecipes.com

This is a Chinese web site providing on-line Chinese food recipes. The interface is quite well in design. It is simple and harmonic in the user view. There are a lot of pictures provided for the recipes instead of text-based information. Search engine is provided to ease the searching process. Other modules provided are:

- User Feedback
- Chat Room
- FAQ (Frequently Asked Question)
- Search Engine
- Recipe Dialogue

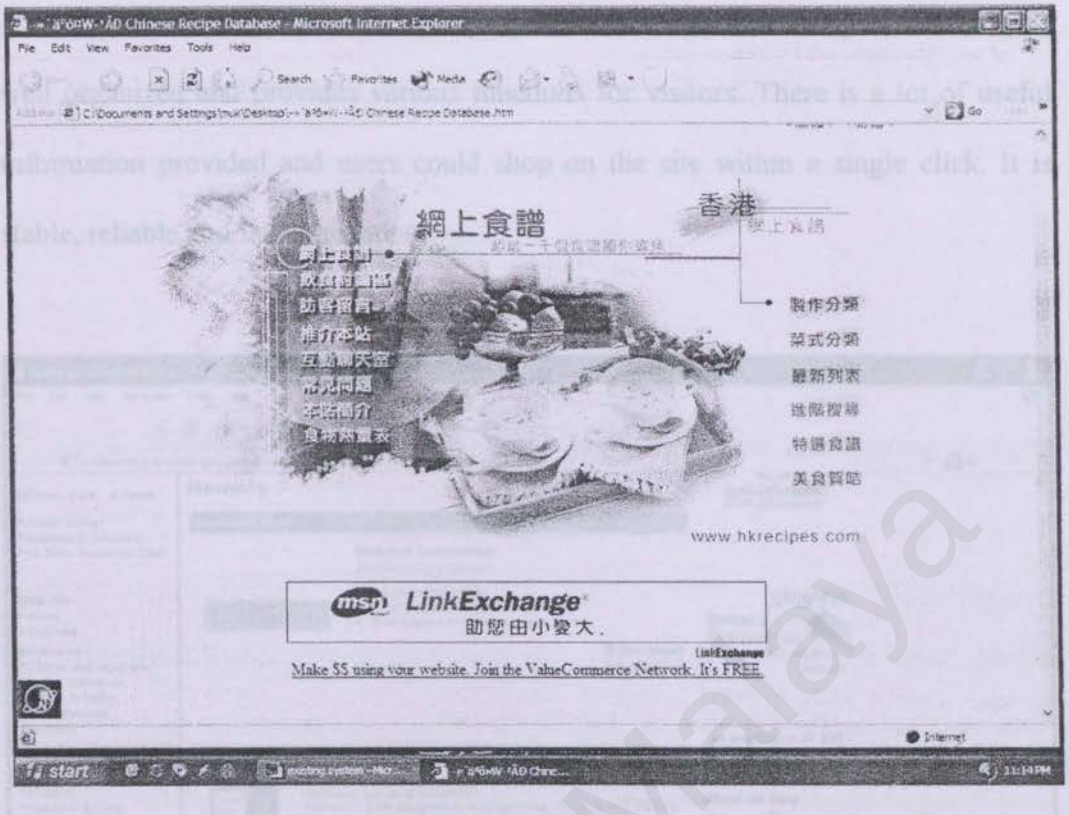


Figure 2.3: Chinese Recipe Web Site - providing several of Chinese food recipes.

Weaknesses:

i) ***Content and Sequence Controls:*** The page content and sequence are not organized. Most of the recipes are not categorized. This has lead to problem looking for information.

ii) Lack of Technical Support: There is no additional help support provided in the web site. There is also no useful link listed to help users connect to other relevant web site for references.

d) Gateway (http://www.gateway.com)

Gateway is a U.S. based company. The web site that set up by Gateway is well organized and provides various functions for visitors. There is a lot of useful information provided and users could shop on the site within a single click. It is stable, reliable and fast in response.

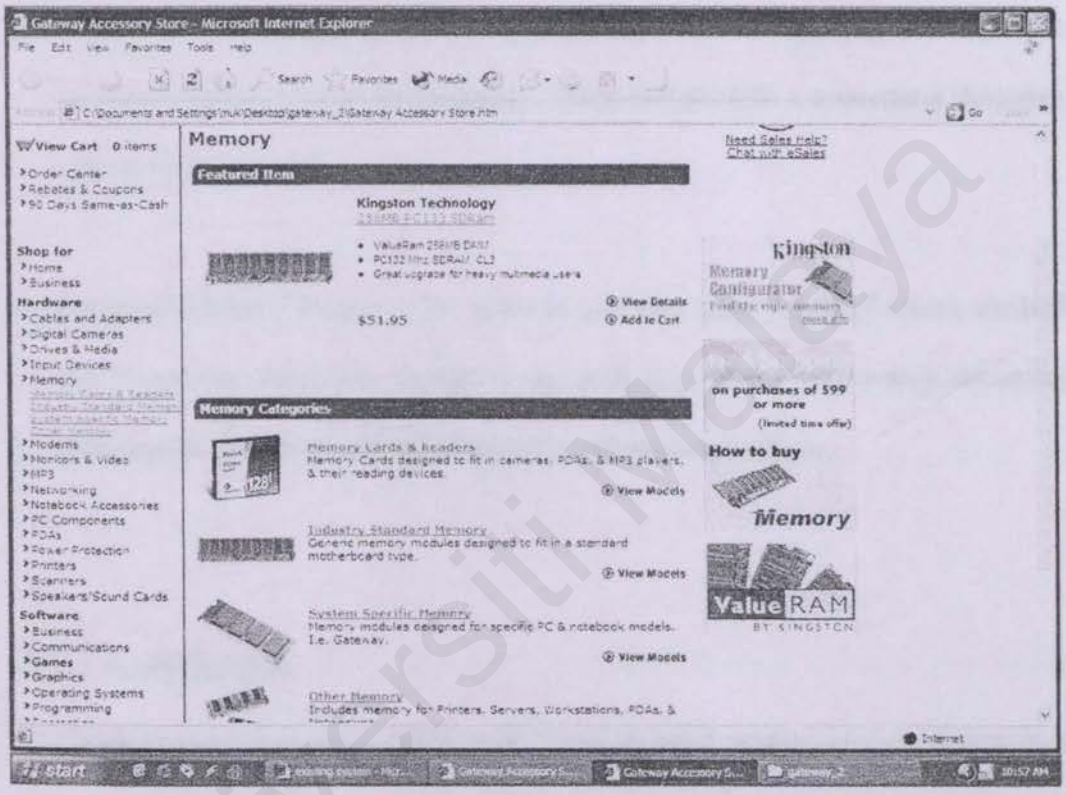


Figure 2.4: Web site of Gateway Company — A computer company based in U.S. but operates world wide.

Strength:

i) ***Attractive User Interface:*** The interface is consistent and easy to learn. There are no confusions occurred when users browse from one page to another page. A lot of images provided for each of the selling products to help users make decisions.

ii) ***Excellent Technical Support:*** There are four options provided which are

- Knowledge Library – includes FAQ, issues and technical documents.
- Driver Download – latest device drivers and tutorials.
- Site Navigation – includes site map, site help and search.
- E-mail – customer feedback and service.

iii) ***A Systematic Catalogues:*** All the products have been categorized into different section according to their functionality. These will provide a convenient shopping environment for users.

iv) ***Integrated Search Engine:*** The web site provides many types of search method and bound the search into smaller scope such as products information, technical information, corporate information and products specification.

2.1.1 Conclusion:

Basically, most of the web sites that have been studied are not design in a good manner to provide information or services. The reasons behind it are as below:

- *Unattractive and Inconsistent Interface*
- *Lack of technical support – online help, link, tutorial, legal documentations and etc.*
- *Lack of features – search engine, add-to-cart technique and etc.*
- *Product Cataloguing*

Therefore, these issues will be taking great consideration in the project development.

2.2 Internet Overview

Internet is like a loose organization of thousands of computers all over the world. Information flow through. The entire network is like an electronic road that allows information flow through all over the world. On October 24, 1995, the FNC unanimously passed a resolution defining the term Internet. The Federal Networking Council (FNC) agrees that the following language reflects the definition of the term "Internet". (Barry et al, 2000)

"Internet" refers to the global information system that -- (i) is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-on; (ii) is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-on, and/or other IP-compatible protocols; and (iii) provides, uses or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein.

Internet originated in United States in 1960s. This research was funded by the American Department of Defence to develop a reliable computer network system. Then, it became increasingly used outside the defence sphere to link universities and other research organization. In 1973, U.S. Defence Advance Research Projects Agency (DARPA) started to investigate techniques and technologies for interlinking packets networks. The project was known as Internetting Project with the objective to develop communication protocols that allowed networked computers to communicate transparently. Consequently, the Internet nowadays is using TCP/IP Protocol Suite as the major system protocol. (Ford *et al*, 1996) (Behrouze *et al, 2000*)

i. TCP (Transfer Control Protocol)

⇒ break information up into packets.

⇒ labelled the packets with sender's and receiver's address.

⇒ call for resent if packet is corrupted during the transmission.

ii. IP (Internet Protocol)

⇒ lingua franca of computer communication.

⇒ routers use this protocol to pass packets on.

Other related protocols are FTP, Gopher, WAIS, NNTP and etc. (Forth net, 2002) (Ford *et al*, 1996) (Behrouze *et al, 2000*)

Internet technology was based on the ideal of multiple independent networks that communicate together. ARPANET was the pioneer to the packet switching network in the past. With the rapid evolution in computer scene, Internet soon included other packet networks such as packet satellite networks and ground-based packet switching networks. Now, Internet is an open architecture network – allows for communication across all types of computer systems.

Internet has made a revolution in communication world. The interaction within individuals or computers is regardless to the geographic location. There are three kinds of connection: (Forth net, 2002) (Behrouze *et al, 2000*)

- ❖ Directly connected to others with wire/fibre optic cables.
- ❖ Through local and long-distance telephone lines.
- ❖ Wireless satellite communications.

2.3 World Wide Web (WWW)

World Wide Web or commonly known as the Web, is based on a standard networking concepts using client/server architecture. Nowadays, the Web probably is the major client/server system with million of users. By running an http daemon a web site could becomes a web server and a user becomes a web client by running a browser (Netscape, Internet Explorer) as a front-ended application.

The concept of Web began in 1989 when Tim Berners Lee (a member of European Laboratory for Particle Physics, CERN near Geneva) first proposed the ideal. The objective of the project was to facilitate collaboration between high energy physics that was working at different location throughout the world. He was the one who first wrote the web server and web browser program. (Caillian, 2000)

The Web is designed to be an open-ended multimedia system. It can deliver both text and non-text (audio, video, graphic) based information. It is interactive and is a realization of the hypertext theory. Hypertext is a computer-based system for linking documents to other related documents. The link is embedded within the text and could be a highlighted words or images. Each site has a server program that will respond to the browsers (clients) which are requesting information resources. A document that is embedded of a series of information resources (text with embedded pictures) consider a separate request issued to the server. (Andrew, 2000) (Caillian, 2000)

In concrete terms there are 3 simple aspects to the Web which enable it to function in practice: (Andrew, 2000)

a) A consistent naming scheme for referring to resources: -

any unit of information (documents, images, video or audio) is known as a resource. Users refer to particular resource by using an identifier which describes the resource location. Current mechanism is known as the URL (Uniform Resource Locator).

b) A mechanism for retrieving a resource: -

the standard Web retrieval mechanism is HTTP (hypertext Transfer Protocol). Protocol is a set of rules for network communication. Without a protocol two devices may be connected but not communicating, just like a person talking French cannot be understood by a person who speaks only Japanese.

c) A system for describing the logical structure of text: -

the logical structure of text is described using mark up language, HTML (Hypertext Mark Up Language). HTML defines the logical components of a document.

Although the primary goal of the Web is information distribution, but it also provide other services that is transcend from those traditional media. (Andrew, 2000)

a) universal interface: - using web browser as a universal client/front-ended application.

b) access to global community: - provide an electronic community transcending national boundaries.

c) corporate Intranets: - can be used internally to provide an easily accessible front-end interface to a private information system with no outside connection.

d) commercial access to global market: - enables a business to reach a rapidly growing global market of potential customers.

e) Easy access to global information services: - the Web provides cheap and simple access to a fast-growing global information services where users could publish and retrieve information on the Web.

2.4 Client/Server Computing

Client/server first used in 1980s, but started gaining acceptance at late 1980s. Compare to the general distributed computing, client/server system is more structured. One should remember that client/server is a software model of computing, not a hardware definition. In the perspective of client/server computing, client generally requests for services and the server executes the tasks. The task could be displaying some information or involved a complex computation. Finger, Telnet, FTP, NFS, Gopher, WAIS and World Wide Web are some of the systems that using the client/server architecture. (Camegie Mellon, 2001)

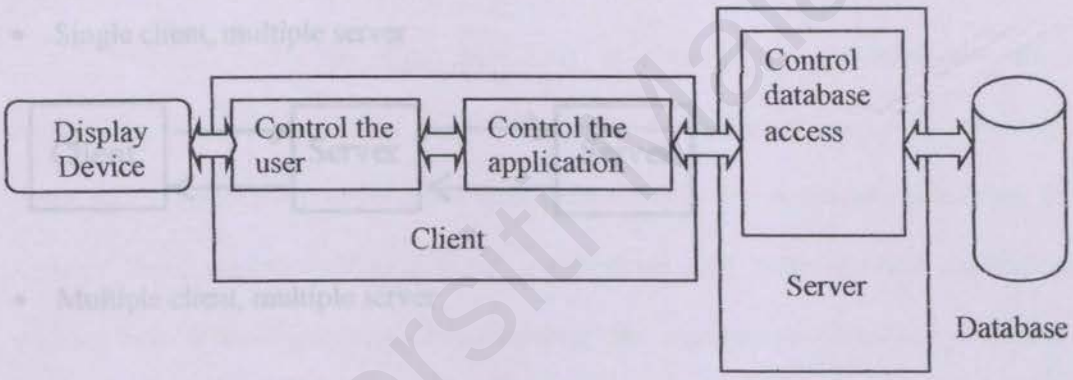
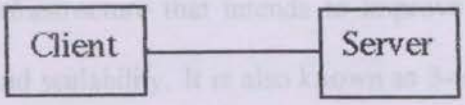


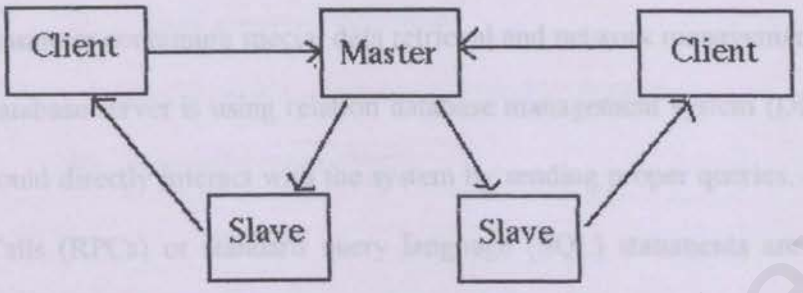
Figure 2.5: Client /Server System – the connection between client and server

2.4.1 Server Distribution

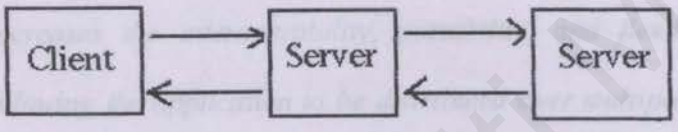
- Single client, single server



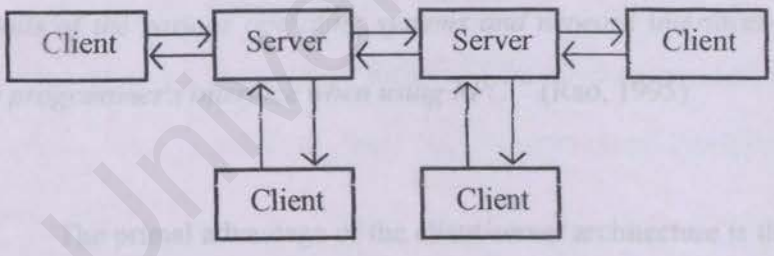
- Multiple client, single server



- Single client, multiple server



- Multiple client, multiple server



2.4.2 Client/Server Architecture

Client/server architecture is a flexible, message-based and modular infrastructure that intends to improve system usability, flexibility, interoperability and scalability. It is also known as 3-tier or n-tier computing. The design was come into view to solve the limitation of the file sharing architecture. This approach had been replaced the file server with a database server. File server is a powerful computer containing special data retrieval and network management capabilities. The database server is using relation database management system (DBMS) which users could directly interact with the system by sending proper queries. Remote Procedure Calls (RPCs) or standard query language (SQL) statements are the tools used to communicate between client and server.

"Remote Procedure Call (RPC) is a client/server infrastructure that increases the interoperability, portability, and flexibility of an application by allowing the application to be distributed over multiple heterogeneous platforms. It reduces the complexity *of developing applications that span multiple operating systems and network protocols by insulating the application developer from the details of the various operating systems and network interfaces--function calls are the programmer's interface when using RPC."* (Rao, 1995)

The primal advantage of the client/server architecture is that the design could reduce network traffic by providing a query response replacing technique of total file transfer to the users. The information will be sorted before returning to users. It has been tested that client/server architecture greatly improves multi-user updating through a front ended GUI (Graphical User Interface) into the database. Other advantages are: (Smith, 1994)

a) matches distributed business models

b) scalable

c) enhanced data sharing

d) sharing resources among diverse platforms

e) data interchange ability and interoperability

f) masked physical data access

g) location independence of data and processing

h) centralized management

The disadvantages of client/server architecture are:

a) harder to build

b) less stable

c) lacking in specialists

d) difficult to debug and test

There are some tradeoffs should be considered to select appropriate client/server architecture. These include (i) business strategic planning, (ii) potential growth on cost, number of users and computational environment. (Rao, 1995) (Smith, 1994)

2.4.3 Two tier Architecture

In the 2-tier architecture, processing management is split within the database management server environment and the user system interface environment which is located in the user's desktop environment. Database management services usually run at the server side – a powerful device that supports many clients. The database management server provides stored procedures and triggers.

2-tier architecture provides a good solution to implement distributed computing system. Each workgroup can be defined until 100 persons on a single LAN simultaneously. However, if the number of user exceeds more than 100, the network performance will become deteriorate. The reason behind is the server keep maintaining a connection with each client even there is no work is being done. Another limitation of this design is implementation of the processing management services using vendor proprietary database procedures has restricts flexibility and choices of DBMS for application. Also there is a limited flexibility in moving or repartitioning program functionality from one server to another. (Camegie Mellon, 2001)

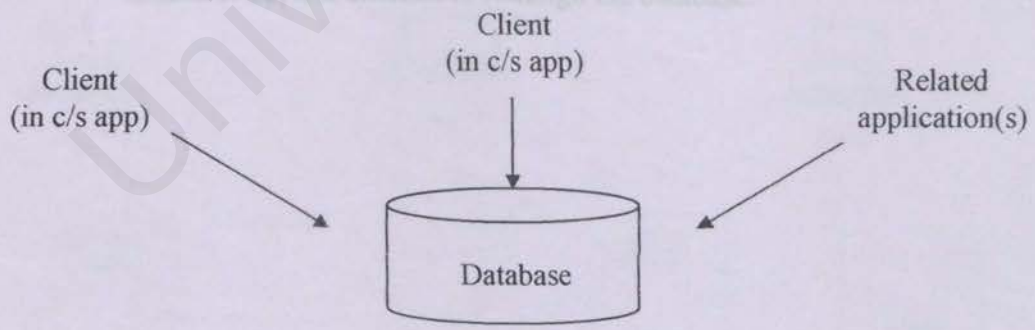


Figure 2.6: Two Tier Client/Server Architecture

The advantages of 2-tier architecture:

a) Familiar: the architecture is simple and similar to the traditional mainframe program.

b) Accessible: many tools can integrate with the 2-tier model.

c) Productive: when working with 2-tier model, less effort is required because many advance tools already provide special optimizations.

d) Proven: this model is widely proven and acceptable to other.

The disadvantages of 2-tier architecture:

a) Scalability: when the users exceed the threshold (above 100 persons) the network performance will degrade rapidly.

b) Poor logic sharing: business logic is kept on the client side in the traditional 2-tier architecture. Therefore there is no reusable logic between application and tools.

c) Remote usage: user normally prefers to be a "thin" client where minimal client software requires installing.

d) Database structure: client applications depend on the existing database structure. So, it is difficult to redesign the database.

2.4.4 Three tier Architecture

3-tier model is designed to overcome the limitations of 2-tier architecture. There was a middle-tier added between the user system interface client environment and the database management server environment. The middle-tier can be implemented using (i) transaction processing monitors, (ii) message servers and (iii) application servers. The middle-tier has the ability to schedule and makes prioritization for tasks in progress. Generally, the middle tier performs querying, application execution and database staging.

3-tier model has greatly improved the performance of network. A single workgroup could support until thousand of people without causing bottle net in the network processing. On the other hand, the design also increases flexibility in partitioning. The process is as simple as "dragging and dropping" codes onto different computers. Somehow, 3-tier model still has its limitation. The development environment is reported more difficult to use, compare with the virtual-oriented development of 2-tier applications. (Camegie Mellon, 2001)

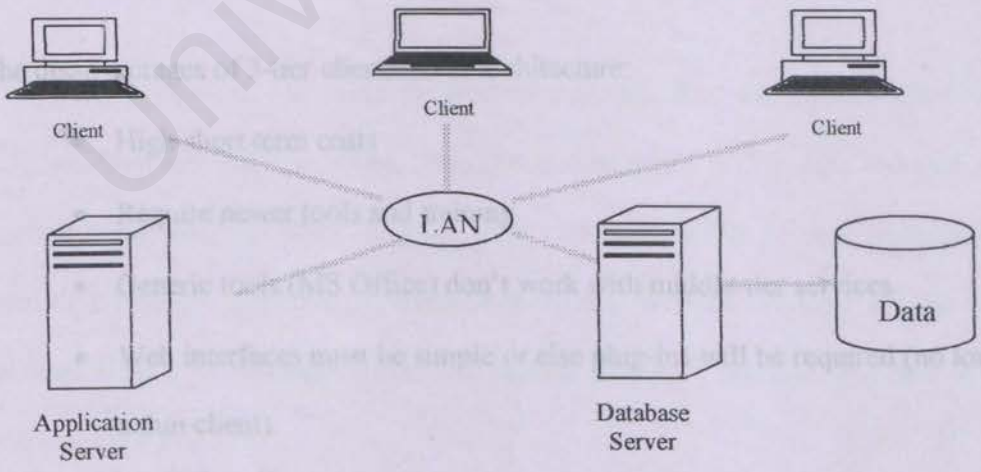


Figure 2.7: Three Tier Client/Server Architecture

The advantages of 3-tier client/server architecture:

- Scalability:
  i. Applying transaction management in middle-tier module could reduce the traffic loaded on the database server.
  ii. Additional application servers can be added to distribute application processing to allocate the processing.
- Flexibility:
  i. Easier to change application platform and DBMS.
- Lower costs:
  i. The user and business layers have been separated by a middle-tier module. Therefore, we can easily replace the components without rebuilding the entire application.
- Better match of system regarding to business needs:
  i. New modules can be built and added to fulfil business requirements.
- Improved customer service:
  i. Different clients can access the same business processes with multiple interfaces.

The disadvantages of 3-tier client/server architecture:

- High short term costs
- Require newer tools and training
- Generic tools (MS Office) don't work with middle-tier services
- Web interfaces must be simple or else plug-ins will be required (no longer a thin client).

2.5 Web Technology

2.5.1 Active Server Pages (ASP)

ASP, an abbreviation for Active Server Pages, was first introduced in 1996 by Microsoft. ASP is a new web-based technology that extended standard HTML by adding built-in objects, server-side scripts, COM objects to access to databases and ActiveX components. Users can use ASP to create interactive Web pages and build powerful Web applications. VB Script is the default scripting language. But, as long as the language (e.g. Perl and Jscript) has a scripting engine that is compatible with the ActiveX scripting standard, then it can be another option rather than using VB Script.

ASP is one of the most favourite technologies for creating dynamic Web pages. Dynamic Web pages displays the most current information each time users come and visit the site. Since that ASP allows standard HTML elements (e.g. tables, text and titles) combines with scripting language elements like database fields, date/time information and personal customization, a web page will be generated dynamically every time when there is a requested from browser.

The requested ASP page is processed by the Internet Information Server (IIS). IIS then runs the VB Script, turning it into standard HTML tags and text. The resulting page contains none of your code and is viewable by any browser like Internet Explorer, Netscape Navigator, or AOL's browser as long as the page contains HTML or browser commands within the ASP portions. (Cooke, 1998) (Subash, 2002)

Active server pages (ASP) are an ISAPI (Internet server application programming Interface) extension to provide a server-side application framework, making it even easier to build dynamic Web applications. Microsoft has implemented their ISAPI extension as a Dynamic Link Library (DLL) which means it is loaded only once, on first demand, and then stays resident in the same process as the IIS Web server. Consequently, the speed in accessing the component will be much faster compared to other web server technologies like CGI, PERL etc. (Microsoft, 2002)

Active server pages include several built-in objects to enhance the power of the scripts. For example, by using these objects, you can gain access to browser requests and control how the server responds to these requests. The built-in objects also provide the control over user sessions and web-server applications. This will certainly increase the security control over the pages. The seven built-in objects are (i) application, (ii) ASPError, (iii) ObjectContext, (iv) Request, (v) Response, (vi) Server and (vii) Session. (DevGuru, 2001) (Subash, 2002)

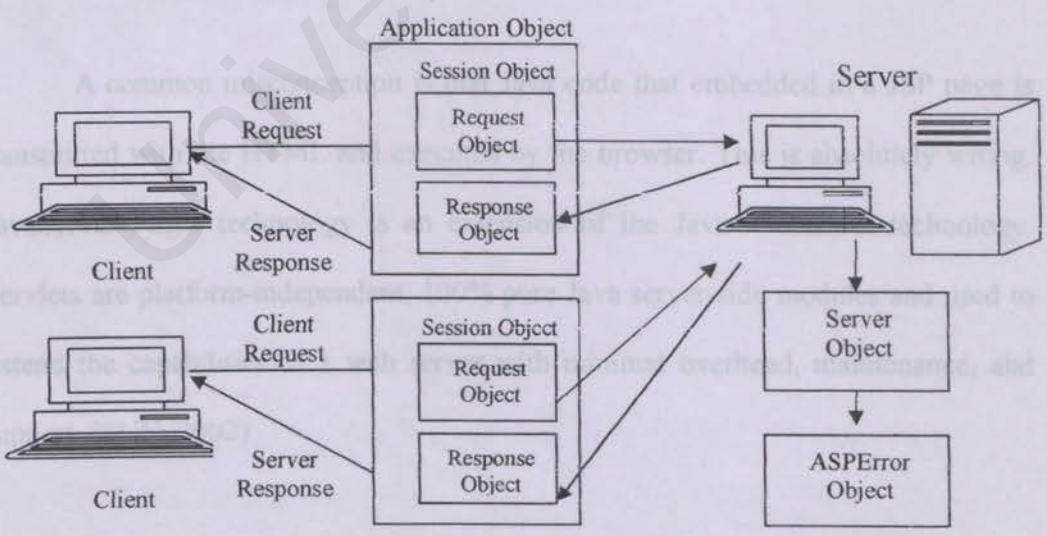


Figure 2.8: Quick View of ASP Built-in Seven Objects.

2.5.2 JavaServer Pages (JSP)

JSP technology is one of the most powerful web technology and basic tools for generate dynamic web contents. JSP combines HTML and XML with the extension of Java Servlet to develop and set out a reliable, interactive, high-performance, platform-independent Web sites. Many Web pages that are built by CGI programs are mostly static and limited in dynamic processing.

JSP technology is designed to integrate various Java family products, such as Servlet, JavaBeans, JDBC, and Enterprise JavaBeans. JSP technology simplifies the creation of dynamic content on the server by separating the information presentation from application logic to encapsulate all the reusable Java-components. JSP technology also separates the user interface from content generation to enable web designers change the overall page layout without altering the underlying dynamic content. It is part of the Java platform's integrated solution for server-side programming. By the way, the design helps to improve faster and easier in building web applications.

A common misconception is that Java code that embedded in a JSP page is transmitted with the HTML and executed by the browser. This is absolutely wrong. JavaServer Pages technology is an extension of the Java ™ Servlet technology. Servlets are platform-independent, 100% pure Java server-side modules and used to extend the capabilities of a web server with minimal overhead, maintenance, and support. (SUN, 2002)

A JSP page is translated into a Java Servlet and executed on the server. The codes embedded inside the JSP page become part of the Servlet. The resulting Servlet is executed on the server to handle all the requests but never visible to the user agent. Whenever that page is called, the resulting Servlet generated from your JSP statements is executed, and there is nothing but just the result. The difference between a JSP page and a normal HTML page is that a JSP page is translated into a Servlet, and when it is executed, the response from the Servlet contains the HTML. The server used different mechanism to process a request but the content is identical. Typically, the page translation step is performed during the first time a given JSP page is requested, and then only that page's source code changes thereafter. Otherwise, the resulting Servlet is simply executed, providing very quick delivery of content to the user.

Lastly, JSP pages share the "Write Once, Run Anywhere ™" characteristics of Java technology. This technology is highly scalable architecture for enterprise applications and is the key component in the Java 2 Platform, Enterprise Edition (J2EE). (SUN, 2002)

2.5.3 Common Gateway Interface (CGI)

CGI or Common Gateway Interface is a standard, not a programming language. The technology is used to create interface between user application and information server, for instance Web or HTTP server. It is a common standard used in the Web nowadays.

Why CGI because HTML documents are static. There is impossible that the HTML document can communicate with server to retrieve data. Certain mechanism is required to make them more interactive with users and servers. A CGI program is executed in real-time environment and therefore capable to display dynamic information. Assume that you would like to share your database on the Web; a gateway is needed to handle the communication flow. Consequently, CGI program is created to allow data transmission that is send a request to database engine to retrieve and display the result on the client interface. The execution time of the CGI program should be reasonable. Otherwise, the user will be staring at the browser waiting for response.

CGI programs are almost platform independent but are mainly for UNIX family of servers. It can be written in many languages such as C, C++, Visual Basic, FORTRAN, PERL, TCL, any UNIX shell, AppleScript. However, people keen to write in CGI script because it is easier to modify, debug and maintain. There is one thing should be remember; CGI program must reside in a special CGI directory. The directory is under direct control of the web master and through this directory, the web server knows which incoming information is intended for a CGI program. (Kotler and Michel, 1997) (ncsa.uiuc.edu, 2002)

There are three possible methods to pass information to and fro between the CGI program and server software.

i) Passing of information via command line arguments: This is used only for passing information to the CGI program.

ii) Passing of information via Environmental variables: The variables are set by the web server software to indicate whatever values need to be passed to the CGI program.

iii) Transferring information using of STDIN and STDOUT: The standard input and output streams use in most operating systems. The web server software sends information to the CGI program's STDIN, and the CGI program sends its response to its STDOUT, which is coupled to the web server software's STDIN.

CGI also has its weaknesses:

i) CGI uses a great amount of server resources to overcome the lack of support in multithreading. But it also could degrade the servers' performance.

ii) CGI installation, especially installs a third party CGI script needs special kind of experience. Moreover writing CGI script is not easy.

iii) CGI programs are executable; allow unauthorized user to run a program on your system, which could be a disaster to the system. The system could be hacked or modified by other users. There is certain security issues should be aware of to protect the system.

(Kotler and Michel, 1997) (ncsa.uiuc.edu, 2002)

2.5.4 ASP.NET

ASP.NET is a new technology in Microsoft .NET Framework that is built on Common Language Runtime (CLR). CLR is responsible for managing the execution of code, the provision of services and the allocation of resources at runtime. ASP .Net is similar to the example of JSPs in the J2EE world. Instead of develop a web page; the process is more like developing a Windows-based application. It supports any .NET compatible language such as Visual Basic .NET, C# .NET or JScript. The page communicates with the server using a browser (web browser or mobile browser) through a mark up language like HTML, WML or XML. (Microsoft, 2002)

ASP.NET uses the approach of object driven to improve performance. The design enables the separation of application logic and user interface. The CLR provides language neutrality to .NET applications. The .NET applications are compiled into common Intermediate Language (IL) irrespective of the language in which they are written. ASP.NET is different from ASP in two major ways: (Microsoft, 2002)

- ASP.NET offers several programmatic enhancements over ASP, such as, Compiled ASP.NET Scripts, Caching: Post-Back Forms: Server Controls, and Deployment.
- ASP.NET offers a change in programming fundamentals. ASP followed procedural pattern of creating pages; while ASP.NET using object-oriented approach.

ASP.NET Architecture

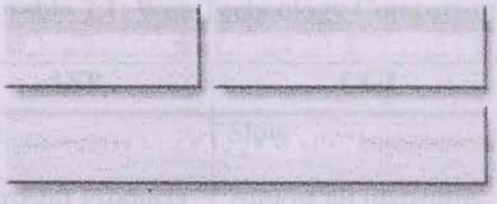


Figure 2.9: ASP .NET Layers

ASP.NET is divided into 3 layers: (Microsoft, 2002)

i) The application - represents the entire solution.

ii) ASP.NET Pages - representing the user interface.

iii) Web Services - exposing selected functionality of the application.

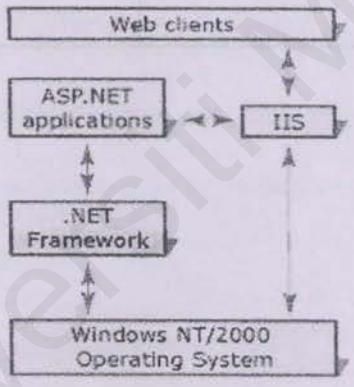


Figure 2.10: ASP .NET Architecture.

ASP .NET Platform Requirements

- Windows 2000 Server or Advanced Server with Service Pack 2
- Windows XP Professional or 64-Bit Edition
- MDAC 2.7 for Data
- Internet Information Services

2.5.5 Web Technology Comparison

Table 2.1: Web Technology Comparison

	ASP	CGI	ASP.NET
Performance	Fast	Slow	Fast
Portability	Microsoft Products.	Almost all platforms.	All platforms.
Programming Tools	▪ VB Script ▪ JavaScript	Mostly Perl.	Language independent.
Ease in programming	Even-driven in VB Script and Java Script.	Handling of environmental variables and string manipulation.	Object-driven in any .NET compatible language.
Others	Create dynamic content web application.	Only static web applications.	Create dynamic content web application and web services.

2.6 Web Development Tools

2.6.1 Java Script

JavaScript first appeared in 1995; developed under the name of LiveScript by Netscape. There is nothing related to Java. Anyway, JavaScript is not a general-purpose programming language. But it still provides some functionality that enhances HTML. Navigator 2.0 was the first browser to support JavaScript. Navigator is the tool used by Netscape to enhance the language.

JavaScript is an example of Web-based scripting language for HTML elements. It is an object-based, but not an object oriented language. JavaScript is based on event processing model and supported by browsers using the SCRIPT tag. By adding some intelligence measurement, it helps browsers to rendering simple text and also images. Using JavaScript can make the web pages more interactive with the users by presenting or requesting user inputs, calculations, validate authorize users, display alerts and so on. JavaScript actually is implementing the notional standard language called ECMAScript.

JavaScript can be run on a web server or in the client-side. The codes are embedded in the HTML page. There is a run-time engine on the server site to pre-process the codes and it's also depending on the browser. An interesting point about server-side JavaScript is that it can be run from a browser which does not itself support JavaScript. (Koch, 1996) (Elliot, 1998) (Karetnikov, 2000)

JavaScript Security:

- No formal security model
- Disk accessing: network limited by non-availability of such JavaScript functions
- Security is dependant on correct implementation of browsers
- Previous bugs included
- Read user's history and URL cache

2.6.2 VB Script

VB Script stands for Visual Basic Scripting Edition. It is developed by Microsoft in 1996, derived from Visual Basic for active scripting – write dynamic interactive web pages. Script language is ideal for smaller programs of limited capability or can be reusable. The syntax of VB Script is very similar to Basic programming language. It is object-based but not an object-oriented language. VB Script is an event processing model. (Microsoft, 2002)

VBScript can be used without any restriction in the MS Windows based intranet. It is fast and portable for use in Web browsers and Windows API. VBScript offers a larger variety of sequence, selection and iteration constructs compare to JavaScript. However, users could combine Java Script and VB Script within the same HTML page. It still works. The tools for writing VB Script are simple - a plain text editor or any other HTML editor, such as SitePad, FrontPage and etc. (DEVGURU, 2001) (Karetnikov, 2002)

VBScript Security:

⇒ No formal security model

⇒ Access to disk, network limited by non-availability of such VBScript functions

⇒ Security is dependant on correct implementation of browsers

2.6.3 Cascading Style Sheets (CSS)

Cascading Style Sheets is a collection of rules that used to control the appearance or look of an HTML document. HTML alone is not enough to precisely define the document presentation on the Web. HTML can only use to define the document structure. Therefore, CSS is used to overcome this problem. The advantages of using CSS are it separates the presentation from the document structure. This kind of design makes the pages easy for future modification and enhanced a consistent look of a site.

As mention above, CSS consists of a set of rules. Each of the rules has a common syntax shown below:

Selector {Style}

The *selector* determines which HTML elements are affected in a Web document. The *style* indicates the appearance of the elements. (Web Design Group, 2002)

2.6.4 Microsoft Front Page 2000

FrontPage 2000 is a tools used to develop and edit a dynamic web application. It is easy to use and learn. There is a help and tutorial section provided in learning Microsoft Front Page. All the editing, publishing and web server setting are available on the interface.

However, there is no direct connection from Microsoft FrontPage to any database. To overcome this phenomenon, FrontPage provides a Database Region Wizard as a basic for database publishing. The wizard is user-friendly and there is no further study required for user to using it. The screen is fairly directed in setting up every component of web database using ODBC connection to SQL statement.

Microsoft FrontPage is not as powerful in database integration as Microsoft Visual InterDev development environment. Besides, the web design capability is more sophisticated than the wizards available in Access. Since Microsoft FrontPage tends to generate extra HTML markup, it could slow down the web site performance. Some more, the application is only compatible with Microsoft products. (P.J, 1998)

2.6.5 Visual InterDev 6.0

Visual InterDev 6.0 was introduced in March, 1997. It is a Microsoft product which provides an environment to rapidly create and manage dynamic web application. Developers can directly design, construct and manage web site using Visual InterDev. The predefine tools are very useful and provide several significant enhancement to the development. The major features of Visual InterDev are shown below: (Joseph, 1998)

i) Site design – create a set of pages and identify the navigation of the pages.

ii) Page design – providing tools to design and develop a page.

iii) Database integration – provides several methods to design and develop applications that will access data from database.

iv) Database management – provides a graphical interface to manage database, such as create or modify database and stored procedures.

v) Debugging – feature that help developers to debug applications. Breakpoint can be set to break program execution under certain conditions.

vi) Site management – developers can use a graphical diagram to identify the links among an application which is good in maintaining the web site integrity.

vii) Team management – provides a control to ease the development. Programmers can use different tools to establish their tasks and then compile with Visual InterDev without any problems. For instance, FrontPage is used to build the page and the Visual J++ is used to create applets, but the script code are developed using Visual InterDev.

2.7 Web Browser

Nowadays, there are so many browsers available to the users. Most of them can be downloaded from the Internet and they are free of charge. But the others are not. Netscape Navigator and Internet Explorer are the two most commonly used applications to browse the Internet.

2.7.1 Internet Explorer

Internet Explorer 6 (IE 6) is the new version of Microsoft's browser series. IE 6 has improved the overall browsing experience and provides greater customization for users. (Microsoft Corporation, 2001)

Some of the major features are:

- ***Privacy and Security Enhancements:***

  Users have greater control over the used of cookies in collecting information from the computers. The 128-bit secure connection (using 128-bit encryption) enables highest level of protection on the Internet communication.

- ***Image Toolbar:***

  A new idea in images processing where a toolbar will appear on certain location within an image to enable users to save, e-mail or print.

- ***Automatic Image Resizing:***

  IE automatic scales to fit an image into the size of browser window and provides a button to resize the image to full size.

- ***Print Preview:***

  A function that enables users to verify printed materials. Users can do some adjustment before printing out the information.

- ***Reliable:***

  IE 6 can generate a report to Microsoft for any failure. If the solution is there, users will be automatically informed by the report mechanism.

- ***XML Supported:***

  IE 6 supports for Microsoft XML 3.0 to provide better performance and up-to-date XML standards support.

- ***CSS Standard Support:***

  IE 6 provides full support for CSS Level 1. Therefore, users can adjust the borders, margins and padding of the inline elements, and also implement dashed or dotted borders.

- ***.NET Integration:***

  IE 6 enables better code integration between the server and client. Functions on the server side can be called to any application asynchronously. By using XML and SOAP, data on the database can be easily retrieved and displayed to the users.

2.7.2 Netscape Navigator

Netscape Navigator is a very stable browser compare to Internet Explorer. It is Java based terminal which is built on the Netscape Gecko technology. One interesting feature with the Netscape Navigator is the Auto Translate feature where users could translate a web page into a native language. The Auto Translate feature is using the Gist-In-Time service developed by the Alis Technologies Inc. (Netscape, 2002) (Wong, 2002)

Other features are:

- Provides powerful and fast searching.
- Interface has been redesign to free up more spaces.
- Support for over 15 platforms.
- Uninstall feature is simple and systematic.
- Very stable
- Built-in HTML authoring tool in the Netscape Navigator (Composer).
- Includes a group-calendar application.
- Customizable interface (font size, font type, cache size and so on).
- Screens out offensive web content by using NetWatch which is based on the PICS standard.
- Supports encrypted communications and transactions via SSL 3.0.

2.8 Web Server

Web server is a typical client/server model that uses Hypertext Transfer Protocol (HTTP). Web server itself consist of a set of Internet-and-Intranet related programs for building and publishing Web pages, e-mail and downloading FTP files. The documents are stored inside the web server and each of them has their own unique URL (Uniform Resource Locator). The document may be a text, image, sound or other type of file. The documents are embedded within the HTML (Hypertext Mark up Language) and viewed using browser, such as Netscape Navigator and Internet Explorer. Web server serves static content of HTML file, but by using server-side technology like Active Server Page (ASP), CGI, and JavaServer Page (JSP) the web server could display dynamic HTML documents. (Serverwatch, 2002) (Hughes and Birznieks, 2000)

Apache and IIS (Internet Information Server) are the two leading web server in the market.

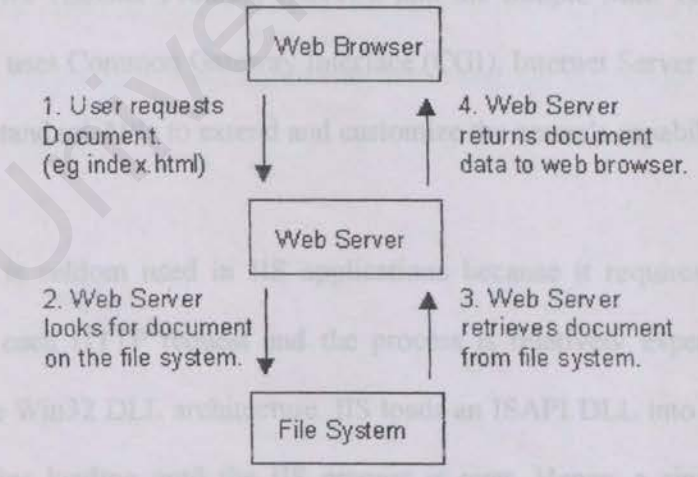


Figure 2.11: How A Web Server Works: static HTML documents workflow.

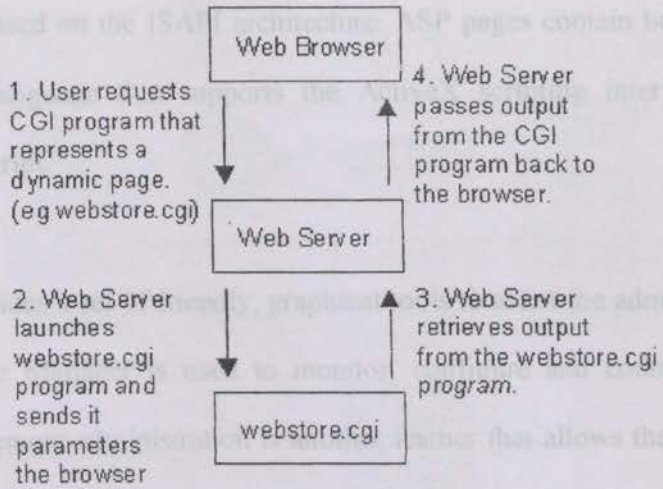


Figure 2.12: How A Web Server Works: dynamic HTML documents workflow.

2.8.1 Microsoft Internet Information Server (IIS)

IIS is a protocol server that uses the most common Internet protocols including Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Network News Transfer Protocol (NNTP), and the Simple Mail Transfer Protocol (SMTP). IIS uses Common Gateway Interface (CGI), Internet Server API (ISAPI) or ASP as the standard APIs to extend and customize the server's capabilities.

CGI is seldom used in IIS applications because it requires a new Win32 process for each HTTP request and the process is relatively expensive. ISAPI is based on the Win32 DLL architecture. IIS loads an ISAPI DLL into the process and object remains loading until the IIS process is over. Hence, a single ISAPI DLL could satisfy all the HTTP requirements without creating any overhead. However, ISAPI is not language-independent and also hard to implement correctly.

Active Server Pages (ASP) is another alternative instead of using ISAP. ASP is completely based on the ISAPI architecture. ASP pages contain both HTML and any scripting language that supports the ActiveX scripting interfaces, such as VBScript or JScript.

IIS provides a set of friendly, graphical tools to assist the administrators. The Internet Service Manager is used to monitor, configure and control the Internet services. The remote administration is another feather that allows the administrators to control the Web services from a server computer or from a workstation on the same local area network (LAN) or even through the Internet facility. (Skonnard, 1999)

Internet Information Server (IIS) Process

i) IIS receives a new HTTP request.

ii) A system object known as WAM director is called to determine which WAM object should receive the request; the requested URL is used to determine the correct application mapping before delegating the request to the appropriate WAM object.

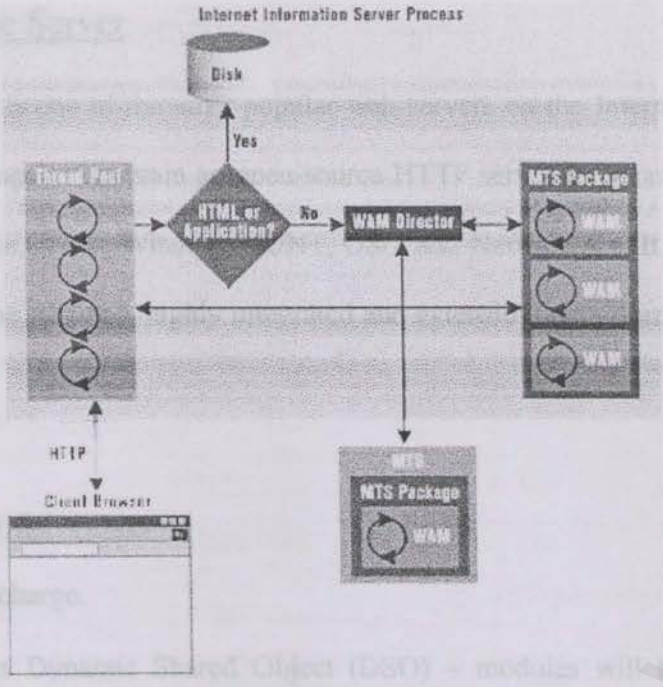


Figure 2.13: Internet Information Server Process

iii) After the appropriate WAM object receives the request, a system object called the Page object is created to process the page. The Page object is responsible for executing any script within the ASP page. The Page object first, will check to see if the page requires a transaction by looking for the transaction attribute.

iv) The results then will be sent back to the ASP pages.

2.8.2 Apache Server

Apache is one of the most popular web servers on the Internet. The Apache Server is develops to maintain an open-source HTTP server for a range of operating systems, such as UNIX, Windows 9x/NT, OS/2 and Netware 5.x. It is customizable by using Apache API and, highly integrated and extensible with third party modules. (Wong, 2001)

Apache Server Advantages:

- Free of charge.
- Supports Dynamic Shared Object (DSO) – modules will be loaded when necessary. Thus reduces the memory usage.
- Reliable Piped Logs.
- Multiple Directory Index and unlimited flexible URL aliasing.

Apache Limitation:

- Lack of software support and expertise.
- Poor content management features.
- Difficult setup and poor administrative tools.

(Apache, 2002) (Cooke, 1999)

2.8.3 Web Server Comparison

Table 2.2: Web Server Comparison.

Features	Apache	IIS
HTTP 1.1	Yes	Yes
SNMP	No	Yes
W3C's extended log format	Yes	Yes
ISAPI	Yes	Yes
SSL 2.0/3.0	Restricted	Yes
WebDAV	Yes	Yes
Price	Freeware	Free
Portability	Almost at all operating system.	Windows operating system.
Ease of configuration	Easy to setup procedures and integrated management tools.	Difficult to setup and poor administrative tools.
Security	Very strong authentication and security features.	No certification support.
Content Management	Can be done through the GUI.	Poor management features.

2.9 Operating System

What is Operating System (O.S.)? Operating System is part of computing system that manages all of the software and hardware. In other words, it controls every resource (file, device, memory and processing time) and activity that is sent to computer. There are five basic components inside an O.S. which includes: (i) Device Manager (ii) Processor Manager (iii) File Manager (iv) Memory Manager (v) User Command Interface. Each of them works closely to each others and performs unique role regardless to what operating system is being using. Commonly, there are four categories O.S. distinguished by the response time and the way data input to system (Ida and Ann, 1997).

i. ***Batch System -***

Developed for earliest computers that used punched cards or tape for input. The cards will be collected together as a job/batched before send through a card reader to process.

ii. ***Interactive System –***

Also known as time-sharing system. Users interact directly with system via commands entered from keyboard.

iii. ***Real-time System –***

Fast performance computing system that is used in time-critical environment. Users normally need immediate decisions.

iv. ***Hybrid System –***

Operating system that support both batch and interactive process. It appears to be interactive because users access system through terminal and get instant reply. But at the back-end, the system uses batch processing.

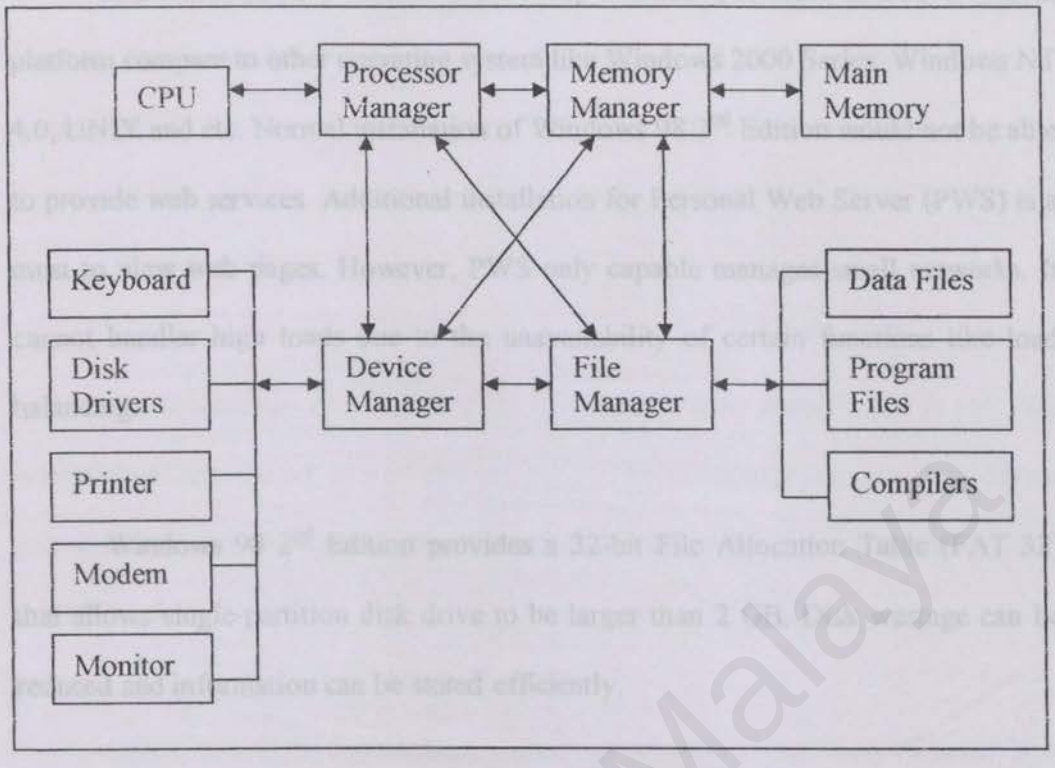


Figure 2.14: The Sub-system Managers and Their Relationship

2.9.1 Microsoft Windows 98 2nd Edition

MS Windows 98 2nd Edition, is a cheap alternative to serve as a development platform compare to other operating system like Windows 2000 Series, Windows NT 4.0, UNIX and etc. Normal installation of Windows 98 2nd Edition would not be able to provide web services. Additional installation for Personal Web Server (PWS) is a must to view web pages. However, PWS only capable manages small networks. It cannot handler high loads due to the unavailability of certain functions like load balancing.

Windows 98 2nd Edition provides a 32-bit File Allocation Table (FAT 32) that allows single-partition disk drive to be larger than 2 GB. Disk wastage can be reduced and information can be stored efficiently.

Windows 98 2nd Edition also supports for a new industry-standard form of power management called ACPI (Advanced Configuration and Power Interface). The system design support a wide range of hardware and peripherals. It enhanced the features in Windows 98 by added in more multimedia capability. (Wong, 2001) (Choo, 1999)

2.9.2 UNIX

UNIX was developed at AT&T Laboratories. This generic O.S. was designed by Ken Thompson and Ritchie in 1969 to build an advanced computing capable system. UNIX is not a single operating system; it refers to a family of operating systems. Some popular members are Linux, Digital UNIX, HP-UX, SCO, Solaris, SunOS, IRIX and AIX.

The advantages of UNIX are: (i) It is portable and scalable. (ii) It has very powerful utilities – a set of well-defines tools to build applications. (iii) It is device independent. (iv) It supports multi-user and multitasking environment – still unparalleled.

UNIX can easily adapt with numerous hardware platforms because it is written in machine-independent language that is C language (95%) instead of assembly language. Since that UNIX treats device drivers as part of its O.S., it can be configured to run any device. As an application server, UNIX has a strong pre-emptive multitasking and protected memory support. In general, UNIX has superior performance and security. It is a reliable operating system.

There is nothing perfect. UNIX did have disadvantages: (i) Its commands are so brief that only high-level programmers can understand. (ii) The interface is unfriendly and inconsistent. UNIX is lack of GUI because it is a command-driven system. It is aim to used by highly skilled programmers who need powerful system to help them in their projects. (Mark, 1998) (Alexander, 2002)

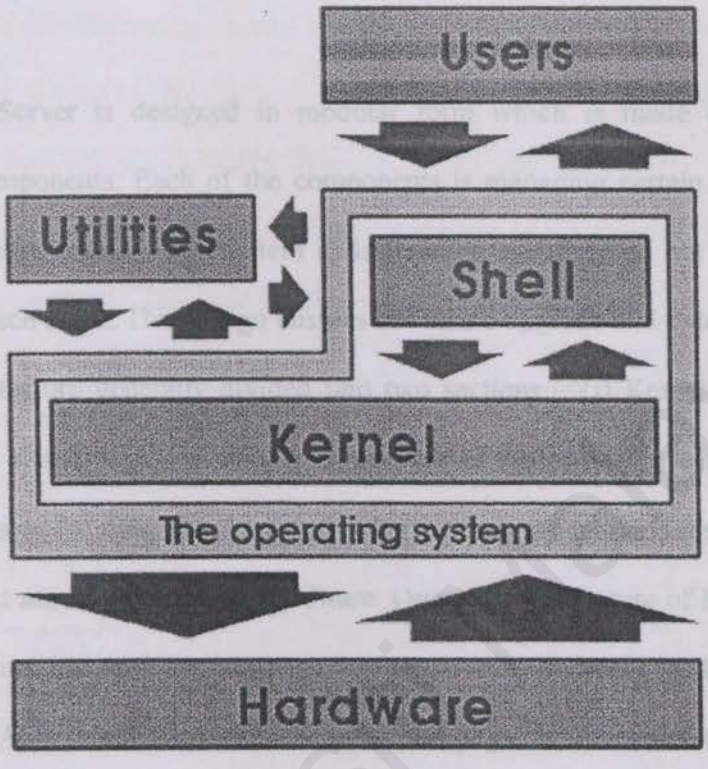


Figure 2.15: The UNIX Operating System – UNIX is a multi layered system.

2.9.3 Microsoft Windows NT 4.0 Server

Microsoft Windows NT Server 4.0 is a new version of NT Technology. It is build for multi-user and multitasking environment. The operating system was created for users and business that needs fast speed and powerful performance.

NT Server is designed in modular form which is made up of separate software components. Each of the components is managing certain functions. The modules communicate using system calls function and they do not share program code with each other. This design ensures for future upgrade and extension. The NT server architecture generally divided into two sections – (i) Kernel Mode and (ii) User Mode. Kernel mode is the key component of the operating system. It permits direct access to the computer hardware whereas the user mode is less privilege and has no direct access to computer hardware. One powerful feature of NT server is the O.S. can run on various computer systems with different architecture. HAL (Hardware Abstraction Layers) hide the actual physical characteristic of computer hardware and performs a uniform interface to high-level components of Windows NT. Therefore this module is operated at low-level system. (Ken and Brandon, 1998) (Paul, 1997)

Since Windows NT server supports 32-bit processing, it is gaining a higher and higher share in both the high-end workstation and server market. NT applications are multithreaded and have multi-platform support. Therefore it is suitable to run as an Internet platform. The IIS (Internet Information Server) is highly integrated with the server to control the web pages and all other related pages like Active Server Pages. NT Server 4.0 is user friendly compare to UNIX. Consequently users will find

more comfortable and flexible to work with the Windows GUI. The Windows-based Management Console and browser-based administration provide a convenient way to manage Windows O.S. The security is good and the controls are configured by the administrators. User ID and password are required to login. The system allows delegation of administration to any users. Another main reason that users are so famous with Windows NT Server are the supports and its applications from Microsoft is well-defines. (Ken and Brandon, 1998) (Paul, 1997)

NT Server combines: (i) Application Server. (ii) File and Print Server. (iii) Communication Server. (iv) Internet/Intranet Server.

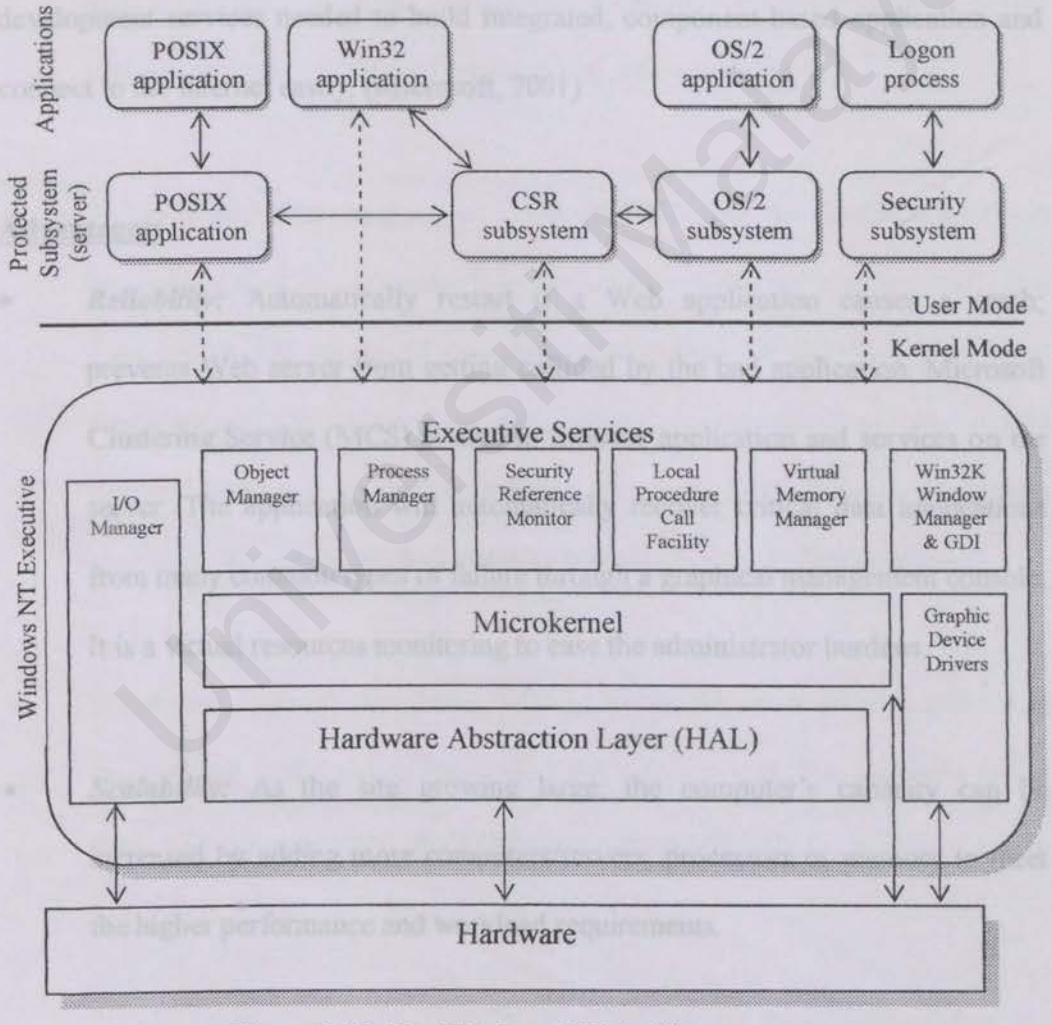


Figure 2.16: The Windows NT Architecture

2.9.4 Microsoft Windows 2000

Windows 2000 was known as Windows NT 5.0 is built on NT Technology. This operating system is claimed to be more stable than Windows 98 and Windows NT 4.0. That means the system is less likely to clash.

Windows 2000 is a Web-aware and multipurpose network operating system. Internet Information Service (IIS) 5.0 is the built-in Web server to support the Windows 2000 Web and Application Services; from hosting a simple Web site to building a sophisticated e-commerce application. It also includes other application development services needed to build integrated, component-based application and connect to the Internet easily. (Microsoft, 2001)

Advantages:

- ***Reliability:*** Automatically restart if a Web application causes a crash; prevents Web server from getting collided by the bad application. Microsoft Clustering Service (MCS) is used to monitor application and services on the server. The application will automatically recover critical data applications from many common types of failure through a graphical management console. It is a virtual resources monitoring to ease the administrator burdens.

- ***Scalability:*** As the site growing large, the computer's capacity can be increased by adding more computers/servers, processors or memory to meet the higher performance and workload requirements.

- ***Manageability:*** Windows 2000 provides flexible help to reduce and helps administrator in managing the system. It can delegate administration tasks for different people to manage different Web sites without being an administrator. This helps in dividing the Web sites maintenance into different work group while retaining control of the overall server.

- ***Security:*** Windows 2000 uses the latest security standards such as Digest Authentication, Kerberos v5 authentication, and Fortezza to increase the system security. In addition, the Active Directory is also uses to centralize the security services in object naming and location, user authentication, single sign-on, and centralized configuration and policy management.

- ***Software and data integration:*** Windows 2000 uses the Extended Mark-up Language (XML) to integrate information from different sources. XML is a data format for structured document interchange on the Web that gives developers a standard way to use information regardless of how it was created. Windows 2000 also includes Microsoft Data Access components such as ADO and OLEDB to virtually access any type of data source.

- ***Hardware Support:*** Windows 2000 is compatible with latest hardware to increase the performance and secure the web services. For instances multi-processor systems, smart cards and commerce acceletors.

2.9.5 Operating System Comparison

Table 2.3: Operating System Comparison.

	UNIX	Windows NT 4.0	Windows 2000
Installation	Need concept on disk partitioning and mounting file system	Easy to install through interface wizard.	Easy to install through interface wizard.
Ease of Use	No. Need to know common line language (CLL)	Yes. The system is using GUI approach.	Yes. The system is using GUI approach.
Security	Very Good	Good	Better than NT 4.0
Price	Expensive	Reasonable	Reasonable
Scalability	Support multitasking	Support Symmetric multitasking (SMP)	Support Symmetric multitasking (SMP)
Stability	Stable	Unstable due to system DLL and register problem	Stable than NT 4.0

2.10 Database Consideration

2.10.1 Microsoft Access 2000

Access 2000 is a new version of Access desktop database series created by Microsoft. Access 2000 is a generic application that is used to develop database applications. It is simple, powerful and easy to use. The Access database configuration is simpler than SQL Server or Oracle for instance, which require additional skills and experiences. However, Access is a relational database that only suitable for small or medium processing.

People are famous with Access because the wizard and interface are so user-friendly. The GUI is consistent help users in learning. Microsoft has added some new features into the Access 2000 database to increase its capability, such as web compatibility, new data analysis and a choice of database engines selection. Access 2000 is web compatible because it could redesign the Access forms and reports made of HTML. Data Access Page (DAP) is the new concept that introduced to the world to make easy of data sharing through an intranet or Internet. DAP stores as HTML file outside the traditional database file (MDB) to reduce the database size. Access can only stored data up to 700MB – 1GB. The database performance will soon be degraded out of 1GB. (Lars and Dave, 1999)

The strategy used by Microsoft while creating Access 2000 is the separation of database engine to increase the database scalability. There are two types of engines provided inside Access 2000; (i) a traditional Jet engine that has been enhanced in certain perspective, (ii) a Microsoft Database Engine (MSDE). Jet

engine is more compatible with previous version of Access database while the MSDE engine is more scalable. Other important features are:

i) ***Backward compatibility***: allows users save their database to a previous version.

ii) ***Name autocorrecting***: the database will automatically changes field name in all related applications.

iii) ***Conditional formatting***: users could change the report views by presetting the conditions format.

iv) ***Automatic compaction***: the system will automatically compact the database upon closing if the MDB file is too large.

Thanks to the Microsoft development teams; Access 2000 now could directly connect to SQL server by included a special file format into the database. This allows the database to be upgraded in the future. On the security perspective, Access 2000 has much more improvement. VBA password has slightly increased the modules protection behind the forms and reports. Administrators of the database also could create and change the workgroup ID with a predefine permission. To prevent database intrusion using VB Script, DAP uses MSODC to connect with data source. MSODC is an internal data access mode use to access data from Access database. (Lars and Dave, 1999) (Wong, 2001)

2.10.2 Microsoft SQL Server 2000

Microsoft SQL Server 2000 is a typical relational database management system (RDBMS) that offers various administrative tools to develop maintain and control the database. The database performance is good and, highly scalable and reliable.

From a data management and analysis perspective, SQL Server 2000 provides a complete database and data analysis package to the rapid development of applications. SQL Server 2000 is a fully Web-enabled database product. In the multi-user distributed client/server environment, the DBMS supports large amount of data processing through a query across the Internet and firewall.

The DBMS is design to understand the Structured Query Language (SQL) and also the Extensible Mark-up Language (XML). Data can be easily retrieved and manipulated through the Web by using XML. Also, SQL Server is highly integrated with NT technology. Therefore, it works closely with Windows NT Server and also Windows 2000 operating systems. The results are better performance and greater stability. (Mike, 2002) (Microsoft, 2001)

Advantages of SQL Server

1. ***Fully Web-Enable*:**

   Query can be send through the Web and run at the server side to perform actions like searching. Besides, data manipulation (delete, update, insert) can be easily done by using XML mark-up language.

2. ***Highly Scalable and Reliable:***

Database can be distributed through out the network and data is load across servers. Several techniques have been improved inside the DBMS to enhance database failover which are log shipping and data backup.

3. ***Integrated and extensible analysis services:***

A powerful and flexible feature used to create valuable data from raw materials (data). Results can be generated and retrieved from the database based on the analysis and complex calculation.

4. ***Rapid development, debugging and data transformation:***

SQL Server is integrated closely with others Microsoft product. Therefore, it allows virtually designs and develops the application code using any Visual Studio tool. The queries are debugged and data is quickly transformed from related resources. Functions are defined and called if they were built in to Transact-SQL.

2.10.3 Database Comparison

Table 2.4: Database Comparison

	MS Access 2000	MS SQL Server
Ease of Use	Good	Better than Access
Database Storage	Medium	Support large database
Compatibility	Tightly integrated with Microsoft products.	Tightly integrated with Microsoft products.
Scalability	Reasonable	Good
Price	Cheap	Cheap

2.11 Methodology Review

Methodology is defined as a complete set of control consists of model, tools and techniques that are used to describe process required in a software development. The methodology which is applied in a software development life cycle could be using structural approach or based on object-oriented concept.

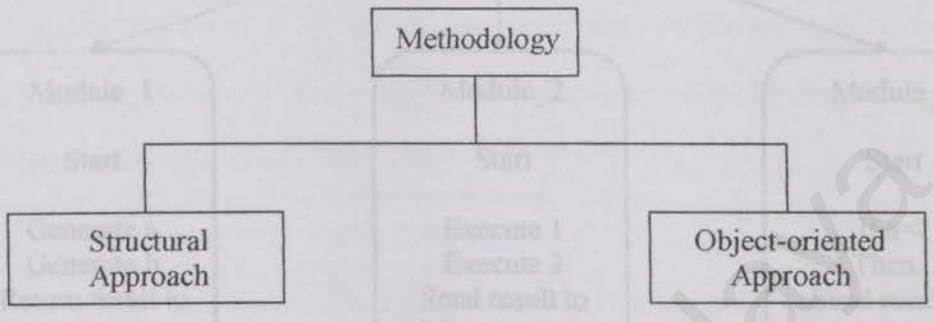


Figure 2.17: Structural Approach and Object-oriented Approach.

2.11.1 Structural Approach

Methodology with structural approach is a procedural/functional oriented technique that breaks a complex system into small piece of modules. Each of the modules is responsible to execute certain functions of the system and the modules work independent without affecting each other – loosely couple. However, the functions within the modules are highly interrelated with each others – highly cohesive. There are 3 techniques used in the procedural software development process: (Mohamad Noorman Masrek *et al*, 2001)

⇒ Structured programming technique

⇒ Structured analysis technique

⇒ Structured design Technique

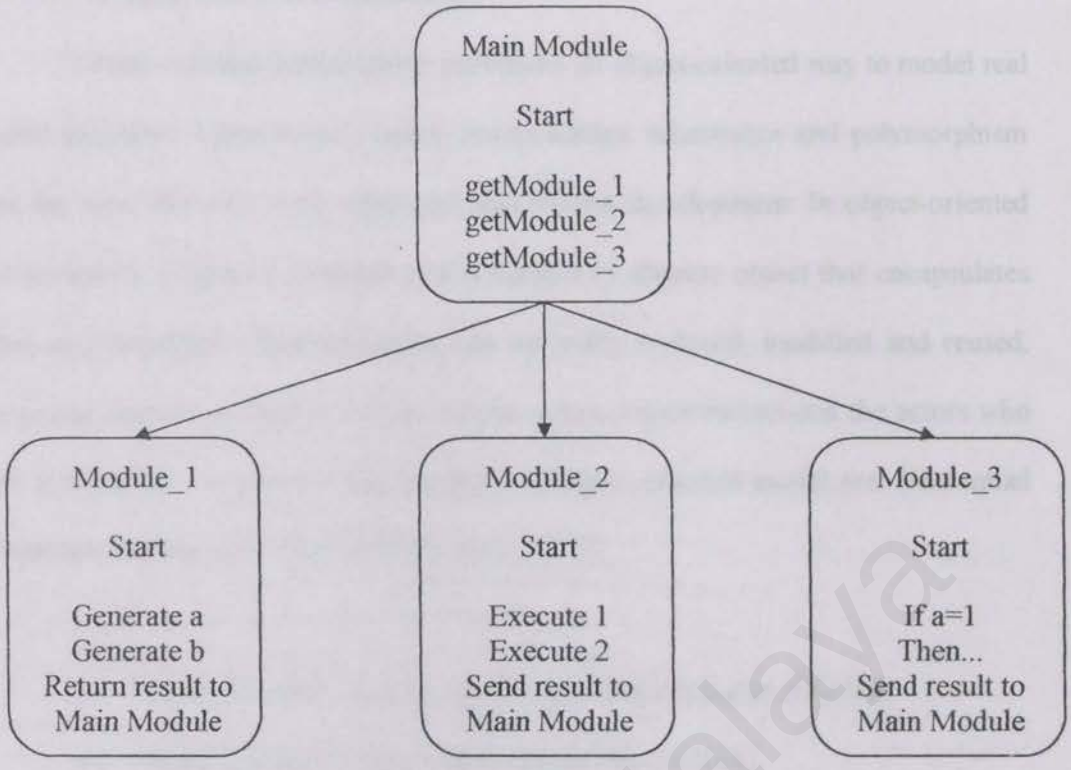


Figure 2.18: The Structural Approach of Methodology

Data Flow Diagram (DFD) is the graphical model used to represent the process of the system. Procedural software development process help developers identified:

- the functions of the system.
- the input/output type of the system.
- how the system is going to work.

The examples of functional models are: (Mohamad Noorman Masrek *et al*, 2001)

- Waterfall Model
- Spiral Methodology
- Jackson Structured Design (JSD)
- Structured Analysis and Structured Design (SASD)
- Rapid Application Development (RAD)

2.11.2 Object-oriented Approach

Object-oriented methodology introduces an object-oriented way to model real world problems. Objects and classes, encapsulation, inheritance and polymorphism are the core elements in an object-oriented system development. In object-oriented environment, software is defined as a collection of discrete object that encapsulates data and functions. Objects/modules can be easily replaced, modified and reused. Use case diagram is used to capture all the system requirements and the actors who are involved in the system. The examples of object-oriented model are: (Mohamad Noorman Masrek *et al*, 2001) (Ali Bahrami, 1999)

a. Object-Oriented Analysis and Design Methodologies (OOAD)
b. Object Oriented Design with Applications (OODA)
c. Object Oriented Analysis and Object Oriented Design (OOAD)
d. Object Modelling Technique (OMT)
e. Object-oriented Process, Environment and Notation (OPEN)

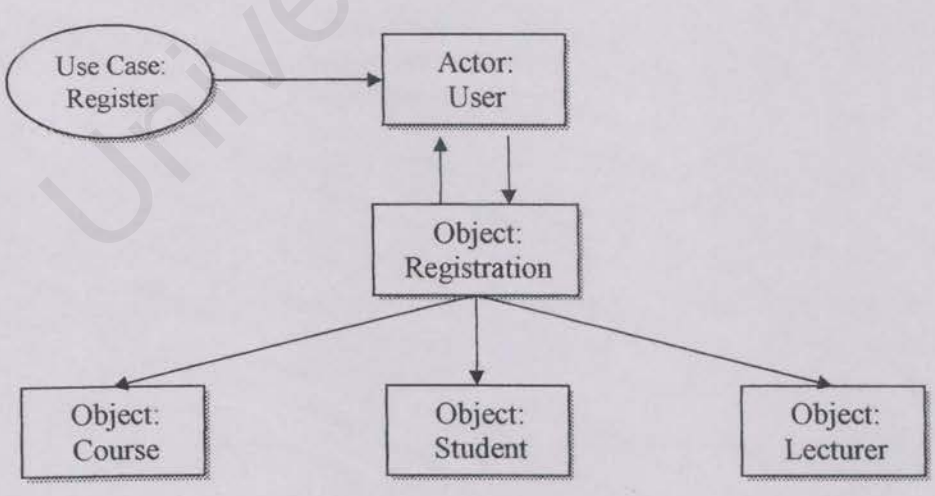


Figure 2.19: Object-oriented Approach

2.11.3 Why Object-Oriented

- Higher level of abstraction where development can be done at the object level. This eventually improves system maintenance and reusable.
- Model GUI and database effectively.
- Inheritance is one of the main features in object-oriented design where functions of the parent class will be automatically inherit/reuse by the child class. Therefore the design of the child class can be more specific and unique.
- Provides a better view of problems modelling compare to traditional method. (Ali Bahrami, 1999) (Kendall, 2001)

CHAPTER 3
Methodology

Chapter 3: Methodology

3.1 The Unified Process

Methodology is a very useful technique in developing a system on schedule and controls the system's quality. Therefore, select a correct methodology is not an easy task. The methodology that is going to use in the hardware pricing system is Unified Process (U.P.).

The Unified Process is an object-oriented methodology made of the following components which are connected via well defined interfaces. These components are:

- Unified Modelling Language (UML)
- Use case driven, architecture-centric, iterative and incremental.

UML is the tool used in Unified Process to model, describe and document all the development process. Unified Process utilized the functions of UML to capture the system's views. UML defines 5 architecture views of a system:

i) *Use Case View* – Focuses on the scenario done by actors. Use case only specified what is the functional requirements of a system but not how the action being done.

ii) Design View – Focuses on the domain problems and identifies solutions.

iii) Process View – Focuses on the time and flow of control in the system. The system will be tested for the performance, scalability and the overall throughput.

iv) Implementation View – Focuses on the essential components that need to figure out the system.

v) Deployment View – Focuses on the hardware components of the system and the software that are going to install on the hardware.

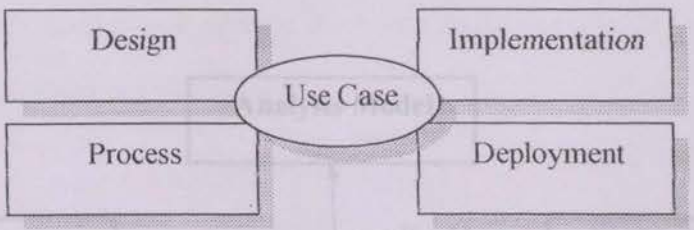


Figure 3.1: Five Views of a System

The Unified Process has four processes in the software development life cycle. The four processes are:

i) Use case driven development

ii) Object-oriented analysis

iii) Incremental development and prototyping

iv) Continuous testing

The methods and technologies that are used in the process are:

i) Unified Modelling Language (UML)

ii) Layered Approach

iii) Repository for object-oriented development pattern and frameworks

iv) Component-based development

3.2 The Six Models of Unified Process

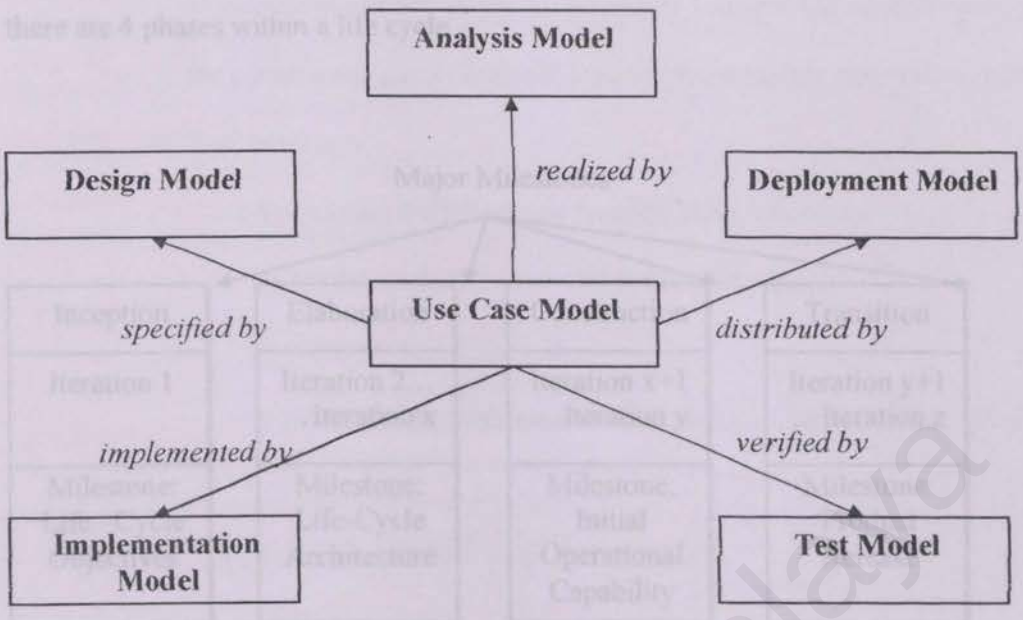


Figure 3.2: The Six Basic Unified Process Models.

The Unified Process consists of six models:

i) *Use Case Model* - models use cases/ functional requirements and their relationships to actors.

ii) *Analysis Model* – refines the use cases.

iii) *Design Model* – describes the physical realization of the use cases.

iv) *Implementation model* – describes the components of design model and the mapping of classes.

v) *Deployment Model* – defines the physical nodes of computers and the mapping of the components to those nodes.

vi) *Test Model* – describe how integration and system tests will be implemented.

3.3 The Four Phases of Unified Process

Software development process involves a series of cycle. In Unified Process, there are 4 phases within a life cycle.

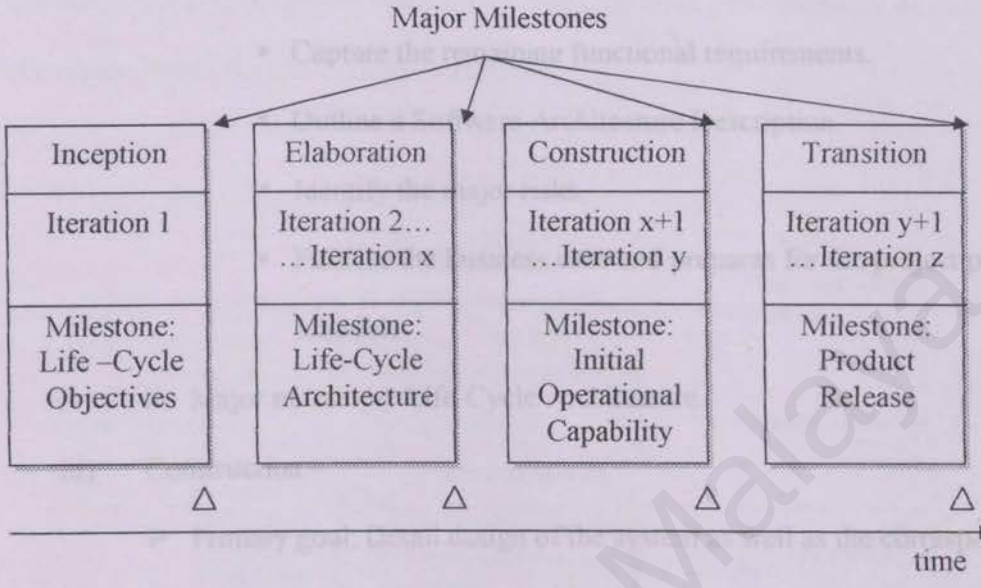


Figure 3.3: The Four Phases and Major Milestones.

i) *Inception* –

- Primary goal: Define the project scope and the business case for the system. The elements identified in the inception phase are used to establish the viability of the suggested system.
- Tasks performs:
  - Identifies the requirements and scopes of the system.
  - Outlines the system's architecture.
  - Critical risks assessment.
  - Project plan.
- Major milestone: Life-Cycle Objectives

ii) *Elaboration* –

- Primary goal: Analyzed the problems domain and the system's architectural outline. Analyze the ability to build the system based on the constraints given (financial constraints, schedule constraints, etc).
- Task performs:
  - Capture the remaining functional requirements.
  - Outline a Software Architecture Description.
  - Identify the major risks.
  - Finalize the business case and prepares for the project plan or schedule.
- Major milestone: Life-Cycle Architecture.

iii) Construction –

- Primary goal: Detail design of the system as well as the corresponding source code.
- Task performs:
  - Building system iteratively and incrementally to ensure the system meets the customer requirements.
  - Build the user manual to provide help task.
- Major milestone: Initial Operational Capability

iv) Transition –

- Primary goal: delivers the system to customers.
- Task performs:
  - Modify the system to overcome the unidentified problems.
  - Train users and maintainers.
- Major milestone: Product Release

3.4 Iteration and Increment

As shown in the figure 3.3 above, each of the phases is divided into iterations. Iteration is a complete development loop resulting in a subset of the final product to increment from iteration to become the final system. Iteration will results an increment because additional modules or functions have been modified or added into the system to improve the system performance.

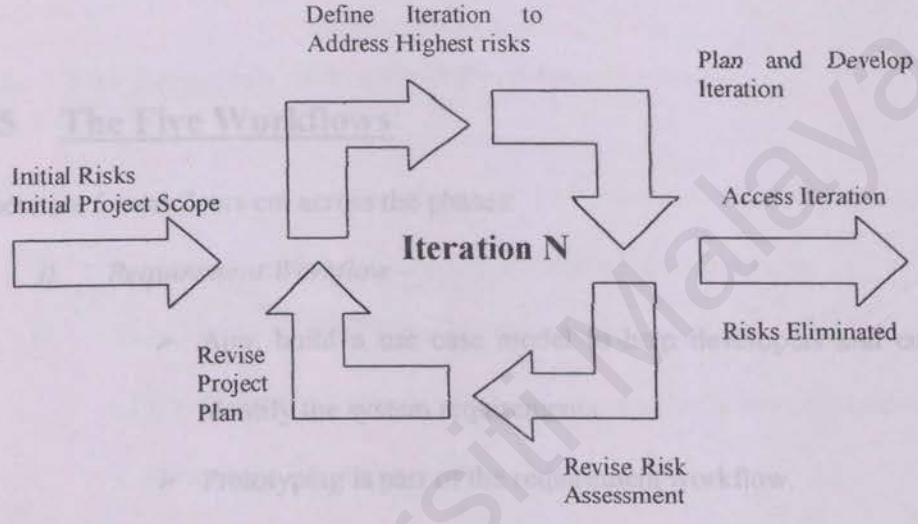


Figure 3.4: Iterative and Incremental Development.

Flow of process:

i) Identify the most critical risk.

ii) Prepare a plan for the iteration with certain level of details.

iii) Perform the five workflows in the Unified Process.

iv) Test the increment that results from the iteration.

v) Remove the risks that have been sufficiently addressed.

vi) Update the ongoing list and carry out with the rest of the risks.

vii) Revise the project plan in response to the changes that have been done on the iteration.

viii) Proceed with the next iteration.

Benefits of Iterative approach:

- Risks can be identified and isolated early.
- Increase reusability.
- Better overall quality.

3.5 The Five Workflows

There are 5 workflows cut across the phases:

i) Requirement Workflow –

- Aim: build a use case model to help developers and customers identify the system requirements.
- Prototyping is part of the requirement workflow.

ii) Analysis Workflow –

- Aim: build an analysis model to help developers refine and structure the functional requirements.
- Analysis workflow participates in both design view and process view.

iii) Design Workflow –

- Aim:
  a) build a design model to describe the use cases.
  b) define the physical organization of the system in the deployment model.

iv) *Implementation Workflow* –

- Aim: build an implementation model to describe how the elements of design model (source code, Dynamic Link Libraries, etc) integrated into the software components.

v) *Test Workflow* –

- Aim: build a test model to describe how the integration and system test are being performed to fulfil the system requirements.

3.6 The Strength of Unified Process

i) The Unified Process combines the best practices, processes, guideline and methodologies from the Booch, Rumbaugh and Jacobson.

ii) The Unified Process is based on software engineering principles such as taking an iterative, requirements-driven, and architecture-based approach to achieve the development.

iii) The Unified Process allowed iterative development where the process can go back and forth between the design and analysis phase. Therefore changes can be made easily.

iv) Unified Process is highly exploits the UML during the software development process. UML is a software modelling language with significant notations and diagrams to model real world problems using object-oriented concept.

CHAPTER 4
System Analysis

Chapter 4: System Analysis

System analysis is very important in software development lifecycle since it helps to:

- Analyse data input, data storage and information output.
- Identify major components of the system.
- Understand the data flow and processing or transformation of the data.
- Identify the hardware and software requirements.
- Improve the system functionality.

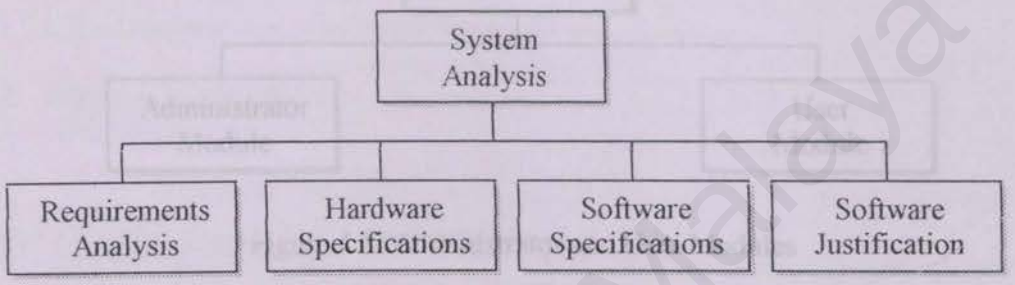


Figure 4.1: System Analysis Checklists.

4.1 Requirements Analysis

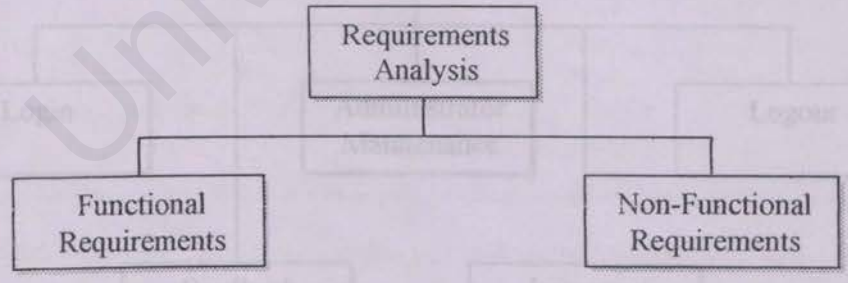


Figure 4.2: Functional and Non-Functional Requirements.

4.2 Functional Requirements

Functional requirements are defined as critical services/functions that a system must perform. It describes the interaction between the system being developed and its environment. In Object-oriented analysis, the requirements are captured using use case diagram. For the DCC system, there are two modules which capture all the functional requirements –

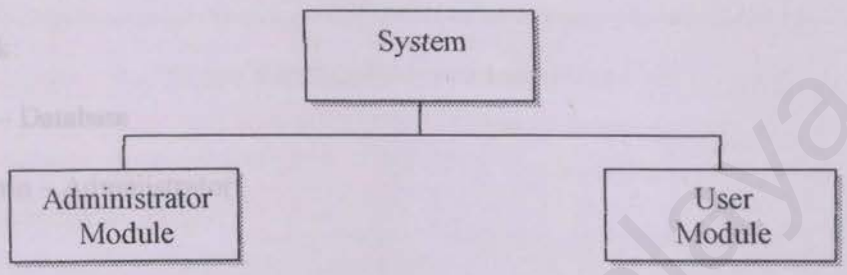


Figure 4.3: Administrator and User Modules

4.2.1 Administrator Module

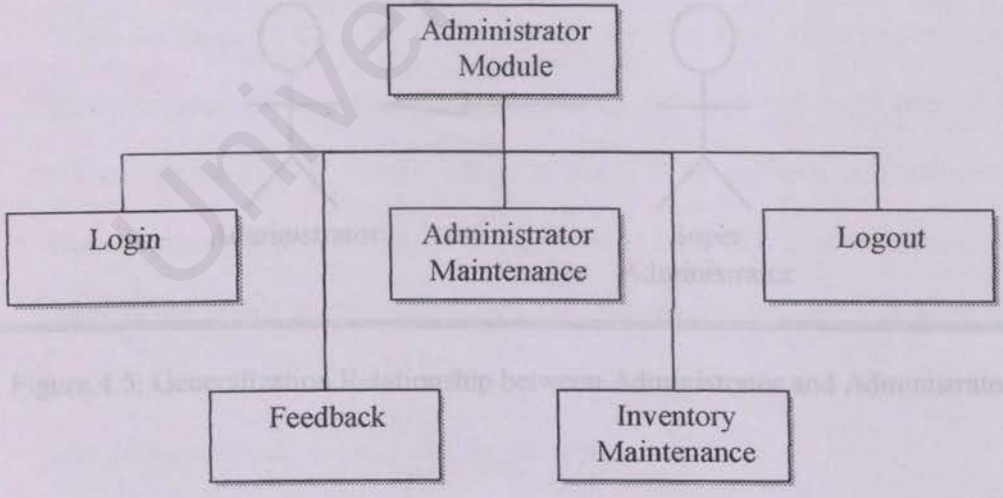


Figure 4.4: The Sub-components of Administrator Module.

Table 4.1: The Functional Requirements of DCC – Administrator Module

Main Module	Sub Module	Description
Admin	Login	Prevent unauthorized users access the DB.
	Logout	Exit the system.
	Feedback	View, delete/ reply the users' comments.
	Inventory Maintenance	Edit, delete or add records in the DB.
	Admin Maintenance	Add, Edit/ delete admin from the system.

*Remark:

1. DB – Database
2. Admin – Administrator

a) The Use Cases for Administrator Module

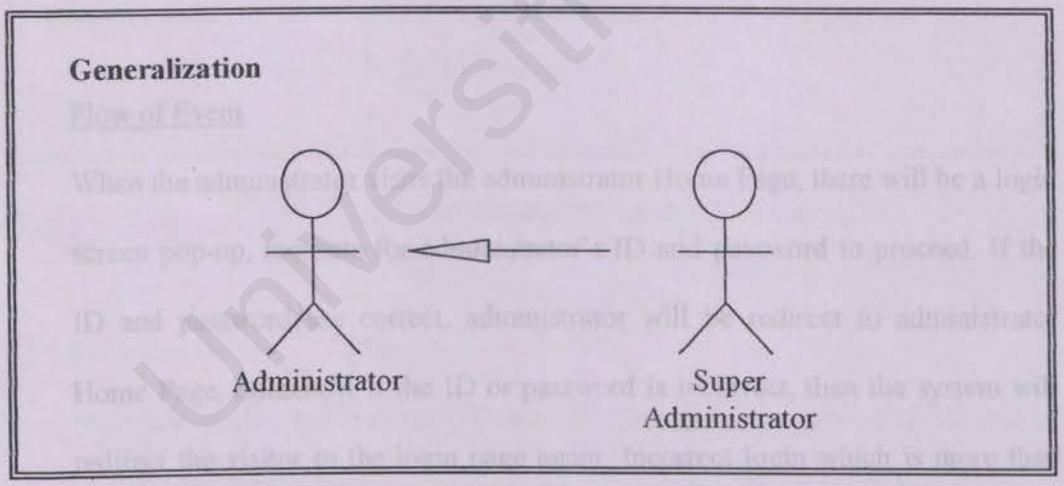


Figure 4.5: Generalization Relationship between Administrator and Administrator

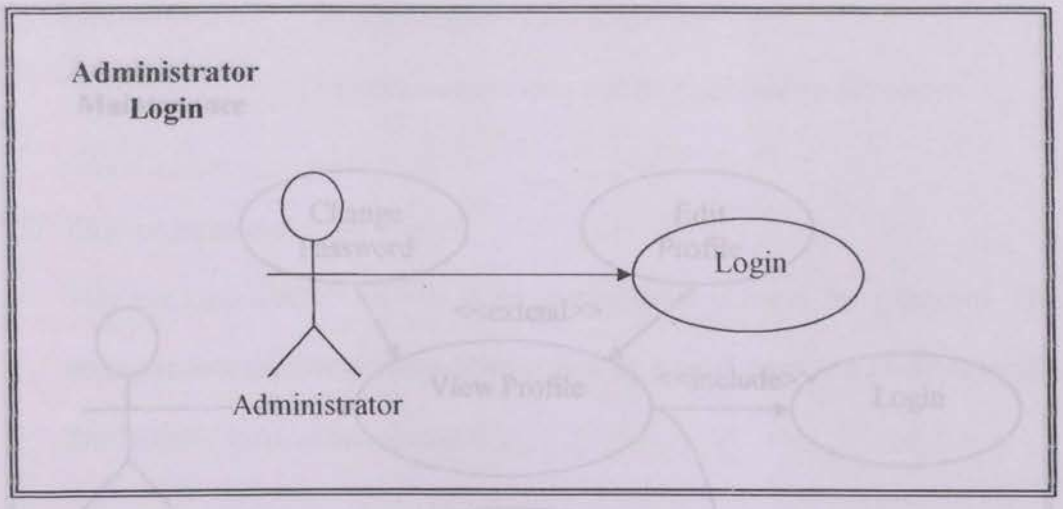


Figure 4.6: Administrator Login Use Case

i) Administrator Login:

The login use case is applied to secure the database from unauthorized access. Administrator's ID and password is required to proceed into the administrator Home Page.

Flow of Event

When the administrator visits the administrator Home Page, there will be a login screen pop-up, requests for administrator's ID and password to proceed. If the ID and password are correct, administrator will be redirect to administrator Home Page. Somehow if the ID or password is incorrect, then the system will redirect the visitor to the login page again. Incorrect login which is more than three times will be redirect to another page to retrieve the losing ID or Password using the e-mail address provided by the administrator.

Precondition : The system request administrator ID and password.

Postcondition : The system displays the index page to the administrator.

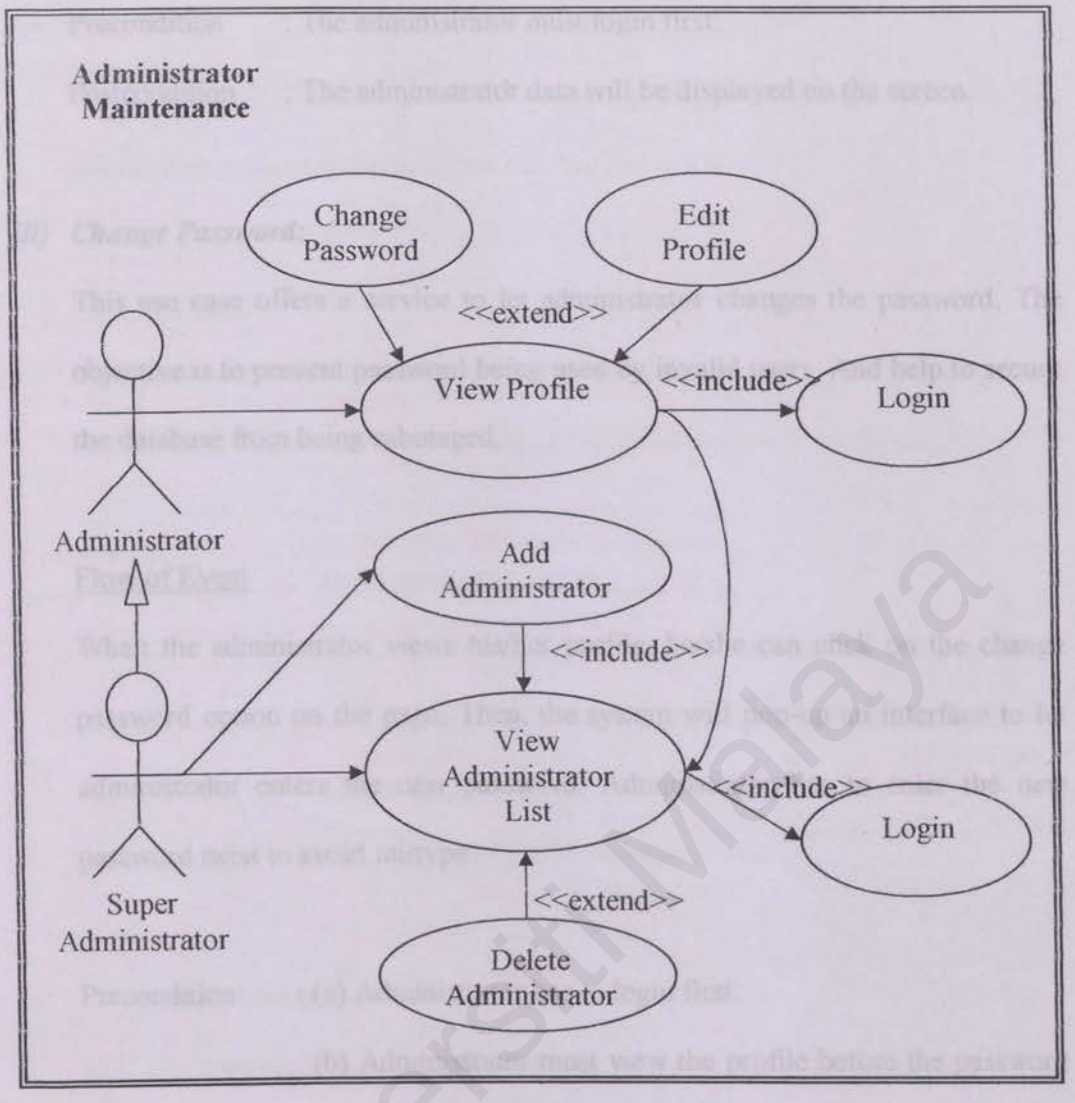


Figure 4.7: Administrator Maintenance Use Case

ii) View Profile:

The View Profile use case let both the administrator and super administrator to view their personal data.

Flow of Event

Administrator clicks on the profile button to view profile. The database will retrieve information from the related table and displays on the screen.

Precondition : The administrator must login first.

Postcondition : The administrator data will be displayed on the screen.

iii) Change Password:

This use case offers a service to let administrator changes the password. The objective is to prevent password being used by invalid users. And help to secure the database from being sabotaged.

Flow of Event

When the administrator views his/her profile, he/she can click on the change password option on the page. Then, the system will pop-up an interface to let administrator enters the new password. Administrator has to enter the new password twist to avoid mistype.

Precondition : (a) Administrator has to login first.

(b) Administrator must view the profile before the password can be changed.

(c) There must be at least one administrator record in the database.

Postcondition : The system updates the database.

iv) Edit Profile:

The Edit Profile use case allows administrator to edit or change their personal information such as address, phone number and so on.

Flow of Event

When the administrator views his/her profile, he/she can edit their personnel data directly. Then, administrator clicks the update button to confirm.

Precondition : (a) Administrator has to login first.
(b) Administrator must view the profile before edit the data.
(c) There must be at least one administrator record in the database.

Postcondition : The system updates the database.

v) View Administrator List:

This use case lets the super administrator to view all the administrators of the system.

Flow of Event

Administrator clicks on the administrator button to view all the administrators. The database will retrieve information from the related table and displays on the screen. If there is no administrator added into the database, the system will display a message to inform administrator.

Precondition : (a) Administrator has to login first.

(b) There must be at least one administrator record in the database.

Postcondition : The system updates the database.

vi) Add Administrator:

Add Administrator use case is used to add new administrator account for the system. It only can be done by the super administrator.

Flow of Event

Super administrator clicks on the add administrator button to add new administrator. The super administrator then fill in a form provided by the system and clicks on the submit button.

Precondition : Super administrator has to login first.

Postcondition : The system updates the database.

vii) Delete Administrator:

The Delete Administrator use case is created to delete administrator record who is no longer an authorize person to access the database.

Flow of Event

Super administrator first requests the administrator list from the server. Then, the super administrator selects the administrators' record which will be deleted from the database. Finally, super administrator clicks the delete button to delete the record(s). Super administrator clicks the O.K. button to confirm. To delete super administrator, password is required to perform the deletion.

Precondition : (a) Super administrator has to login first.

(b) Super administrator must view the administrator list before delete the record(s).

(c) There must be at least one administrator record in the database.

Postcondition : The system updates the database.

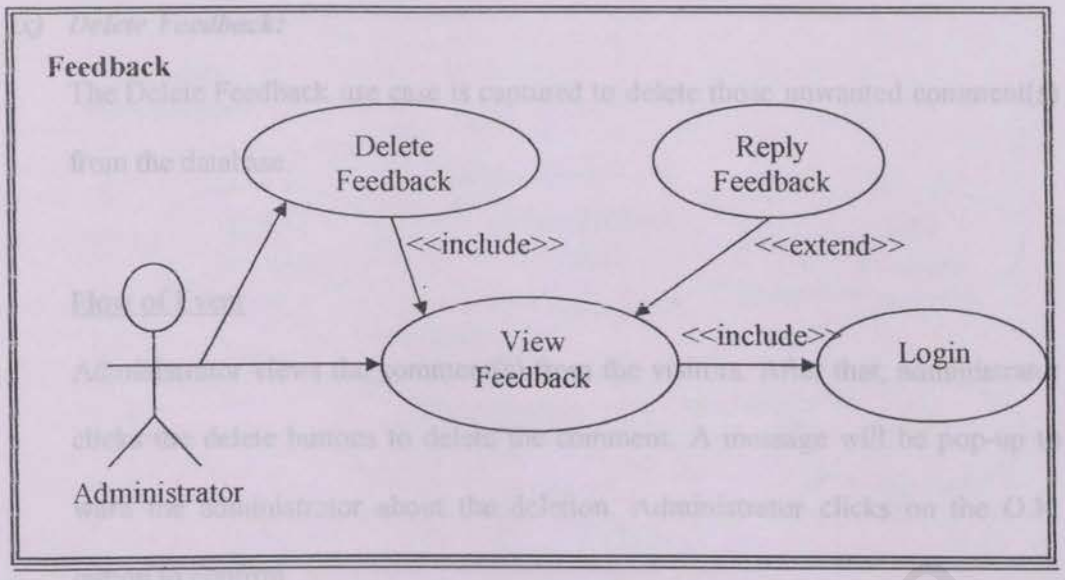


Figure 4.8: Feedback Use Case

viii) View Feedback:

The View Feedback use case is to view all the comment wrote by the visitors.

Flow of Event

The administrator clicks on the user feedback button on the administrator Home Page. The system then retrieves all the comments from the related table and displays on the screen. If there is no comment from the visitors, then the system will display a message to inform administrator.

Precondition : (a) Administrator has to login first.

(b) There must be at least one record in the database.

Postcondition : The system displays the comment(s) on the screen.

ix) Delete Feedback:

The Delete Feedback use case is captured to delete those unwanted comment(s) from the database.

Flow of Event

Administrator views the comment(s) from the visitors. After that, administrator clicks the delete buttons to delete the comment. A message will be pop-up to warn the administrator about the deletion. Administrator clicks on the O.K. button to confirm.

Precondition : (a) Administrator has to login first.

(b) There must be at least one record in the database.

Postcondition : The system updates the database.

x) Reply Feedback:

The Reply Feedback use case is used to answers those comment(s) from the visitors.

Flow of Event

Administrator views the comment(s) from the visitors. After that, administrator clicks the reply buttons to write a feedback.

Precondition : (a) Administrator has to login first.

(b) There must be at least one record in the database.

Postcondition : The system updates the database.

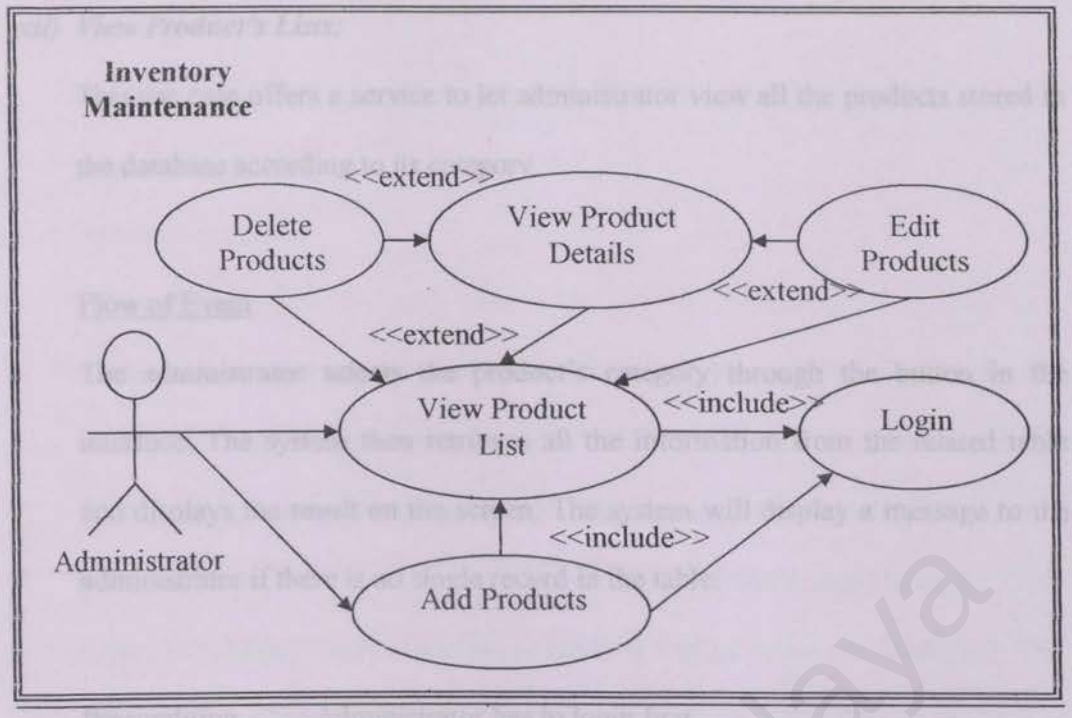


Figure 4.9: Inventory Maintenance Use Case

xi) Add Products:

Administrator uses the Add Products use case to add new release of hardware components into the database.

Flow of Event

When administrator clicks on the add products button, the system will display a form to let administrator fill in the related information. After that, administrator clicks the submit button to update the database.

Precondition : (a) Administrator has to login first.

(b) The record(s) is not in the database.

Postcondition : The system updates the database.

xii) View Product's Lists:

This use case offers a service to let administrator view all the products stored in the database according to its category.

Flow of Event

The administrator selects the product's category through the button in the interface. The system then retrieves all the information from the related table and displays the result on the screen. The system will display a message to the administrator if there is no single record in the table.

Precondition : Administrator has to login first.

Postcondition : The system displays the result to the administrator.

xiii) View Product Details:

The View Product Details use case let both the administrator and super administrator to view the product detail information.

Flow of Event

Administrator clicks on the product name to view product detail. The database will retrieve information from the related table and displays on the screen. The system will display a message to the administrator if the table is empty.

Precondition : (a) The administrator must login first.

(b) Administrator must view the product's lists first.

Postcondition : The product information will be displayed on the screen.

xiv) Delete Products:

The Delete Products use case is created to delete the outdated record(s) from the database.

Flow of Event

Administrator first requests the product's lists from the server. Then, the administrator selects the record(s) which will be deleted from the database. Finally, administrator clicks the delete button to delete the record(s). A message box will be pop-up to notify the administrator. Administrator clicks the O.K. button to confirm. There is another alternative way to delete the product(s). The administrator can also delete the product(s) when the administrator looking at the product's detail information.

Precondition : (a) Administrator has to login first.
(b) Administrator must view the product's lists before delete the record(s).
(c) There must be at least one record in the database.

Postcondition : The system updates the database.

xv) Edit Products:

The Edit Product use case allows administrator to edit or change the products' information.

Flow of Event

When the administrator views the product's details information, administrator can edit the data directly. Or the administrator can clicks the edit button on the product's lists interface. Then, administrator clicks the update button to confirm.

Precondition : (a) Administrator has to login first.

(b) Administrator must view the product's lists first.

(c) There must be at least one record in the database.

Postcondition : The system updates the database.

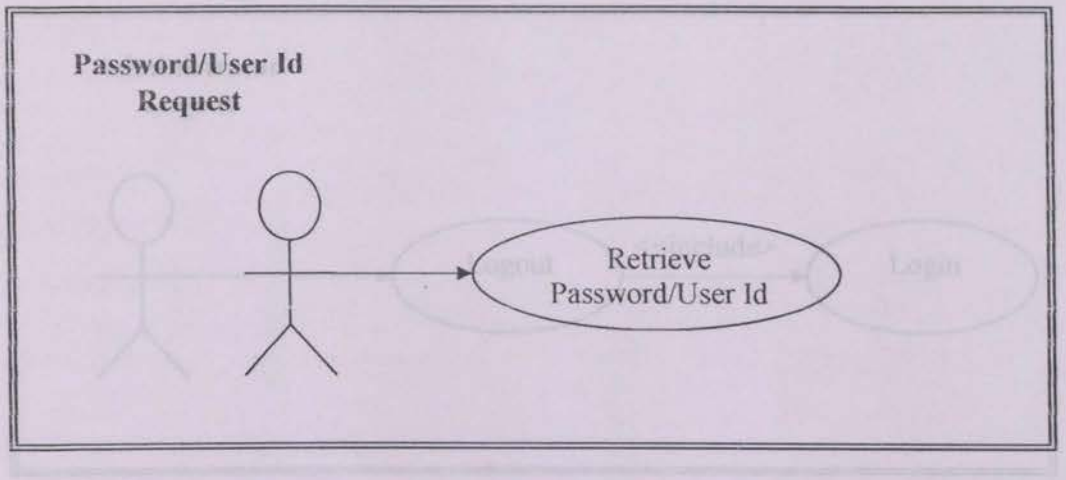


Figure 4.10: Password/User Id Request Use Case

xvi) Retrieve Password/User Id:

A use case used to help administrator to retrieve their password or user id by providing their unique email address.

Flow of Event

When the administrator forgot his/her password or user id, the administrator can click on the link provided in the login page to submit their email address. Each administrator has their own unique email address in this context. The administrator will soon receive an email within three days.

Precondition : None

Postcondition : The system updates the database and save the administrator email address.

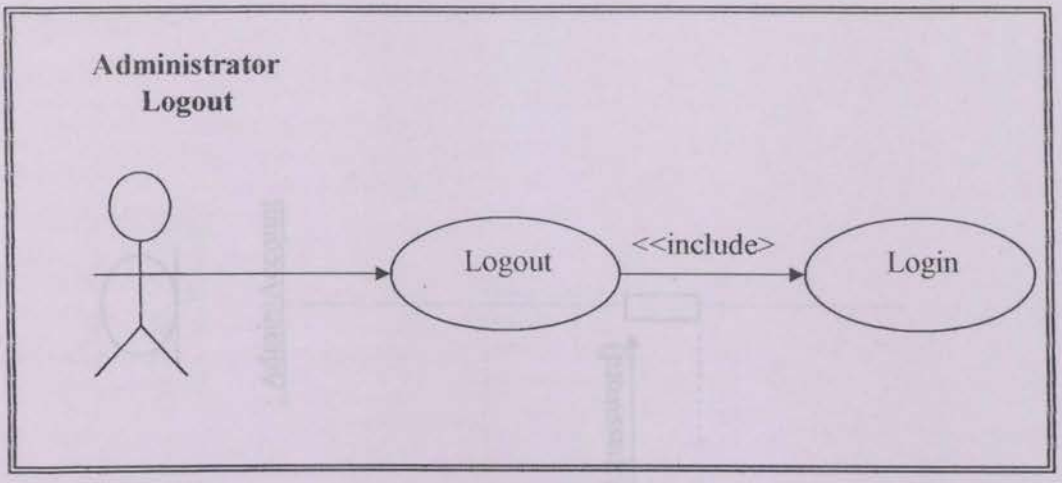


Figure 4.11: Administrator Logout Use Case

xvii) Administrator Logout:

The logout use case lets the administrator exist the system.

Flow of Event

The administrator clicks the logout button to exist the system. The system will automatically redirect the administrator the DCC Home Page.

Precondition : Administrator has to login first.

Postcondition : the system has been logout.

a) **The Sequence Diagram for Administrator Module**

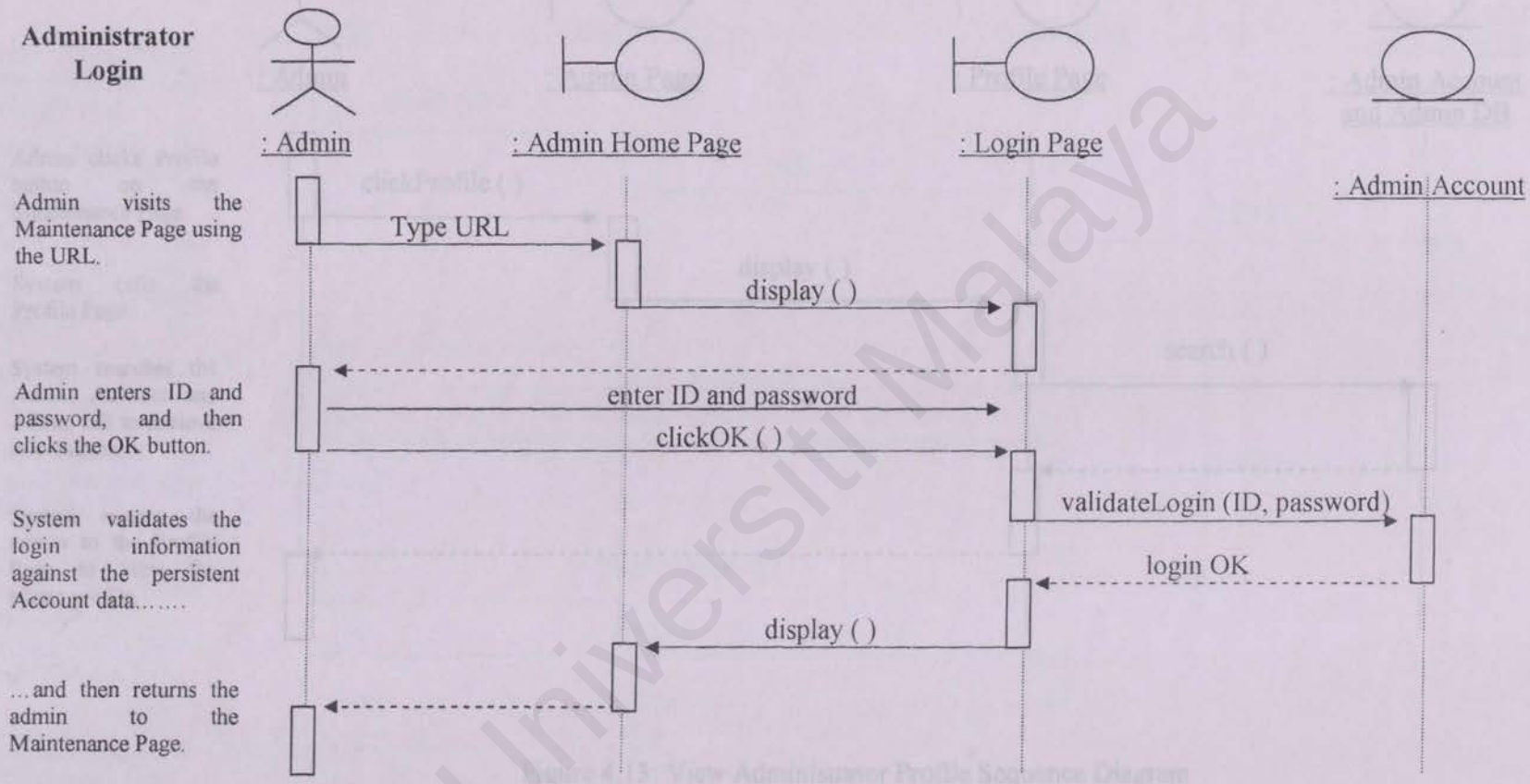


Figure 4.12: Administrator Login Sequence Diagram

View Profile

Admin clicks Profile button on the Maintenance Page.

System calls the Profile Page.

System searches the Admin Account and Admin DB to retrieve information.

System returns the admin to the Profile Page to view the admin profile.

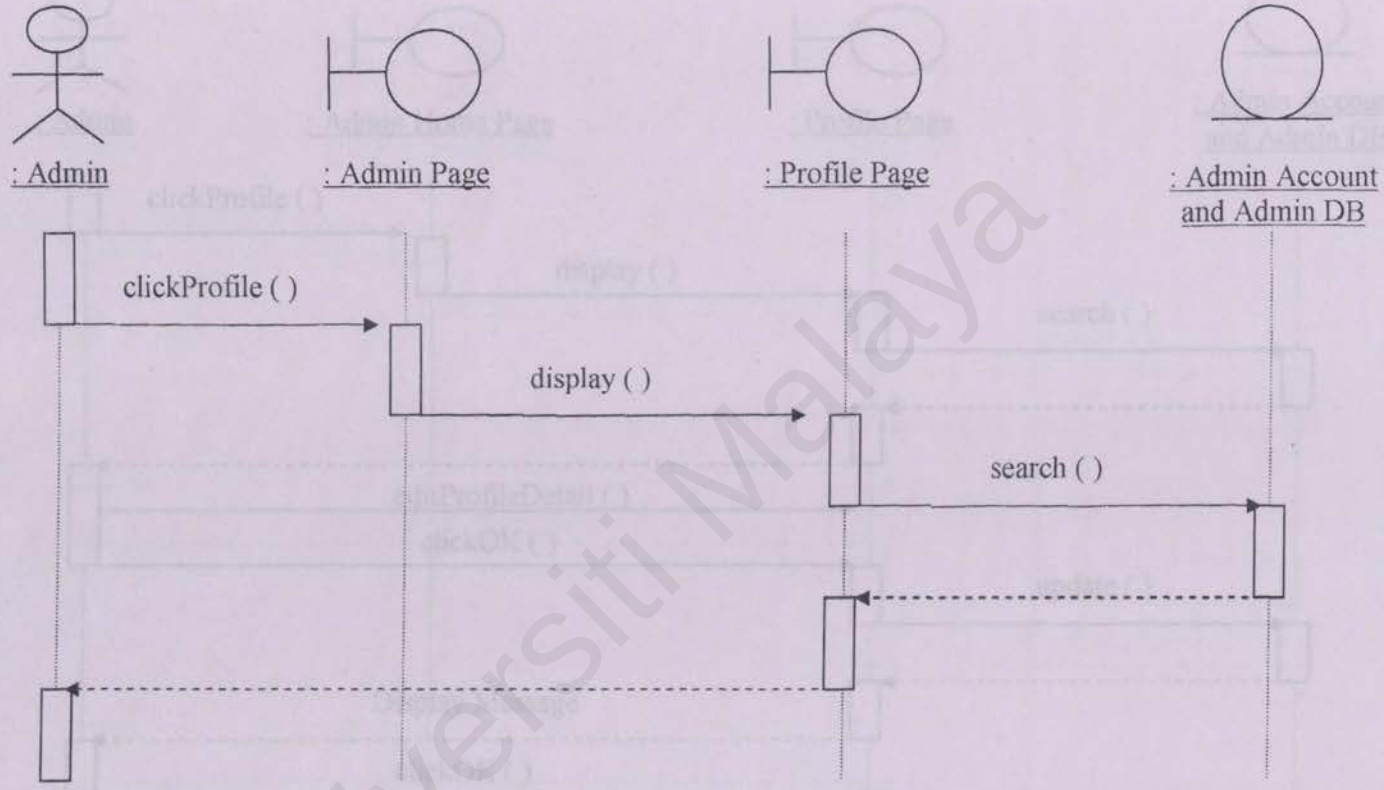


Figure 4.13: View Administrator Profile Sequence Diagram

Edit Profile

Admin clicks Profile button and system calls the Profile Page.

System searches the database to retrieve information.

System returns the admin to the Profile Page to view the admin profile.

Admin edits profile and click OK button.

System updates the Admin Account and Admin DB.....

..... & displays a message to inform admin.

Admin click OK button.

System returns admin to the Maintenance Page.

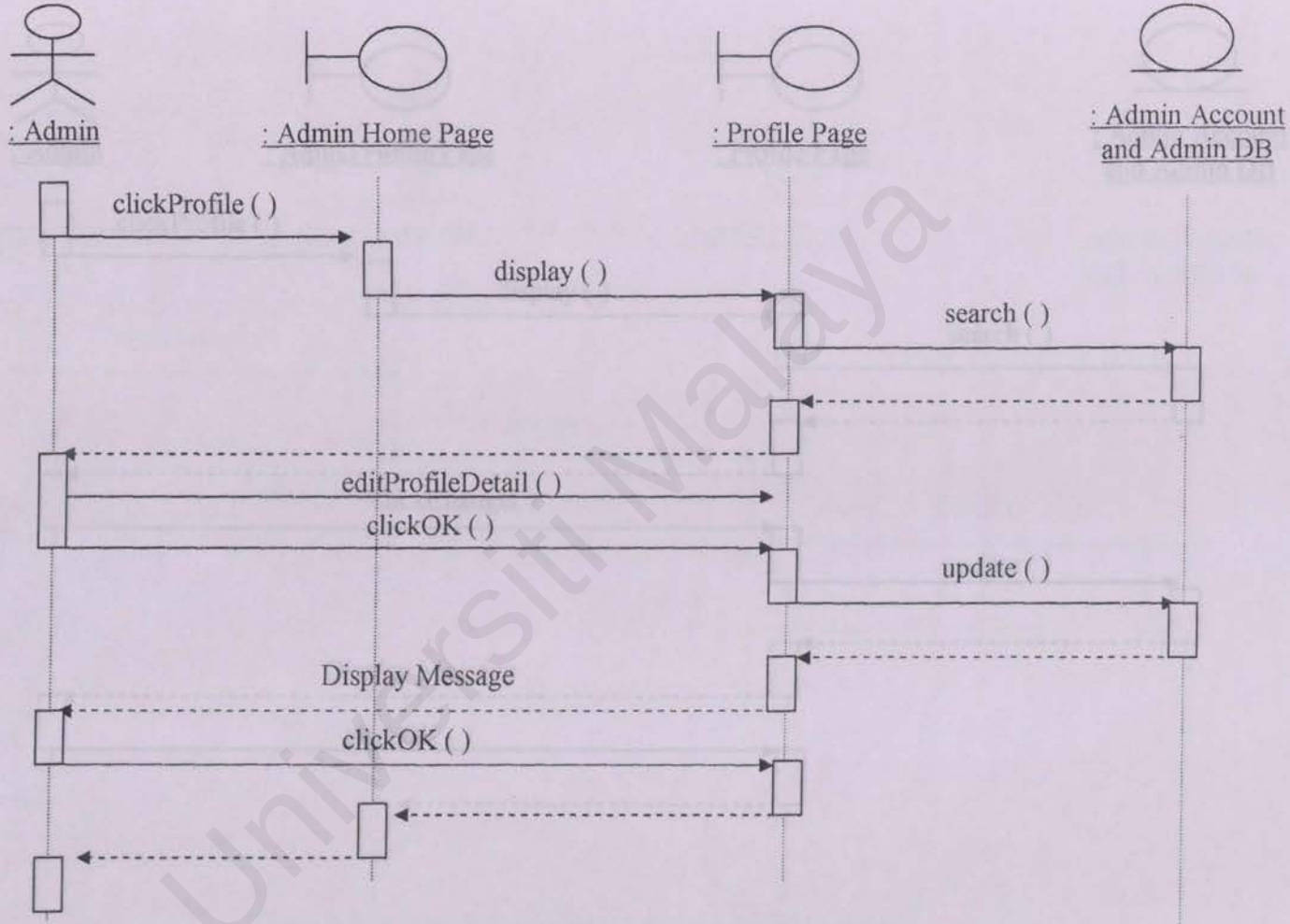


Figure 4.14: Edit Administrator Profile Sequence Diagram

Change Password

Admin clicks Profile button and system calls the Profile Page.

System searches the database to retrieve information.

System returns the admin to the Profile Page to view the admin profile.

Admin edits profile and click OK button.

System updates the Admin Account and Admin DB……

…. & displays a message to inform admin.

Admin click OK button.

System returns admin to the Maintenance Page.

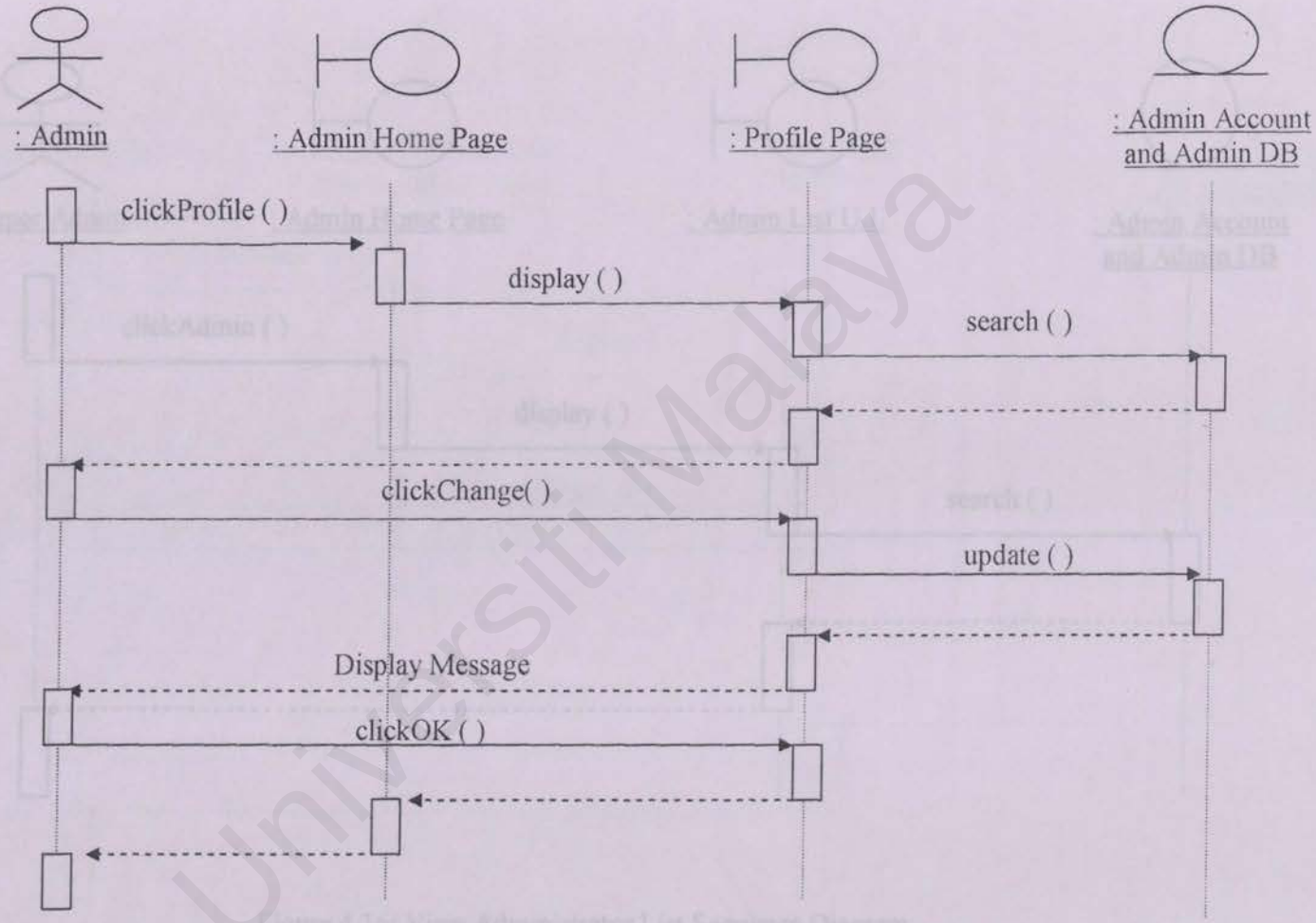


Figure 4.15: Change Password Sequence Diagram

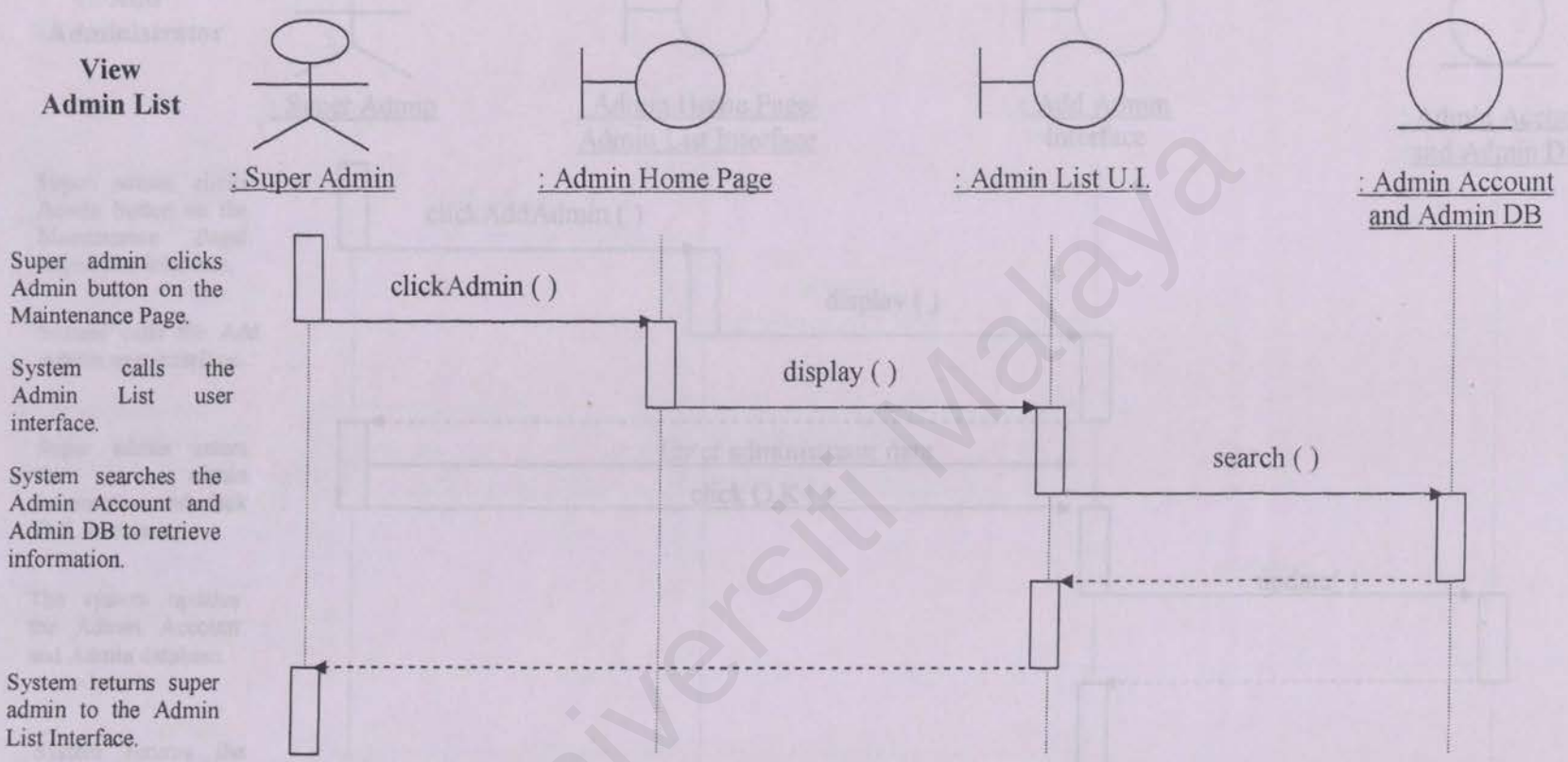
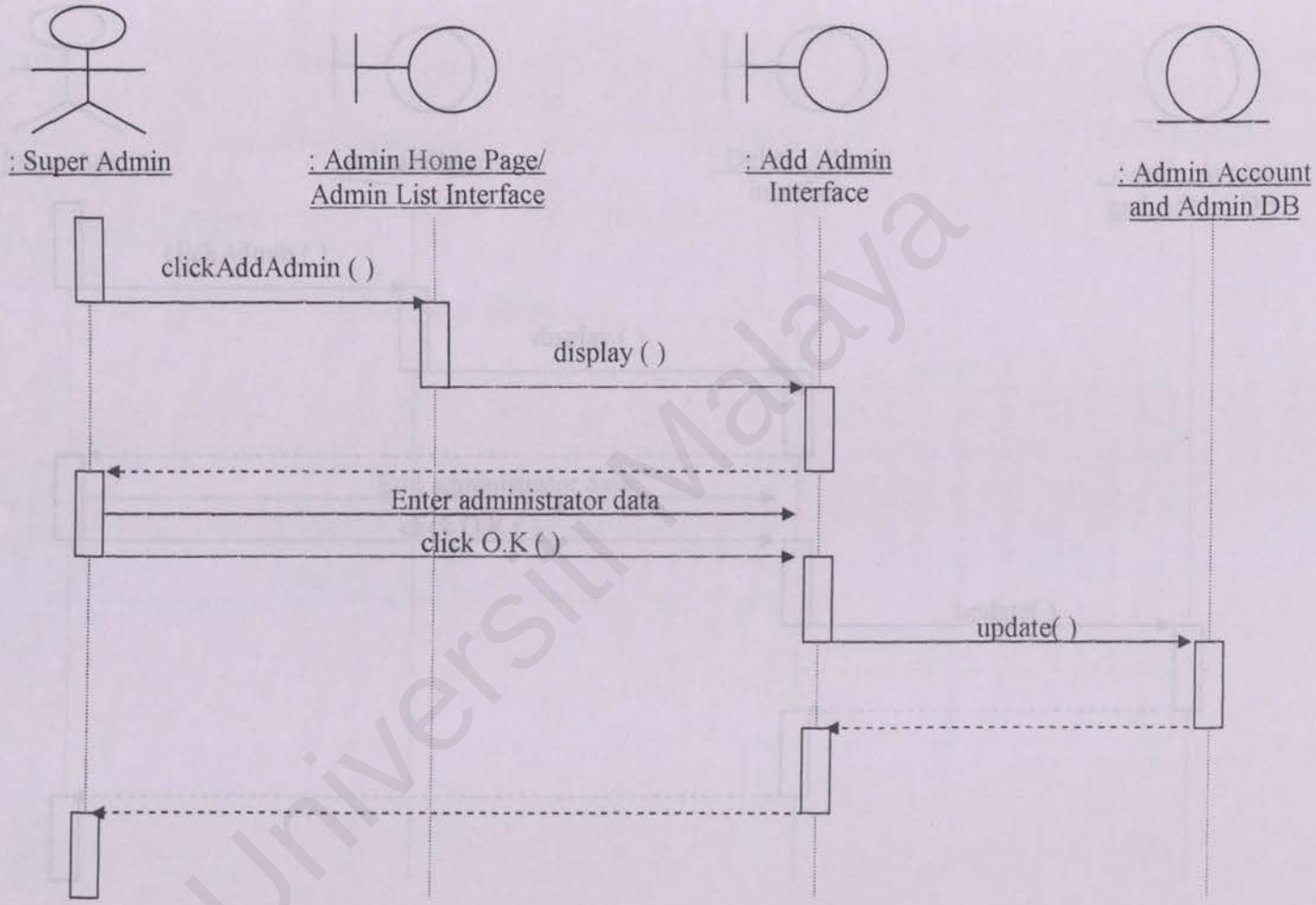


Figure 4.16: View Administrator List Sequence Diagram

Add Administrator



Super admin clicks Admin button on the Maintenance Page/ Adnin List Interface.

System calls the Add Admin user interface.

Super admin enters the admin information and click O.K. button.

The system updates the Admin Account and Admin database.

System returns the super admin to the Add Admin user interface.

Figure 4.17: Add Administrator Sequence Diagram

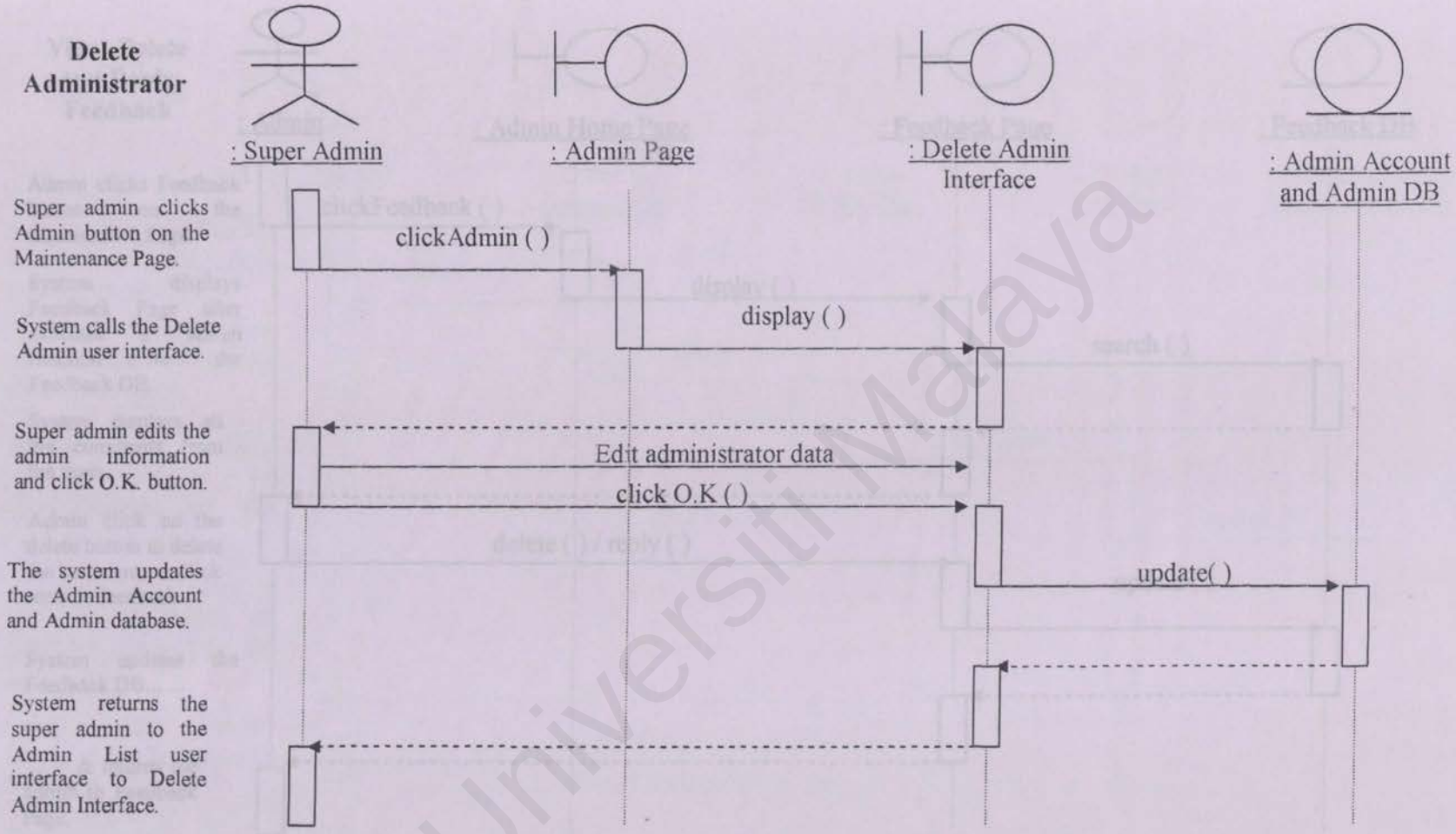


Figure 4.18: Delete Administrator Sequence Diagram

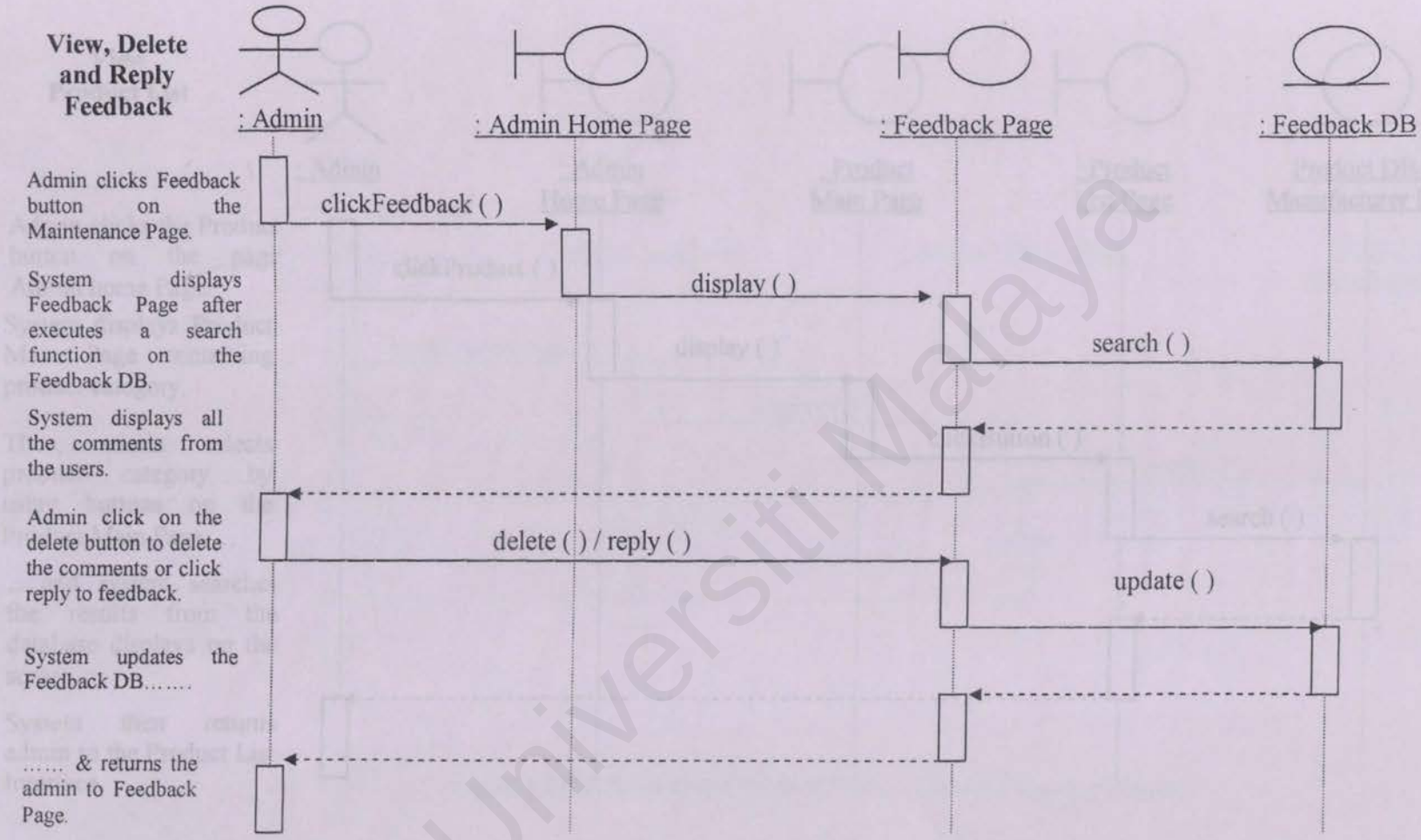


Figure 4.19: View, Delete and Reply Feedback Sequence Diagram

View Product List

Admin clicks the Product button on the page Admin home Page.

System displays Product Main Page containing product category.

Then, admin selects product category by using buttons on the Product Main Page....

....and system searches the results from the database displays on the screen.

System then returns admin to the Product List Interface.

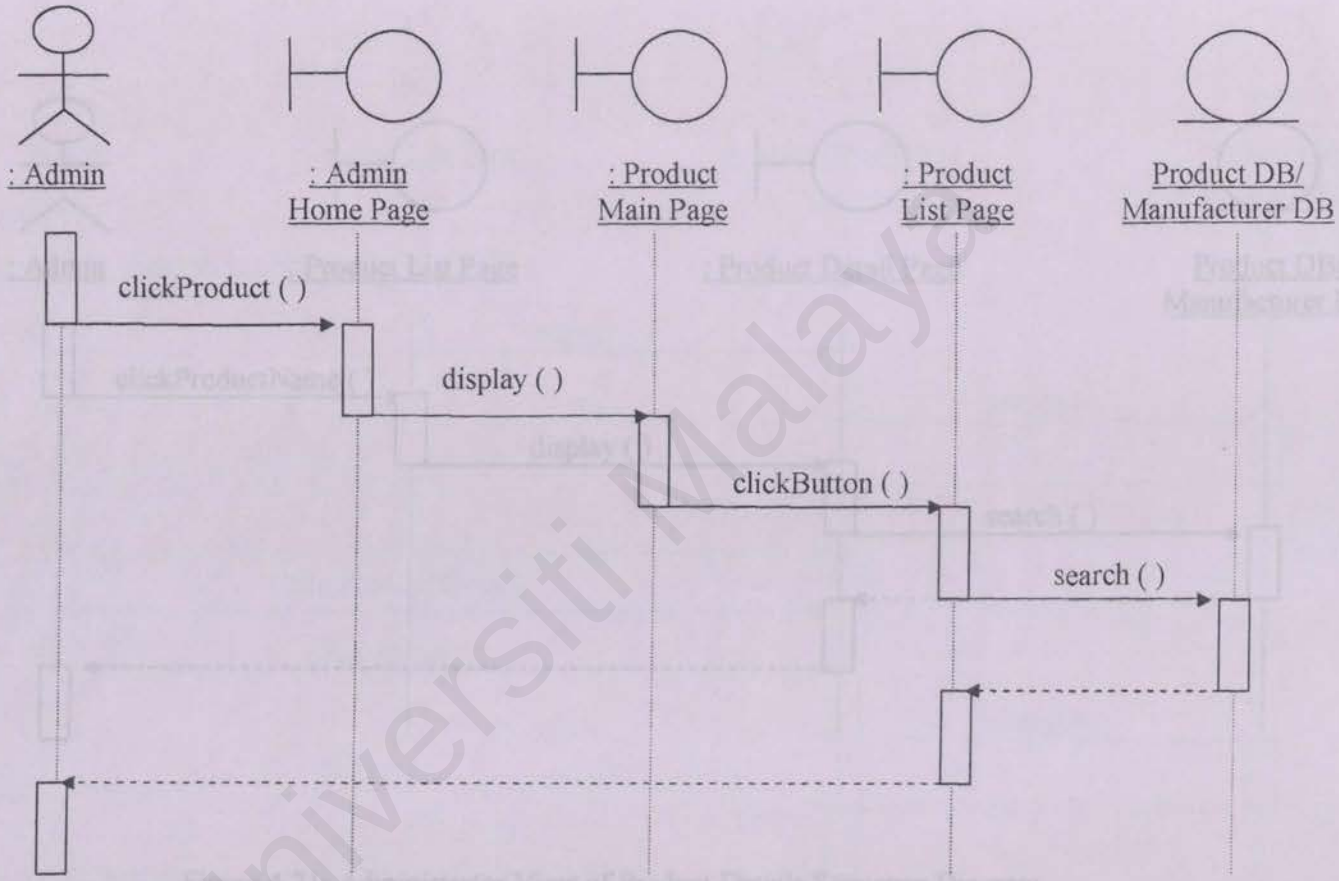
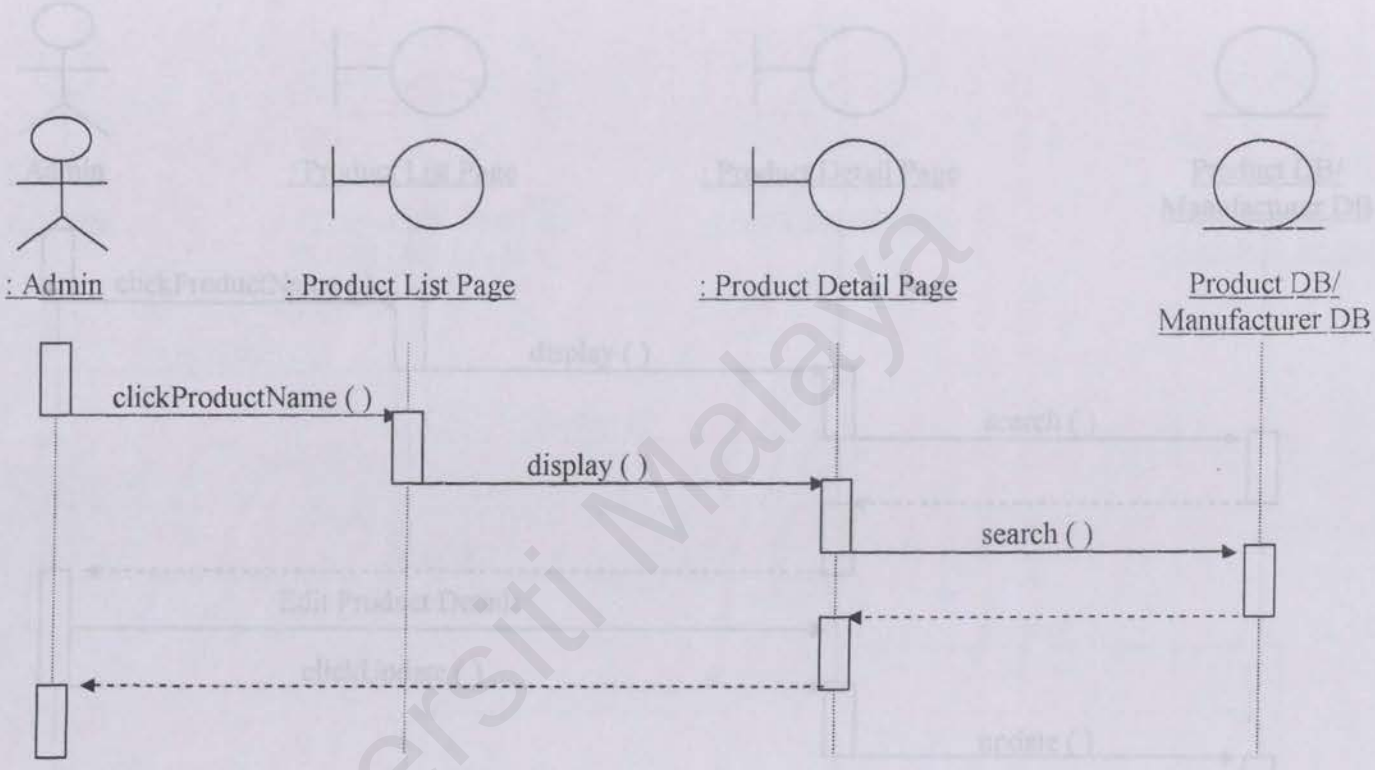


Figure 4.20: Administrator View of Product List Sequence Diagram

View Product Details



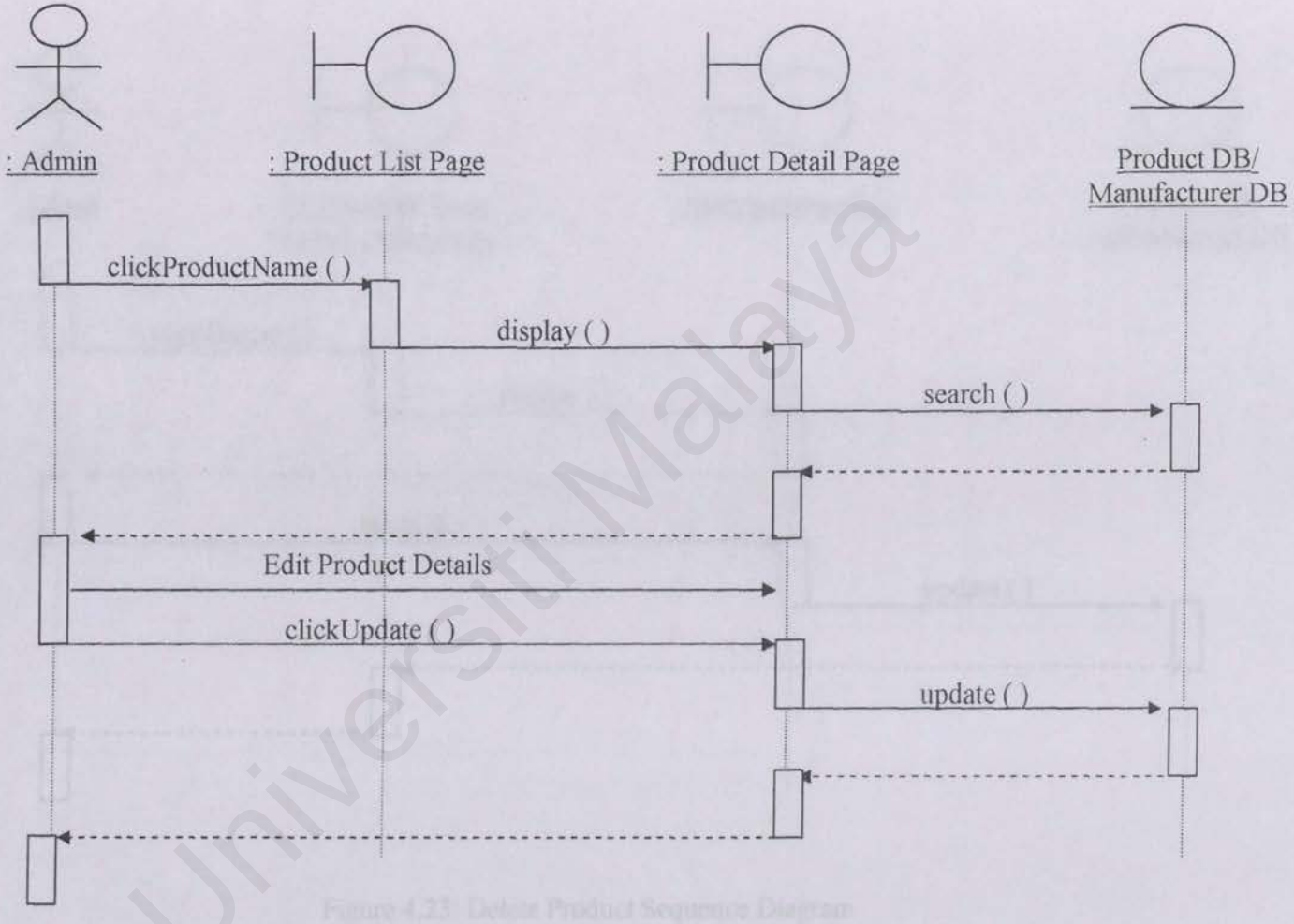
Admin clicks the product name on the Product List U.I.

System displays a page containing product detail after searching from product DB…..

….after system retrieves information from the database.

Figure 4.21: Administrator View of Product Details Sequence Diagram

Edit Product



Admin clicks the product name on the Product List U.I.

System displays a page containing product detail after searching from product DB…..

….after system retrieves information from the database.

Admin edits the product information directly and clicks Update button.

The system then returns the administrator to the Product List Page.

Figure 4.22: Edit Product Sequence Diagram

Delete Products

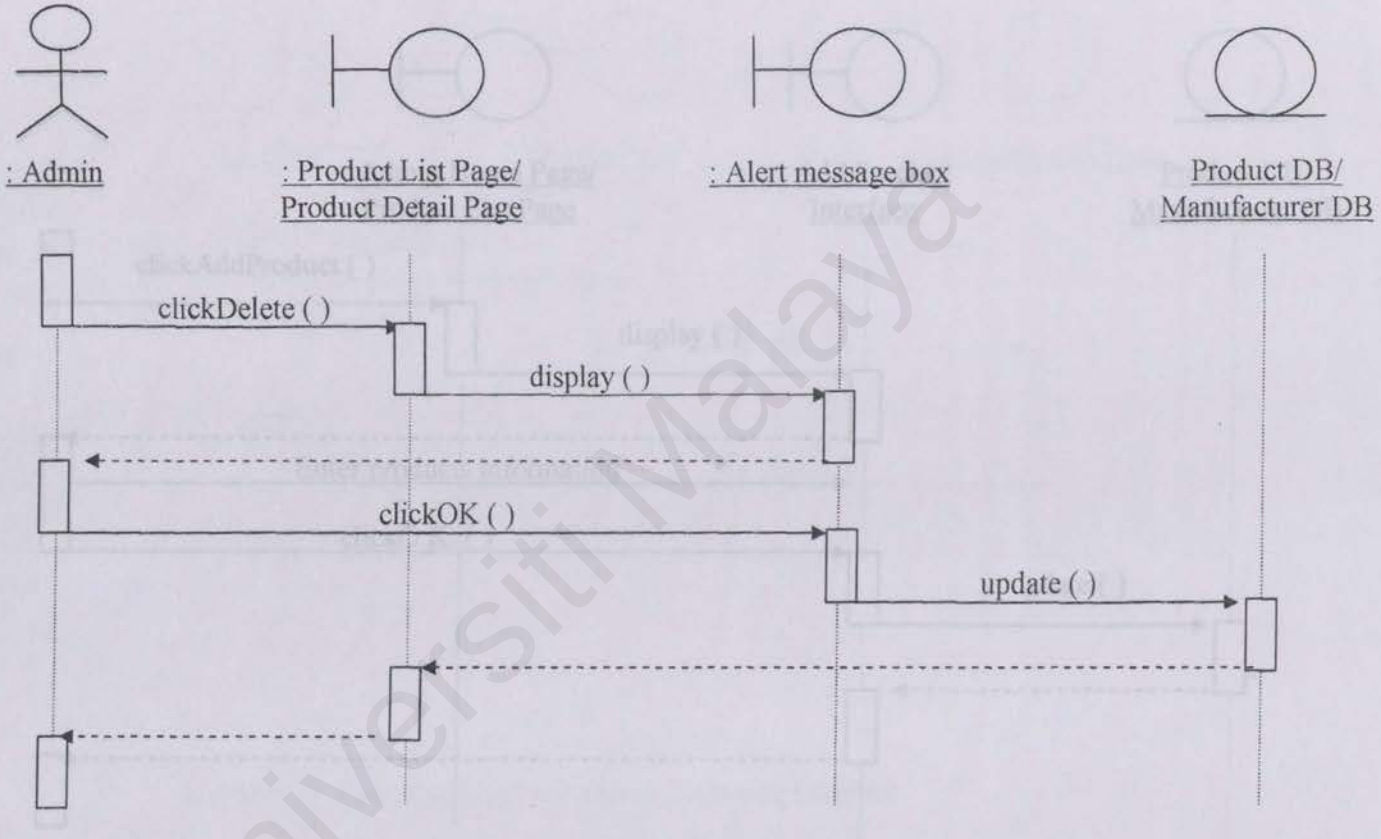


Figure 4.23: Delete Product Sequence Diagram

Add Products

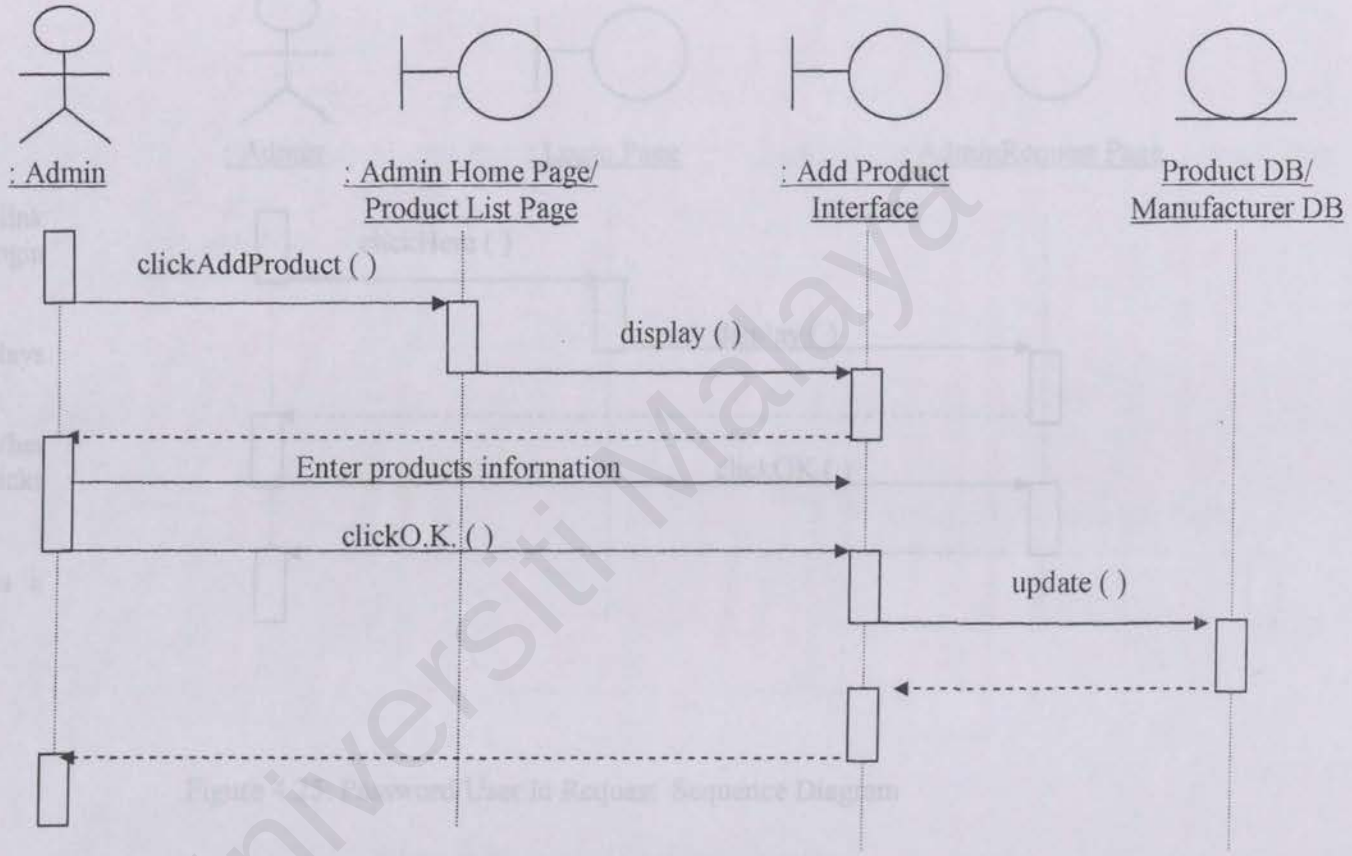


Figure 4.24: Add Product Sequence Diagram

Retrieve Password/User Id

Admin clicks the link provided in the Login Page

System displays AdminRequest Page.

Admin submits his/her email address and clicks OK button.

...and system returns a message to the admin.

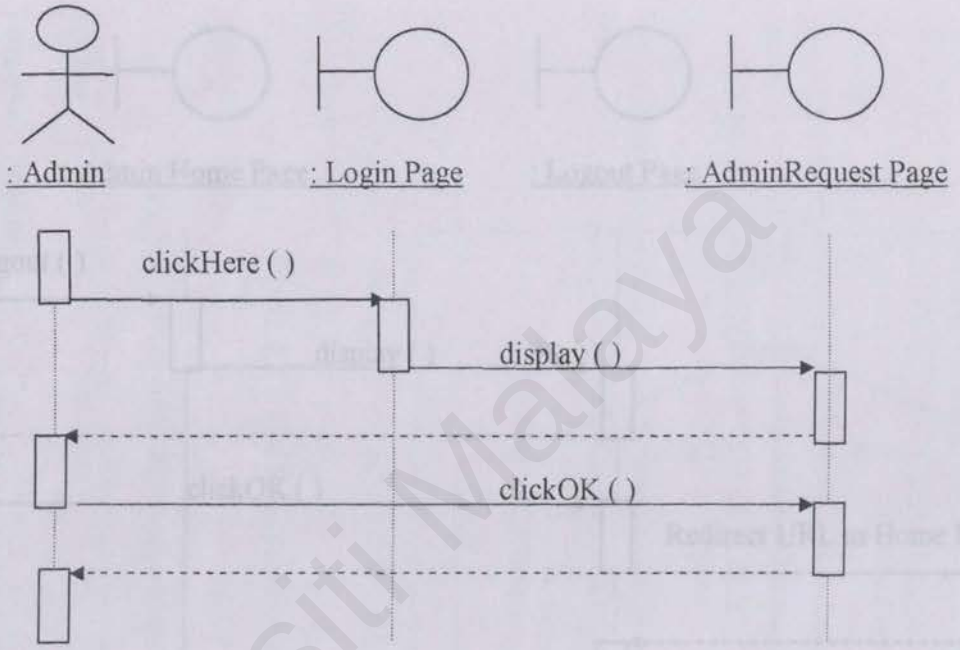


Figure 4.25: Password/User Id Request Sequence Diagram

Logout

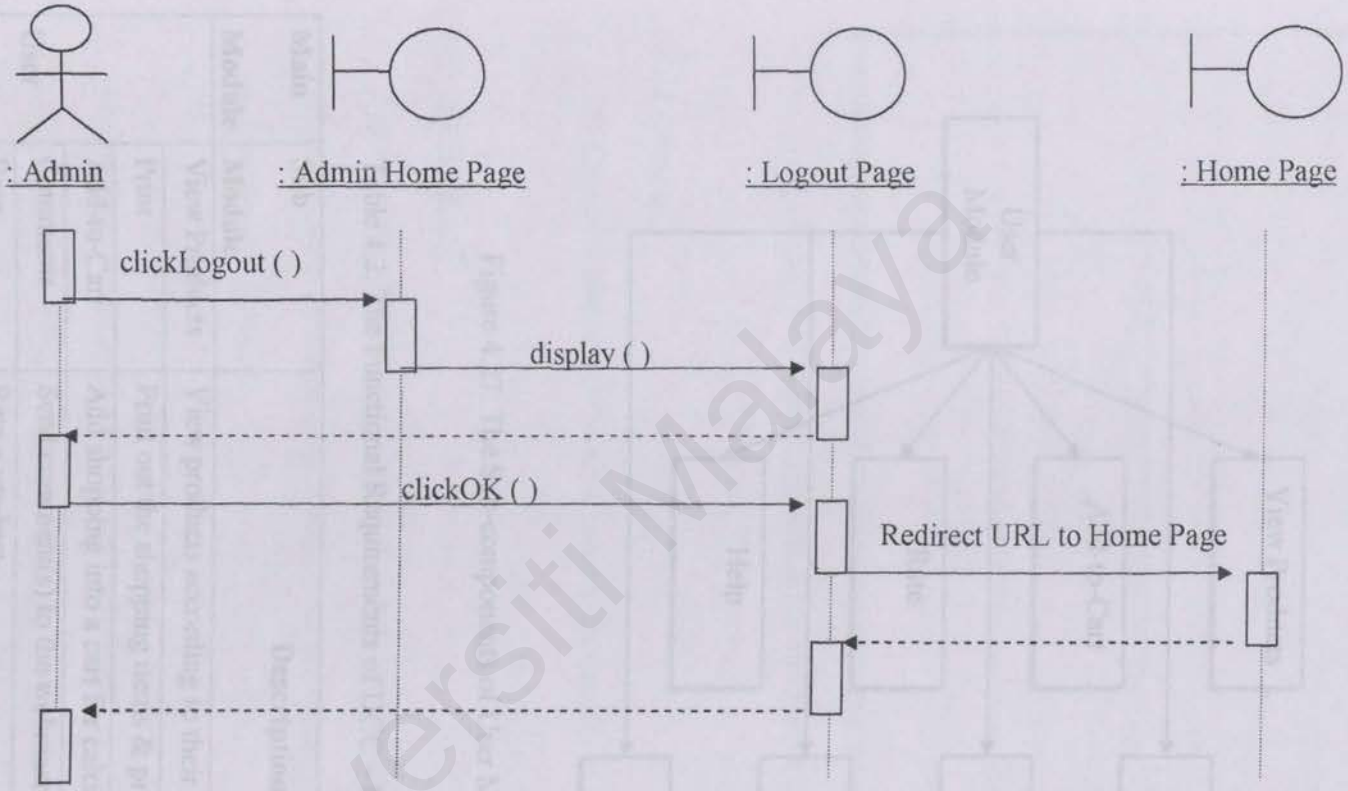


Figure 4.26: Logout Sequence Diagram

4.2.2 User Module

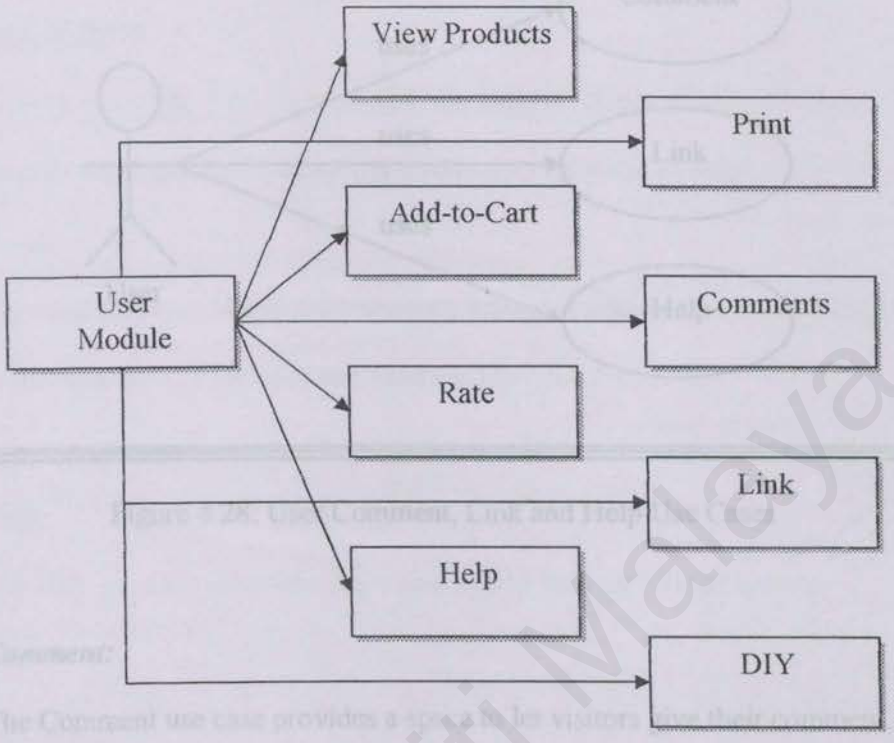


Figure 4.27: The Sub-components of User Module.

Table 4.2: The Functional Requirements of DCC – User Module

Main Module	**Sub Module**	**Description**
User	View Products	View products according to their category.
	Print	Print out the shopping items & products' information.
	Add-to-Cart	Add shopping into a cart for calculation.
	Comments	Send comment(s) to the webmaster.
	Rate	Rate a product.
	DIY	Help users setup/configure computer.
	Link	Provide surface link to other related sites.
	Help	Provide online helps to visitors/users.

a) **The Use Cases Of User Module**

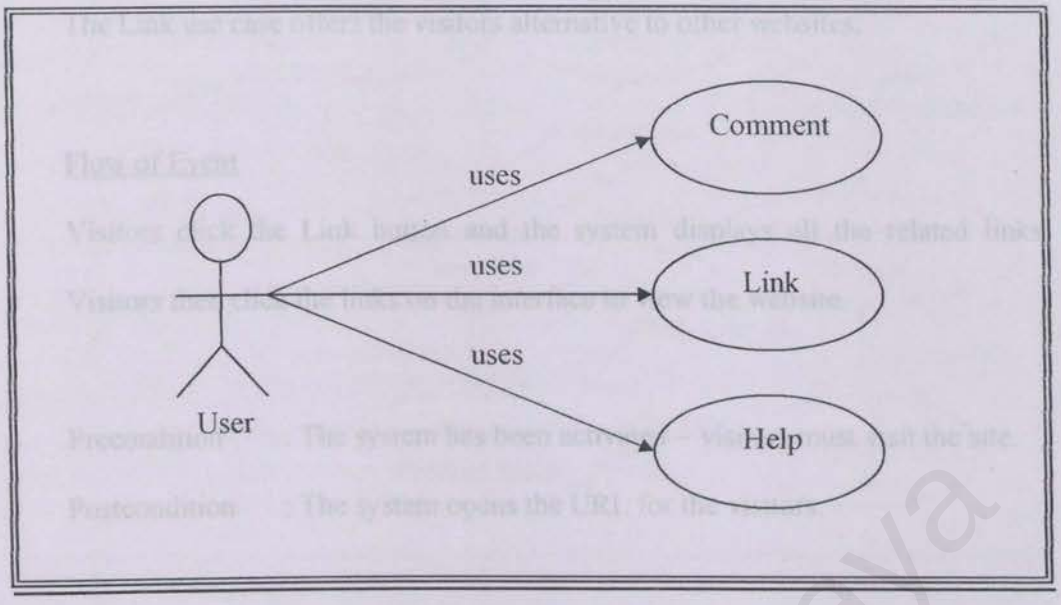


Figure 4.28: User Comment, Link and Help Use Cases

i) Comment:

The Comment use case provides a space to let visitors give their comment.

Flow of Event

Visitors click the comment button and the system displays the interface on screen. Visitors then type their comment on the space provided in the interface and click submit button.

Precondition : The system has been activated – visitors must visit the site.

Postcondition : The system updates the database.

ii) Link:

The Link use case offers the visitors alternative to other websites.

Flow of Event

Visitors click the Link button and the system displays all the related links. Visitors then click the links on the interface to view the website.

Precondition : The system has been activated – visitors must visit the site.

Postcondition : The system opens the URL for the visitors.

iii) Help:

The Help use case describes the help function provided in the system.

Flow of Event

Visitors click the Help button and the system displays the help file on the screen.

Precondition : The system has been activated – visitors must visit the site.

Postcondition : The system opens the help file to the visitors.

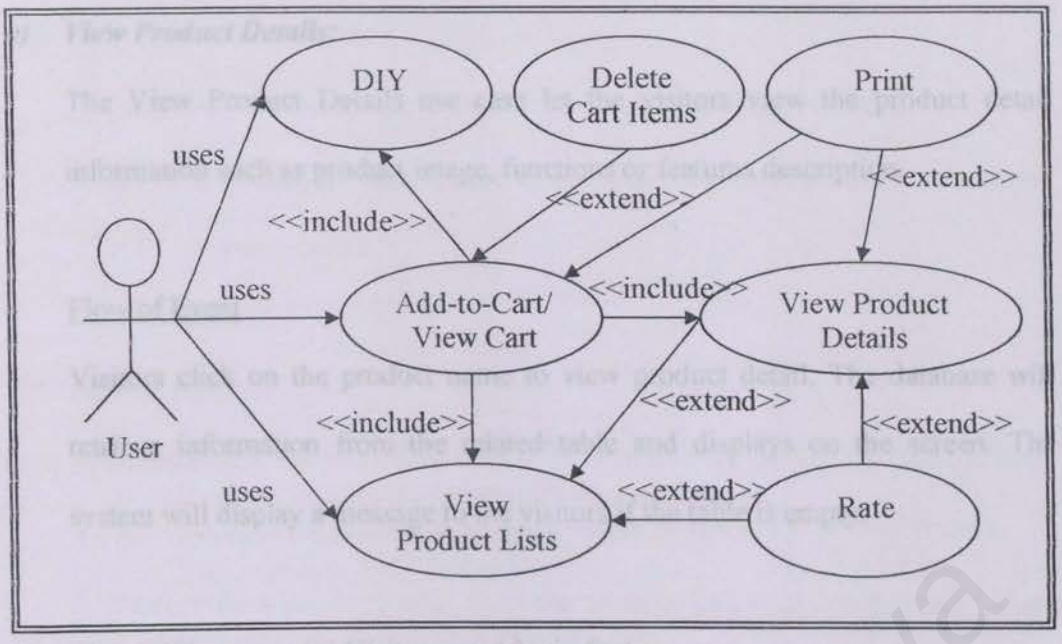


Figure 4.29: The Use Cases of User

iv) View Product Lists:

This use case offers a service to let visitors view all the products stored in the database according to its category.

Flow of Event

Visitors select the product's category through the button in the interface. The system then retrieves all the information from the related table and displays the result on the screen. The system will display a message to the visitors if there is no single record in the table.

Precondition : The system has been activated – visitors must visit the site.

Postcondition : The system displays the result to the visitors.

v) View Product Details:

The View Product Details use case let the visitors view the product detail information such as product image, functions or features description.

Flow of Event

Visitors click on the product name to view product detail. The database will retrieve information from the related table and displays on the screen. The system will display a message to the visitors if the table is empty.

Precondition : (a) Visitors must login first.
(b) Visitors must view the product's lists first.

Postcondition : The product information will be displayed on the screen.

vi) DIY:

The DIY use case is used to provide the step-by-step help to setup a computer.

Flow of Event

Visitors click the DIY button and the system displays a set of instruction on the screen. Visitors then follow the on-screen instructions to complete the tasks.

Precondition : The system has been activated – visitors must visit the site.

Postcondition : The system displays the help file to the visitors.

vii) View Cart/Add-to-Cart:

1. The View Cart use case lets the users to view their shopping items.
2. The Add-to-Cart use case is used to temporary store and performs calculation to the shopping items.

Flow of Event

1. Visitors click the View Cart button on the menu bar of the web page. If there is no record in the session, a message will be displayed to inform visitors.
2. Visitors view the product(s) from the product lists or product details. Then, visitors select the product(s) and click the cart button. The system will generate a session and temporary store the item(s). The system will automatically add the item into the session and calculate the total value.

Precondition : Visitors must login first.

Postcondition : (a) The system creates a session to store the product(s).
(b) The system will display the item(s) in the shopping cart and the total value.

viii) Delete Cart Items:

The View Cart use case lets the users to view their shopping items.

Flow of Event

Users view the shopping cart and click the Delete button on the Shopping Cart. The system updates the Shopping Cart session and displays updated information to the users.

Precondition : Visitors must login first.

Postcondition : (a) The system updates the shopping cart session.

(b) The system displays the updated information on the screen.

ix) Rate:

The Rate use case is used to let the visitors to rate a product according to the product's functionality. This could help other visitors to choose a better product.

Flow of Event

Visitors view the product(s) from the product lists or product details. Then, visitors click the rate button on the interface. The system will display another interface to let the visitors rate the product(s). The system will automatically calculate the rating-point and generate a new rating for the particular product(s).

Precondition : (a) Visitors must login first.

(b) Visitors must in the view of product lists/ product details.

(c) There must be at least one product record in the database.

Postcondition : The system will automatically calculate the new rate of the product and stores the new rate into database.

b) The Sequence Diagram for Administrator Module

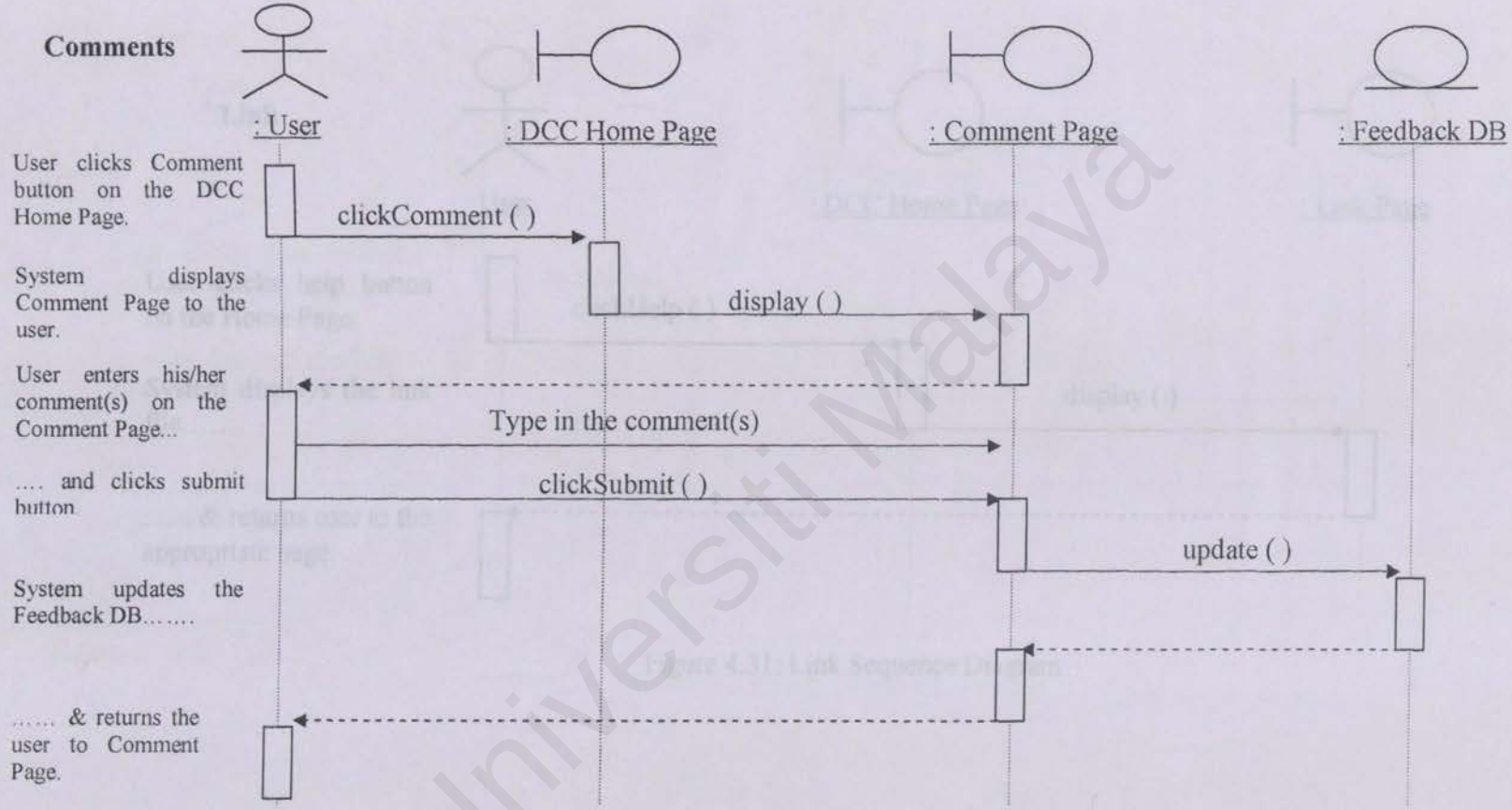


Figure 4.30: User Comment Use Case

Link

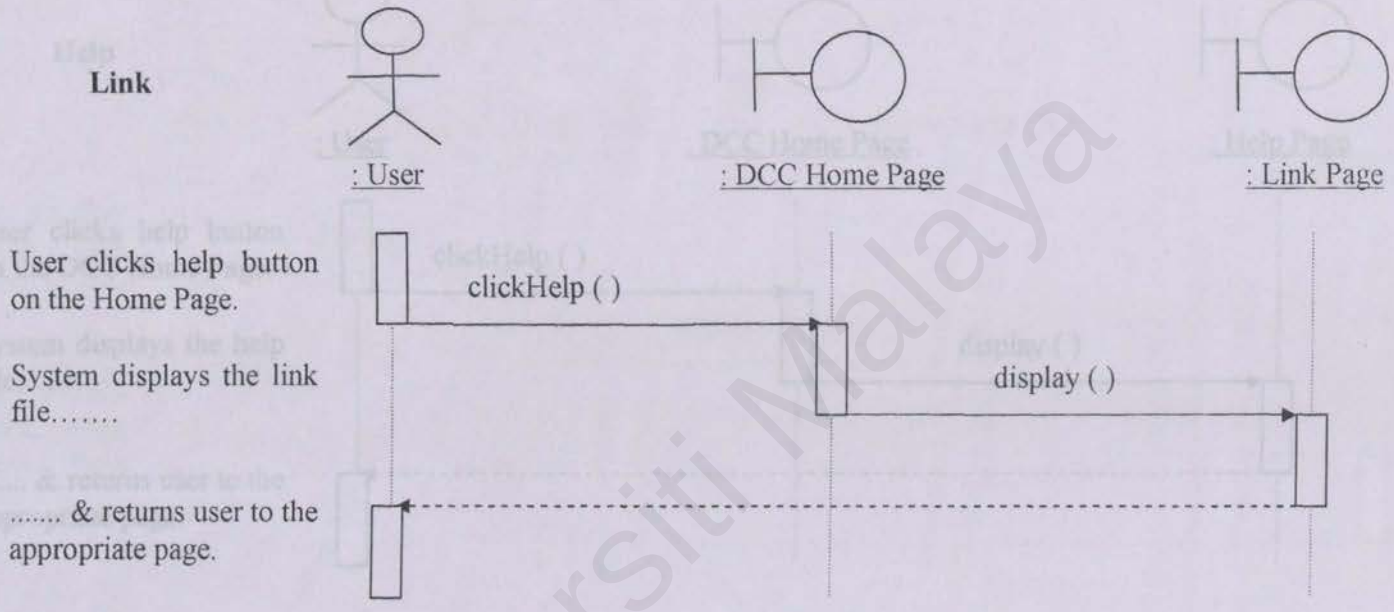


Figure 4.31: Link Sequence Diagram

Help

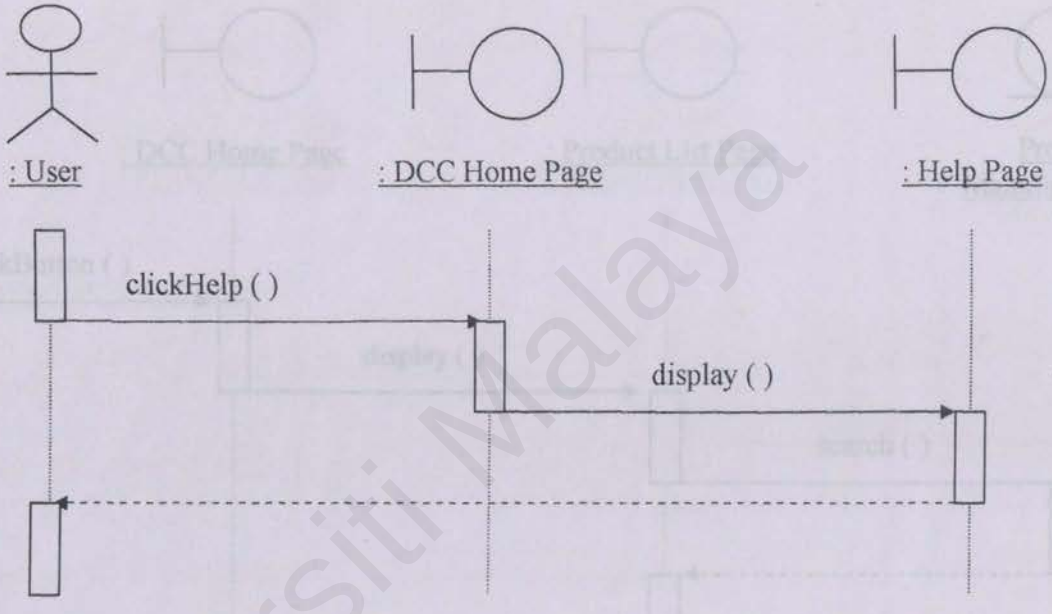


Figure 4.32: Help Sequence Diagram

View Product List

User selects the Product category using the buttons provided on the page.

System displays a page containing product detail after searching from product DB.

System then returns the user to the Home Page.

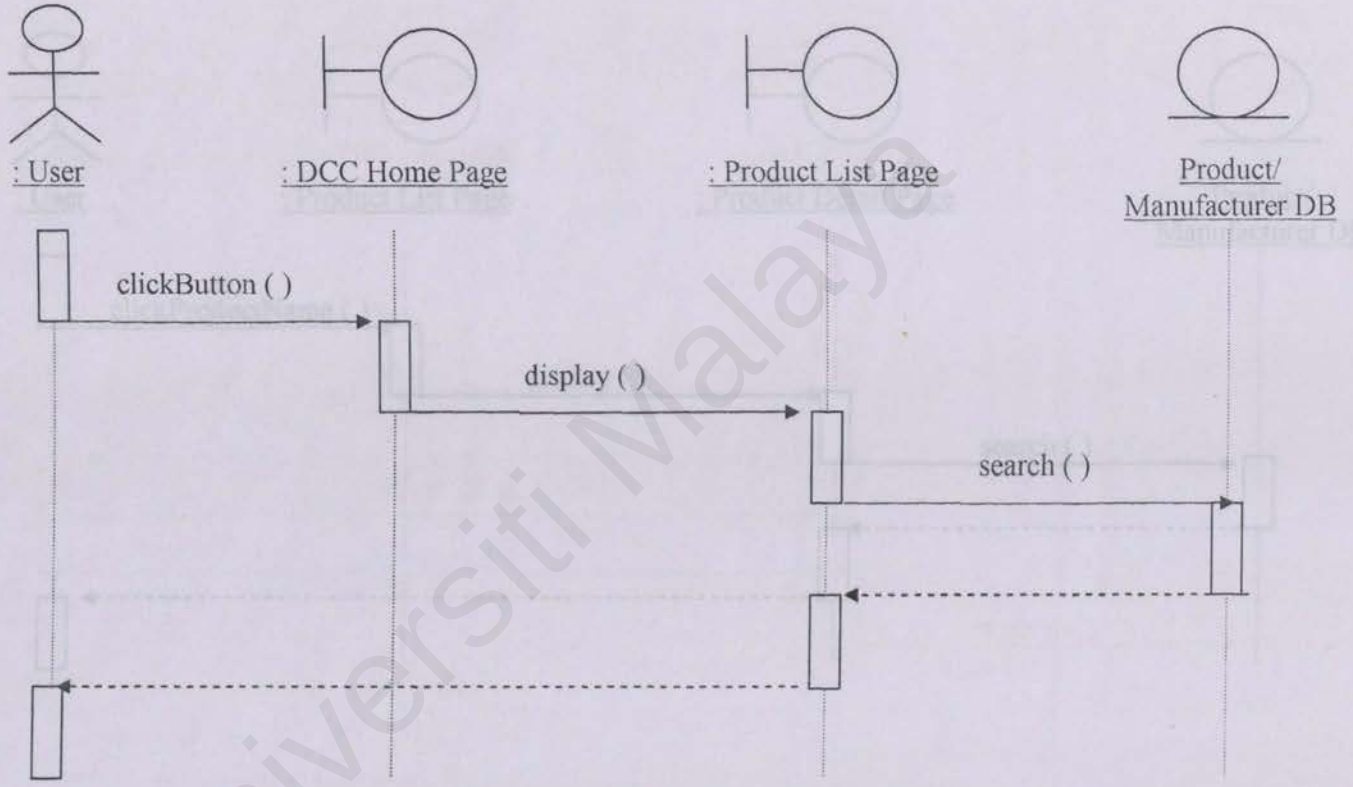
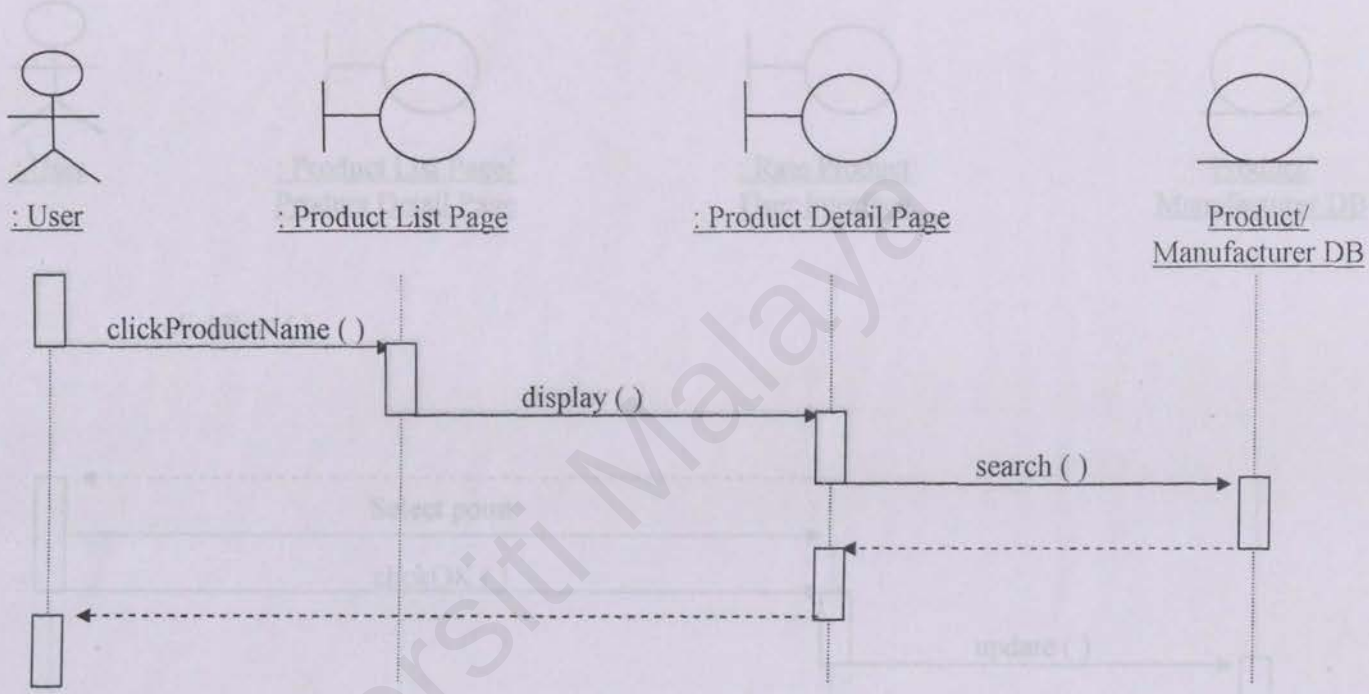


Figure 4.33: View Product Sequence Diagram

View Product Details



User clicks the product name on the Product List U.I.

System displays a page containing product detail after searching from product DB…..

….after system retrieves information from the database.

Figure 4.34: View Product Details Sequence Diagram

Rate

User clicks the Rate button on the Product List Page/ Product Detail Page.

System displays the Rate Product User Interface

User clicks OK button to confirm.

System updates the database and return user to Product List Page/Product Detail Page.

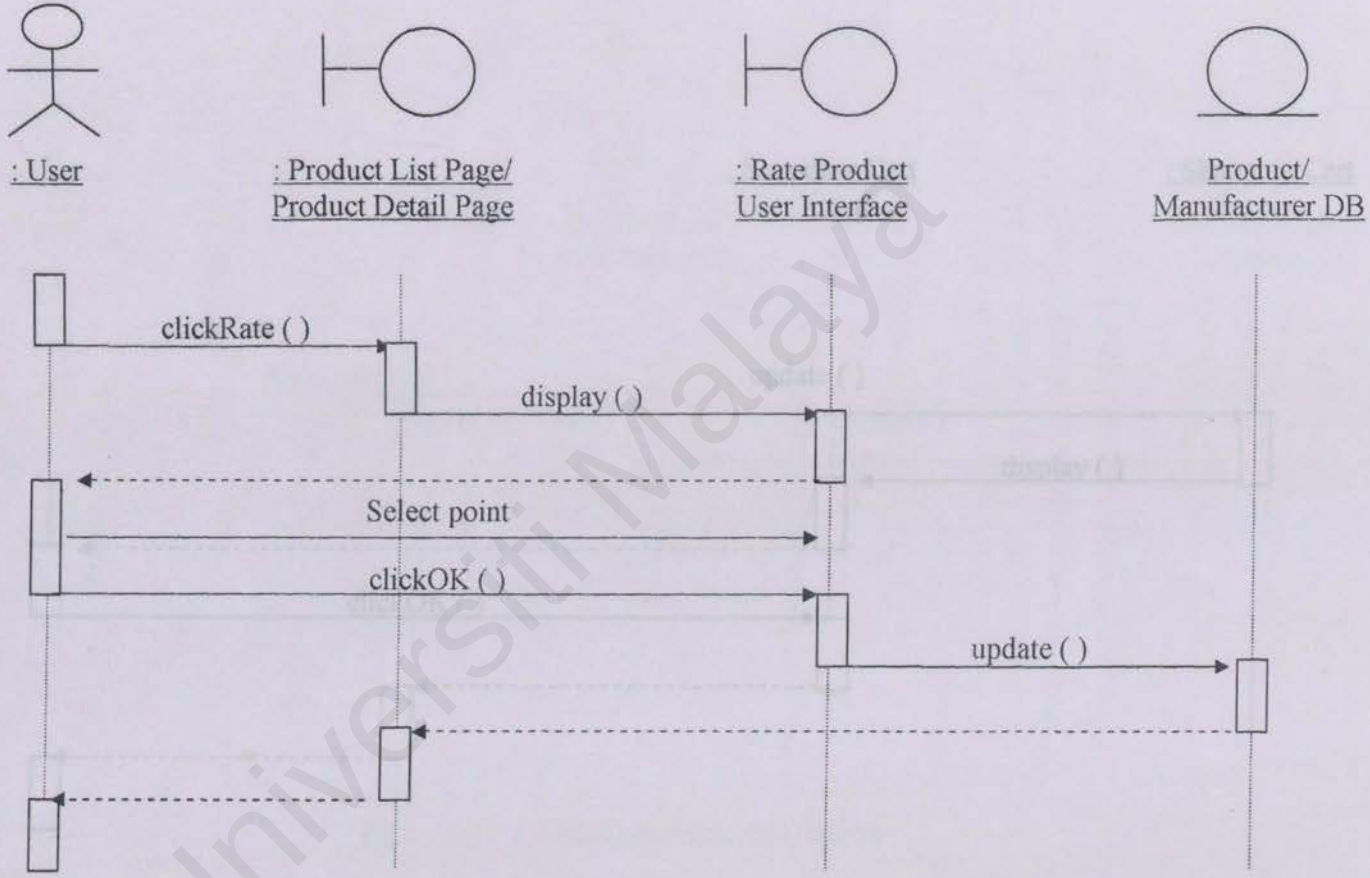


Figure 4.35: Rate Product Sequence Diagram

Add-to-Cart

User clicks the Cart button on the Product List Page/ Product Detail Page.

System updates the Session and displays the Add-to-Cart user interface to the users.

User clicks OK button to confirm.

System returns the users to the Product List Page/Product Detail Page.

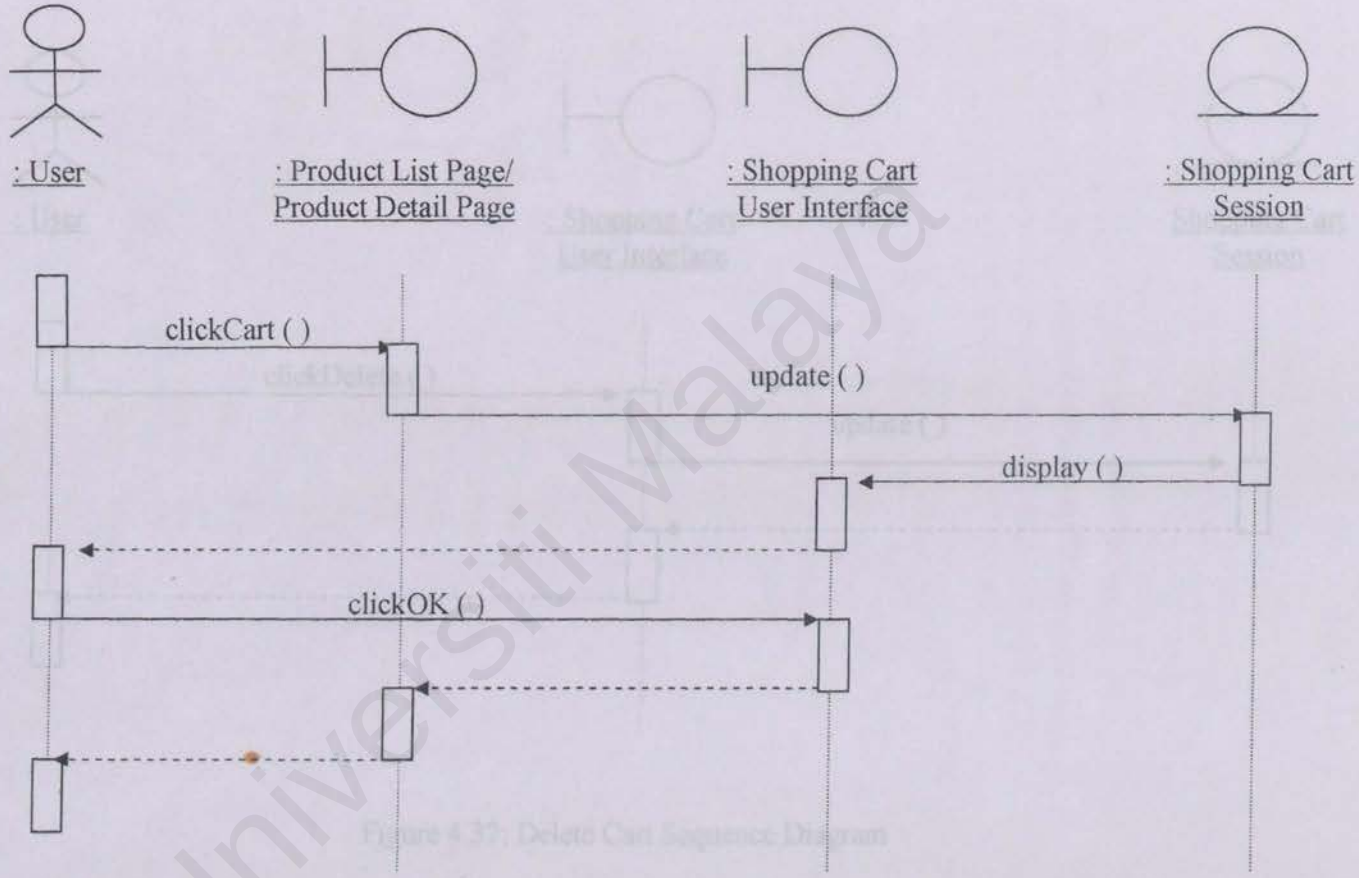
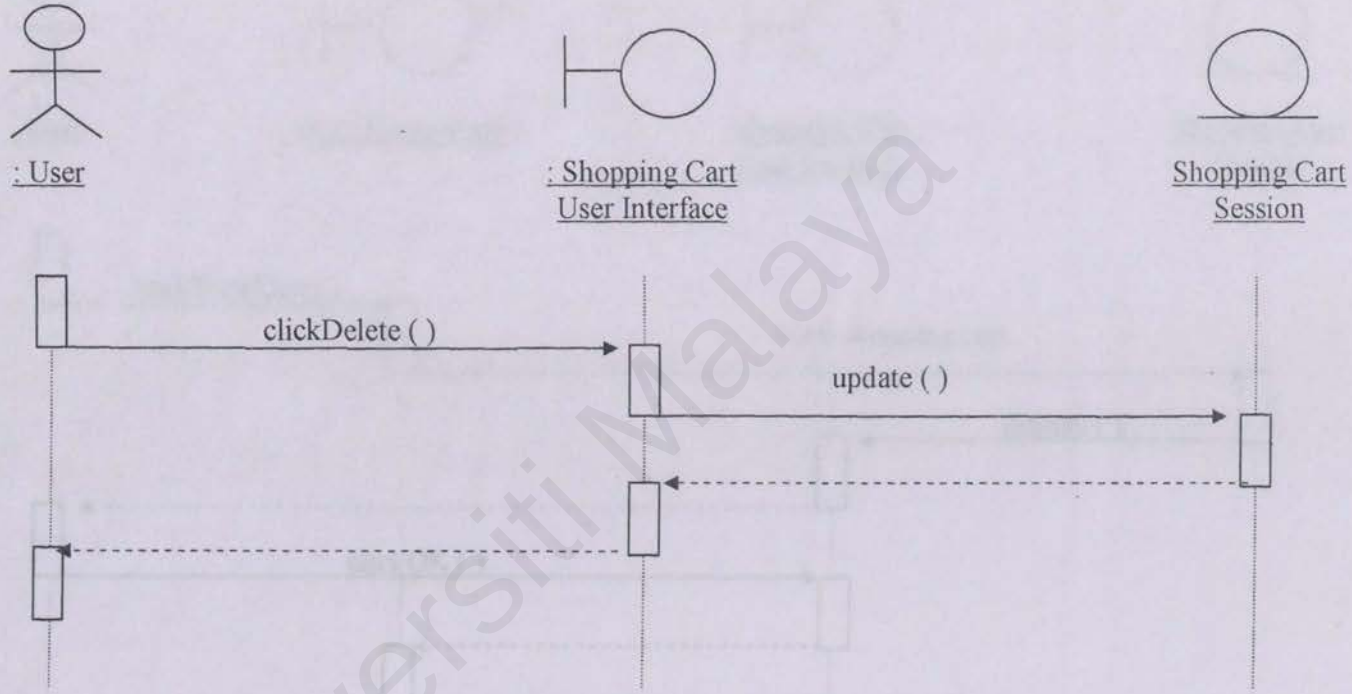


Figure 4.36: Add-to-Cart Sequence Diagram

Delete Cart



User clicks the Delete button on Shopping Cart Interface.

System updates the Session and displays the Shopping Cart interface to the users.

System returns the users to the Shopping Car Interface.

Figure 4.37: Delete Cart Sequence Diagram

View Cart

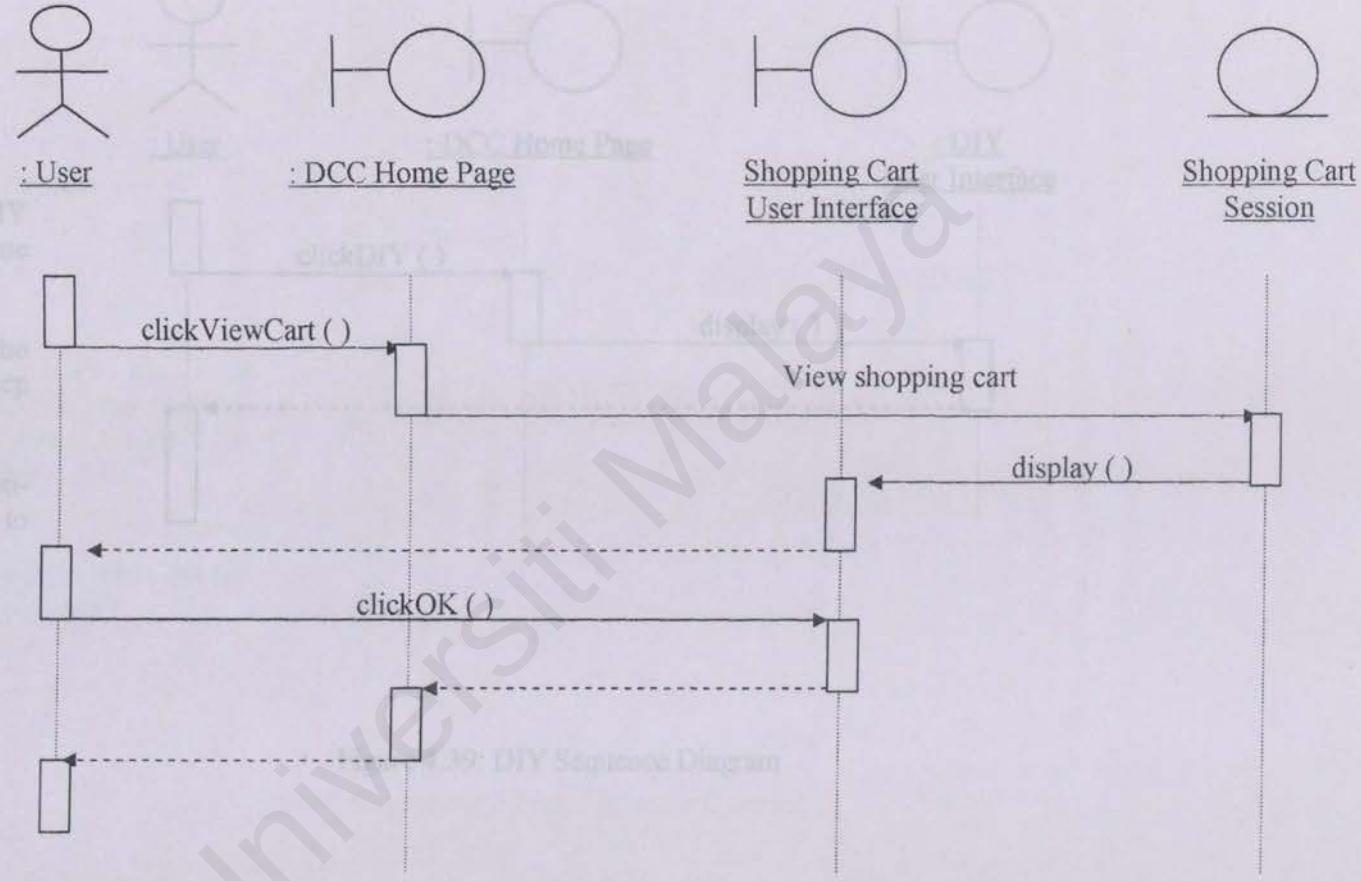


Figure 4.38: View Cart Sequence Diagram

DIY

User clicks the DIY button on the DCC Home Page.

System displays the DIY's step-by-step instructions files.

User follows the on-screen instructions to complete the task.

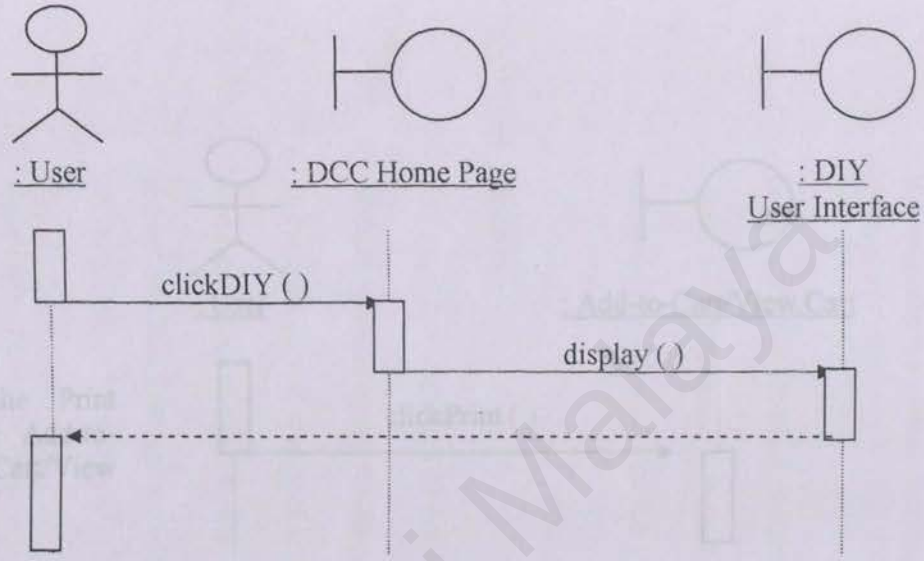


Figure 4.39: DIY Sequence Diagram

Print

User clicks the Print button on the Add-to-Cart/View Cart/View Product Details

The printer prints out the selected object.

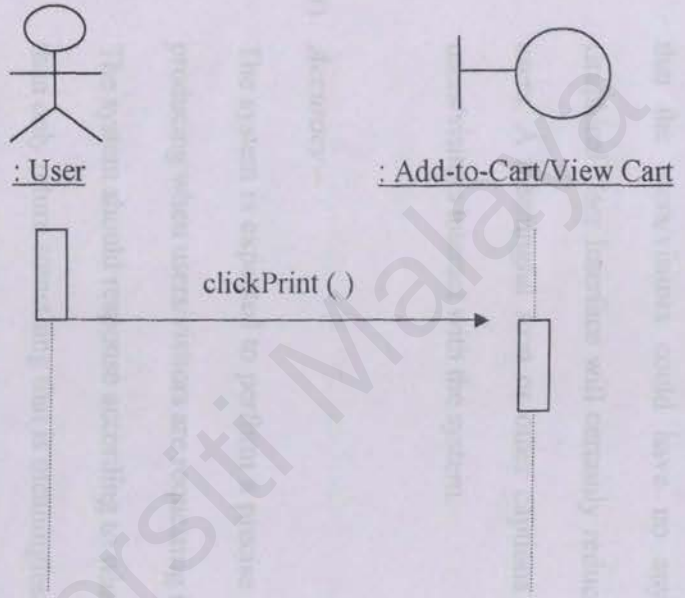


Figure 4.40: Print Sequence Diagram

4.3 Non-Functional Requirements

Non-functional requirements are defined as constraints which describes the restrictions on the system. The system is expected to meet certain standards to improve it perform in the delivery phase. The non-functional requirements for the DCC are:

i) *User-friendly interface* –

It is important to adopt the user-friendly interface into the system since that the users/visitors could have no any computer knowledge. A Graphical User Interface will certainly reduce the learning curves of the users. A meaningful icon or other captions will be very helpful when users/visitors interact with the system.

ii) *Accuracy* –

The system is expected to perform a precise calculation and information producing when users/visitors are requesting information from the server. The system should response according to what users/visitors needs rather than only return something that is meaningless. The logic using should be correct and free from computation errors.

iii) *Reasonable response time* –

Response time is a very important element and should be taken into account. A good system should have a fast response time which means the time to retrieve information within a reasonable interval time, normally not more than 5 seconds.

iv) *A reliable performance* –

A reliable system is under which conditions the system can work consistently without causing any serious failures. The system should work in the manner as expected by the users and the developers. A stable system will definitely have greater competitive compare to others.

v) *Modularity* –

Modularity refers to a system which is composed of different modules with distinct functionality. And it makes the system easy to test, expand or maintain.

vi) *Implementation* –

Since DCC is using the .NET technology, therefore it can be view under different browsers.

vii) *Flexibility* –

As DCC is using latest web technology, the system will not facing any problems to integrate into the website. On the other hand, the system is using latest web technology, therefore it could easily adopt other technology and flexible to the change of environment.

4.4 Hardware and Software Specification

Table 4.3: Minimum Hardware Specification.

Requirement	Server-Side	Client-Side
Hardware	▪ PIII 533MHz processors	▪ Pentium 166Mhz
	▪ Hard Disk space 5 GB or higher	▪ Hard Disk space 5 GB
	▪ 64 RAM or higher	▪ 32 RAM or higher
	▪ Network Interface Card (NIC)	▪ NIC/Modem (14.4Kbps)
	▪ Video Graphics Adapter (VGA)	▪ Video Graphics Adapter
	▪ Network connection($\geq$ 10Mbps)	▪ Telephone line/ LAN
	▪ Mouse, keyboard, etc	▪ Mouse, keyboard, etc

Table 4.4: Software Specification.

Requirement	Server-Side	Client-Side
Software	▪ Windows 2000 Professional	▪ Any OS that support Internet Access.
	▪ ASP.NET	
	▪ Internet Information Server 5.0	
	▪ Internet Explorer 5.0	
	▪ MS SQL Server 2000	▪ Internet Explorer (recommended)
	▪ MS Visual Studio .NET	
	▪ JavaScript	

4.5 Software Justification

4.5.1 Operating System

Windows 2000 Professional is chosen as the development platform due to several advantages and powerful features provided compare to other operating system such as UNIX, LINUX or Microsoft Windows 98.

- *More user-friendly compare to UNIX* –

  There are no single common recalls from the users. The graphical user interface (GUI) helps users manage the system easily. Every single process or instruction can be done within a single click on the icons.

- *Compatible with other development tools and DBMS* –

  Windows 2000 is compatible with other development software, especially those are Microsoft products. This will help developers to integrate their works.

- *Built-in web server* –

  Windows 2000 has a built-in web server – Internet Information Server (IIS). It is totally free and all the latest update is provided on the Internet.

- *Stable* –

  Windows 2000 is built-on NT technology but it has been improved from many aspects compare to Windows NT 4.0 Server. It is more stable, reliable and powerful.

- *Support for innovative web publishing features*

4.5.2 Web Technology

After comparing with other web technologies, ASP.NET has better advantages since it has been power up with many advanced features. Furthermore, ASP.NET is highly integrated with Microsoft products. Other considerations are:

* ***Enhanced Performance.*** ASP.NET is based on the services of Common Language Runtime which take advantages of early binding, just-in-time compilation, native optimization, and caching services right out of the box. This amounts to better performance before developers start writing their codes.

* ***World-Class Tool Support.*** The ASP.NET framework is complemented by a rich toolbox and designer environment. It has a VB-like control where designers could drag-and-drop server controls. ASP .NET also supports dynamic DLL updates, extensible configuration using XML files and automatic deployment.

* ***Flexibility.*** Because ASP.NET is based on the common language runtime, the entire .NET Framework class library, Messaging, and Data Access solutions are accessible from the Web. Since that ASP.NET is language-independent, programmers could choose any language that best applies to the application or partition the application across many languages.

* ***Simplicity.*** ASP.NET has makes common tasks simpler than ever; developers can handle events in a VB-like form processing model. Furthermore, the common language runtime has simplifies development, with manageable code services.

* ***Security.*** ASP .NET secures web applications with a built in Windows authentication and per-application configuration.

* ***Manageability.*** ASP.NET uses a text-based, hierarchical configuration system. The design has simplified the settings apply to the server environment and Web applications; only the necessary application files will be put into the server and there is no server restart is required, even to deploy or replace running compiled code.

* ***Scalability and Availability.*** ASP.NET has been designed to improve performance in clustered and multiprocessor environments. The ASP.NET runtime is so powerful and helps monitoring the running process. One misbehaves (leaks, deadlocks) of the process will be replaced with a new one. Therefore, the application is always available to handle requests

4.5.3 Web Server

Internet Information Server (IIS) 5.0 is built into the Windows 2000. That means it is highly integrated with the operating system, make the system easier to develop. This also included other Microsoft products such as Microsoft Visual InterDev, Microsoft FrontPage, Microsoft Access and SQL Server.

IIS provides GUI support for server administration. IIS also provides logging to any ODBC database. It has a built-in security system which help administrator secure the website. Because of the ability to integrate Web server security with Windows security features, IIS uses the ACLs (access control lists) in Windows 2000 which can store in Active Directory, to administer Web server security. Moreover, Windows 2000 can store its ACLs in Active Directory and support authentication using digital certificates (such as those that conform to the X.509 certificate standards). IIS can then leverage these security mechanisms directly.

Besides that, IIS 5.0 is capable in handling server-side processing and publishing through Windows-style tools.

Table 4.5: The Strength and Weakness.

	Apache	IIS
Strength	Freeware, reliable, good performance, support for HTTP 1.1 protocol, quick technical support via USENET Newsgroup.	Free download, superior administration control, HTTP 1.1 supported, virtual server support, excellent combination with Windows NT 4.0 and Windows 2000.
Weakness	Lack of graphical administration tasks and tools for configuration.	NNTP does not support USENET feeds, SMTP does not support POP3 mailboxes.

*Remark:

NNTP – predominant protocol used by computers for managing the notes posted on USENET Newsgroup.

4.5.4 Database Management System (DBMS)

There are two DBMS have been considered to develop the database of the system – Microsoft Access 2000 and Microsoft SQL Server 2000. After a thorough analysis, it is explicitly obvious that SQL Server provides convenience database management features than Access.

DCC is a web-based application which distributes information using Internet access. Therefore, it places a heavy demand on database application to store and manage the data. Moreover, SQL Server supports XML, offers a better solution for on-line database connectivity.

Since that SQL Server provides an extensive database programming language which is based on web standards, thus it ensures of database interoperability and flexibility. Also, SQL Server as other common relational DBMS is designed to understand the Structured Query Language (SQL). Other reasons for choosing SQL Server 2000 are listed as below:

- Has a tight integration with Windows and Windows-based application
- Support development of active web site
- Reasonable cost and lowest complexity
- High security – password protection and data encryption is provided
- Support full-text searching
- Tight integration with IIS
- Larger data storage capability compare to Access 2000

4.5.5 Web Development Tools

There are two development tools have been chosen to develop the DCC system. There are Microsoft Visual InterDev 6.0 and Microsoft FrontPage 2000. MS Visual InterDev is the primary tools and FrontPage will be the option.

MS Visual InterDev is designed to build a robust and dynamic web application. One of the major advantages of MS Virtual InterDev is the integrated environment that integrates various technologies (for instance, CSS, DHTML, ODBC, ActiveX, Java Object and etc). There is a direct database connectivity offered by MS Virtual InterDev. Consequently, it could enhance the productivity of the system. In addition, MS Virtual InterDev supports both Java Script and VB Script.

FrontPage actually is easier to learn and use. But it is not as powerful as MS Visual InterDev. However, both are compatible to each other. FrontPage has a comprehensive set of publishing wizards where developers can publish their works faster and easier. The graphical management tools offer a convenience way to edit and control the site. FrontPage has a unique feature which it combined the Editor mode with the Explorer mode. Developers can edit the interface or code, and view the result within a single click. However, FrontPage cannot create a pixel-precise layout correctly.

4.5.7 Web Browser

Internet Explorer (IE) is recommended as the default web browser. However, there will be more flexible at the clients-side to choose either Internet Explorer or Netscape Navigator as their web browser.

Internet Explorer is chosen because it is integrated well with Microsoft .NET Framework. The new version IE enables better code integration between the server and client. Functions on the server side can be called to any application asynchronously using XML or SOAP. Internet Explorer also compatible with other technologies, such as CSS and DHTML to increase its performance on the web.

4.6 Conclusion

System analysis is one of the critical phases in the software development process. It helps developer to identify all the requirements of the system and transforms those requirements into system characteristics in a systematic manner. In the analysis stage, all the software and hardware specification will be identified. The selection is based on the compatibility of the software and hardware.

The next chapter will be the system design which includes the system architectural design, flow of events, object state tracking, database design and interface design.

CHAPTER 5
System Design

Chapter 5: System Design

5.1 Architectural Design

The architectural design of DCC is decomposed into a number of sub-systems. Each of the sub-system is independent and offers different services to the system. The sub-system alone is not enough to present the system at whole. Consequently, the communication between the sub-systems is very important and must be identified clearly.

Since that DCC is a web-enabled application therefore the system is designed using 3-tier client/server architecture. The deployment diagram for DCC is shown in the figure below:

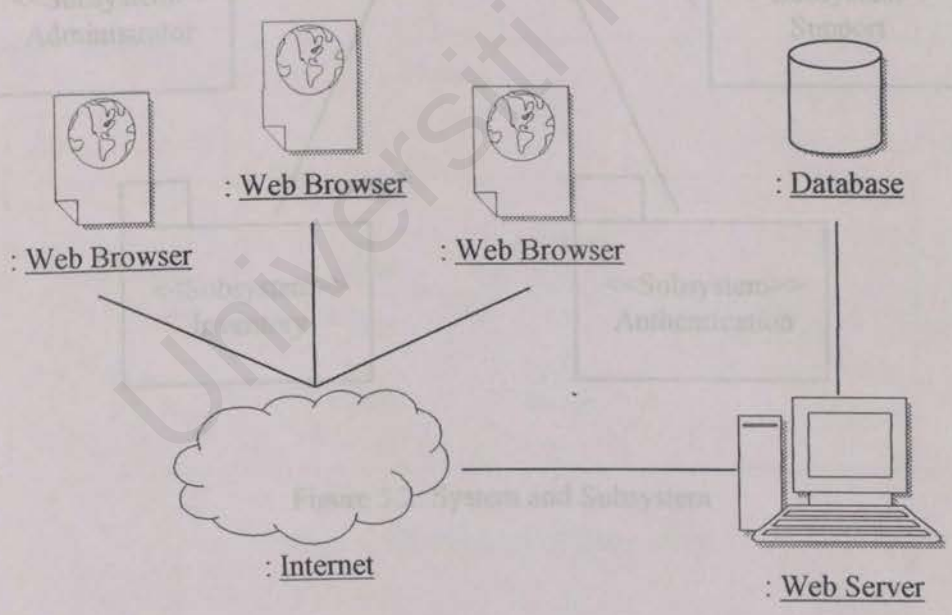


Figure 5.1: Deployment Diagram of DCC

5.2 System and Subsystem

System and subsystem are the stereotyped package in UML notation. The system contains those models created along the development cycle. Meanwhile, the subsystem is a grouping of all the related functions or elements which are part of the system. For the DCC system, there are four subsystems have been identified: Administrator Subsystem, Help Subsystem, Inventory Subsystem and Authentication Subsystem. The functions of each subsystem are shown in Figure 5.3.

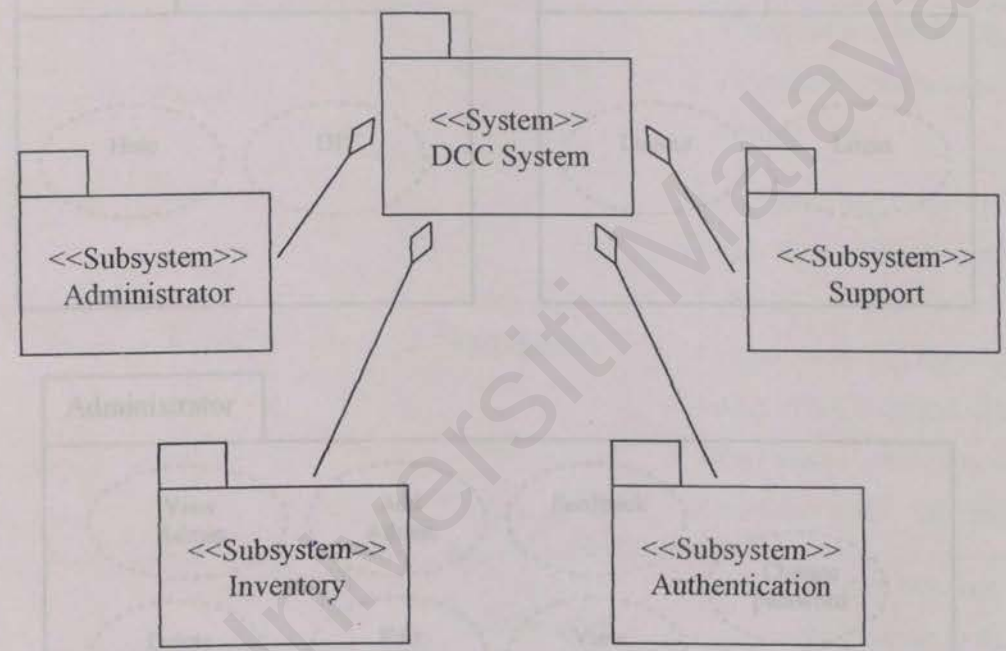


Figure 5.2: System and Subsystem

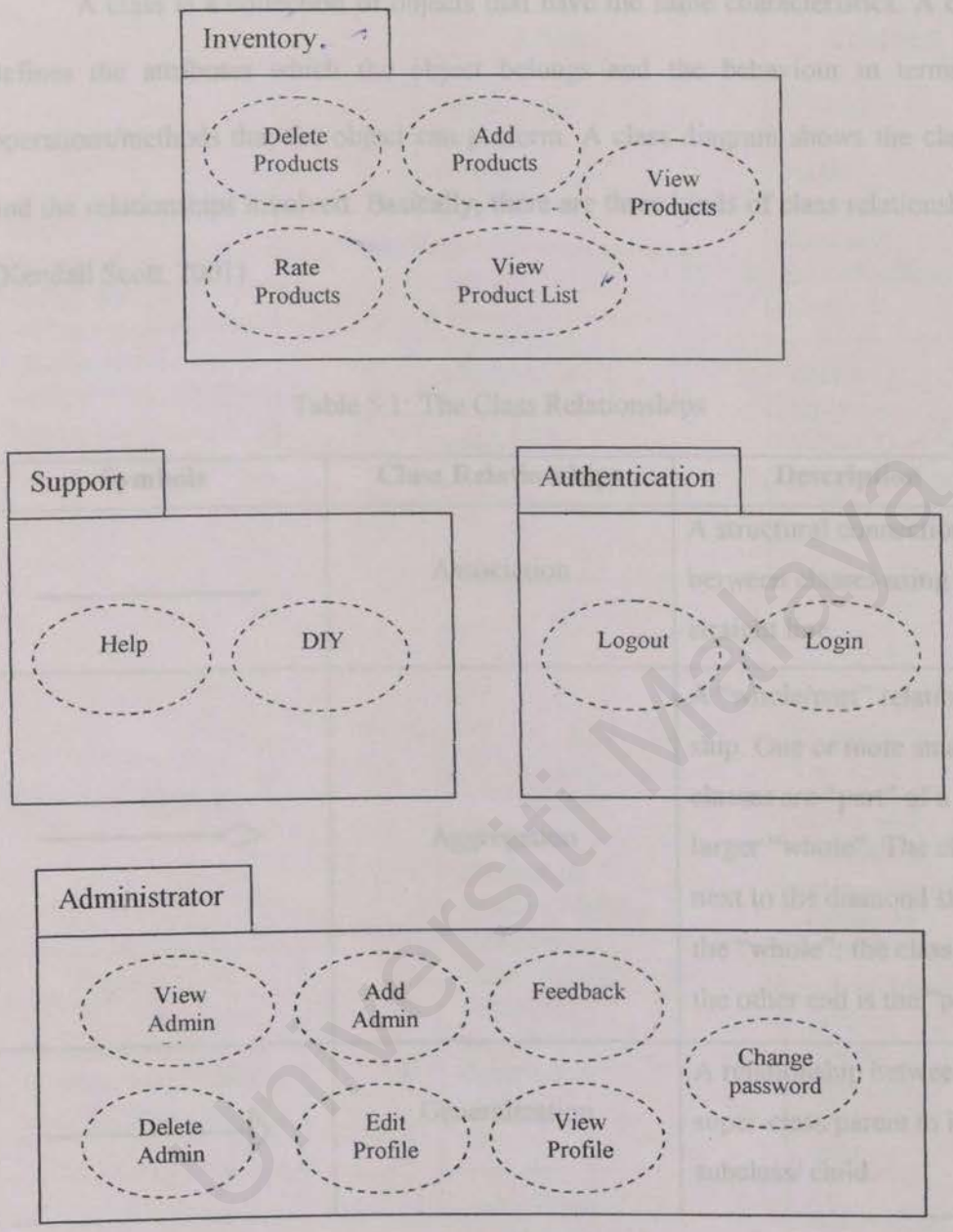
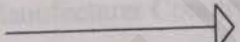


Figure 5.3: Package of Subsystem

5.3 Class Diagram

A class is a collection of objects that have the same characteristics. A class defines the attributes which the object belongs and the behaviour in terms of operations/methods that the object can perform. A class diagram shows the classes and the relationships involved. Basically, there are three kinds of class relationships. (Kendall Scott, 2001)

Table 5.1: The Class Relationships

Symbols	Class Relationships	Description
	Association	A structural connection between classes using a straight line.
	Aggregation	A "whole/part" relation-ship. One or more smaller classes are "part" of a larger "whole". The class next to the diamond ship is the "whole"; the class at the other end is the "part".
	Generalization	A relationship between the super-class/parent to its subclass/ child.

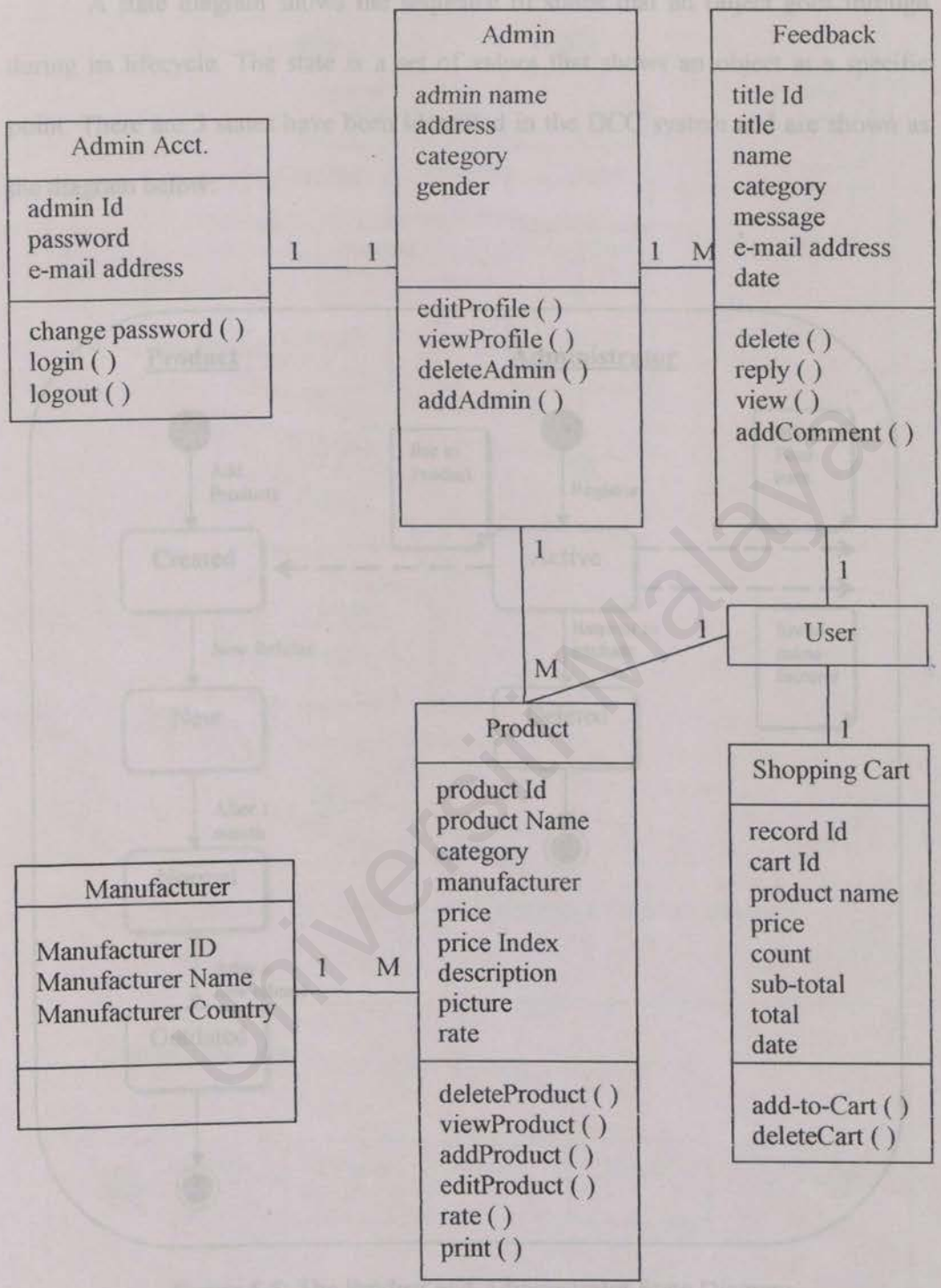


Figure 5.4: The Class Diagram of DCC.

5.4 State Diagram

A state diagram shows the sequence of states that an object goes through during its lifecycle. The state is a set of values that shows an object at a specific point. There are 5 states have been identified in the DCC system and are shown as the diagram below:

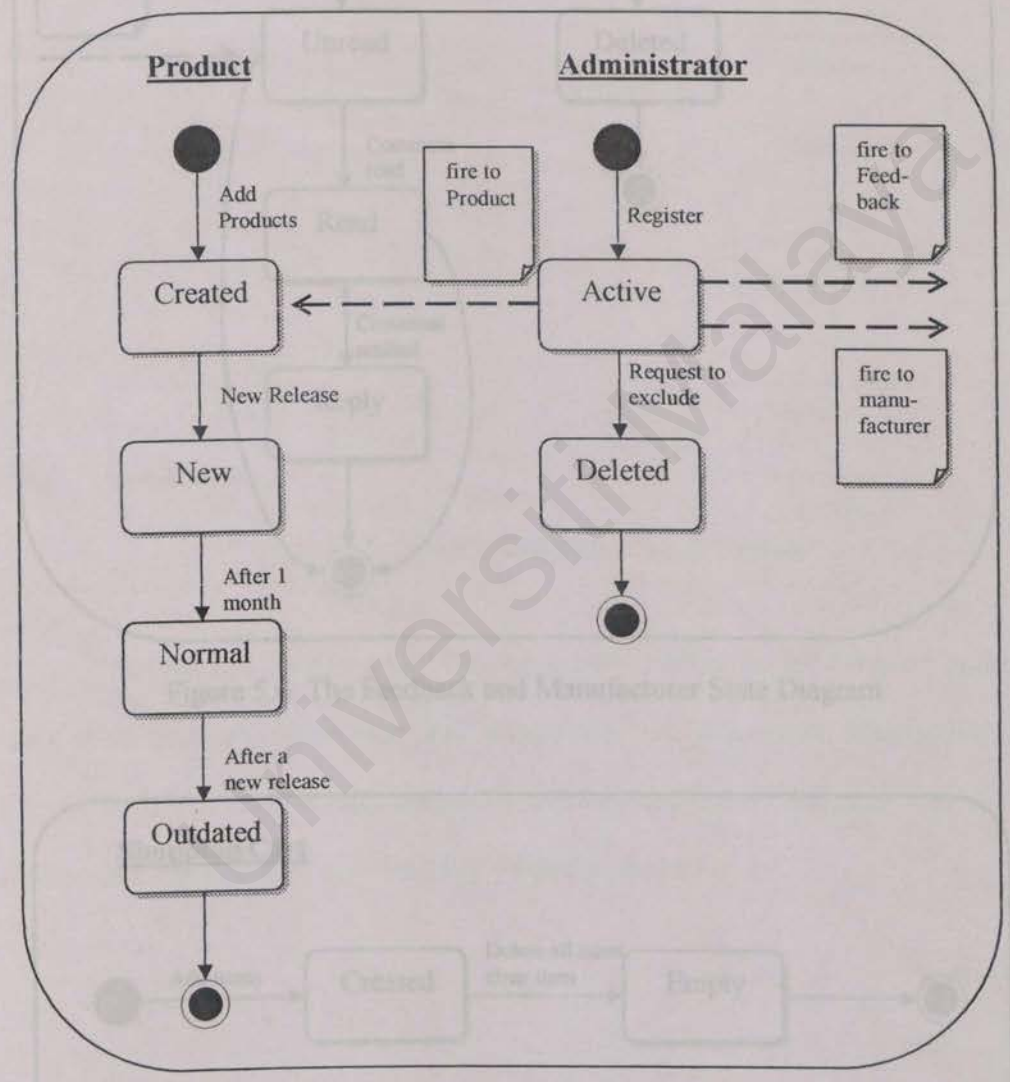


Figure 5.5: The Product and Administrator State Diagram

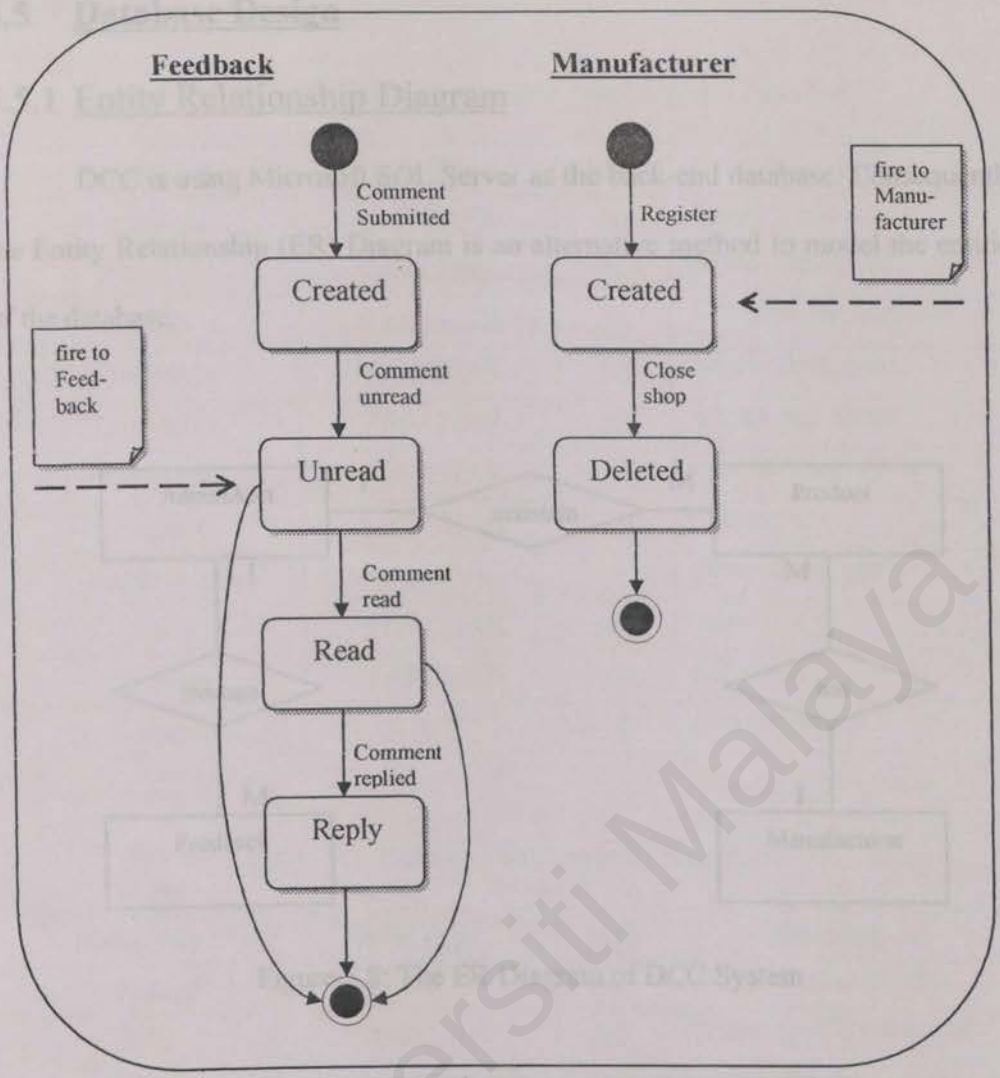


Figure 5.6: The Feedback and Manufacturer State Diagram

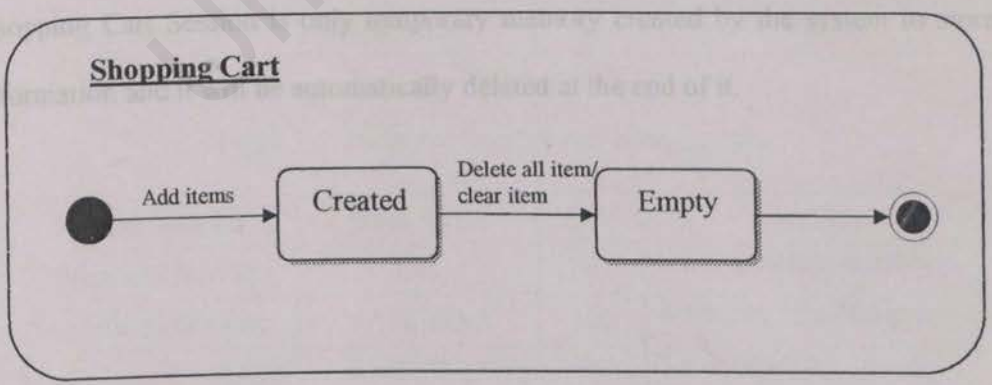


Figure 5.7: The Feedback and Manufacturer State Diagram

5.5 Database Design

5.5.1 Entity Relationship Diagram

DCC is using Microsoft SQL Server as the back-end database. Consequently, the Entity Relationship (ER) Diagram is an alternative method to model the entities of the database.

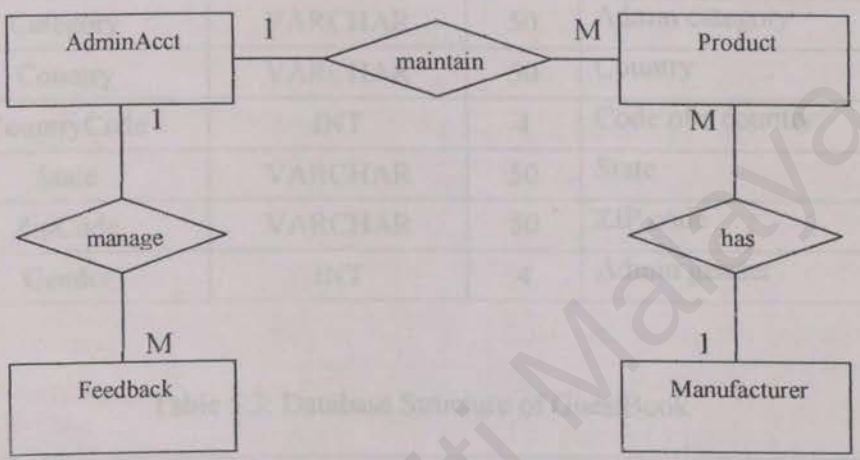


Figure 5.8: The ER Diagram of DCC System

The User and Shopping Cart Session is not model in the ER Diagram because there is no user information required to perform certain function. Meanwhile, the Shopping Cart Session is only temporary memory created by the system to stored information and it will be automatically deleted at the end of it.

5.5.2 Database Structure

Table 5.2: Database Structure of Administrator Account

Field Name	Data Type	Size	Description
UserId	VARCHAR	50	Admin login ID
Password	VARCHAR	50	Admin password
Email	VARCHAR	50	Admin email address
FirstName	VARCHAR	50	Admin first name
LastName	VARCHAR	50	Admin last name
Category	VARCHAR	50	Admin category
Country	VARCHAR	50	Country
CountryCode	INT	4	Code of a country
State	VARCHAR	50	State
ZipCode	VARCHAR	50	ZIP code
Gender	INT	4	Admin gender

Table 5.3: Database Structure of GuestBook

Field Name	Data Type	Size	Description
TitleId	INT	4	Auto-generate number
Title	VARCHAR	50	Title of user's comment
Name	VARCHAR	50	User Name
Email	VARCHAR	50	User email address
Message	VARCHAR	500	User comment
DateTime	VARCHAR	50	Date Submitted

Table 5.4: Database Structure of Manufacturer

Field Name	Data Type	Size	Description
ManufacturerId	INT	4	Auto-generate number
ManufacturerName	VARCHAR	100	Manufacturer of a product
ManufacturerCountry	VARCHAR	50	Manufacturing country

Table 5.5: Database Structure of Product

Field Name	Data Type	Size	Description
ProductId	INT	4	The ID of a product
ProductName	VARCHAR	100	Name of a product
Category	VARCHAR	50	Product category
CategoryIndex	INT	4	Id of a product category
Manufacturer	VARCHAR	50	Manufacturer of a product
ManufacturerIndex	INT	4	Id of a manufacturer
Rate	CHAR	18	Product rating
Image	VARCHAR	100	Product image
TotalPoint	INT	4	Total rate of a product
TotalHit	INT	4	Total hit of a product
Details	VARCHAR	500	Further description of a product
Description	VARCHAR	200	Product description
PriceIndex	MONEY	8	Status of product price
Comment	INT	4	Total comments of a product
DateCreated	VARCHAR	50	Date a product created
Price	MONEY	8	The price of a product

Table 5.6: Database Structure of AdminRequest

Field Name	Data Type	Size	Description
Number	INT	4	Auto-generate number
Email	VARCHAR	50	Admin email address

Table 5.7: Database Structure of Comment

Field Name	Data Type	Size	Description
CommentId	INT	4	Auto-generate number
ProductId	INT	4	Id of a product
Name	VARCHAR	50	User Comment of a product
Title	VARCHAR	50	Title of the product comment
Comment	VARCHAR	500	Product comment
DateCreated	VARCHAR	50	Date comment submitted

Table 5.8: Database Structure of ShoppingCart

Field Name	Data Type	Size	Description
RecordId	INT	4	Auto-generate number
CartId	VARCHAR	50	Id of a shopping cart
Quantity	INT	4	Product quantity
ProductId	INT	4	Id of a selected product
DateCreated	VARCHAR	50	Date of a particular cart is created

5.6 Interface Design

User interface design is very important. It provides a more convenient way to help both user and developer to retrieve information. A single modification on the interface could affect the whole system design, especially the database design. The interface design should include the following features:

- Provide a user-friendly interface to the users to help them navigate the website.
- Provide a consistent look and feel across the website to avoid unnecessary confuse of the users.
- Provide a convenient way to navigate across all the web pages.
- Provide an easy way to retrieve information and display the information in a systematic mode.

5.6.1 The Interface Template

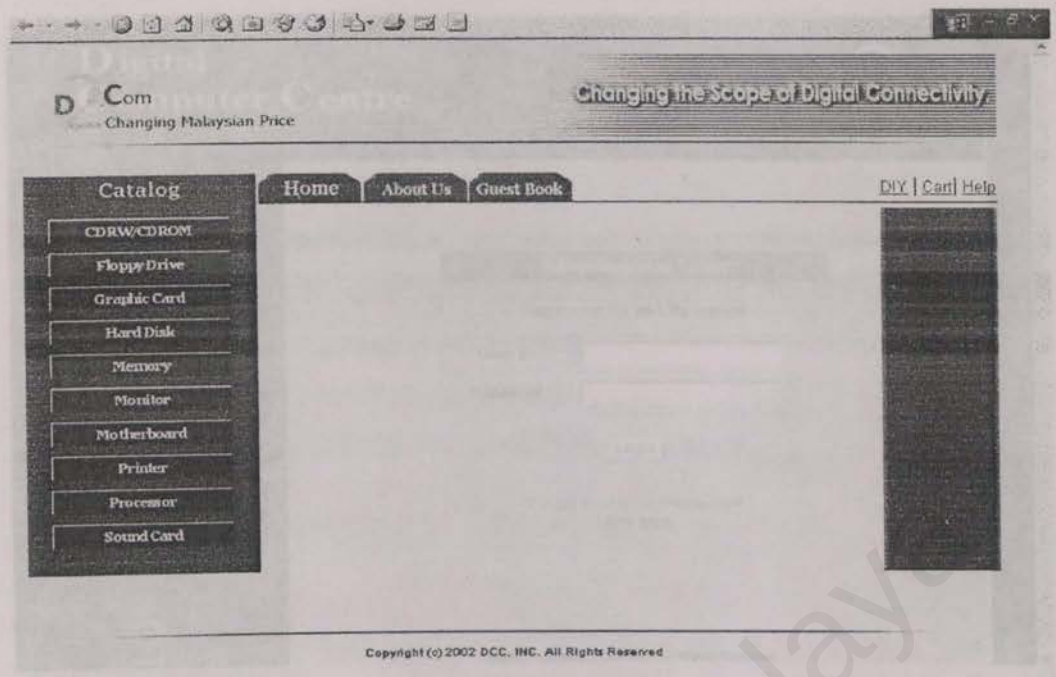


Figure 5.9: Template for User Page

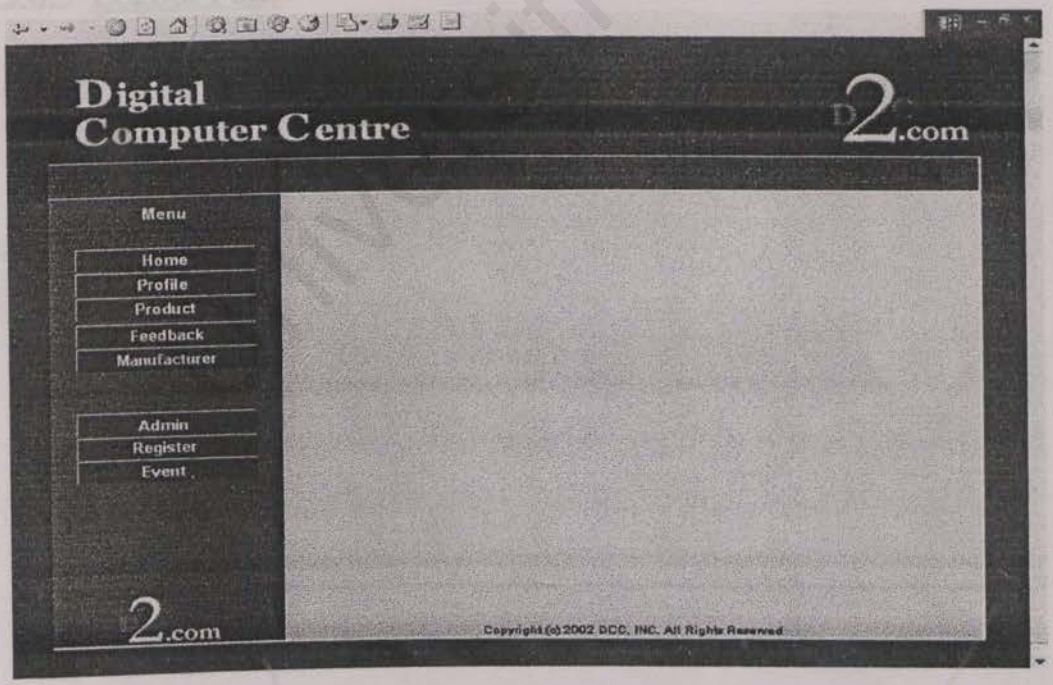


Figure 5.10: Template for Admin Page

5.6.2 Login Page

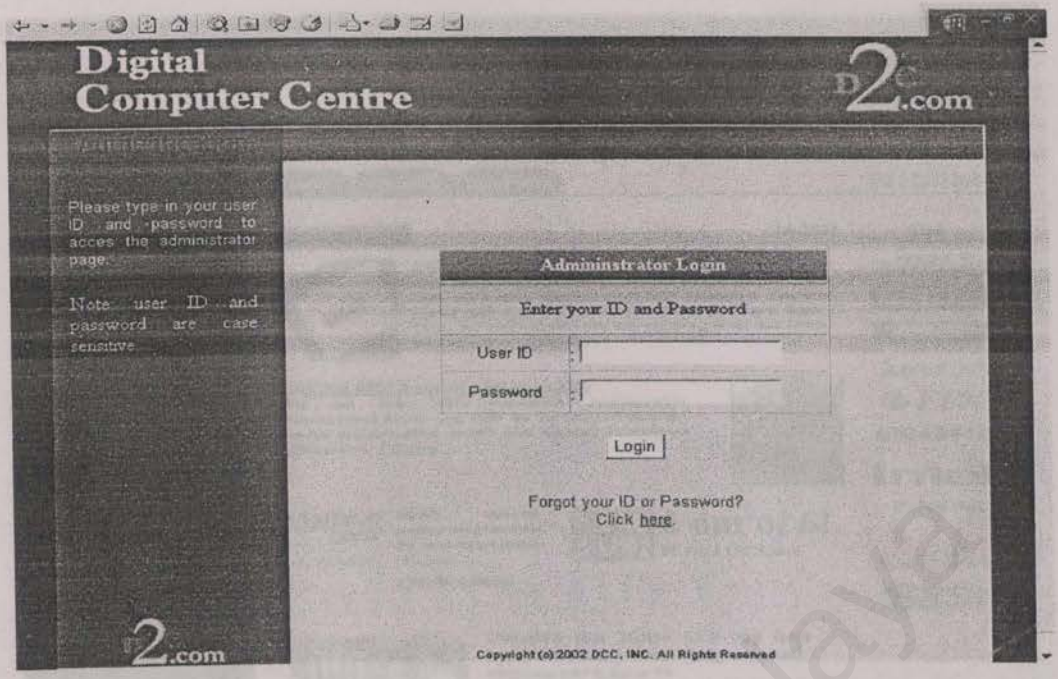


Figure 5.11: Administrator Login Page

5.6.3 Logout Page

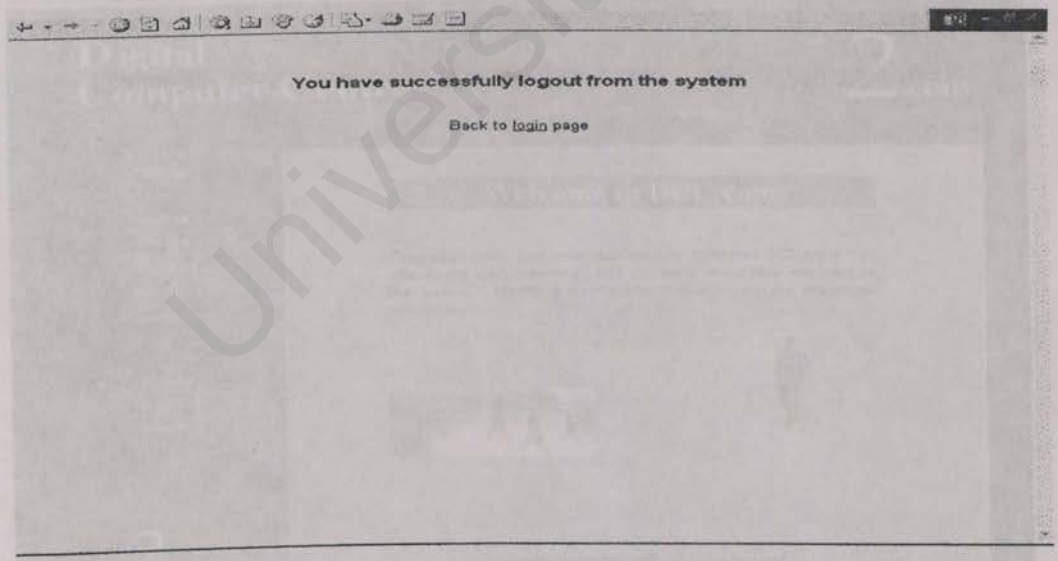


Figure 5.12: Administrator Logout Page

5.6.4 Home Page

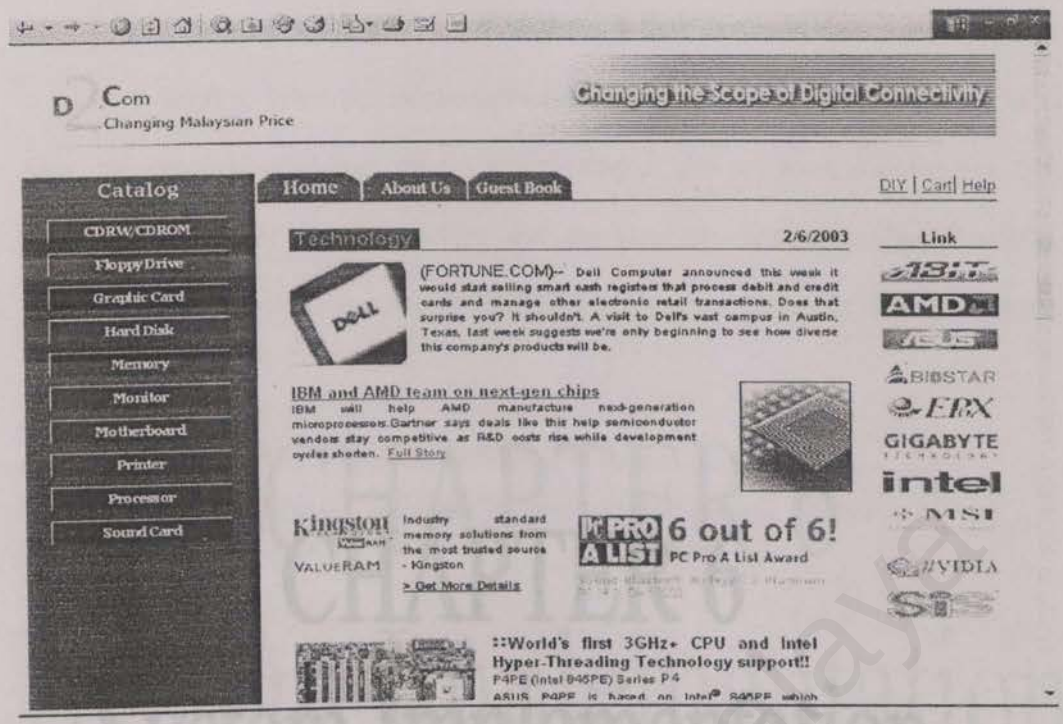


Figure 5.13: Home Page for DCC

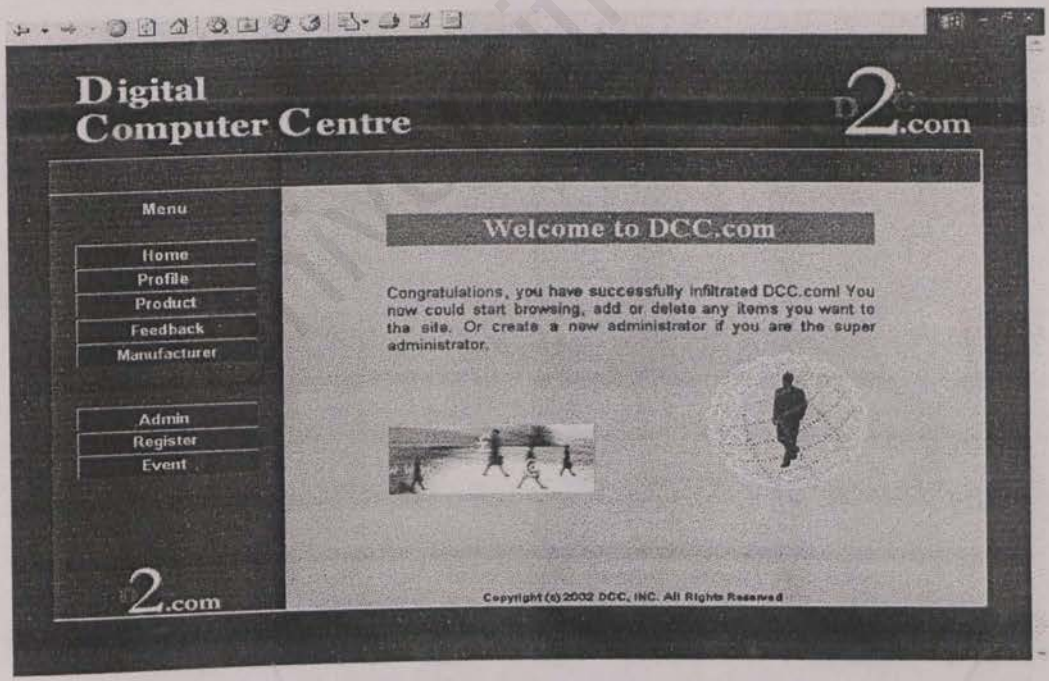


Figure 5.14: Home Page for Admin

CHAPTER 6
System Implementation

Chapter 6: System Implementation

While implementing the system into real world environment, implementation diagram is used to show the implementation phase of system development, that is how the elements of design model are packaged into software components. For instance, the source codes structure and the run-time implementation structure. (Kendall, 2001) (Ali Bahrami, 1999) There are two types of implementation diagrams:

i). Component diagrams – show the structure of the code itself

ii). Deployment diagrams – show the structure of the run-time system

6.1 System Environment

The environment of the system is very important and will affect the system's performance as a whole. Therefore choosing appropriate hardware and software tools are one of the concerning elements. The hardware and software specification are shown as below:

6.1.1 Hardware Specification

Table 6.1: Hardware Specification

Requirement	Description
Hardware	▪ PIII 533MHz processors
	▪ Hard Disk space 10 GB
	▪ 128 RAM
	▪ Network Interface Card (NIC)
	▪ Video Graphics Adapter (VGA)
	▪ Network connection (10Mbps)
	▪ Mouse, keyboard, etc

6.1.2 Software Specification

Table 6.2: Software Specification

Requirement	Description	
Software	▪ Windows 2000 Server	System Requirement
	▪ ASP.NET	System Requirement
	▪ IIS 5.0	System Requirement
	▪ Internet Explorer 5.0	System Requirement
	▪ MS SQL Server 2000	System Requirement
	▪ MS Visual Studio .NET	System Requirement
	▪ JavaScript	Performance Requirement
	▪ ArcSoft Photo Studio 2000	Design Requirement
	▪ Corel Draw 9	Design Requirement

6.2 Design Environment

During the system implementation, instead of fulfilment the functional requirements, other challenges including create a connection to the web server and database. This could be accomplished by creating a virtual directory for the new web site and declares an ADO.NET data link to the database. Security management is a must to provide a secure web based application to the users.

6.2.1 Virtual Directory

Virtual directory is folder that is outside the physical directory structure of the Web site but that someone wishes to include within the Web site. There are few steps to be followed while creating the virtual directory.

i). Right-click the Web site or folder where the virtual directory needs to be added, and select New followed by Virtual Directory as shown by the figure below:

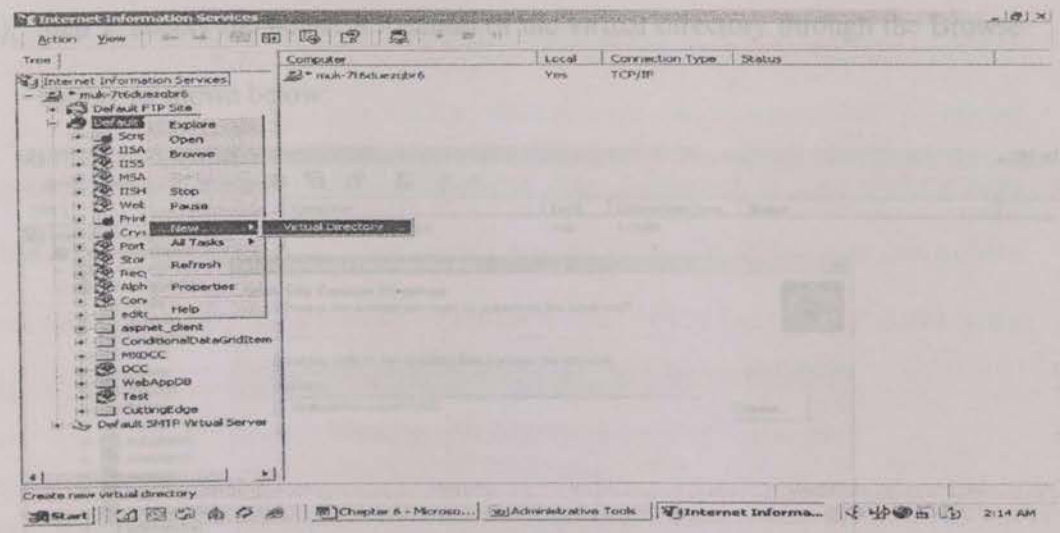


Figure 6.1: Creating Virtual Directory

ii). Selecting this item will launch the Virtual Directory Creation Wizard. The first thing to enter into the wizard is the alias name that the virtual directory should go by when it is accessing through the Internet. For instance, DCC.

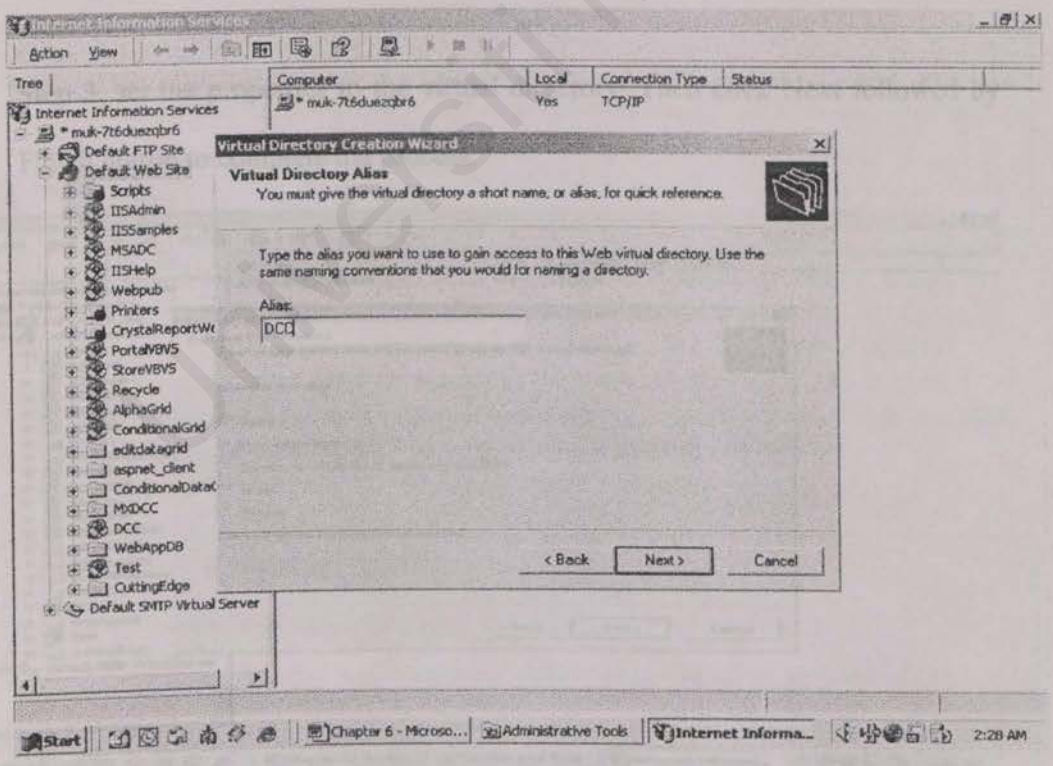


Figure 6.2: Create Alias Name for the Web Site

iii). Step 2, supply the physical location of the virtual directory through the Browse button, as shown below:

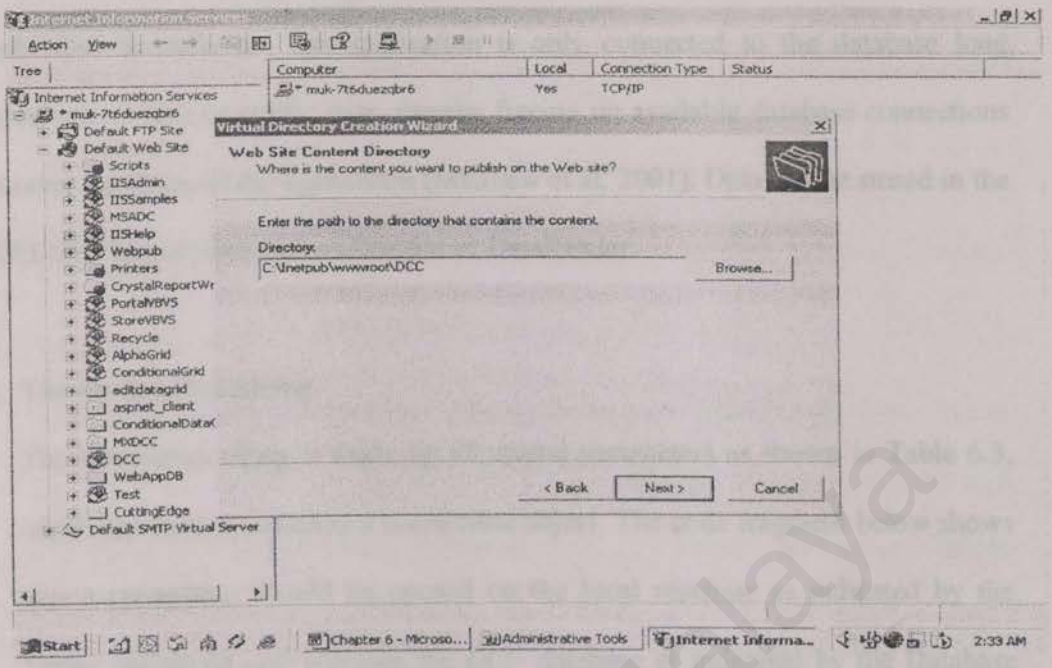


Figure 6.3: Browsing Physical Location

iv). Step 3, set the properties to the virtual directory. Then click Next followed by Finish button to complete the process.

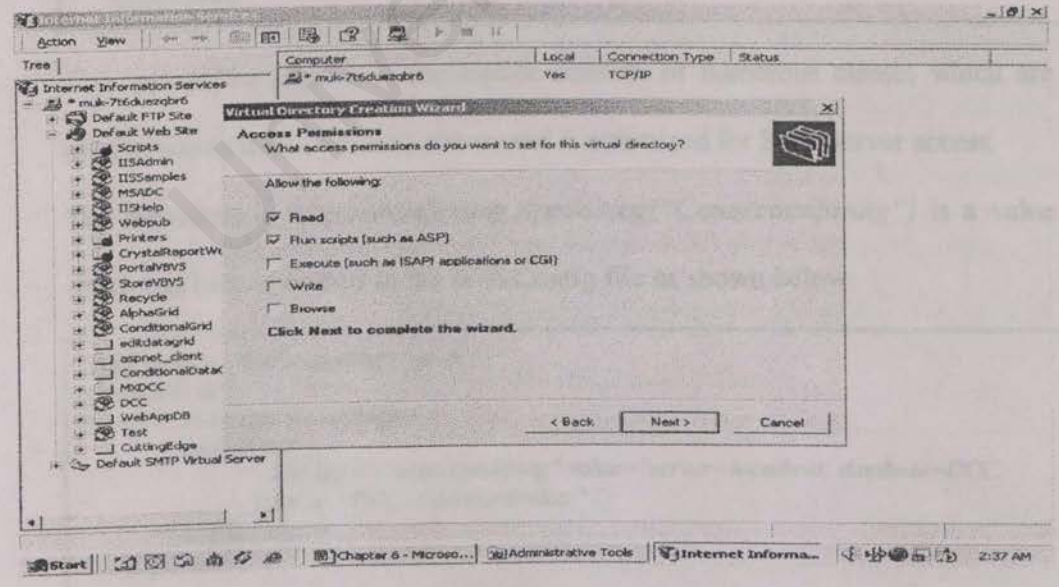


Figure 6.4: Setting Up the Properties

6.2.2 Accessing Database Programmatically

ADO.NET architecture is a disconnected architecture which allows application to scale up. The application is only connected to the database long enough to retrieve or update data, thereby freeing up available database connections for other instances of the application (Matthew et al, 2001). Data can be stored in the ADO.NET base object such as DataSet or DataReader.

a) The Connection String

The connection string is made up of several parameters as shown in Table 6.3, which are used to initialize a connection object. The code fragment below shows that a connection should be opened on the local machine as indicated by the Server parameter and accesses the *DCC* database as indicated by the Database parameter.

```
Import System.Data.SqlClient

Dim Conn As New SqlConnection ( ConfigurationSettings.AppSettings ( "ConnectionString" ) )
.....
Conn.Open()
Conn.Close()
```

The *System.Data.SqlClient* namespace consists of numerous classes which are used to access data from data source and is optimized for SQL Server access.

The statement *ConfigurationSetting.AppSetting("ConnectionString")* is a value which has been specified in the Web.Config file as shown below:

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
<!-- application specific settings -->
        <appSettings>
                <add key="ConnectionString" value="server=localhost; database=DCC;
                User Id =DCC; Password=dcc;" />
        </appSettings>
</configuration>
```

Table 6.3: Connection String Parameters

Parameter	Description
Server	Specifies the server/machine name where the data store is.
Database/ Initial Catalog	Specifies the database name to be used.
User Id	Specified the user ID of the user logging on.
Password	Specified the password of the user logging on.

b) The SqlCommand

The SqlCommand class represents a query to be made against a database. It can be a *SELECT, INSERT, UPDATE,* or *DELETE* query, and can be represented as a SQL string or a store procedure (Matthew et al, 2001). The code fragment below demonstrates the initializing of a SqlCommand object:

```
Import System.Data.SqlClient

Dim Command As SqlCommand = New SqlCommand ( "ShoppingCartAddItem", Connection )
Command.CommandType = CommandType.StoredProcedure
```

c) The SqlDataReader

ADO.NET DataReader is used to retrieve a read-only, forward-only stream of data from a database. Using the DataReader can increase application performance and reduce system overhead because only one row at a time is ever in memory (Microsoft, 2002). After creating an instance of the Command object, a DataReader is created by calling Command.ExecuteReader method to retrieve rows from a data source, as shown in the following example:

```
Import System.Data.SqlClient

Dim Command As SqlCommand = New SqlCommand ( "ShoppingCartGetItems", Connection )
Command.CommandType = CommandType.StoredProcedure
Dim CartList As SqlDataReader = Command.ExecuteReader(CommandBehavior.CloseConnection)
```

6.2.3 Security Management

The security clearance of a system is depending on the user access level. In order to prevent unauthorized access into the system, users have been restricted to access the system according to their role. The objective is to protect the system from accidentally or intentionally being destroying.

Microsoft SQL Server 2000 provides two built-in security modes to increase the security features of the application. There are (i). Windows Authentication Mode (ii). SQL and Windows Authentication Mode. The first one used the Windows accounts for authentication. While the second mode required a user id and password for each connection to the data source. The SQL and Windows Authentication Mode is selected for this system.

Store procedures are used to execute query such as UPDATE and INSERTION since it can be used to perform customize security permissions. For instance, a procedure can be created to grant users permissions to execute a particular store procedure.

In the sense to protect the administrator module, the authentication policy has been set to deny invalid users from accessing the application. Users will be redirect to the login page if the system detects an invalid access. User Id and password is required to enter the administrator module. This could be done by defining all the sub-module of administrator as a secure path in the Web.Config file as shown in the text box below:

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
<system.web>
    <! -- enable Forms authentication -->
    <authentication mode="Forms">
      <forms name="DCCAuth" loginUrl="admin/login.aspx" protection="All" path="/" />
    </authentication>
</system.web>

<! -- set secure paths -->
  <location path="admin/index.aspx">
    <system.web>
      <authorization>
        <deny users="?" />
      </authorization>
    </system.web>
  </location>

  ... ... ... ... ... ... ... ....

  <location path="admin/productAdd.aspx">
    <system.web>
      <authorization>
        <deny users="?" />
      </authorization>
    </system.web>
  </location>
</configuration>
```

6.3 Component Diagram

Component diagrams model the physical components (such as source code, executable program, user interface) in a design. According to the book UML Explained, written by Kendall Scott, component is defined as a physical and replaceable part of a system that conforms to, and realizes, a set of interfaces. Whereas the component diagrams is a collection of related components. In other words, it is a graph of the design's components connected by dependency relationships. An UML component is represented by a boxed figure shown as below:

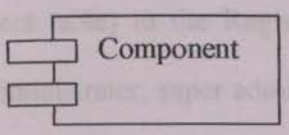


Figure 6.5: UML Component Notation

6.3.1 Administrator Login

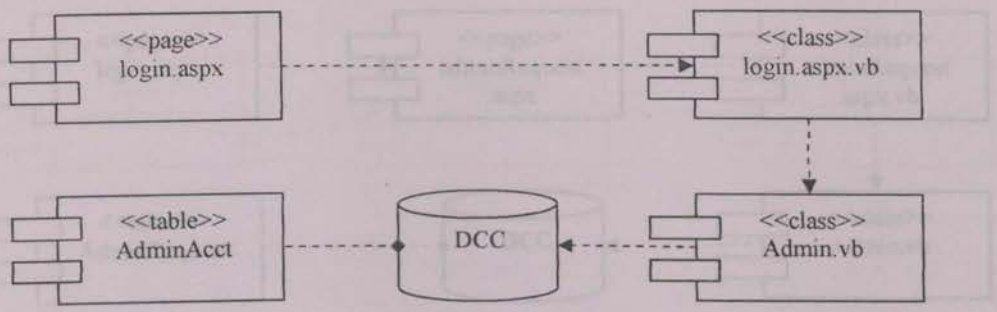


Figure 6.6: Administrator Login Component Diagram

Figure 6.6 show that there are three components in the Administrator Login Component Diagram that is the login.aspx page, login.aspx.vb class and the AdminAcct table. Administrator must submit his/her login id and password to login to the system. Then, the code-behind class file which is the login.aspx.vb will take over the process and verify the valid user for the system.

6.3.2 Register Administrator

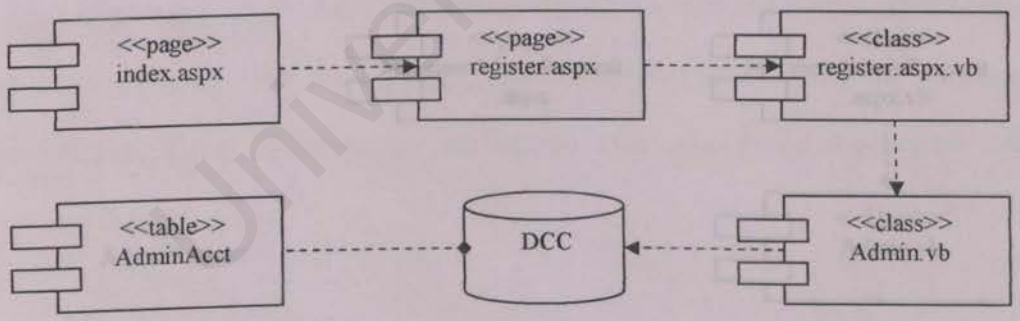


Figure 6.7: Register Administrator Component Diagram

Figure 6.7 shows that there are four components (index.aspx, register.aspx, register.aspx.vb and AdminAcct table) in the Register Administrator Component Diagram. To register a new administrator, super administrator must first move from the index page to the register page. Then, the system will update the DCC database.

6.3.3 Request Forgotten Password/User Id

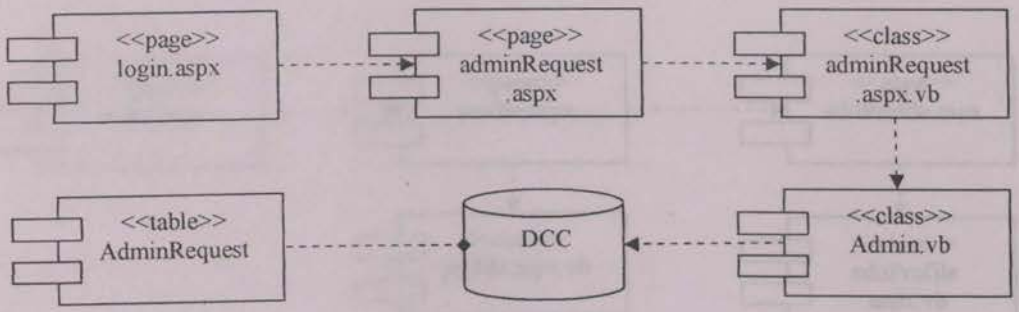


Figure 6.8: Request Forgotten Password/User Id Component Diagram

There are four components in the Request Forgotten Password/User Id Component Diagram as shown in Figure 6.8. From the login page, administrator can navigate to the adminRequest page where administrator has to submit their email address. The system then validates the input and return appropriate message to the administrator.

6.3.4 View Admin Request

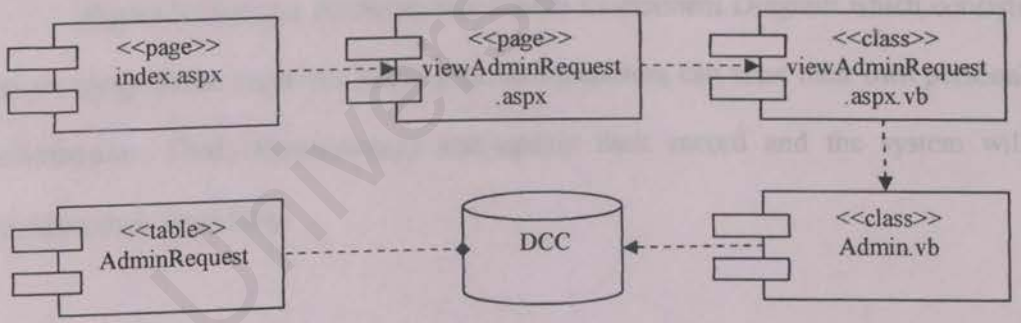


Figure 6.9: View Admin Request Component Diagram

For the View Admin Request Component Diagram, there are about four components as shown in Figure 6.9. First, super administrator moves from the index page to viewAdminRequest page. The code-behind class file then will search the records from the AdminRequest table.

6.3.5 Administrator Profile

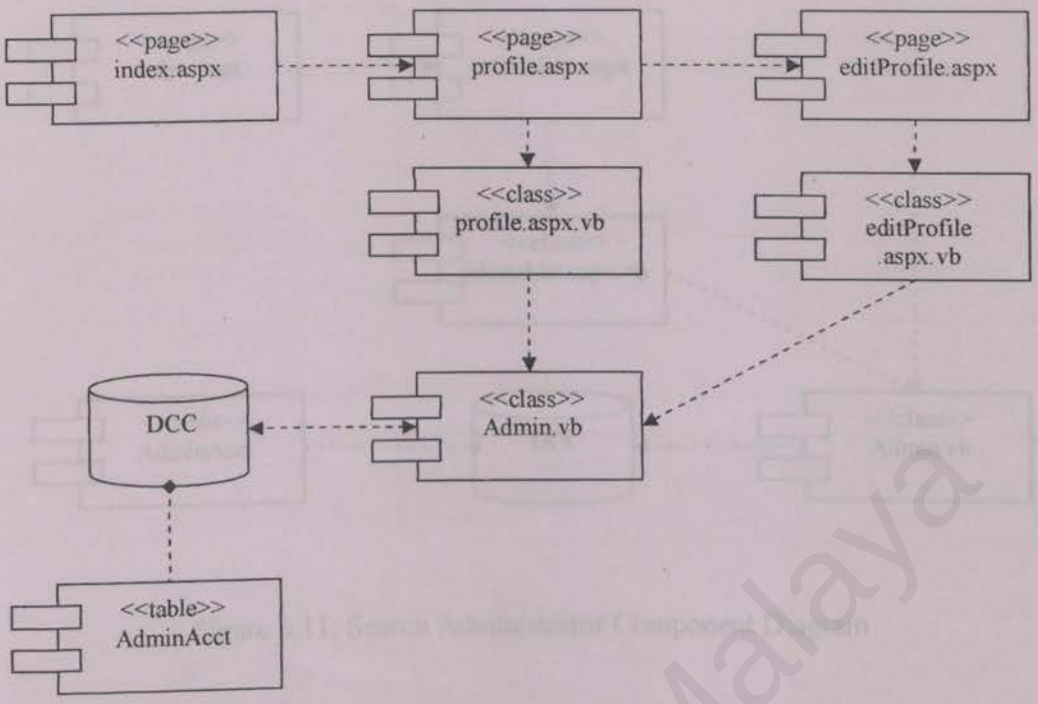


Figure 6.10: Administrator Profile Component Diagram

Figure 6.10 is the Administrator Profile Component Diagram which consists of six components. From the index page administrators can view their own personal information. Then, administrators can update their record and the system will validate their input data.

6.3.6 Search Administrator

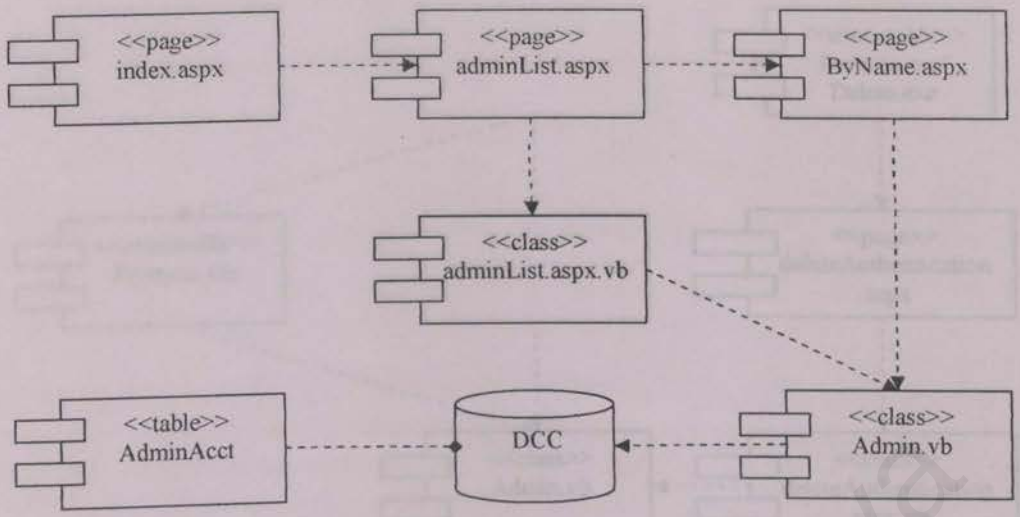


Figure 6.11: Search Administrator Component Diagram

Figure 6.11 shows that there are about five components in the Search Administrator Component Diagram. Moving from the index page to the adminList page, super administrator can view all the system's administrators. The search page (ByName.aspx) will search and display a list of administrators according to the administrator's name in the AdminAcct table.

6.3.7 Manage Administrator Account

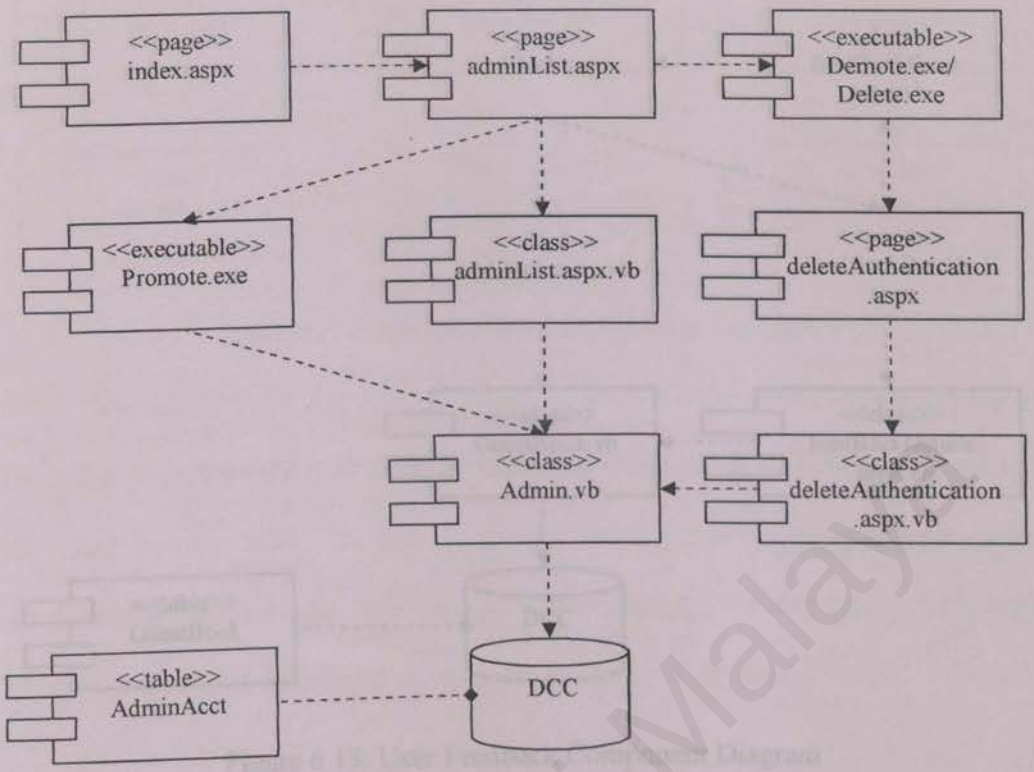


Figure 6.12: Manage Administrator Account Component Diagram

Figure 6.12 shows that Search Administrator Component Diagram which has eight components. First, super administrator move from index page to adminList page to view a list of system's administrator. Then, from the adminList page, super administrator can demote, promote or delete administrator. Deletion and demotion will invoke an authentication form for confirmation.

6.3.8 User Feedback

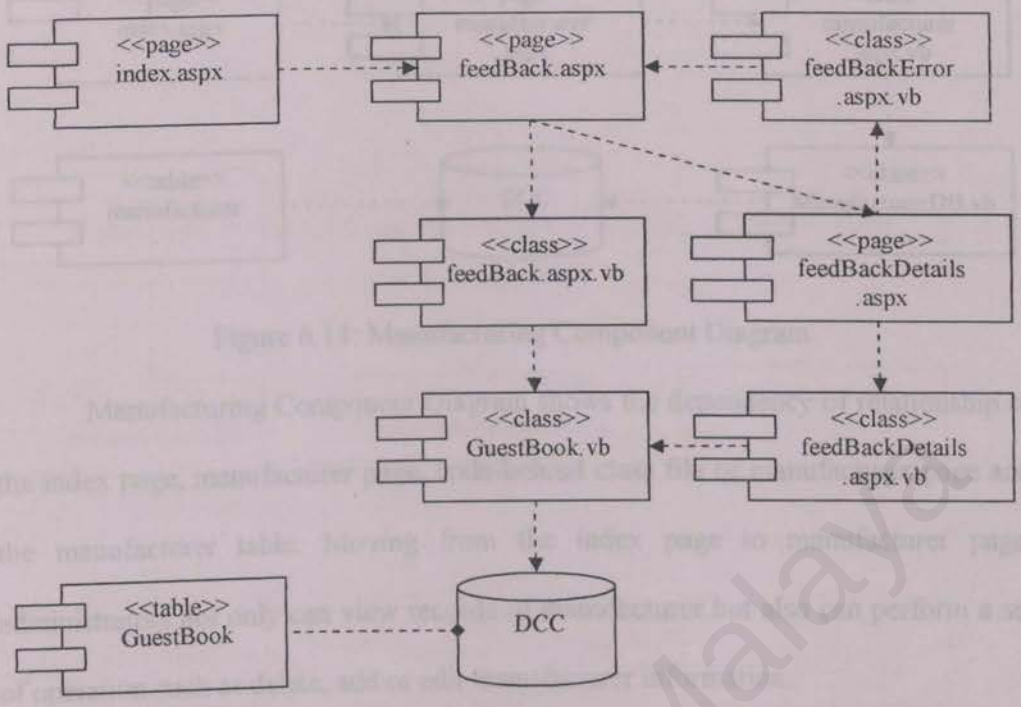


Figure 6.13: User Feedback Component Diagram

User Feedback Component Diagram consists of seven components. A list of user's comments will be displayed when administrators move from index page to feedback page. From the feedback list, administrators can select and view a particular comment which is stored in the GuestBook table. An error page will be displayed when errors occur during the record retrieving. The error page is linked to the user's feedback page.

6.3.9 Manufacturing

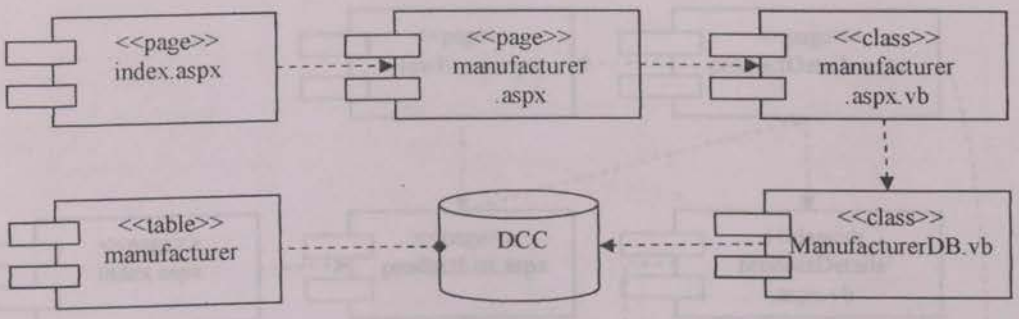


Figure 6.14: Manufacturing Component Diagram

Manufacturing Component Diagram shows the dependency of relationship of the index page, manufacturer page, code-behind class file of manufacturer page and the manufacturer table. Moving from the index page to manufacturer page, administrators not only can view records of manufacturer but also can perform a set of operation such as delete, add or edit manufacturer information.

6.3.10 View General Information

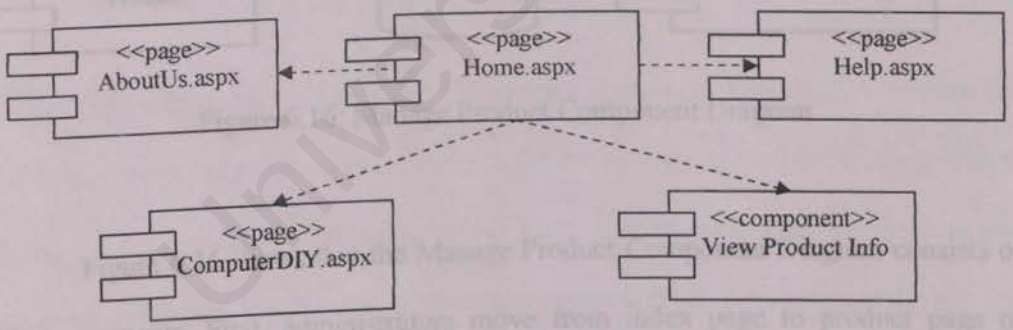


Figure 6.15: View General Information Component Diagram

Figure 6.15 shows that the View General Information Component Diagram that consists of four components. Moving from home page, users can view information such as product information, help file, computer DIY (Do-It-Yourself) and introduction of the DCC.

6.3.11 Manage Product

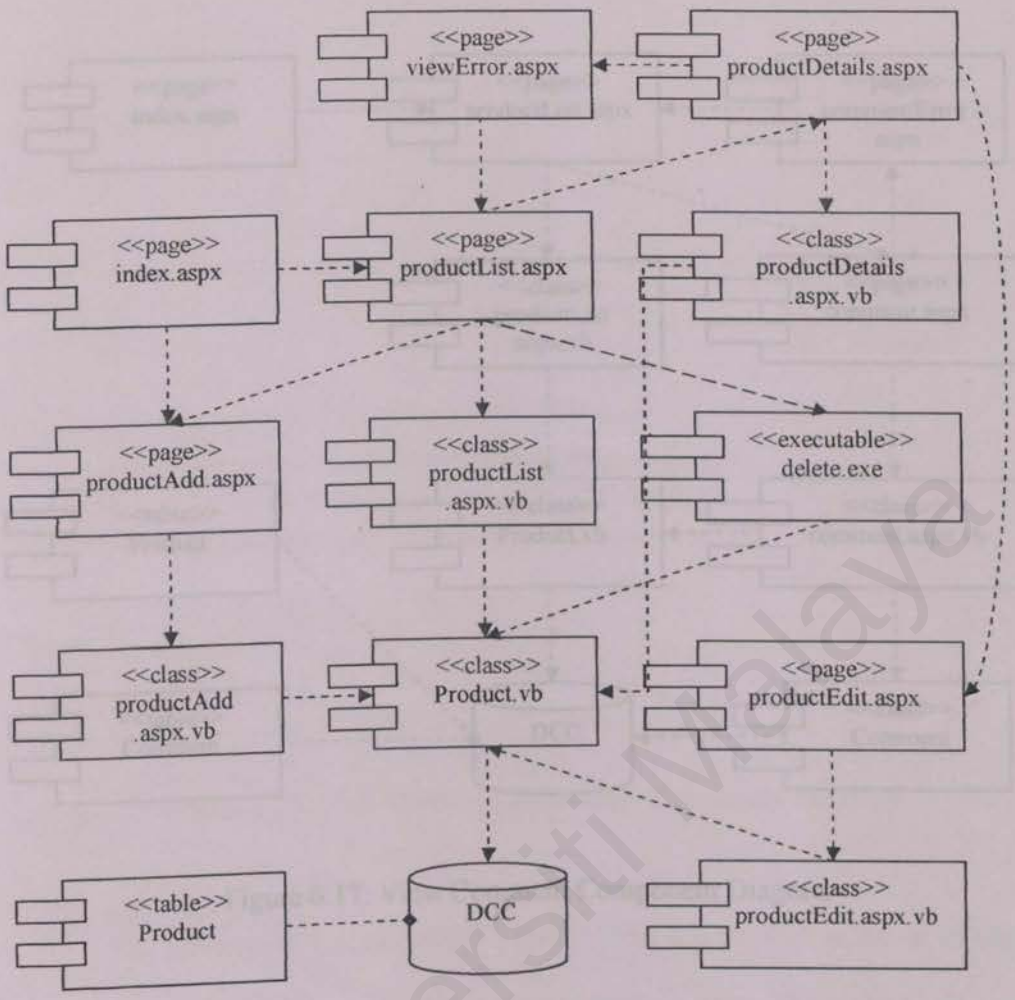


Figure 6.16: Manage Product Component Diagram

Figure 6.16 shows that the Manage Product Component Diagram consists of 13 components. First, administrators move from index page to product page or product adding page. From the product page, administrators can view a product details description by navigating to the productDetails page. The system will display an error page if errors occur during retrieving record from the Product table. Administrators also can edit the product record through the productEdit page and delete one or more product's records from the product page.

6.3.12 View Comment

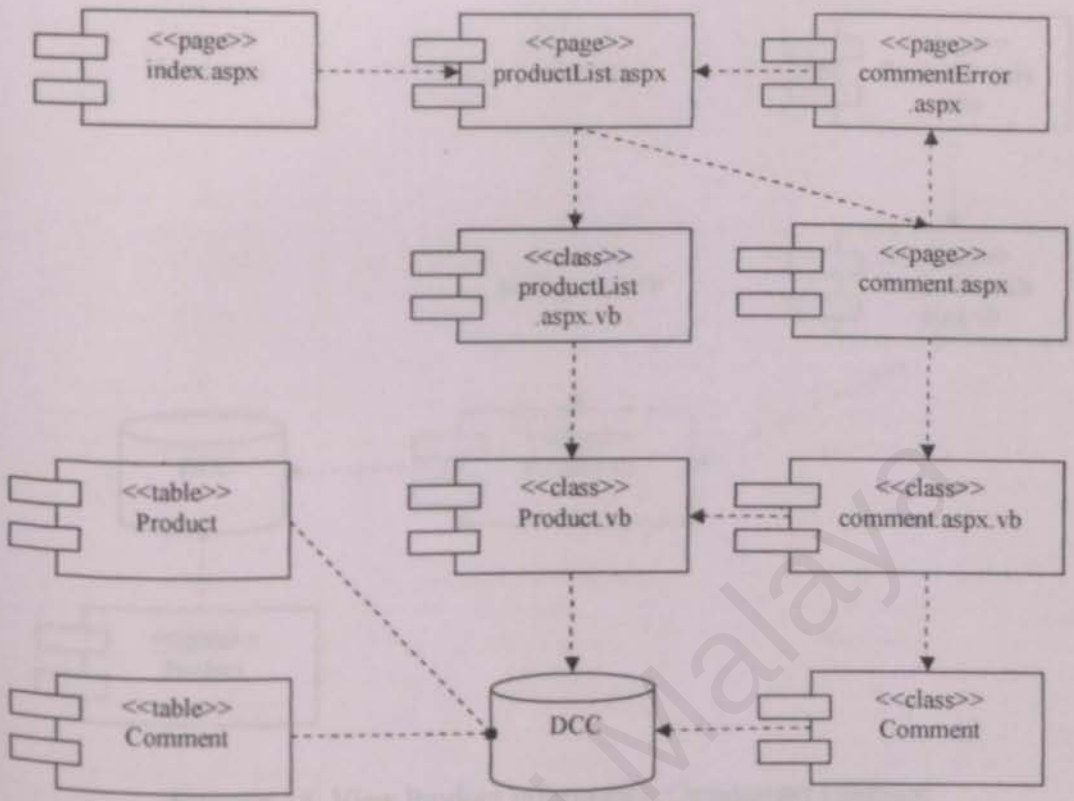


Figure 6.17: View Comment Component Diagram

Figure 6.17 shows the View Comment Component Diagram. As shown by the figure above, administrators move from the index page to the product page which shows a list of selected product category. Then, administrators can navigate to the comment page and display the product's comment(s). If errors occur during the records being retrieved from the database, an error page will be displayed and link the administrators back to the product page.

6.3.13 View Product Information

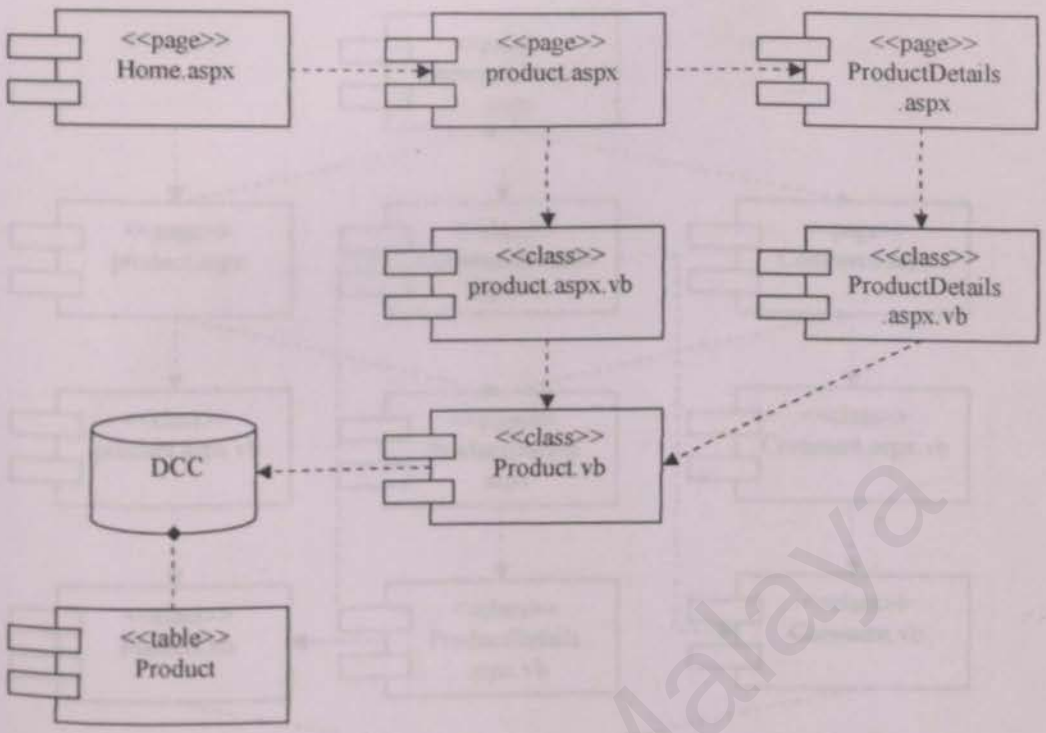


Figure 6.18: View Product Information Component Diagram

The component diagram of the View Product Information is shown as Figure 6.18. First, users move from the home page to product page. The system will search and display a list of products according to the users' preference. From the product list, users can select a particular product to get further description. All the retrieving process is done through a class file called Product.vb.

6.3.14 Comment Product

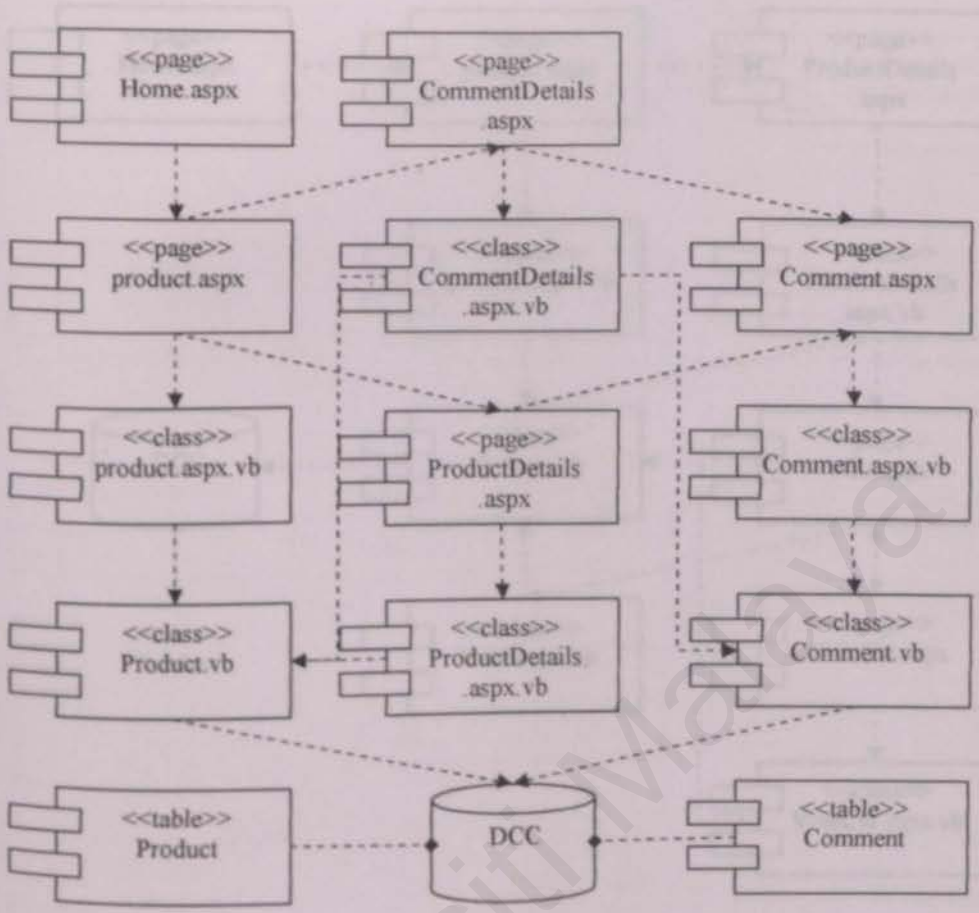


Figure 6.19: Comment Product Component Diagram

The Comment Product Component Diagram shows the dependency of product and its comment(s). First, users move from the home page to product page. Then, users can view all the comments of the selected product which will be displayed in the comment details page. New comment can be added through from a comment adding page which is linked with the product page and the comment details page. All the processes are done through by calling the Product and Comment classes. The Product table and Comment table will then updating the transactions.

6.3.15 Vote

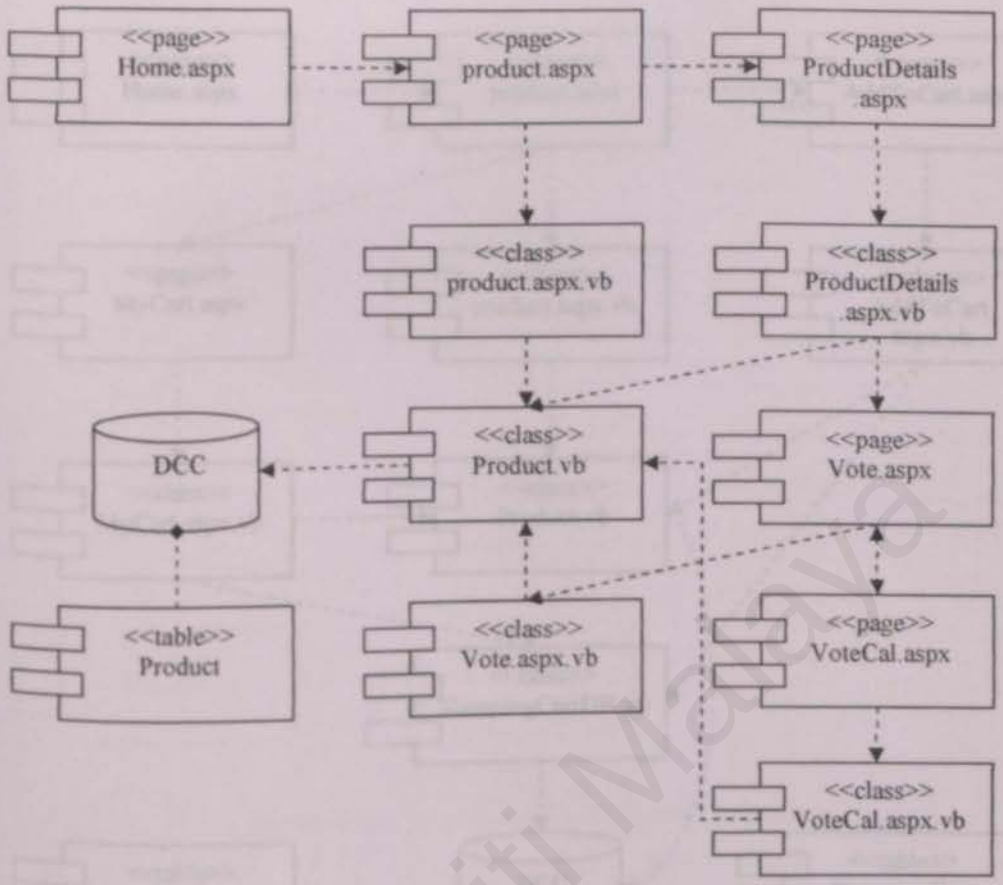


Figure 6.20: Vote Component Diagram

Figure 6.20 is a Vote Component Diagram. To vote a product, users must select a product to view its description. The product description page is link with the vote page. Product description is displayed when users select a product from the product page which consists of a list of categorized products. The calculation mechanism is performed by a code-behind class file that is the VoteCal.aspx.vb. The calculation page is called by the vote page. The database is updated after the calculation finish.

6.3.16 Shopping Cart

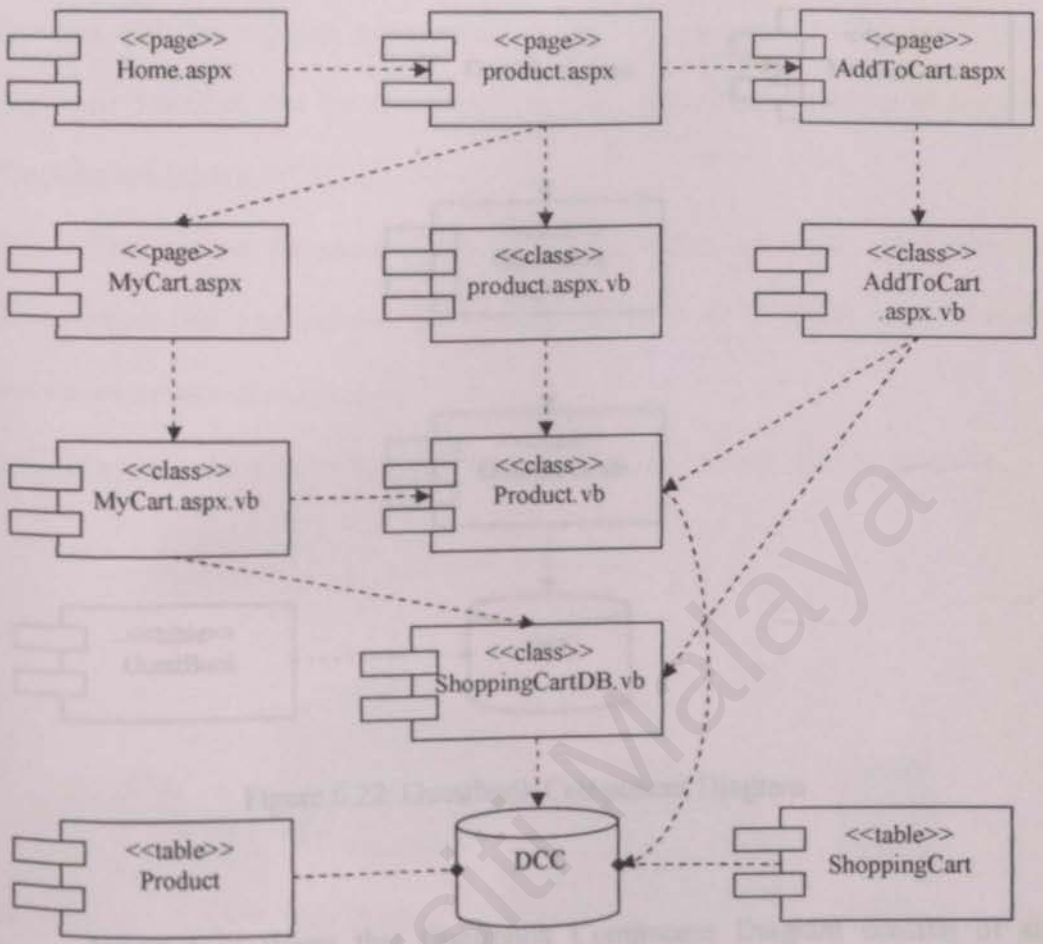


Figure 6.21: Shopping Cart Component Diagram

Figure 6.21 shows that Shopping Cart Component which consists of 11 components. First, users move from the home page to product page. The product page is linked with the shopping cart pages. The products are stored in the ShoppingCart table.

6.3.17 Guestbook

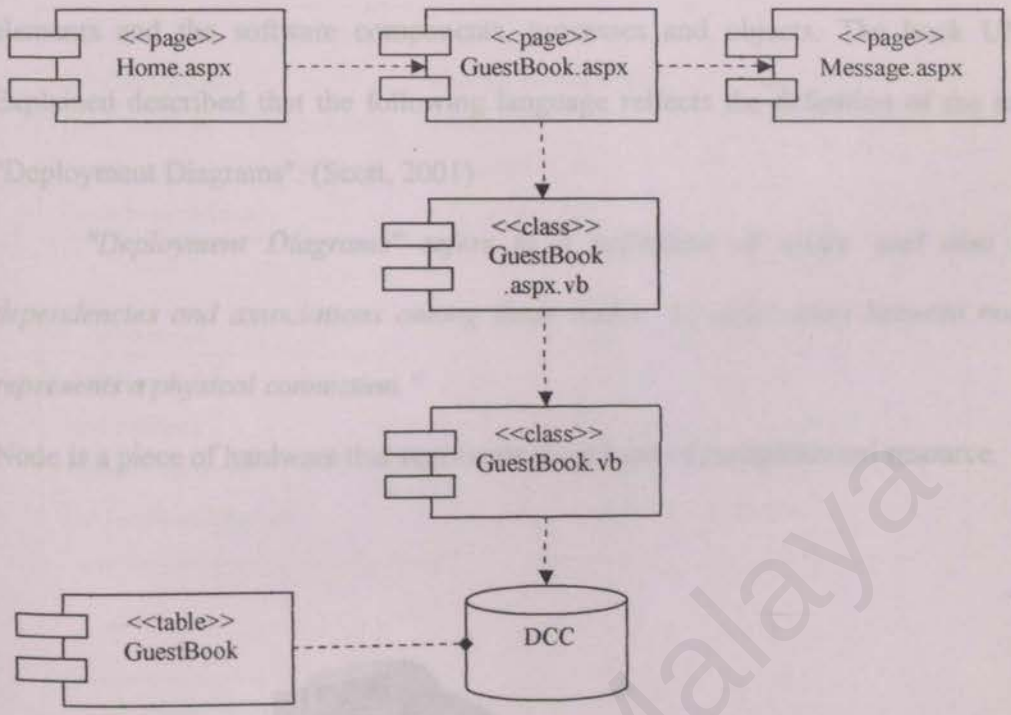


Figure 6.22: Guestbook Component Diagram

Figure 6.22 shows that Guestbook Component Diagram consists of six components. Moving from the home page to Guestbook page, users can submit their comments. The class file GuestBook.vb then is called and updates the GuestBook table which is located in the DCC database.

6.4 Deployment Diagrams

Deployment diagrams show the configuration of run-time processing elements and the software components, processes and objects. The book UML Explained described that the following language reflects the definition of the term "Deployment Diagrams". (Scott, 2001)

"Deployment Diagrams" refers to a collection of nodes, and also the dependencies and associations among those nodes. An association between nodes represents a physical connection."

Node is a piece of hardware that represents some kind of computational resource.

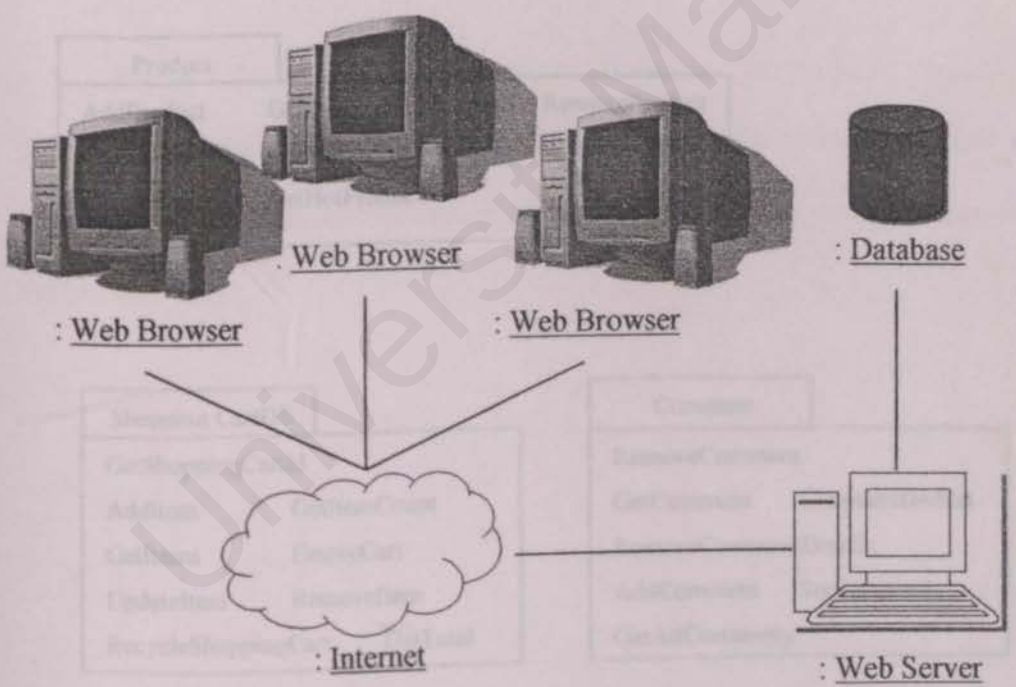


Figure 6.23: Deployment Diagram of DCC

6.5 Implementation Package

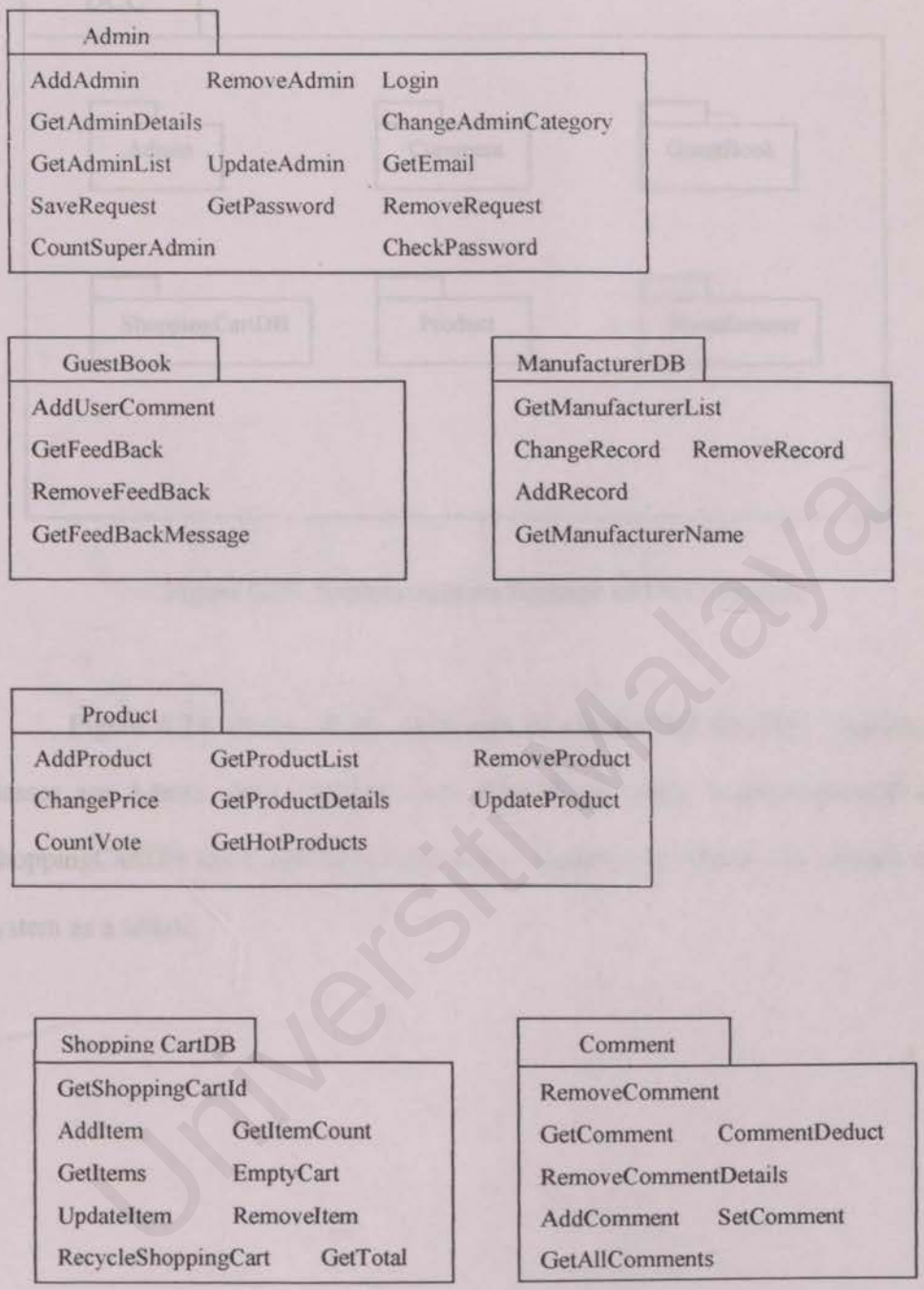


Figure 6.24: Packages of Classes for DCC System

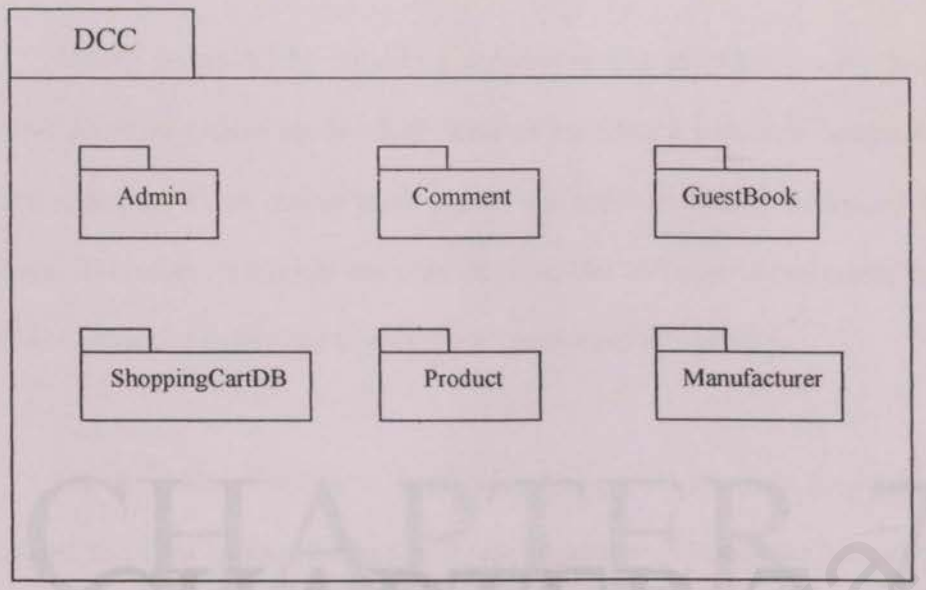


Figure 6.25: Implementation Package of DCC System

Figure 6.24 shows all the packages of classes for the DCC System. The classes are Admin class, Product class, GuestBook class, ManufacturerDB class, ShoppingCartDB class and Comment class. Figure 6.25 shows the classes of the system as a whole.

CHAPTER 7
System Testing

Chapter 7: System Testing

Testing is extremely important activity in the software quality assurance process. A robust system needs a high level of confidence that each component will behave correctly which means there are no incorrect collective behaviour will be produce. Therefore, testing is not only done to the software components but also involve a collective behaviour to maximize operational reliability.

The objective of testing is to detect and eliminate the logic bugs. Faults are identified and then corrected/removed from the system. During the system testing, the process has been organized into three stages that are unit test, integration test and system test.

7.1 Unit Testing

The major goal of unit testing is to verify that a particular component/unit functions properly. A set of predetermined set of data is fed to the system unit and the output action and data are being observed. The whole process is done in a controlled environment. Generally, unit test followed the steps described as below:

i). First, read through the examining codes and try to spot the algorithm, data and syntax faults.

ii). Next, compile the code and eliminate the remaining faults.

iii). Finally, develop test cases to show the input is properly converted to the desired output.

There are three testing strategies being applied during the unit testing stage. There are Ad Hoc testing, Black Box testing and White Box testing.

7.1.1 Ad Hoc Testing

Ad Hoc testing is simple but effective. Testing is done by playing around with the program, trying to break the program or make the program fail. It is so effective because the tester tends to begin to identify psychologically with the programmer and lead the tester to parts of the software. Ad Hoc testing does not provide systematic method to trace the system faults. One could find many errors but can never be sure what was or was not tested. However, it could be considered as a testing method during the early development stage. (Alka et al, 1997)

7.1.2 Black Box Testing

Black box testing assumes that the logic structure of code is unknown. The word, black box, is representing a system whose inside working are not available for inspection. It is an imaginary box that hides its internal working to outsider. (Ali, 1999) (Alka, 1997)

The program evaluation is done through by observing the inputs and the resulting output. The input and output are defined using use cases or other analysis information. Tester learns what the box does but nothing more about the implementation of the conversion.

Black box testing works nicely in an object-oriented environment and also is an ideal testing method for scenario-based test.

7.1.3 White Box Testing

White Box Testing involves with the code structure of a module/code segment during the component being tested. The logic of the box must be identified early. Since it is considered as an important part of the system, the box's logic must be tested thoroughly to guarantee the system's proper functioning. The bugs that were looking for were those had low probability of execution, had been carelessly implemented or were over locked previously. (Alka et al, 1997) (Ali, 1999)

There are two forms of white box testing have been used – statement testing coverage and branch testing coverage. The mechanism of the statement testing coverage is testing every statement in the objects method by executing it at least once. Whereas branch testing coverage (e.g. IF...THEN...ELSE...END IF statement) is to perform enough tests to ensure that every branch alternative has been executed at least once under some tests. (Ali, 1999)

However, it is impossible to test every statement or branch alternative on every single input. The program could be fail on certain untested input.

Below listed the summary of units that were independently unit-tested:

a) Opening and closing of database connection
b) Validating users before granting permission to the administrator module
c) Data insertion/edition/deletion
d) Validating the user input data before submitting the value to server
e) Uploading of picture files
f) House-Keeping of shopping cart items and event data

g) Data retrieving from database

h) Sql statement (store procedure)execution

i) Terminate application session when administrator logout

j) Registering new administrator

7.2 Integration Testing

Integration test is a process of verifying that the system components work together as described in the system design specifications. It helps to recognize the source of problems when a failure occurs.

The incremental integration testing method is used for the system evaluation. Incremental approach requires a test to be performed for every single created unit. The related units is added together and tested as a whole rather than a separate component. Those units normally perform a common goal or function.

7.3 System Testing

System testing ensures that the system does what has been specified in the documentation which is agreed by the customers and developers. It consists of a series of different tests designed to fully exercise the system to uncover its limitations and measures its capabilities. System testing consists of four processes:

i). Functional Testing –

Check the integrated system performs the functionality as specified in the requirement.

ii). Performance Testing –

Compare the system with the non-functional requirements.

iii). Acceptance Testing –

Assure the customers that the system fulfils all the requirements as specified in the documentation.

iv). Installation Testing –

Allow users to exercise the system and document additional problems which have been occurred.

Additional functional tests that involve are:

i). Event List –

A list of events which is used to examine the system functions. The results will be compared with the expected result.

ii). Screen Mapping –

A map through all the screens which can lead to other menus/pages

iii). Documentation Testing –

A test to all the examples used in the user manual.

7.4 Test Case

Test case is a particular choice of input data to be used in testing a system. It describes how each test is to be conducted and also the input/output details. Creating test cases will help developer to keep track of what is tested, when and the outcome of the test. Eventually, it will ease the developer to re-create the problem. (Alka et al, 1997)

Generally, test cases consist of three steps that is creating, executing and ensuring the end results. The test cases of this project are shown as below:

7.4.1 Login

Table 7.1: Login Test Cases

Test Description	Input	Expected Output	Output
Login with valid user id and password.	Valid user id and password	Session created and administration page is opened.	As expected
Login with invalid user id and password.	Invalid user id and password	Login failed and a message is displayed	As expected

7.4.2 Registration and Profile Editing

Table 7.2: Registration and Profile Editing Test Cases

Test Description	Input	Expected Output	Output
Displaying error message if required field is blank.	Blank	Error message is displayed. Transaction failed.	As expected
Displaying error message for invalid input type.	Invalid input type	Error message is displayed. Transaction failed.	As expected
Displaying error message if password and confirmation password not same.	Password different with confirmation password.	Error message is displayed. Transaction failed.	As expected
Displaying message if update fail.	Click submit or update button	Registration fail	As expected

7.4.3 Vote Product

Table 7.3: Vote Product Test Cases

Test Description	Input	Expected Output	Output
Display vote page when vote button is clicked.	Click vote button	Display vote product page.	As expected
Update the product record after vote.	Click the refresh button	Product rating changed	As expected

7.4.4 Event

Table 7.4: Event Test Cases

Test Description	Input	Expected Output	Output
Request user id and password.	Valid email address	Request accepted and a message is displayed.	As expected
	Invalid email address	Request rejected and an error message is displayed.	As expected
View admin request	Click event button	Display admin request page	As expected
Delete admin request from database	Click delete button	Record successfully deleted	As expected

7.4.5 Manage Administrator Account

Table 7.5: Manage Administrator Account Test Cases

Test Description	Input	Expected Output	Output
Delete/Demote super admin.	Valid super admin password	Record successfully updated.	As expected
Delete normal admin.	Click delete button	Account is deleted	As expected
Promote normal admin	Click promote button	Admin status being updated.	As expected
View personal profile	Click profile button	Admin profile is displayed	As expected

7.4.6 Manufacturing

Table: 7.6: Manufacturing Test Cases

Test Description	Input	Expected Output	Output
Displaying error message if require field is blank when add new manufacturer.	Blank	Error message is displayed. Transaction failed	As expected
Delete manufacturer	Click delete button	Account is deleted	As expected
Edit Manufacturer	Click edit button	Record successfully updated.	As expected

7.4.7 Manage Product

Table 7.7: Add Product Test Cases

Test Description	Input	Expected Output	Output
Displaying error message if required field is blank.	Blank	Error message is displayed. Transaction failed.	As expected
Displaying error message for invalid input type.	Invalid input type	Error message is displayed. Transaction failed.	As expected
Uploading product image to the image folder and table.	Browse and select image, then submit form	Product has been added and image has been saved to the desire web folder.	As expected
Display product image when it is selected.	Browse and select image	Image preview is displayed	As expected
Delete product	Click delete button	Product deleted	As expected

7.4.8 Product Comment and Guestbook

Table 7.8: Product Comment and Guestbook Test Cases

Test Description	Input	Expected Output	Output
Displaying error message if require field is blank when add new comment.	Blank	Error message is displayed. Transaction failed	As expected
Add new comment.	Click add button	Record successfully updated.	As expected

7.4.9 Shopping Cart

Table 7.9: Shopping Cart Test Cases

Test Description	Input	Expected Output	Output
Add selected product to the shopping cart.	Click the basket image	The product has been added to the shopping cart table.	As expected
Delete selected cart item from the table.	Click the delete button	The item has been removed.	As expected
Calculate the total price of the items in a shopping cart.	No input is required	Sum of the items' price in the shopping cart	As expected

7.5 Summary

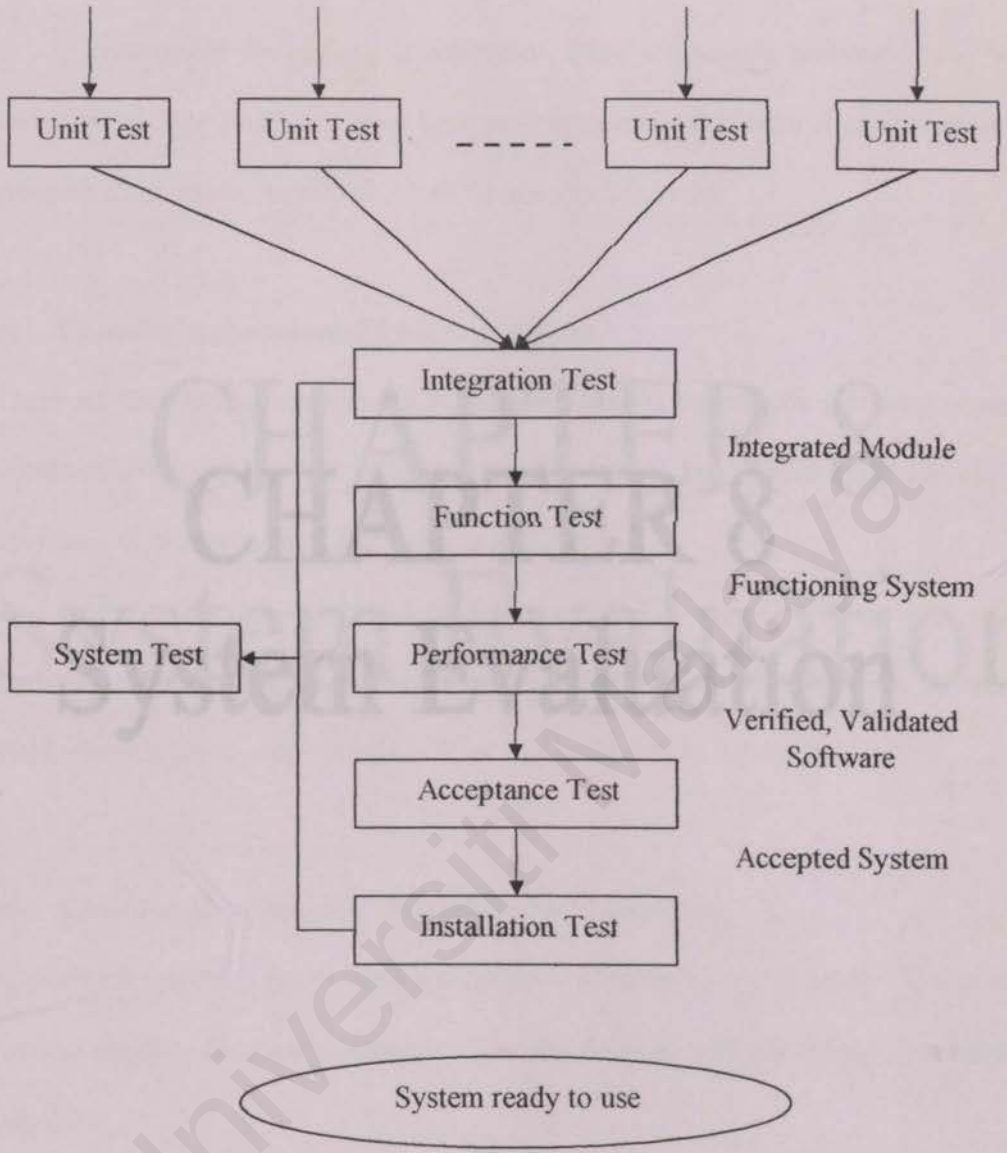


Figure 7.1: The Process of System Testing

CHAPTER 8
System Evaluation

Chapter 8: System Evaluation

8.1 Problem Encounter and Solution

Throughout the project development, there are several problems have been encountered. The problems have kept unfolding one after another as development progress from one to another phase of the project life cycle.

a) Choosing Appropriate Operating System

There are few options which have been determined as the project operating system - Windows 2000, UNIX and LINUX. Decision has to be decided since the chosen operating system will work as a host for the system.

Due to the constraint of limited facilities to LINUX and UNIX, as well as the knowledge required, both the operating systems are not implementing. Windows 2000 which is more user-friendly will be an ideal solution for this project.

b) Choosing Development Technology and Language

Choosing a suitable development technology and language are not easy. This critical process requires deep understanding. A wrong decision will affect later development processes.

Therefore, advises and views from project supervisor and course mate has been carried out. Internet is another alternative to clarify doubts.

c) Lack of Knowledge In The Language

Since that .NET is a brand new technology introduced by Microsoft, it requires a lot of time to study and understand its architecture. Most of the time, learning and development process are done in parallel. Time is spent in looking for the project solutions especially during the code developing.

Internet is definitely the primary resource to handle problems throughout the whole development process.

d) Determining The Project Scope

The project scope in some extend is depend on the time constraint and cost of the project, so that the project could be completed on time and fulfil all the requirements. A lot of analysis has been done especially on the capability of the development tools and technology being used before the project scopes can be determined.

e) Unanticipated Appearance of Web Pages

The appearance of web pages is different depending on the selected web browser. Normally, the alignment of the elements will be out of position when using different browser to navigate the web site. Worse come to worse, some images cannot be displayed since the images are not supported by the browser.

8.2 System Strength

Even though the system might not consider as a powerful web portal but it has some strengths which cannot be found in other web site. The strengths of the system are:

i). Online database maintaining:

The main features of the system in such a way that it allows members to edit or update the database through Internet accessing. Therefore, it is flexible and accessible at anytime in anywhere.

ii). User friendly interface:

The web page is designed to be simple and systematic in the sense of to ease the users navigate and explore the web site. Icons are used to deliver and perform certain operation. A meaningful icon will certainly improve the users understanding and reduce the time to learn. Colour and images are another alternative used to attract users.

iii). Fast response in data retrieving:

The web page is designed in a lightweight form which means the loading time for a page is within a reasonable interval. Therefore, heavy graphic is avoided if possible when designing the interface. Users should not wait too long to view a page.

iv). **Simple search engine:**

A pre-define built-in searching mechanism has been defined for the users. Products are searched and displayed according to the product's category, whereas administrators can be searched through the alphabet literal provided in the system.

v). **Error messaging:**

DCC provides a simple and understandable message for every single click action. The message could be a static message which is hard coded into the program. It also could be a system's error message which has been simplified but yet still reasonable to some extent.

vi). **System transparency:**

DCC is transparent in the sense of hides the implementation details from users. Users do not need to know the database location, the structure of the system and the logical implementation of the program. All the database transactions are done within a click operation.

vii). **Online information:**

The DCC system provides the online products checking. Users can view related product information on the Internet without physically visit the computer shops.

8.3 System Limitation

There are some limitations of the system which , perhaps could be overcome due the time constraint. Time normally is the killer to the developers in developing a system. In such a way that it prevents developers to do further research on a particular work.

The limitations of the system are:

i). The system could not be functioning without the Internet.

ii). The system only displays latest computer hardware products which are in the Malaysian market.

iii). The system will not incorporate with any on-line transaction, such as on-line payment or products ordering.

iv). Store management will only be done on-line.

v). English will be the only language using in the system and there will not have other foreign currency, other than Ringgit Malaysia, provided in the system.

vi). The system does not support email servicing and therefore the administrators will need to borrow other web service provided by outsider such as Hotmail, Yahoo and so on.

8.4 Future Enhancement

The future enhancements of the system are listed and prioritized as below:

- Set up a SMTP Server on the web server to provide email servicing.
- Enhance existing module to provide more powerful function. The refinement process should be in the extent of consistency and stability.
- Increase the system security feature in the way that password is encrypted before it is stored into the database and decrypt it after retrieve from the table.
- Add in more features to the user module such as provide a chart room or forum for the users.
- Increase the system portability in order to support other web browser for instance Netscape Navigator.
- Add-on additional module to allow retailers from other places in Malaysia to join as a member in such a way that the system allows them to supply their own hardware pricing list.
- Provide advanced search engine which is capable of recognize the nearest search results to users when the search criteria match nothing to the database.

Conclusion

Conclusion

Generally, the project has achieved and fulfilled most of the objectives and requirements of the system. The aim of the project is to develop an online product pricing system which is accessible to all Internet users. The ideal is to get use of the Internet facility to create a paperless environment. The Hardware Pricing System consists of two modules – administrator module and user module. The development process is not easy since various objectives have been targeted. Event thought it is not a very complex system; it nevertheless achieved a successful development which is the first step towards the future development of the system.

Throughout the project development life cycle, invaluable insight was gained into the complexity and intricacies of the programming concept, as well as the programming techniques. For instances, the .NET architecture design and ASP .NET programming skills are fields that have been studied to develop the project. Skills in using software tools such as MS Visual Studio .NET, MS SQL Server, ArcSoft Photo Studio and Corel Draw have been acquired too.

Besides, it also provides a chance to apply good practice on the software engineering techniques which have been learn previously. It is believed that the experiences gain from this project should be useful in future endeavours.

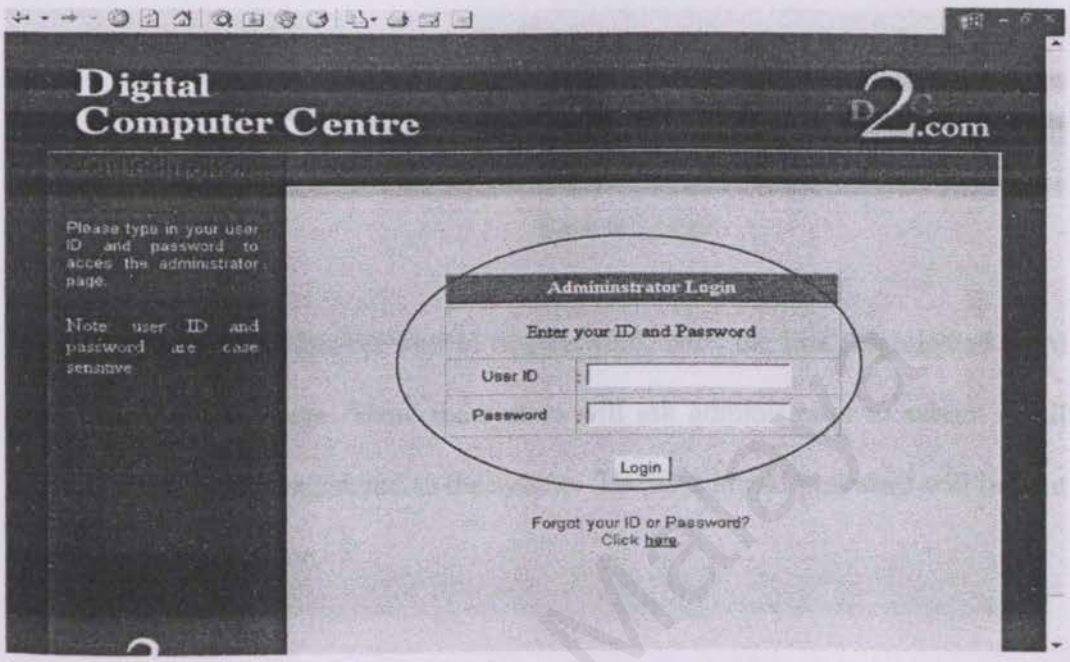
Lastly, there are some improvements is required to further enhance the system as mentioned in the previous chapter. A lot of efforts are needed and the time will be the main constraint for the process.

Appendix A

User Manual

A) Administrator Module

i). Login

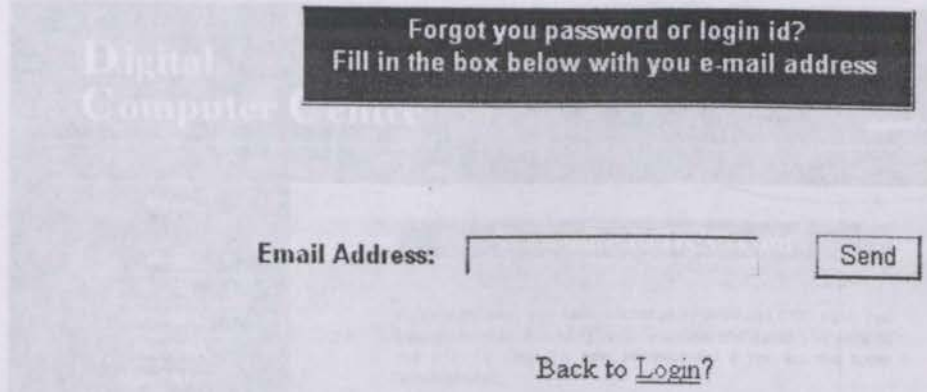


Administrator Login:

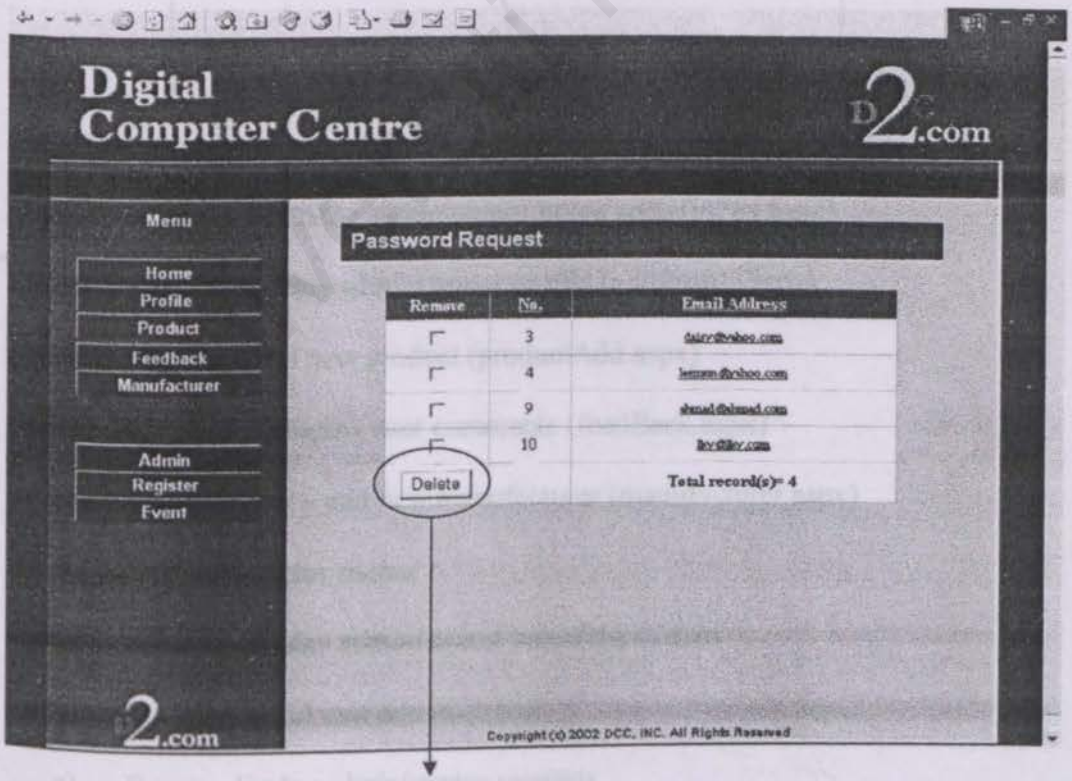
1. Enter user id (case sensitive)
2. Enter password (maximum 8 characters)
3. Click Login button

   * The system will redirect user to the administrator home page if login accepted.

ii). **Retrieve Password/User Id**

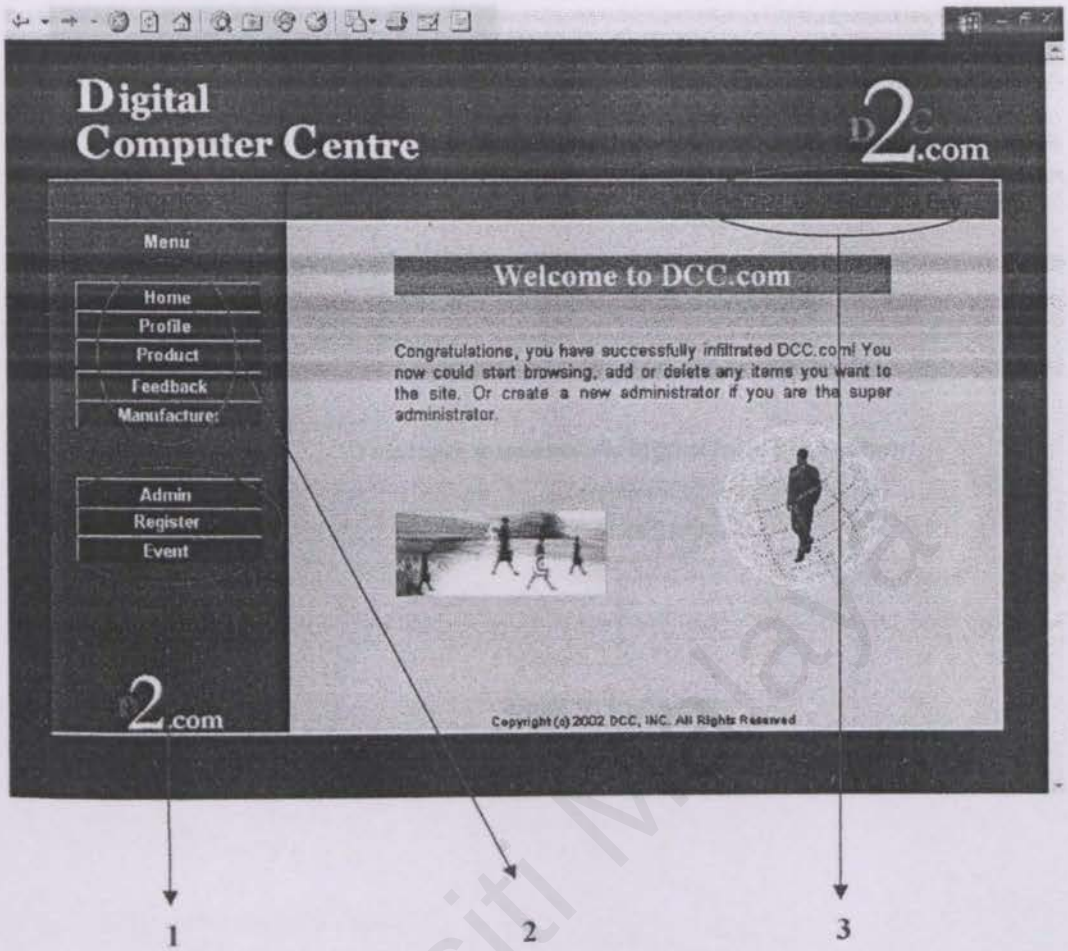


If administrator forgot his/her user id or password, click the link (highlighted word "here") in the login page. Then, the system will ask administrator to submit email address which he/she registered to the system. The user id and password will be sent to the administrator soon.



Delete Request

iii). **Home**



1. **Administrator menu:**

   a) Home – link to the administrator home page (index.aspx)

   b) Profile – display administrator profile (editProfile.aspx)

   c) Product – add new product (productAdd.aspx)

   d) Feedback – display user comments (feedBack.aspx)

   e) Manufacturer – add new manufacturer (manufacturer.aspx)

2. **Super Administrator menu:**

   a) Admin – display administrator list of the system

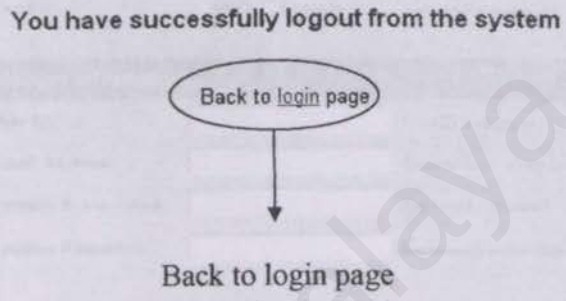
   b) Register – Add new administrator

   c) Event – display administrator requests

3. [redacted]

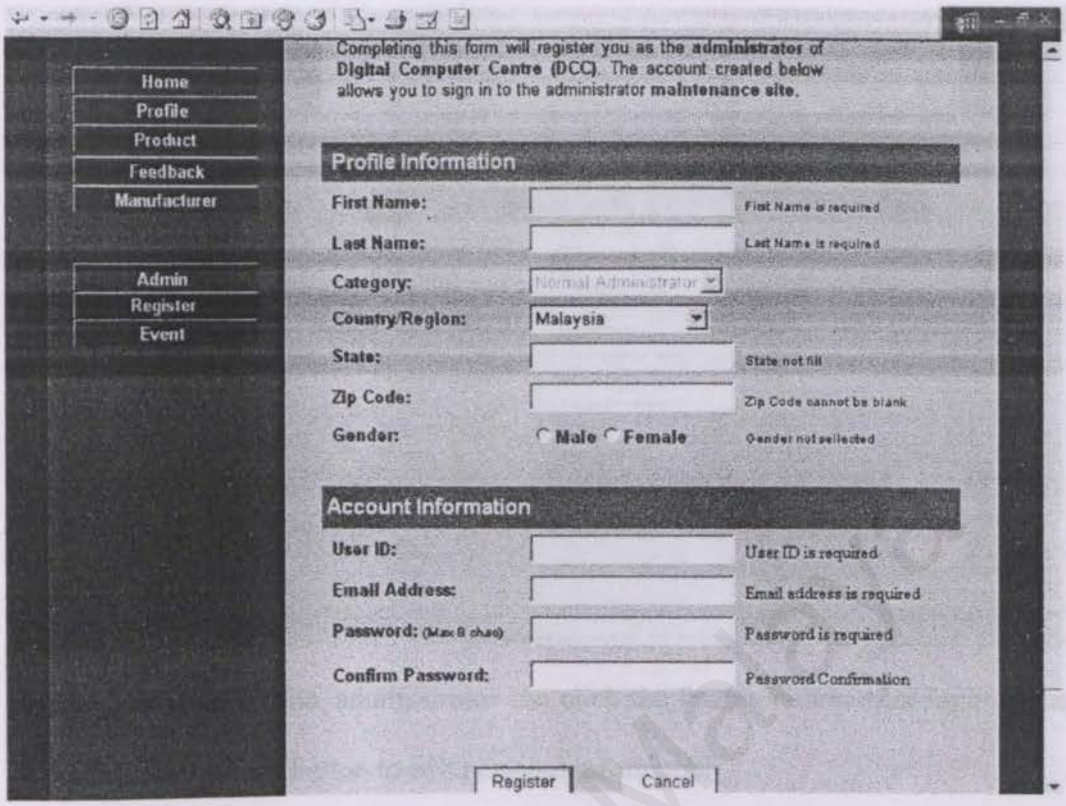
a) View List – display product according to its category

b) Sign Out – logout and exit the system



Back to login page

iv). **Registration**

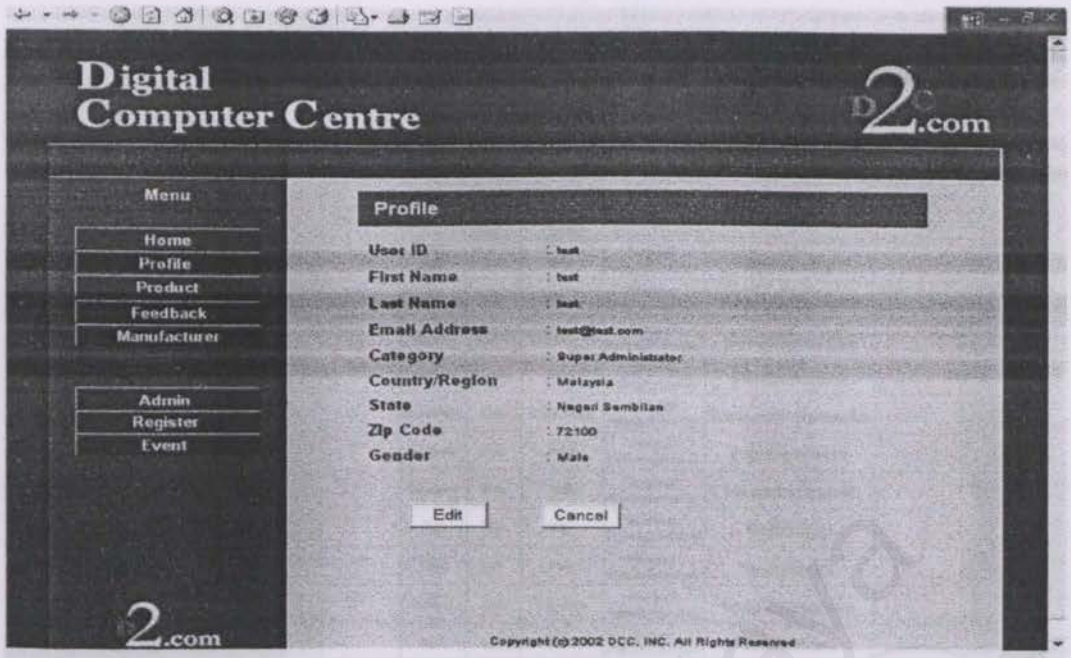


Register administrator:

1. **Insert the personal information as requested.**
2. **Click Register button.**

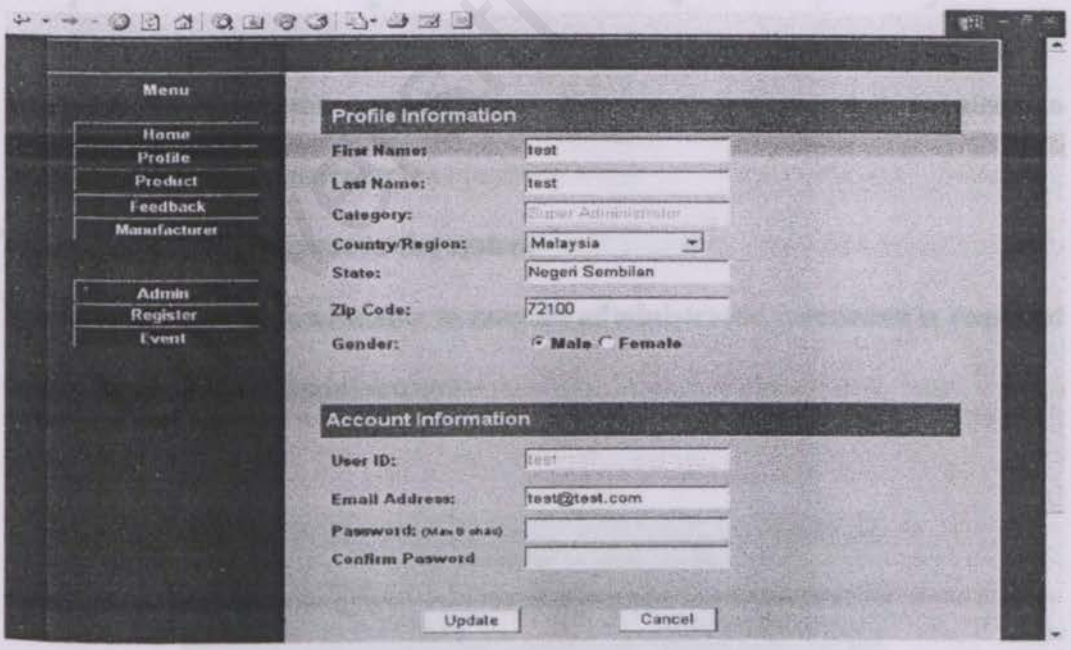
Error message will be displayed if the required fields are not filling in with appropriate value as shown in the figure above. The Cancel button will redirect administrator to the administrator list.

v). View Profile



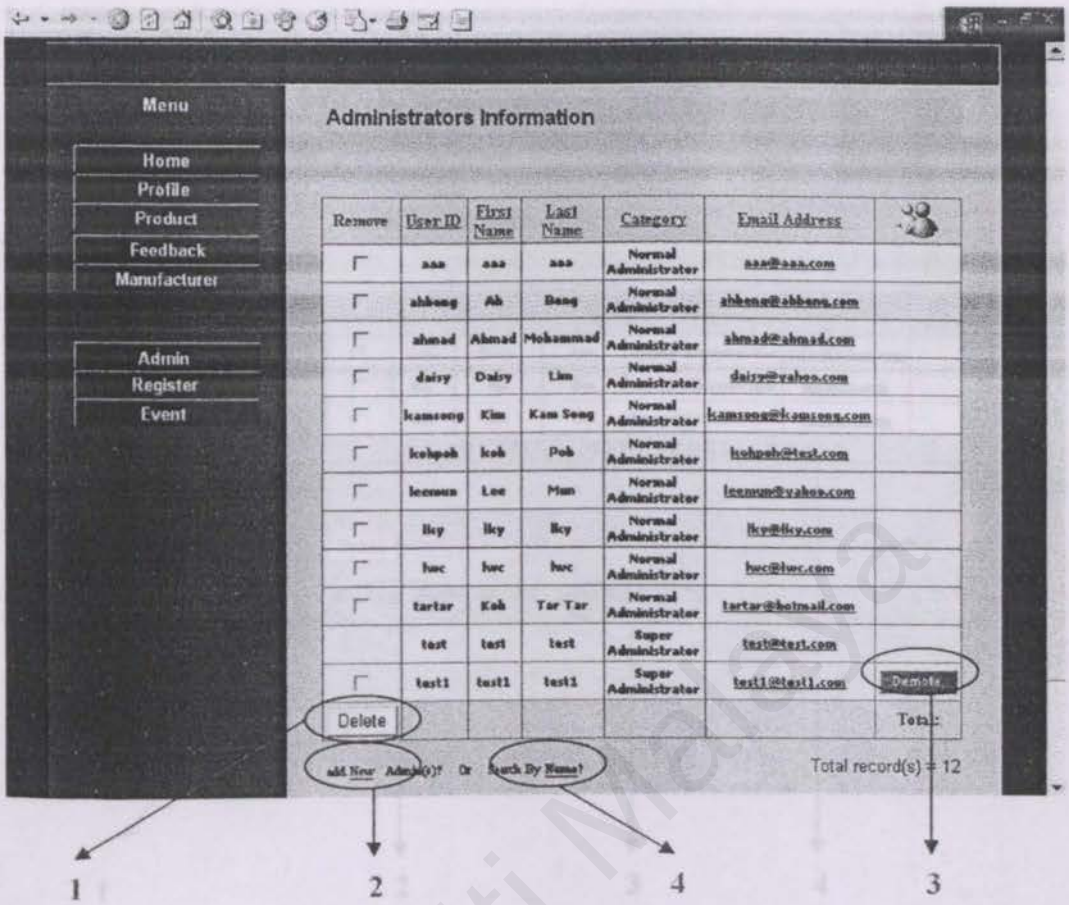
To view personal profile, administrator can click the Profile button after login to the system. Click the Edit button to edit personal information.

vi). Edit Profile

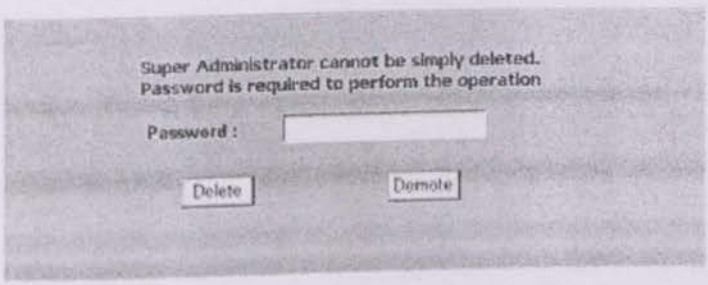


Insert the fields with appropriate value and click Update. Messages will be displayed if require fields are empty. Click Cancel to cancel the process.

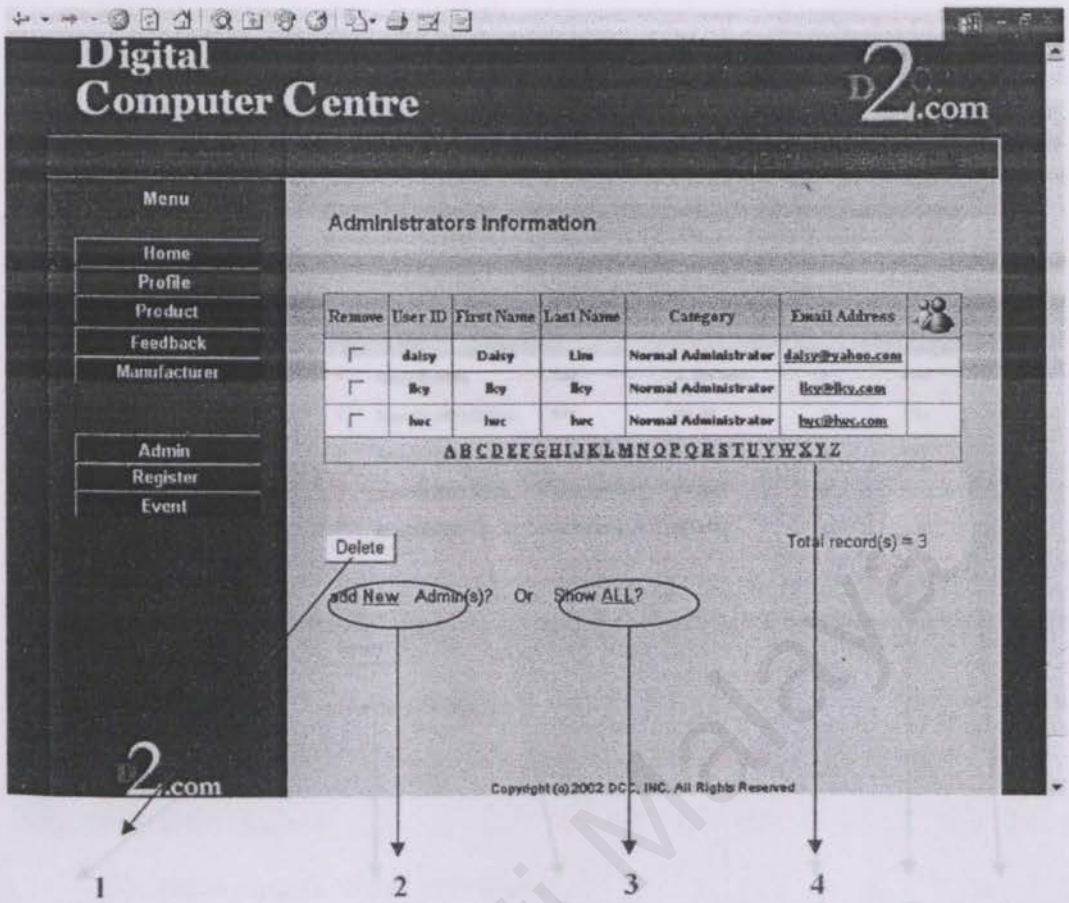
vii). Administrator List



1. **Delete administrator record(s) from the system (password is required to delete super administrator)**
2. **Add new administrator to the system**
3. **Demote super administrator to normal administrator (password is required to demote super administrator)**

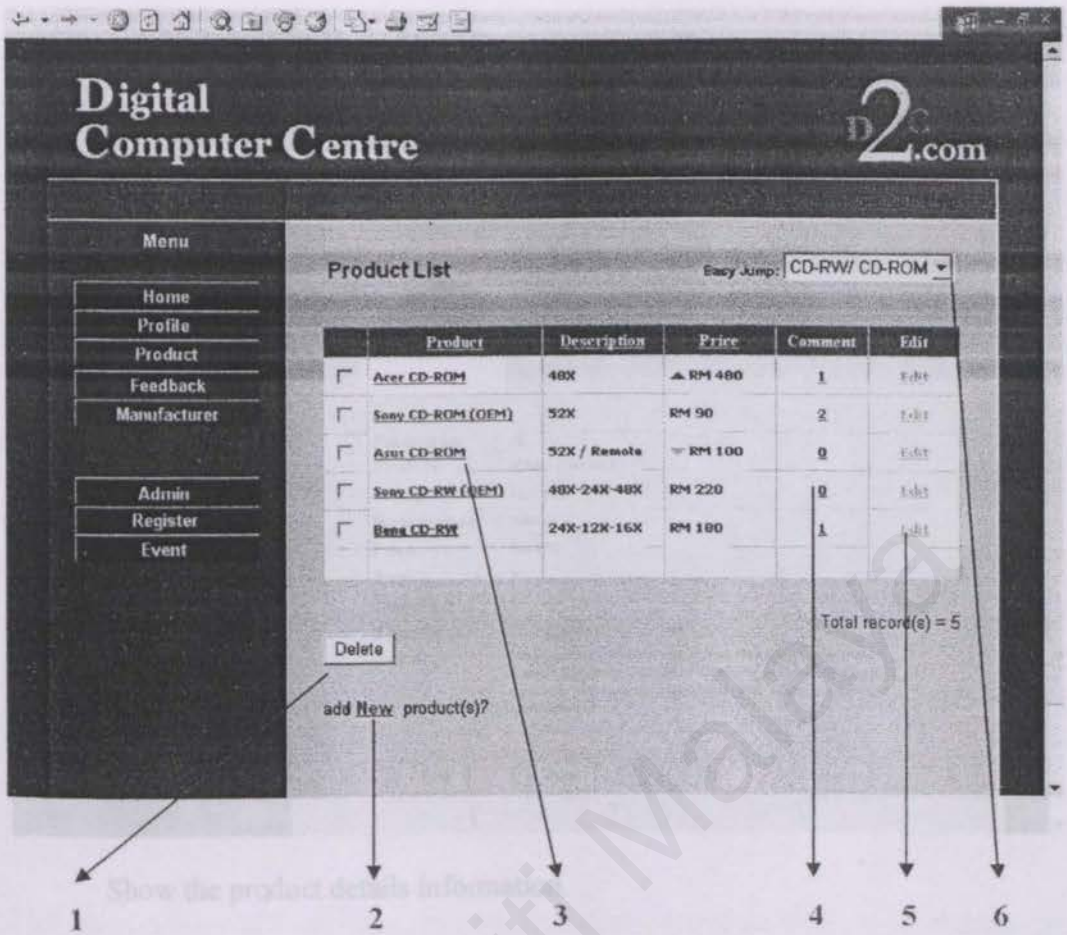


4. **Search administrator**



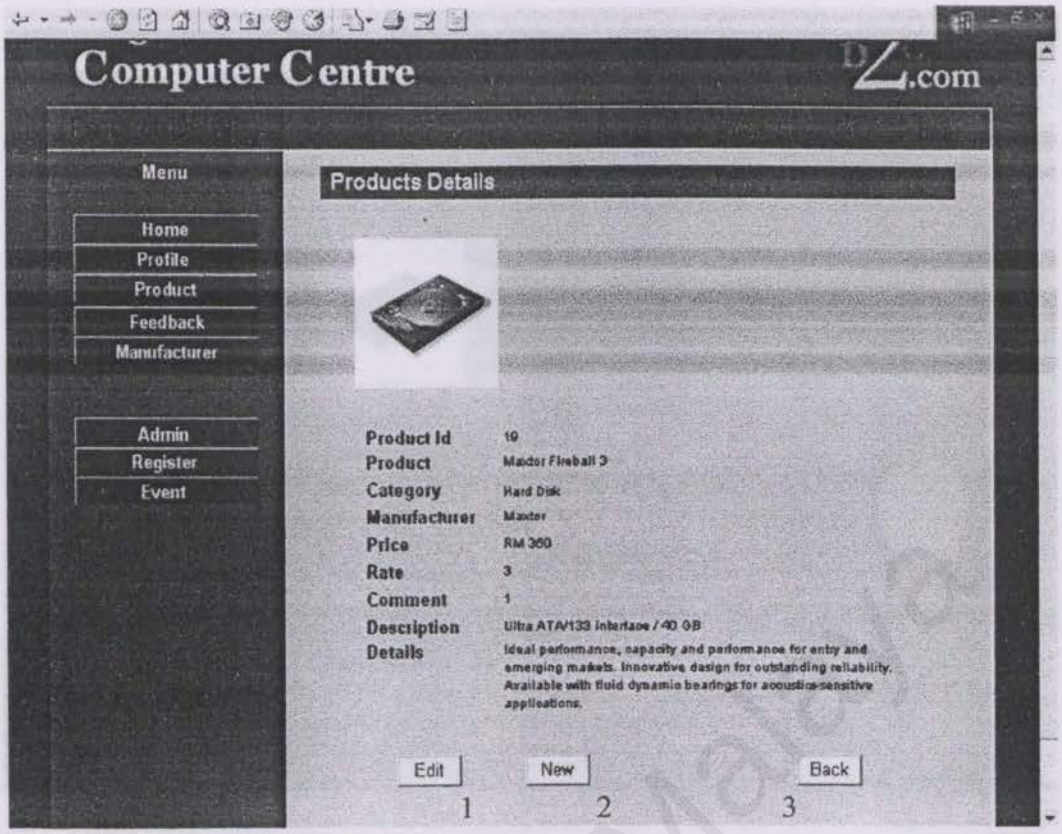
1. **Delete administrator record(s) from the system.**
2. **Add new administrator to the system.**
3. **List all the available system administrators.**
4. **Search the administrator by name.**

viii). **Product List**



1. **Delete product record from database.**
2. **Add new product to the database.**
3. **Click to view product description.**
4. **Click to view product comment. The number indicates that how many comments have submitted from the users.**
5. **Click to edit the product price.**
6. **Provide an easy jump to view other product category.**

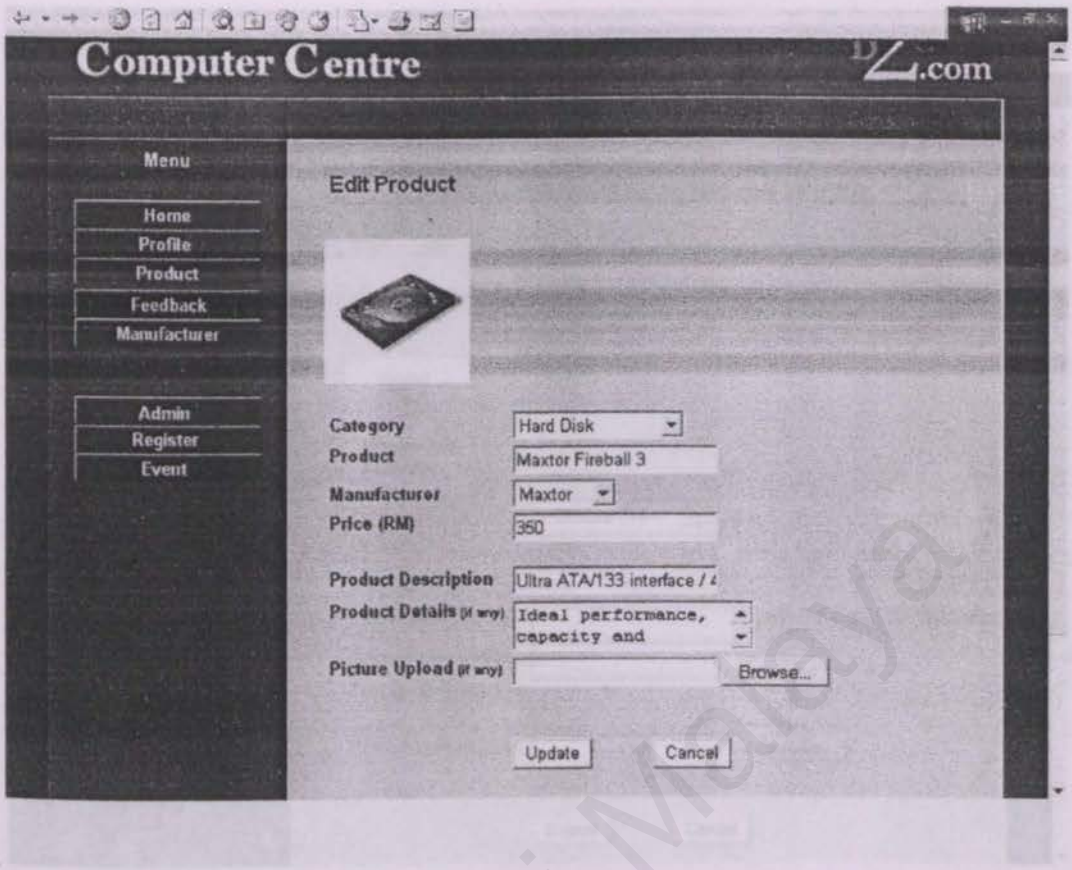
ix). **Product Details**



Show the product details information.

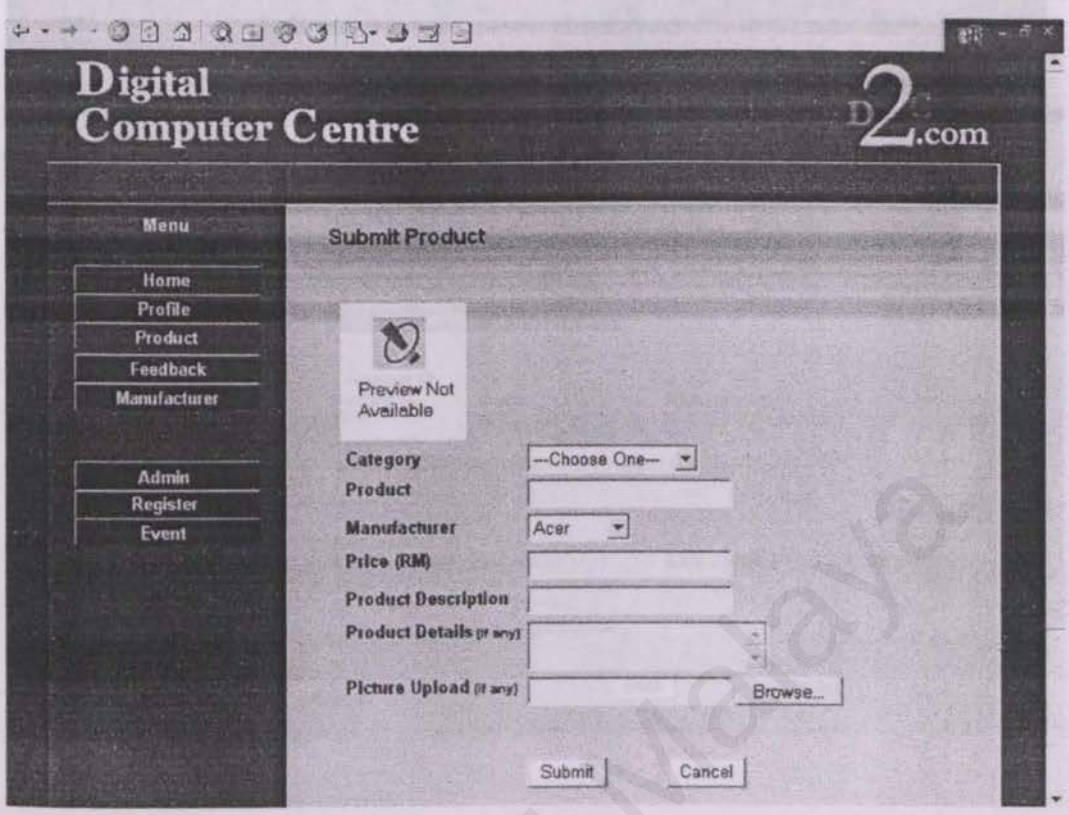
1. **Click Edit button to modify the record.**
2. **Click New button to add new product.**
3. **Click Back button to return previous page.**

x). **Edit Product**



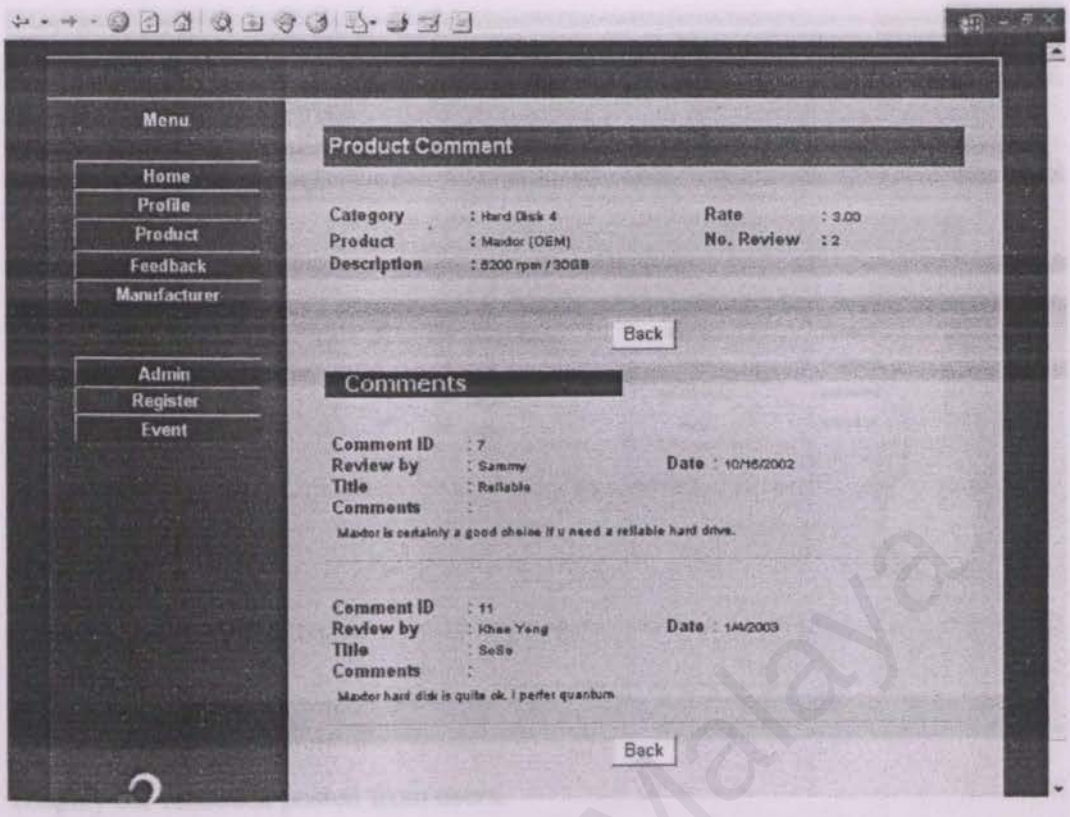
This page allows administrator to edit a product record as well as to change the product's image. Use the browse button to select a new picture. Click Update after modify the record. Error message will be displayed if require fields are blank. Click Cancel button to cancel the operation.

xi). **Add Product**

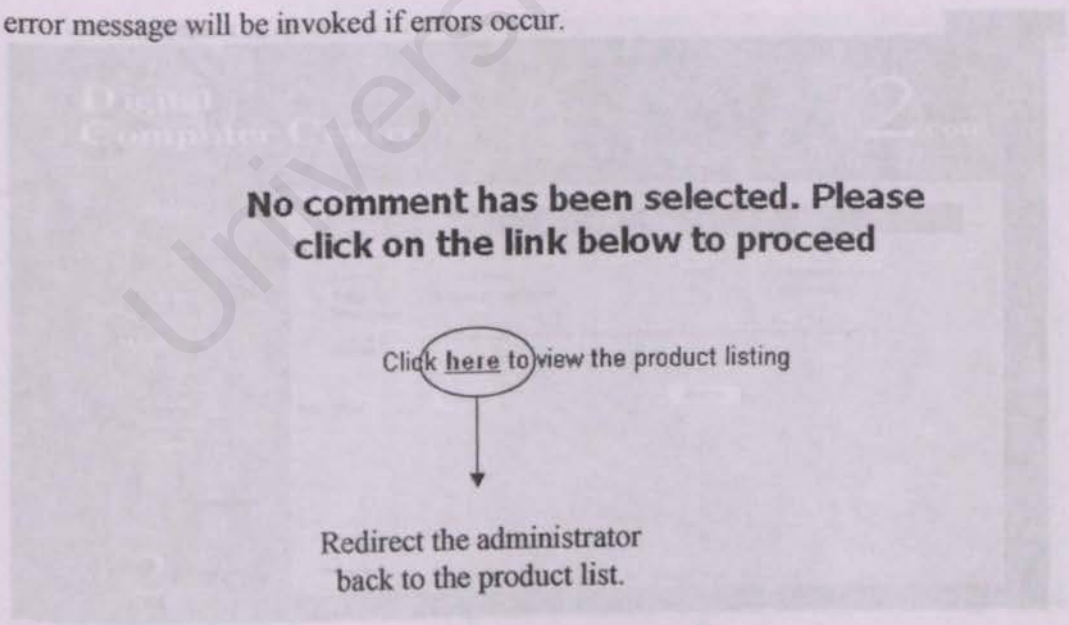


Add new product to the database. Use the Browse button to choose the product image. Click Submit button to update the database and click Cancel to terminate the process.

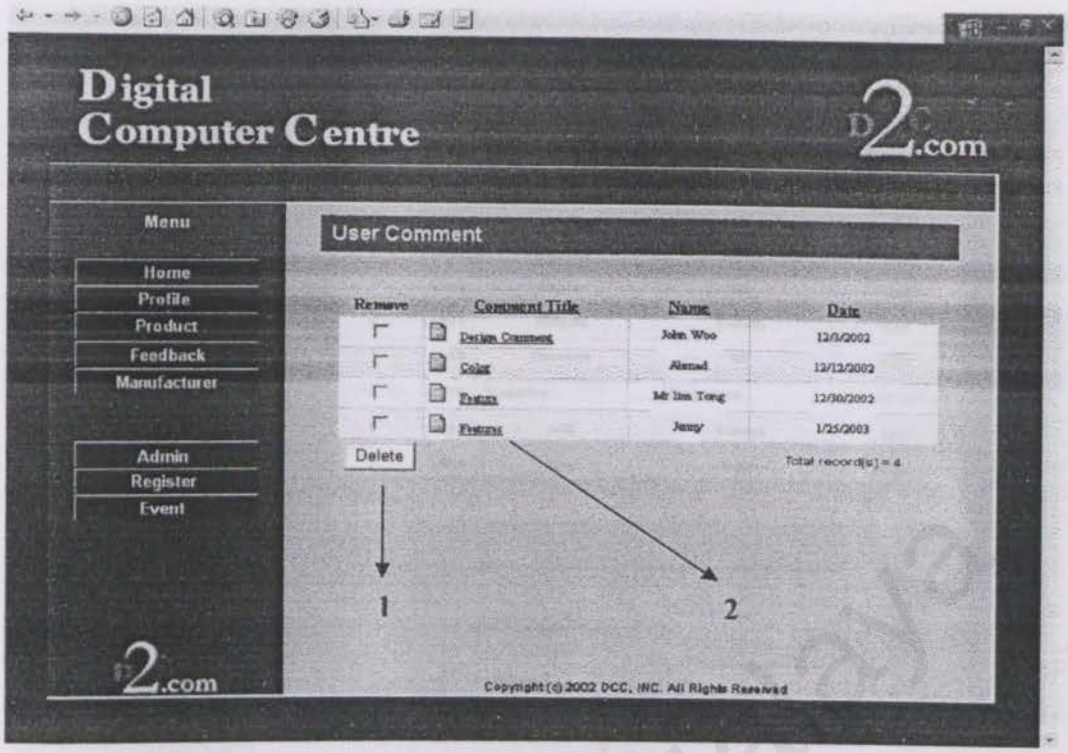
xii). View Comment



This page displays the product's comment(s) which is submitted by the users. An error message will be invoked if errors occur.



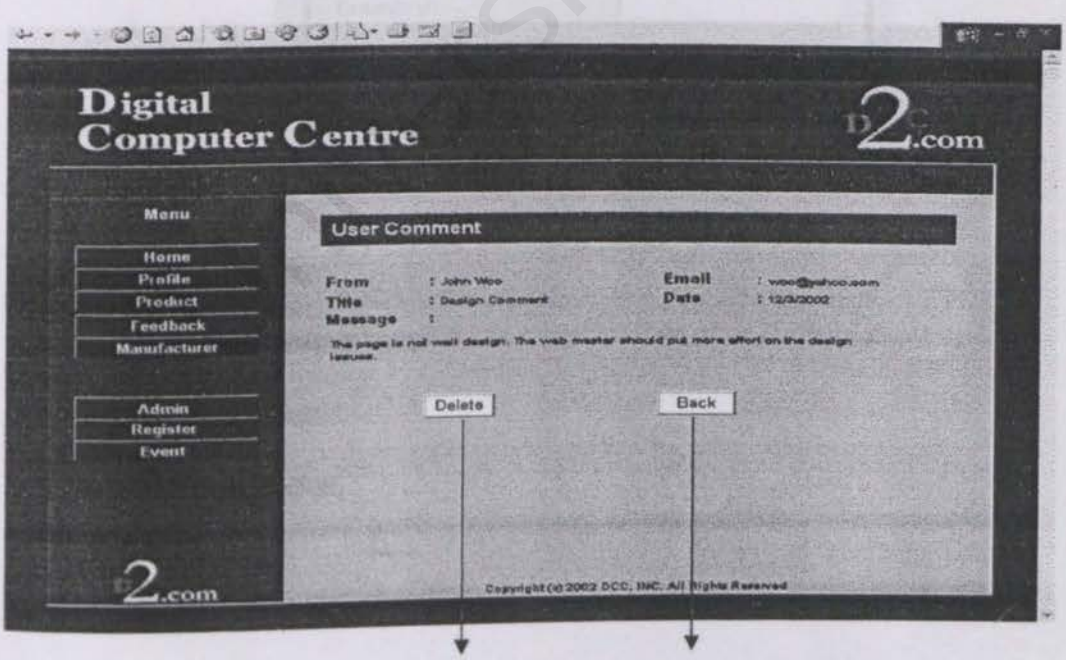
xiii). User Feedback



Display the feedback posted from users.

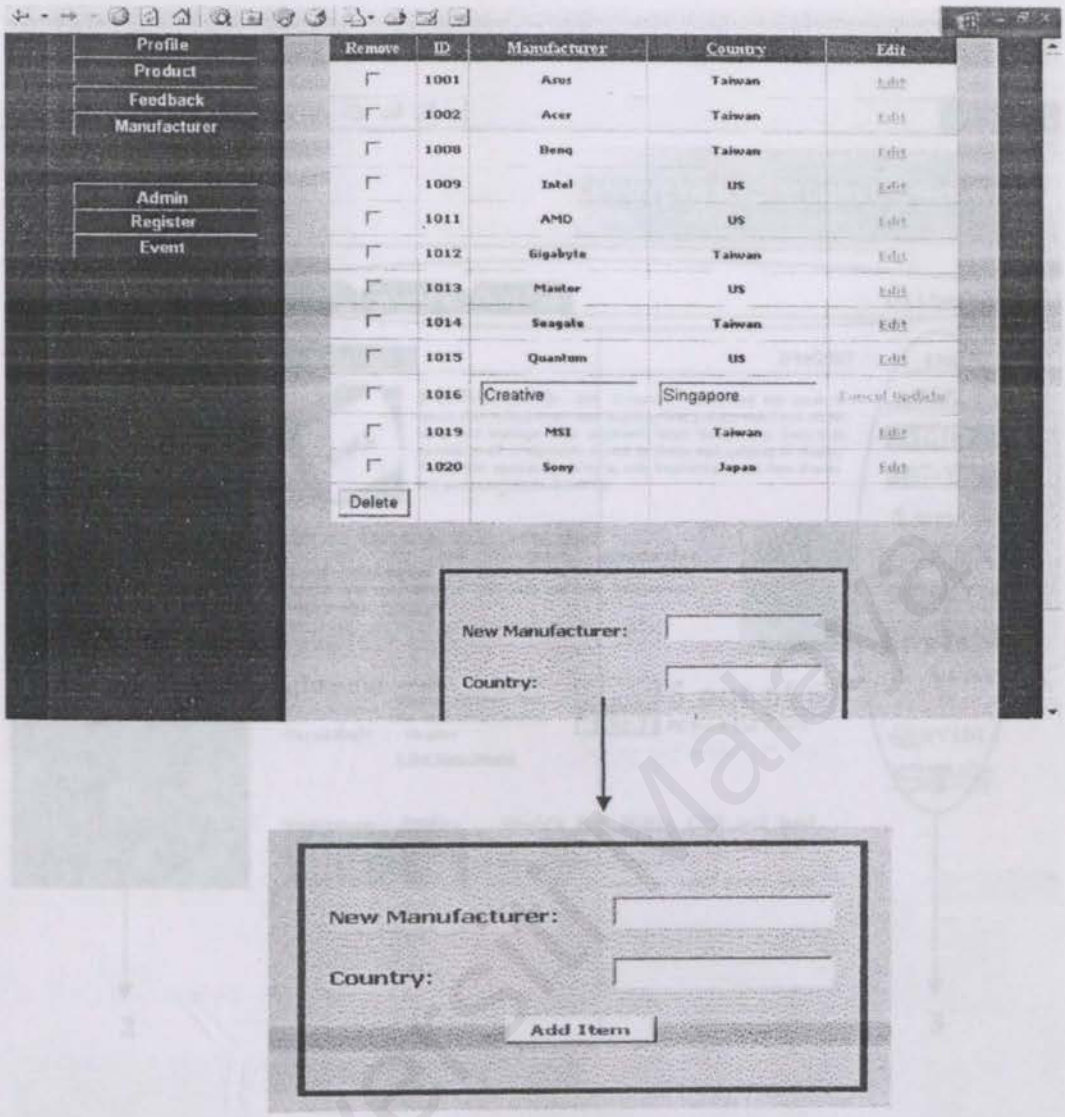
1. **Delete the feedback of users.**

2. **Click to view the feedback.**



Delete comment Back to previous page

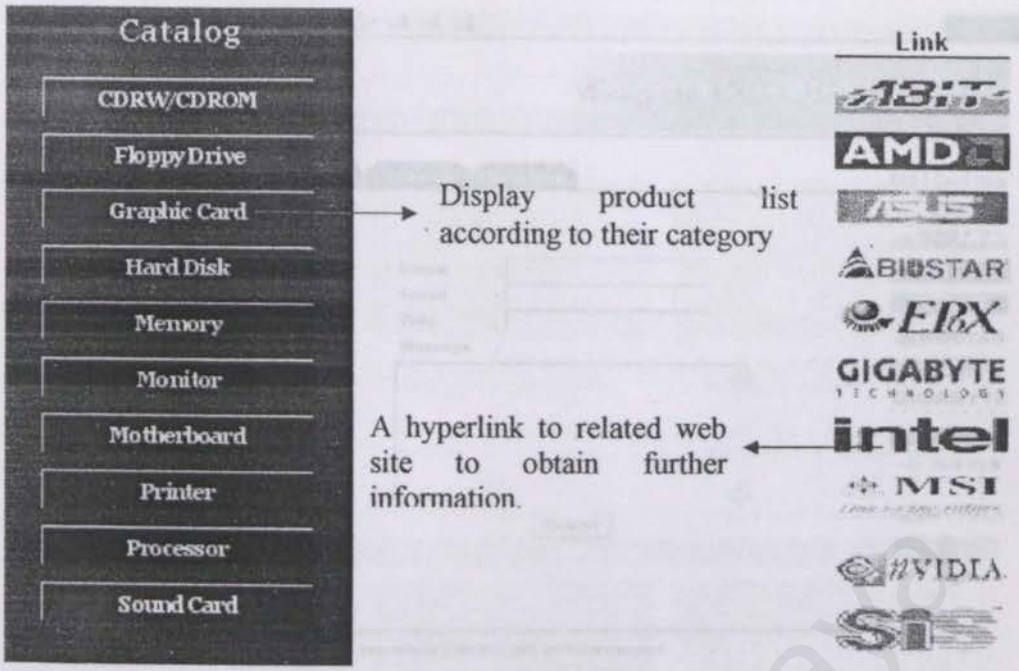
xiv). Manufacturing



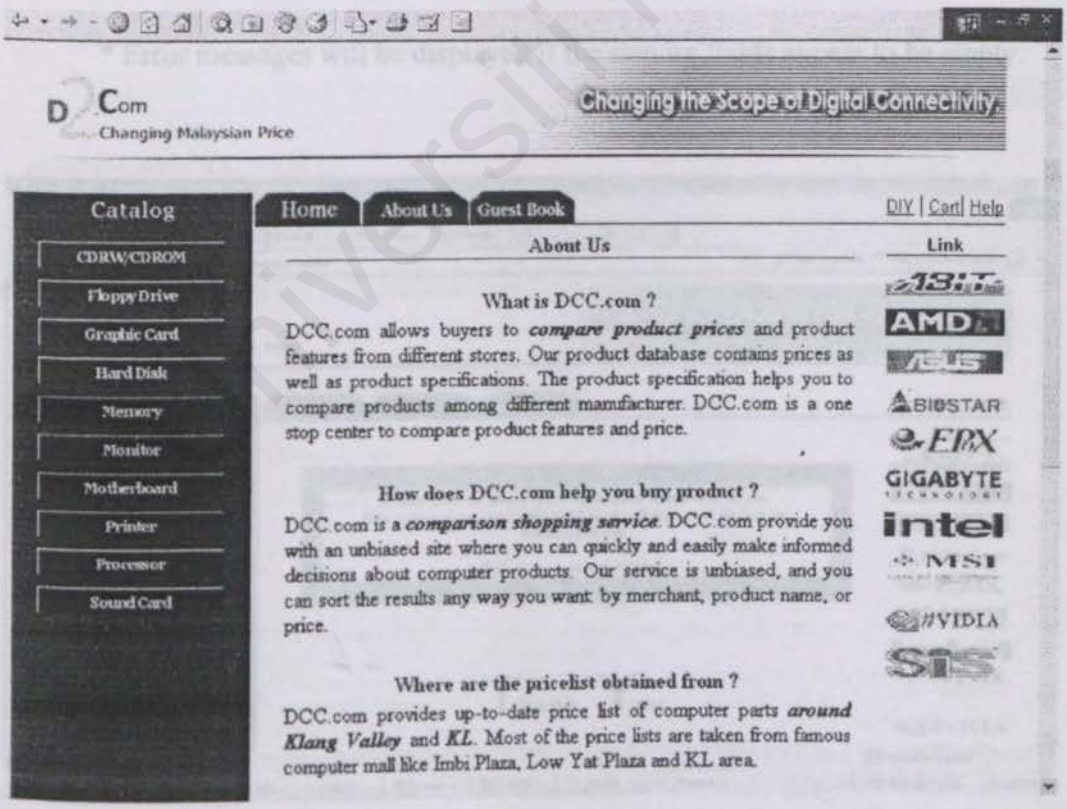
Add new manufacturer:

1. Insert new manufacturer name.
2. Enter the country name.
3. Click Add Item Button.

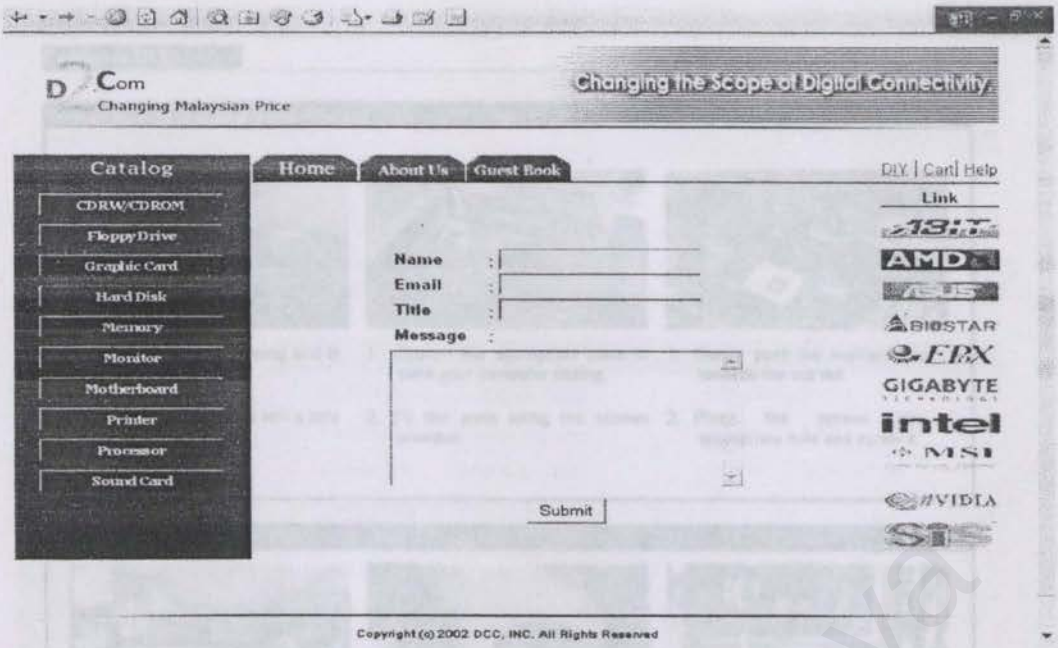
2. Product Catalog **3. Link Menu**



ii). About Us



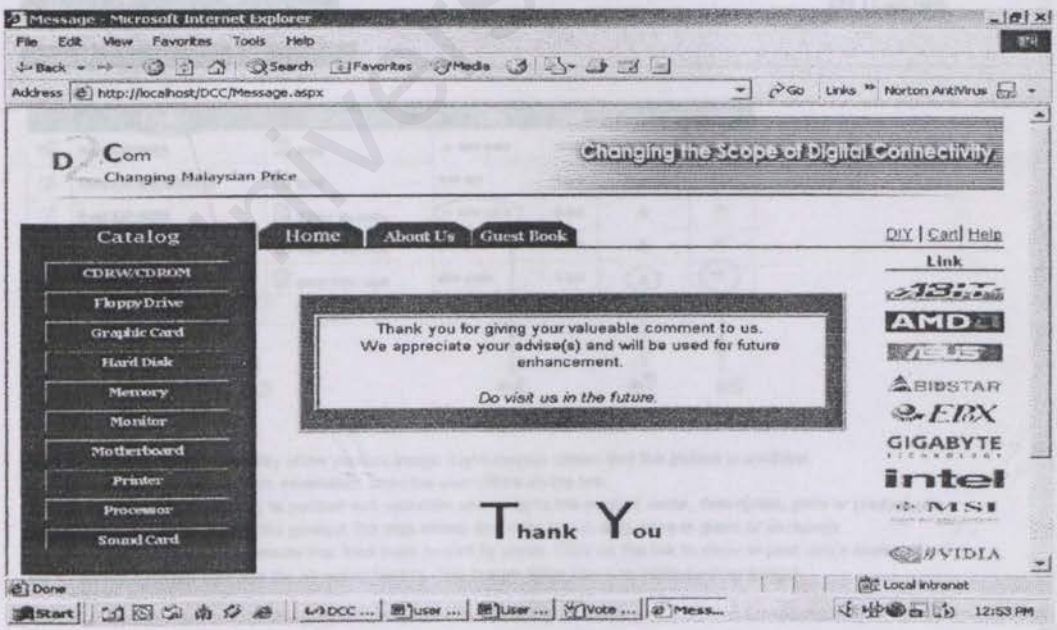
iii). Guestbook



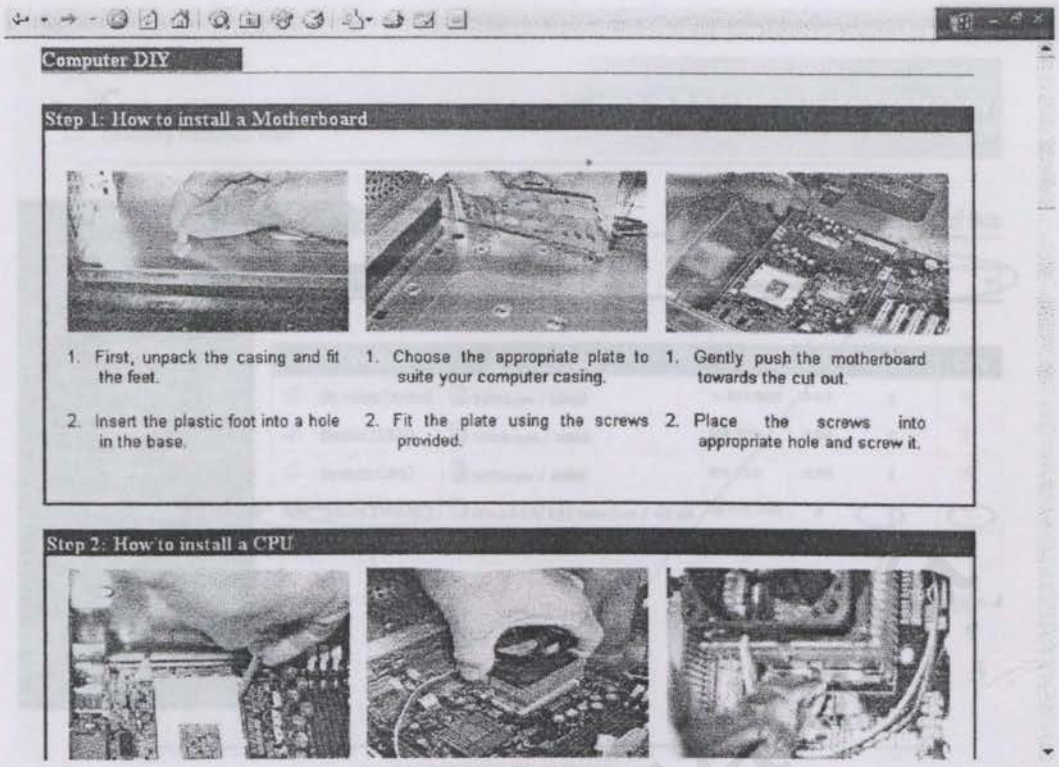
Post Comment/Question:

1. Enter the data as required by the form.
2. Click Submit to post the comment/question.

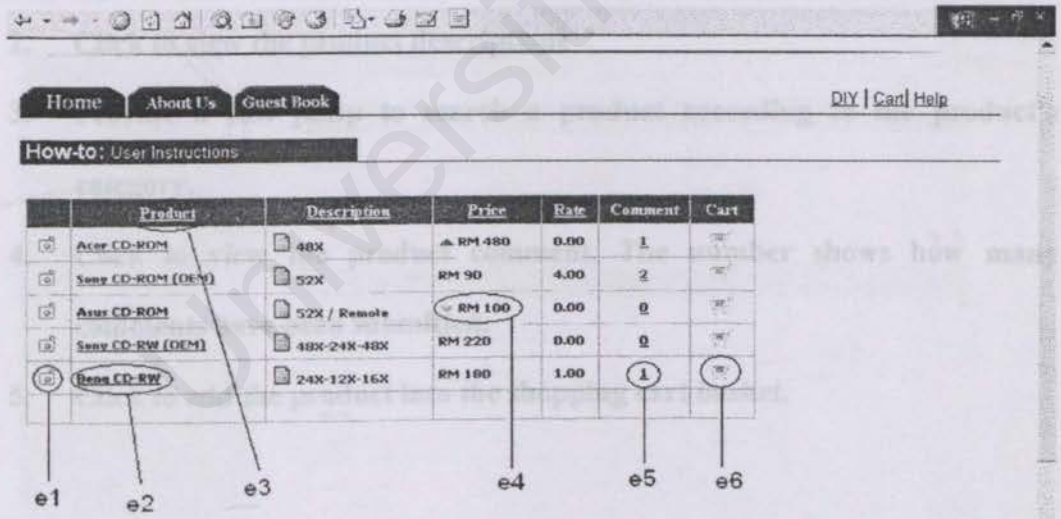
* Error messages will be displayed if the require fields appear to be empty.



iv). DIY

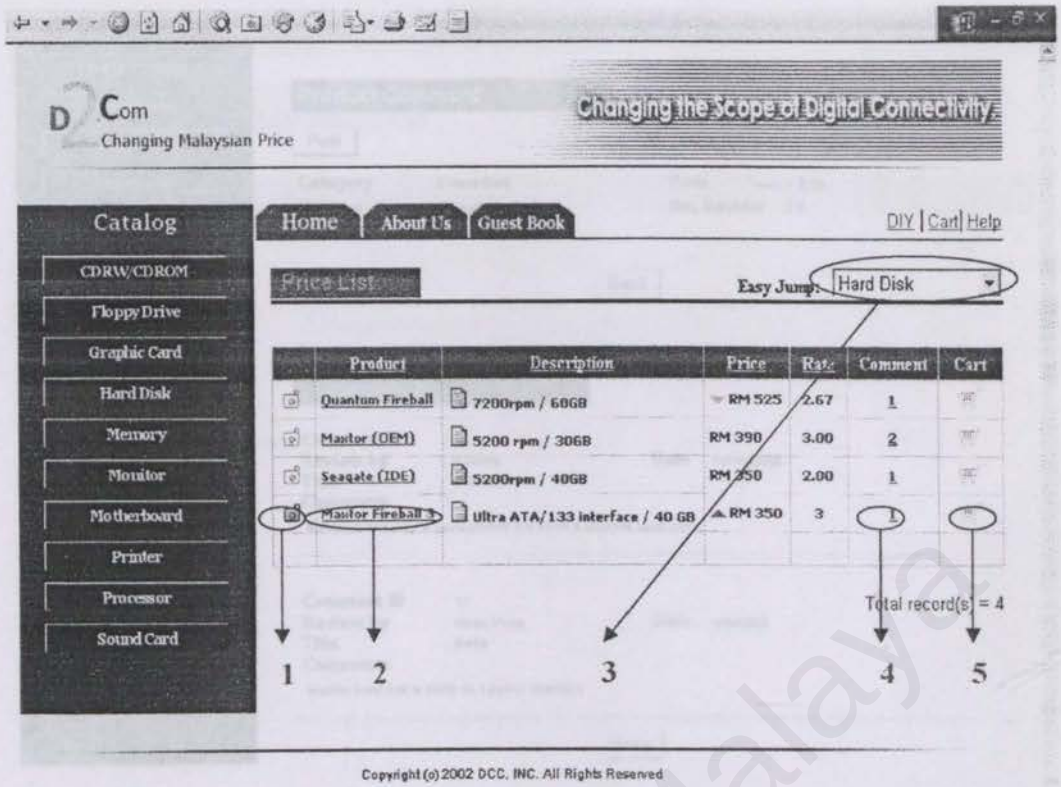


v). Help



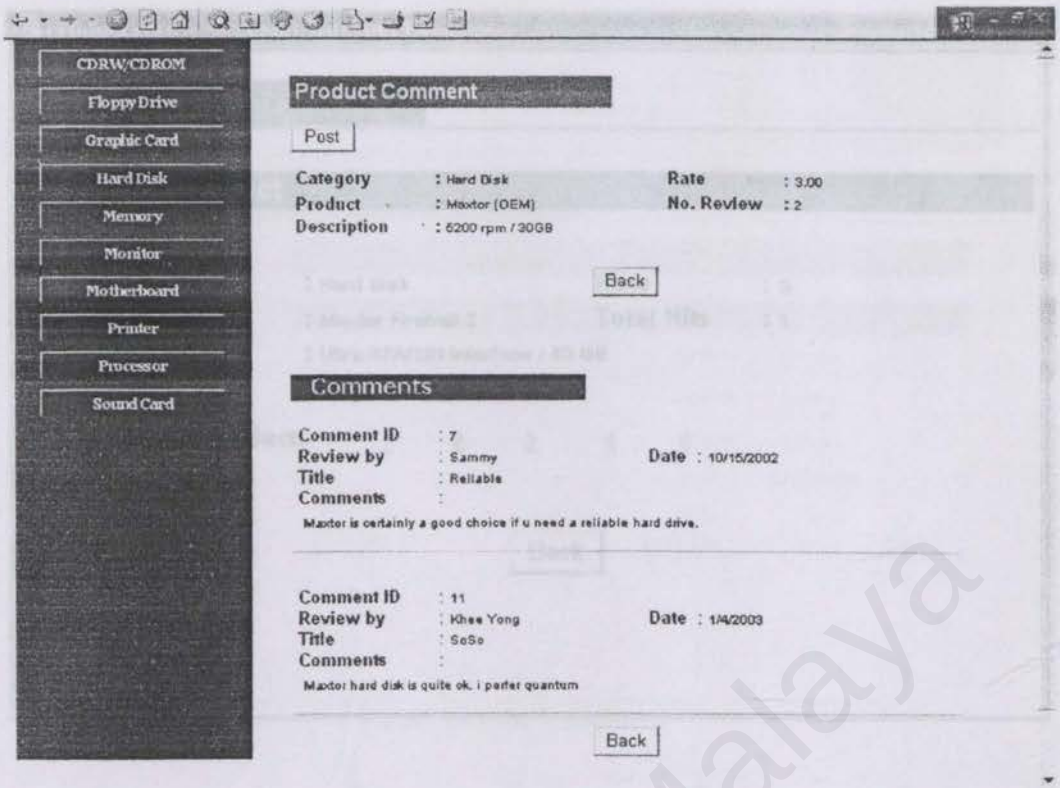
e1 - Indicated that the availability of the product image. Light camera shows that the picture is available.
e2 - Show the particular product information when the user clicks on the link.
e3 - Click the selected subject to perform sort operation according to the product name, description, price or product rate.
e4 - Show the current price of the product.The sign shows rise price in red, drop price in green or unchange.
e5 - Show the number of comments that have been posted by users. Click on the link to show or post user's commnets.
e6 - Add the selected item into the shopping basket. This feature helps users to estimate thier budget.

vi). **Product List**

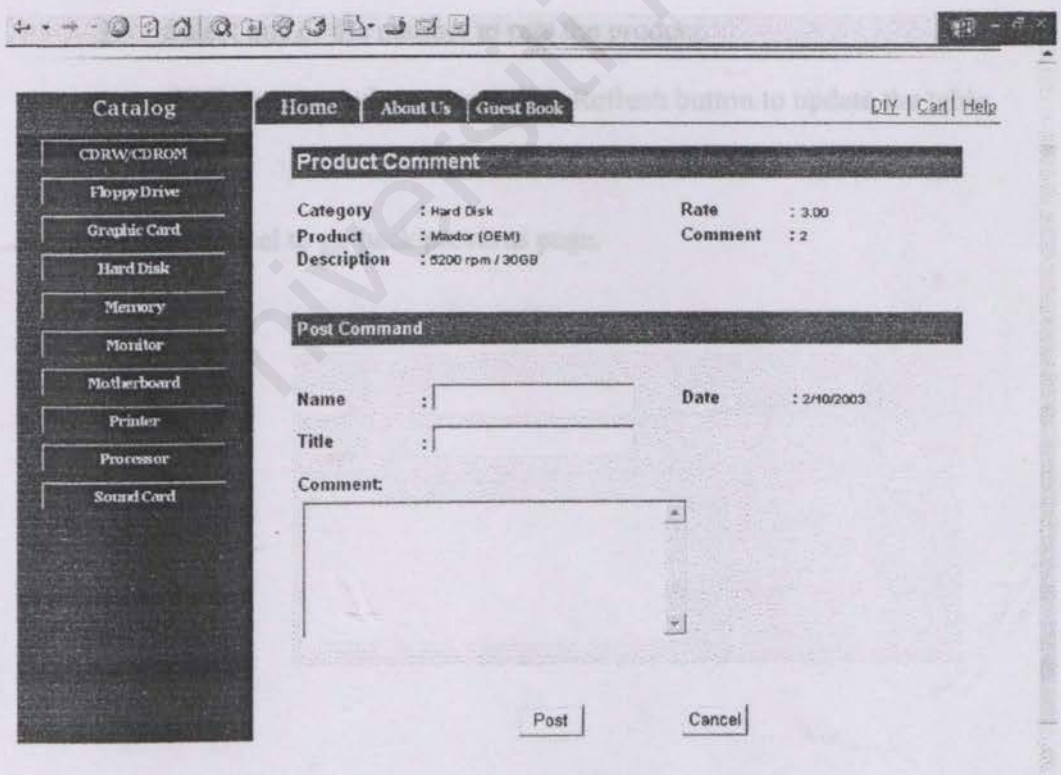


1. **Indicate that a product image is available or not.**
2. **Click to view the product descriptions**
3. **Provide a fast jump to search a product according to the product's category.**
4. **Click to view the product comment. The number shows how many comments have been submitted.**
5. **Click to add the product into the shopping cart basket.**

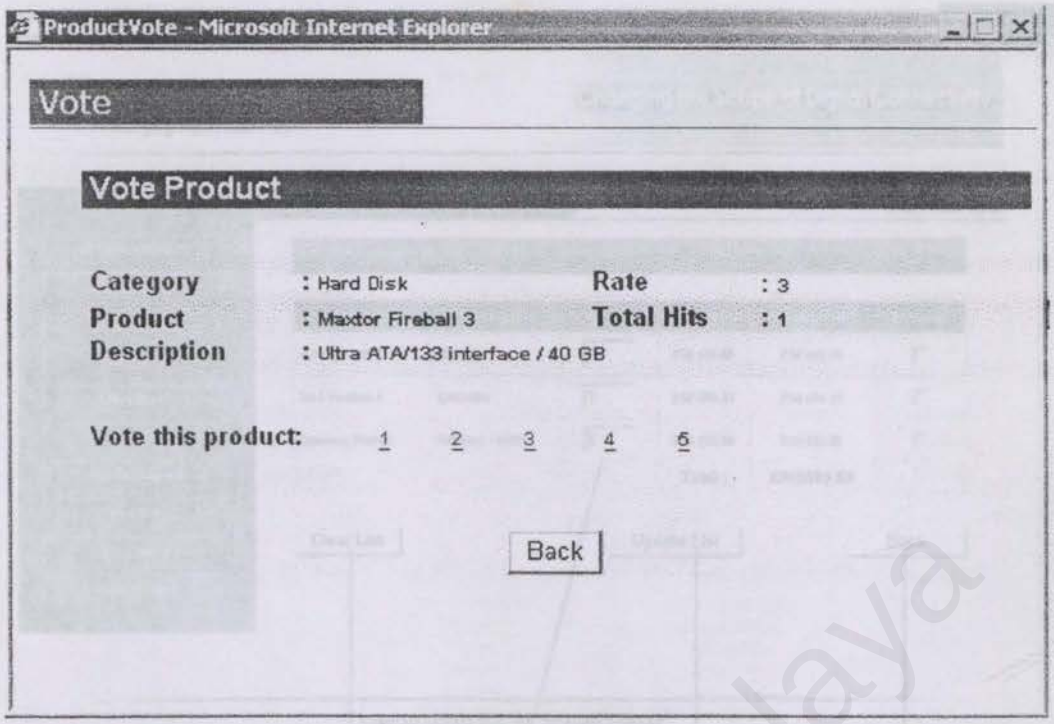
vii). Product Comment



viii). Post Product Comment



ix). **Vote Product**

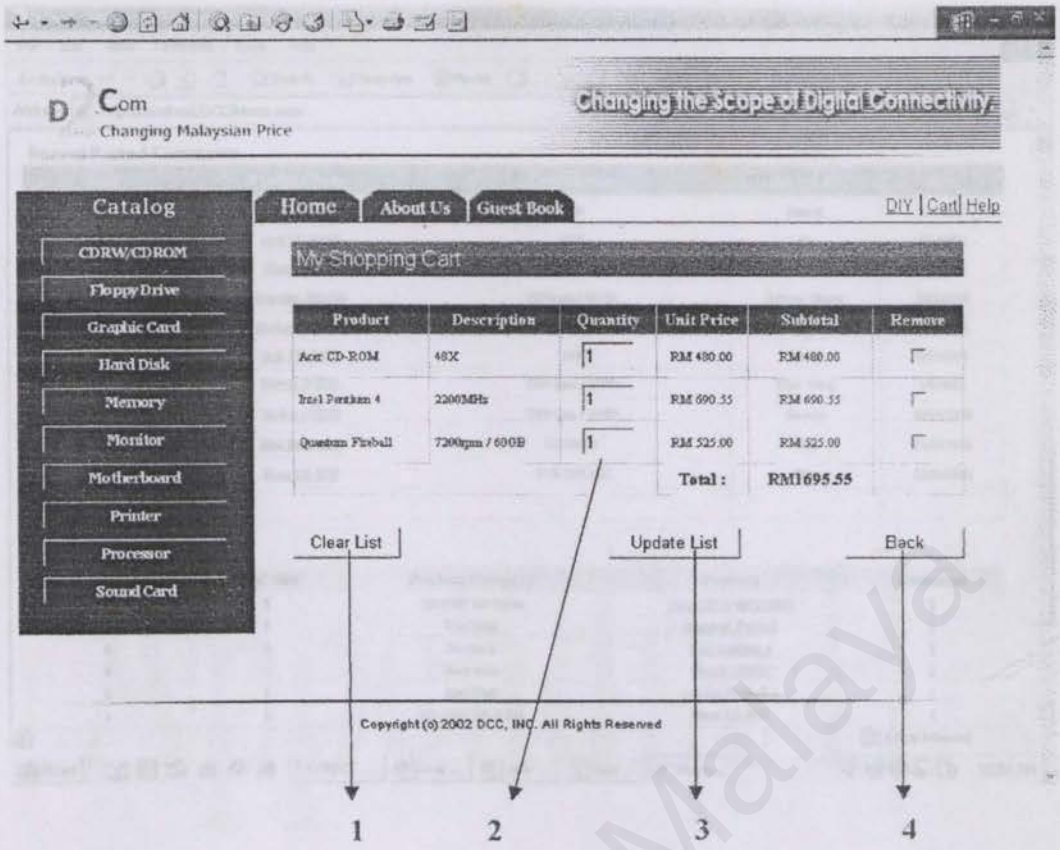


Vote Product:

1. Select one of the number to rate the product.
2. Close the vote window and click Refresh button to update the table.

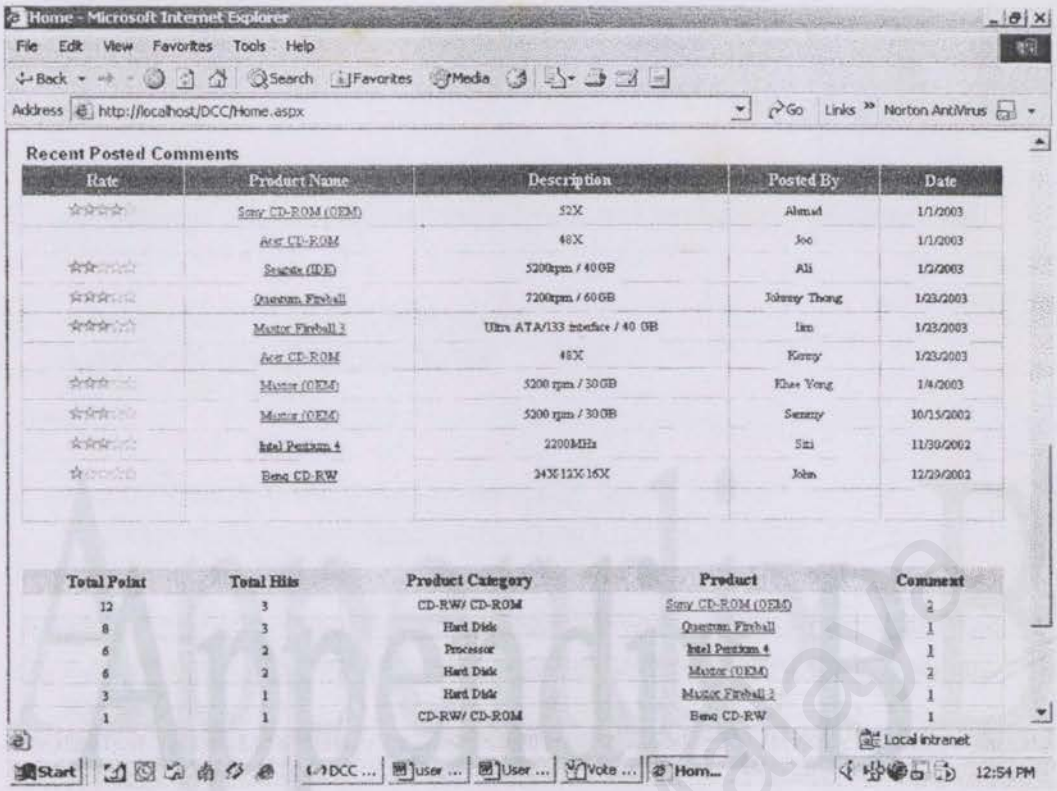
* Click Cancel to go back previous page.

x). **Shopping Cart**



1. **Click to explicitly clear all the shopping cart items.**
2. **Modify the order quantity of a product.**
3. **Click to update the cart items.**
4. **Click to return previous page.**

xi). Top Ten



Appendix B

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