Faculty of Computer Science

and

Information Technology

University of Malaya

Online University Used Book Center

Prepared by

Chang Mei Ying
WET 990088

Session 2002/2003

Department of Library and Information Science

Under the Supervison of
Cik Rafidah Mohd. Noor

Moderator
Cik Fazidah Othman

Dissertation submitted in partial fulfillment of the requirements for the Degree of Bachelor of Information Technology

ABSTRACT

Online University Used Book Center (OUUBC) is a web-based application to provide undergraduate, graduate student and public in Malaysia environment to buy and search the university used books online. Next, it enables administrator to coordinate the task and manage the database online. The main objective of OUUBC is to sell and search the university used books in order to increase work efficiency. A thorough research and analysis has been done. The information gathered via the Internet, library and the observation of existing website. PHP (web development), MYSQL (database) and Apache (web server) have been chosen as the development tools for OUUBC, base on their strength and outstanding advantages compared to other in-market tools. The functional requirements for OUUBC are membership, search function, online purchasing and administration features. The most significant feature that makes OUUBC different from other existing product is provides the services using the advanced online technologies. Besides, OUUBC eliminates the expensive shipping charge by the existing system, via the delivery service by POS Malaysia. Finally, OUUBC is expected to provide a user friendly interface that save the time for users and administrators.

ACKNOWLEDGEMENTS

I would like to express my deepest thanks and appreciation to Cik Rafidah Mohd.Noor as my project supervisor who has given me continuing guidance, support and advice throughout the development of Online University Used Book Center. I especially hope to thank her for her valuable persistent patience in identifying and adjusting my points of view whenever there is a shortcoming. Special thanks to my project moderator, Cik Fazidah Othman for her precious opinions and constructive comments on my project proposal presentation.

I also extend my appreciation to my lecturers, course mates, friends, and the staffs in FSKTM who are willing to help me.

I wish to acknowledge my beloved family, thanks for supporting me, and being tolerate and considerate to me during this project.

Thank you very much.

Chang Mei Ying

WET 990088

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Chapter 1 - INTRODUCTION

1.1 Project Overview

Nowadays, electronic commerce (e-commerce) has become a form of popular online business. There are a lot of companies that involve in e-commerce have gain high revenue and performance in their business, such as amazon.com. Nonetheless, many small and medium size businesses still maintain the traditional way and conduct business at physical stores only. The most probably reasons they do not involve in e-commerce are lack of Information Technology (IT) knowledge and high cost to have their own web sites.

The e-commerce still a new concept in Malaysia. This concept will be introduced into my project, which aims at developing a web application of electronic commerce on the title "Online University Used Book Center".

An online university used book center is a business to consumer that sells used books. The business here refers to the owner of the site while the consumer refers to the customers of the site in Malaysia. This is also a storefront model in electronic commerce, which allows the interaction between the buyers and sellers directly.

The project has been naming "Online University Used Book Center" (hereinafter known with the abbreviation **OUUBC** in the following parts), which means to electronic university used book center in Malaysia.

The OUUBC performs the daily buying and selling used books activities in the Internet environment. It handles the transaction online with the new and advanced technologies like the shopping cart. This benefits both the owner and the consumers by expanding the business widely and makes the book shopping a pleasant experience for customers.

In addition, the OUUBC is expected to cater the users' preference with the value added to the site such as search books and book display.

1.2 Objectives of the Project

The main objective of this Online University Used Book Center is to build a web application on an online university used book center that store and sells used books locally.

The proposed project hopes to achieve the following objectives:

a. To provide an efficient website for purchasing used books in local universities.
b. To provide a local space for users searching university used books.
c. To build a database that enable to manage the used books in book center.
d. To form an electronic environment eases for administrators to manage the online university used book center.

1.3 Project Scope

The major goal of the OUUBC is to provide an effective and time-efficient web application in handling the selling university used book, which only for registered members. A simple and an interactive user interfaces will be adopted whenever users need to log in, search and purchase. The OUUBC comprises two main modules – Administrator and Non-Administrators, together with 7 integrated sub-modules are provided to keep track of each process of this project. The Administrator module and Non-Administrators module are designed to separate activities that can be undertaken by each user group.

1.3.1 Administration Module

The Administrator module allows assistant registrars who are responsible for handling the OUUBC website. This module provides templates for assistant registrars to perform the maintenance task in the site and managing the database efficiently. Administrators can view the transactions done by users, delete users, and search for users whenever it is needed. Besides, administrator can manage the status of books order by users with the notice 'Shipped' or 'Pending'.

The proposed main features of this module are as follows:

(a) Transaction Management sub-module

The Transaction Management sub-module create template for the administrators to check the ship order books in the university used book center. All the monetary transactions are in Ringgit Malaysia (RM). All the charges on delivery services are based on the POS Malaysia parcel delivery rates.

(b) Login sub-module

The Login sub-module will handle the validation of the administrator through ID name and password. It will authenticate whether the user is an administrator or a normal user and display the login page again if the login failed.

(c) User Management sub-module

This module will create templates for the administrator to perform the management of the OUUBC members information. Administrator can view the users' record such as the quantity of book order and the status of the ship order. Besides that, administrator also can delete the selected users from the user list.

(d) Search for user sub-module

The Search for user sub-module is provides the functions to search the users in OUUBC. Above and beyond, this sub-module will generate the result of search users and display the users record when administrator click on to see.

1.3.2 Non-Administrators Module

The Non-Administrators module enables the registered users to login using password. Basically, unregistered users are allowed to view the web page only.

The sub-module proposed is as follows:

(a) Login sub-module

The Login sub-module will handle the validation of the user through ID name and password. It will determine whether the user is an administrator or a normal user. This sub-module also can check for whether the user had type in the correct ID name and password. New user will required to register before login.

(b) Search sub-module

Search sub-module allows searching of requested university used books by every registered user of the proposed project. It will process user's request and get the relevant information from the database. Therefore, this sub-module saves users' time and effort in browsing the OUUBC.

(c) Online Purchasing sub-module

The Online Purchasing sub-module will allow registered members to select and purchase university used books via shopping cart technology. Users are provided with the delivery services.

1.4 Project Limitations

The limitations of OUUBC are listed as below :

- OUUBC only serves local users due to the expensive shipment to overseas.
- Some Malaysians still feel hesitant to give their credit card information online, due to the security issues.
- Not every clients use credit card, especially the undergraduate students.
- Clients might feel unreliable on the books condition since they do not glimpse the books themselves.

However, the OUUBC has the following assumptions :

- All the delivery services handle by POS Malaysia.
- OUUBC has an access line directly linked to the internet.
- Assumes that clients who visit to the purchase site using credit card are trust OUUBC in the online monetary transaction services.

1.5 Project Schedule

Figure 1.1 shows a Gantt chart for the Online University Used Book Center. Project development Part I comprises four chapters, which are Introduction, Literature Review, Methodology / System Analysis as well as System Design, whereas the project development Part II consists of the other three chapters, which includes System Implementation, Testing as well as the System Evaluation and Conclusion.

Throughout the whole process of system development, documentation is carried out from time to time to keep track of any project changes and work done.

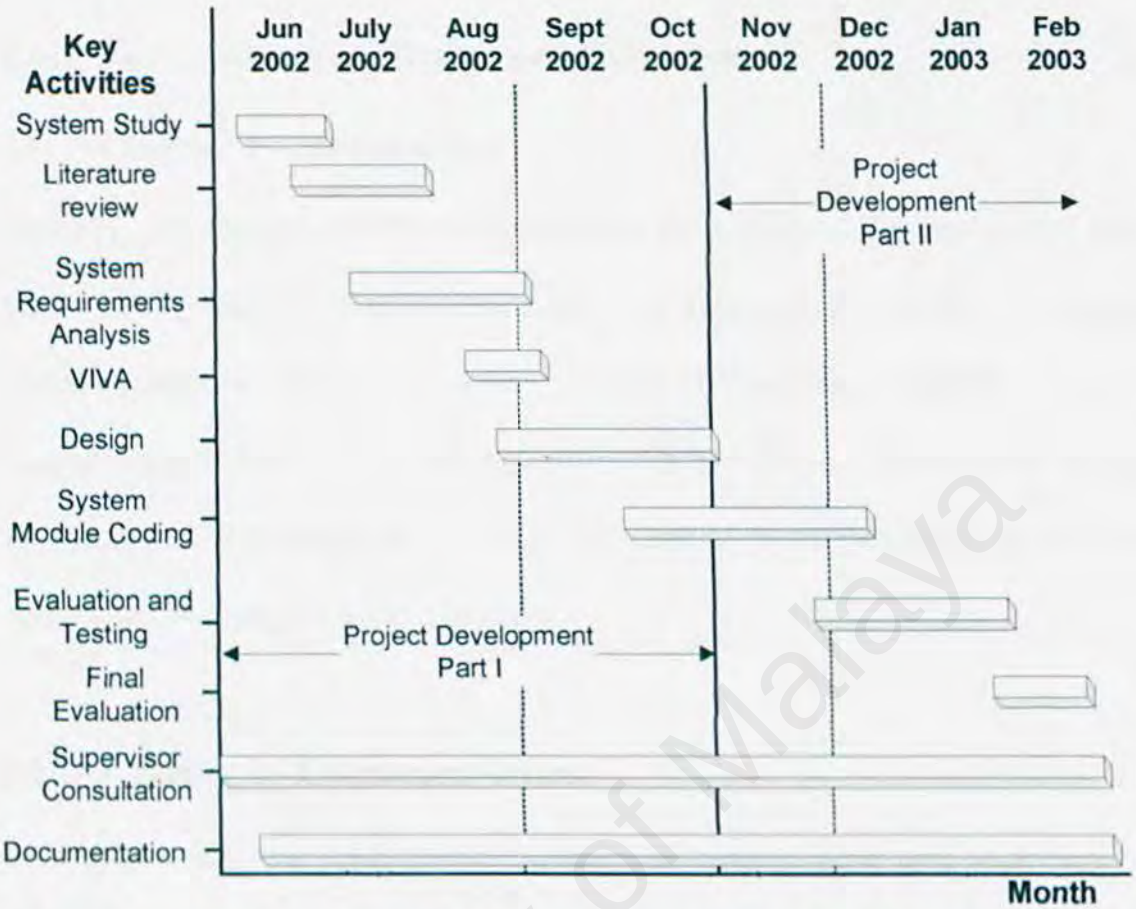


Figure 1.1 The Gantt Chart for Online University Used Book Center Development Schedule

1.6 Organization of the Thesis

1.6.1 Part 1 – Analysis, Design and Development

(a) Chapter 1 – Introduction

Basically, this chapter presents the introduction on the Online University Used Book Center as one kind of electronic-commerce that appear as a new form of business nowadays. Base on the historical survey, the idea of developing a web-based business merged and its objectives were stated clearly in this first chapter. The methodology used for this project was introduced as well as the scope of the project, which gives a brief explanation on separate project's modules.

(b) Chapter 2 –Literature Review

This chapter discusses the review of literature on existing online used book center. A wide scope of research findings is obtained from various sources (through library of University of Malaya, online website, articles, reference books). Generally, Part I consists of the general review of literature on electronic commerce, whereas Part II comprises the analysis on similar existing website in the market. Besides this, a brief overview on all the relevant technologies in the market will be included as well.

(c) Chapter 3 – Methodology / System Analysis

Apart from the study on system requirements, an overview on the methodology and system analysis is carried out. In this case, the methodology, mechanism and approaches that will be used in develop the system are decided.

(d) Chapter 4 – System Design

In this phase of systems development life cycle, three-tier application architecture, interfaces design, database design and logical data flow design will be taken into account. All the related data flow diagrams will be included as well.

1.6.2 Part 2 – Development and Evaluation

(a) Chapter 5 – System Implementation

The Online University Used Book Center built will be implemented after the completion of the designing phase. Here, the designed system is developed according to the specified requirements.

(b) Chapter 6 – Testing

In this chapter, explanations on approaches used for the project debugging and testing will be described. Evaluation is based on achieved and unachieved objectives as well as problems encountered and solutions taken during the project development.

(c) Chapter 7 – System Evaluation and Conclusion

When come to system evaluation and conclusion of the final product, strength, weaknesses and limitations of the developed system will be stressed. In this chapter, suggestions and proposal for future enhancement will be delivered.

CHAPTER 2

LITERATURE REVIEW

2.1 The Electronic Commerce in Online University Used Book Center

2.2 E-Commerce

2.3 Online University Used Book Center

2.4 Analysis of Existing Online University Used Book Center

Chapter 2 – LITERATURE REVIEW

2.1 The Electronic Commerce in Online University Used Book Center

It is appropriate to begin by defining what is **Electronic Commerce (E-Commerce)**? To many people, the term e-commerce means shopping on the part of the Internet called World Wide Web (the Web). The Pew Internet and American Life Project is funded by the Pew Charitable Trusts, and began conducting several long-term research projects in 2000 and 2001 to study the growth of the Internet and its effects on society. Pew Project studies concluded in early 2001 found that about 60 percent of U.S. households had Internet connections, and about 16 percent of those were using those connections to buy goods and services. **(Gary P. Schneider)**

Despite the fact that the research above is found in foreign country, Malaysia are now transmittable to IT-knowledge based country, especially with the development of Multimedia Super Corridor (MSC). Therefore, it can be said that the households in Malaysia are no longer using the facilities of Internet to buy goods and services.

2.2 E-commerce

Electronic Commerce has different definitions, as below :

- From a *communications* perspective, electronic commerce is the delivery of information, products or services, or payments via telephone lines, computer networks or any other means.

- From a *business process* perspective, electronic commerce is the application of technology toward the automation of business transactions and workflows.

- From a *service* perspective, electronic commerce is a tool that addresses the desire of firms, consumers, and management to cut service costs while improving the quality of goods and increasing the speed of service delivery.

- From an *online* perspective, electronic commerce provides the capability of buying and selling products and information on the Internet and other online services.

All of the above definitions are valid. It is a matter of which lens is used to view the electronic commerce landscape. Broadly speaking, electronic commerce emphasizes the generation and exploitation of new business opportunities and, to use popular phrases: "generate business value" or "do more with less'. Electronic commerce endeavors to improve the execution of business transactions over various networks. These improvements may result in more effective performance (better quality, greater customer

satisfaction and better corporate decision-making), greater economic efficiency (lower costs), and more rapid exchange (high speed, accelerated, or real-time interaction). More specifically, electronic commerce enables the execution of information-laden transactions between two or more parties using interconnected networks. These networks can be a combination of POTS (plain old telephone system), cable TV, leased lines, and wireless. Information-based transactions are creating new ways of doing business and even new types of business. (Kalakota and Whinston p.3)

2.2.1 B2B (Business to Business) (Berger)

B2B is an acronym for business-to-business, a type of e-commerce involving a transaction from one business to another via the Net. B2B incorporates everything from manufacturing to solution providers. With improved efficiency and lightning speed, businesses can access procurement sites and services to get multiple bids, issue purchase orders, make payments, etc. The volume of money involved in B2B transactions has already surpassed individual consumer transactions by10:1 as reported by the Aberdeen Group. In addition, the potential growth is impressive. The Yankee Group predicts American business-to-business commerce will grow 41% annually over the next five years.

2.2.2 B2C (Business to Consumer) (Berger)

B2C is similar to traditional retailing by a business to a consumer. The novelty is that the retailing is now done on the Internet rather than at a brick and mortar store location. Note that the novelty is the medium used, in this case, the Internet. The idea of using a different approach for retailing rather than a fixed store location has been around awhile. Back in 1886, a jeweler unhappy with a shipment of watches refused to accept them. Much to the delight of the manufacturer, a local telegraph operator bought the whole shipment. Being an opportunist, he used the telegraph to sell all the watches to fellow operators and railroad employees.

2.2.3 Transactions and business Processes (Gary P.Shneider)

The transactions and business processes that companies, governments, and other organizations undertake on the Internet to support selling and purchasing activities.

2.2.4 Storefront Model

A storefront e-commerce allows the buyer and the seller to interact directly. The on-line seller offers items for sale, takes the orders on-line, accepts payments securely, and then sends the merchandise to the consumer. The Web allows small and large businesses to conduct commerce on an equal footing 24/7 and around the world. An important part of e-commerce is the on-line shopping cart, which allows the consumer to "pick up" and accumulate items they want to buy while they continue to shop for more. (Geocities)

To some people, a products-offered site is narrowly defined as a "true" eCommerce site. A website that offers products for sale is the electronic version of a catalog. These virtual storefronts are built to describe the offering with pictures and words, offer promotions, provide a "shopping cart," and complete the purchase transaction. Once the product is purchased, the cyber enterprise arranges for product fulfillment including shipping and handling. The fulfillment is sometimes completed by the website enterprise or directly from the manufacturer in a drop shipping arrangement. Some manufacturers are now passing up the intermediary wholesalers and retailers by offering their products directly to consumers. This collapsing of the supply chain is called disintermediation.

Although the vast majority of these sites offer tangible products, they can work for service products too. The primary characteristic of these types of sites is the ability to make a one-time purchase with no future obligations.
(Samuelsan)

2.2.5 Transaction

Transactions are exchanges that occur when one economic entity sells a product or service to another entity. A transaction takes place when a product or service is transferred across a technologically separable interface that links a consumer (client) with a producer (server). When buyer or seller transactions occur in the electronic marketplace, information is accessed, absorbed, arranged, and sold in different ways. To manage these transactions, electronic commerce also incorporates transaction management, which organizes, routes, processes, and tracks transactions. Electronic

commerce also includes consumer making electronic payments and fund transfer. (Lauden)

Diagram below shows the flows of information when a transaction occurred.

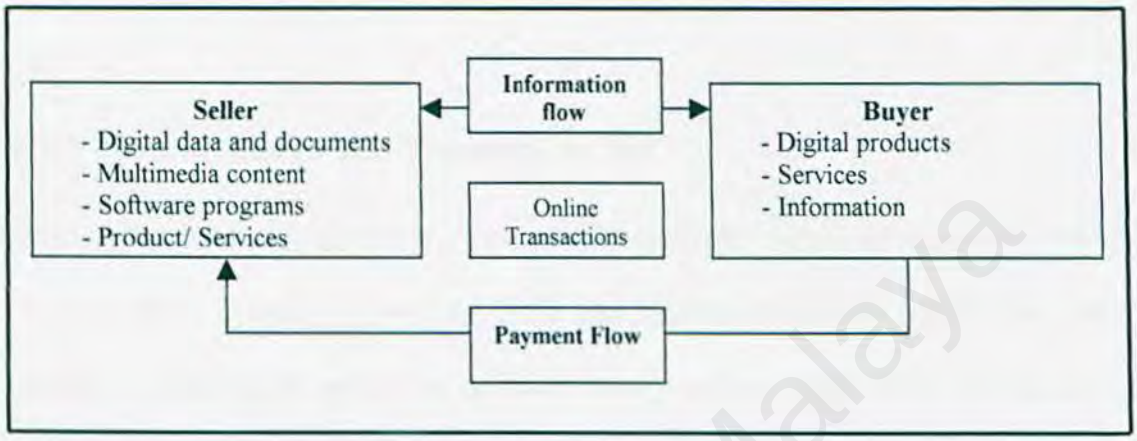


Figure 2.1 Buyer / Seller Transactions

2.2.6 Cyber Cash

CyberCash enables businesses to receive payments through the Internet. CashRegister, an online service created by CyberCash, makes it possible for merchant to receive credit card numbers, offer the numbers to the appropriate financial institution for validation and accept credit-card payments in a secure environment over the Web. CashRegister can process all major credit cards, such as Visa, MasterCard, Discover/Novus, and some debit cards.

The CashRegister process begins once a customer is finished shopping on a merchant's Web site. The customer completes a form, entering credit card and shipping information,

and is presented with a screen containing items selected, prices and billing information. This information is then sent to CyberCash for validation. Once validation is received, the purchase can be completed, and funds are transfer electronically from the customer's account to the merchant's account. (Dietel, Dietel & Nieto p.137)

2.2.7 Secure Electronic Transaction (SET)

Secure electronic transactions is a protocol for encrypted credit card payment transfers. Announced in February 1996, by VISA and MasterCard, SET establishes a single technical standard for protecting payment card purchases made over the Internet and other open networks. Participants in the SET consortium include Microsoft, Netscape, GTE, IBM, SAIC, Terisa Systems, and Verisign. SET is based on public-key encryption and authentication of cardholders, merchants, and acquirers; provide confidentiality of payment data; preserve the integrity of payment data; and define the algorithms and protocols necessary for these security services. (Kalakota and Whinston p.172)

2.2.8 Secure Sockets Layer (SSL)

Short for ***Secure Sockets Layer***, a protocol developed by Netscape for transmitting private documents via the Internet. SSL works by using a public key to encrypt data that is transferred over the SSL connection. Both Netscape Navigator and Internet Explorer support SSL, and many Web sites use the protocol to obtain confidential user

information, such as credit card numbers. By convention, Web pages that require an SSL connection start with *https:* instead of *http*.

Another protocol for transmitting data securely over the World Wide Web is *Secure HTTP (S-HTTP)*. Whereas SSL creates a secure connection between a client and a server, over which any amount of data can be sent securely, S-HTTP is designed to transmit individual messages securely. SSL and S-HTTP, therefore, can be seen as complementary rather than competing technologies. Both protocols have been approved by the Internet Engineering Task Force (IETF) as a standard. (Webopedia)

2.3 Online University Used Book Center

2.3.1 Introduction

Online University Used Book Center is still rare among the Internet users, especially in Malaysia environment. However, there are online used book center, which can be found in foreign country.

An Online University Used Book Center is a form of B2C (Business to Customer) which allow customers to search, shop, buy and arrange shipment online. It is the combination of virtual storefront model in e-commerce, security and information storage to facilitate the promotion of used book in the website.

The task for the online university used book center are typically same with the ordinary online book center. The different between both is their products, which the online university used book center selling the used book instead of selling the new books.

The basic feature for the online university book center are listed as below :

- Search function
- Shopping cart
- Used book online selling

Inspite of these, the online university book center also can have other feature as listed below :

- Books listing
- Members registration and login authentication

Following is the detail of each features' description listed above.

2.3.2 Search Function

A search function in an online used bookstore provides the book searching service to the users of the site. With the help of the search function, users can easily find the books they are looking for.

There are three categories in search function, the search by author, search by book and search the entire database. The search the entire database function allows users to search books with keywords. The keywords may be the title or author of the books.

The internal search engine that does the searching work and returns the related results from database to the user supports the search function in an online used book center.

The advantage of search engine is that it saves user's time in searching book. Instead of browsing the site to find a particular book, user can use the search engine to perform search and therefore get the return in a short while.

2.3.3 Shopping Cart

A shopping cart is a piece of software that acts as an online store's catalog and ordering process. Typically, a shopping cart is the interface between a company's website and its deeper infrastructure, allowing consumers to select merchandise; review what they have selected; make necessary modifications or additions; and purchase the merchandise. (Webopedia)

One of the most commonly used e-commerce enablers is the shopping cart. This order processing technology allows customer to accumulate items they wish to buy as they continue to shop. Supporting the shopping cart is a product catalog, which is hosted on the merchant server in the form of a database. (Deitel, Deitel & Nieto p.72)

Online shopping carts are similar to real shopping cart. The customer sees which items are selected before checking out of the store and has an opportunity to review the items and make changes. A typical shopping cart program will list each item in the cart, the quantity of items in the cart, a description of each item, the price per item and the subtotal of the order before taxes and shipping charges. (Greenspan)

Although the shopping cart is only one method of conducting transactions online, it is an effective way of buying and selling products on the Internet. Many e-businesses use shopping carts. The sites record what the customer wants to purchase and provide an easy and understandable way to shop online. The user can add or remove items to or

from their shopping cart and the site automatically updates the total. When the user "check out", they pay for whatever items are in the shopping cart.

While shopping cart technology offers consumers the convenience of quick and easy transactions, it creates problems regarding consumer privacy and online security.

2.3.4 Used Book Online Selling

Sell used books online means selling books in a virtual store in the Internet instead of in a physical book center. The process of selling books online is simple. The customer who wants to buy book will have to browse the web site and select the book they wish to buy. After selecting the book, they will have to pay using the payment method accepted by the site.

The drawback of selling used books online is it might be unreliable. Customer cannot know the book's condition before they buy the book. Some customers prefer to see the book before buying.

2.3.5 Books Listing

Some online used bookstores provide the details of books as value added to customers who use the site. Some customers prefer to view the book and know more detail about

the book before purchase. Therefore, this feature will attract books' lover who want to purchase books online before know more about the books.

The book listing might allow users to see the book description which may include the book title, author and price of the book.

2.3.6 Members Registration and Login Authentication

Registration of membership is a popular feature practiced by many e-commerce sites nowadays. These sites will provide services incorporated in the site to their registered members.

In an online used bookstore, the services like books' purchasing and selling is only for the registered members. The login authentication feature will act as the gateway to access the facilities in the site, where the controlling of users over the site will be control by the engine that works transparently.

The advantage of membership in an online used bookstore is the site administrators can easily trace the members who had access to the site. Besides, the owner of the site can provide their services and products to the customers according to their preference and therefore cater the users' preference.

2.4 Analysis of Existing Online University Used Book Center

The selection of the existing online used book center is based on their functionalities, value added services and the appearance via personal observation to the sites. For instances, the likely features in those sites are taken into account when selecting the sites.

In the fact that the websites used book center for selling and trade in university used books are less in number, either in Malaysia or in foreign country, thus most of the studies are based on the website of used book center.

For the purpose of this project, ten of the online used book center are selected to study to find out what are the popular features that are practiced by the sites' owner. Summaries of the ten selected sites are in Table 2.1.

From table 2.1, the online books purchasing and ordering feature, the searching feature, and the shopping cart and e-payment technologies exist in all the online used bookstores system, except the *Recollection Used Books* bookstore. As with the name "online used book center", the main purpose of the online used book center is to provide the facilities of book ordering and purchasing via the Internet.

A membership service is still not common in the online used book center system. However, complete sites like *Powells.com*, *21 North Main* and *TomFolio.com* practice this feature, since this can cater the members preference and thus give a personalized effect to users.

The appearance of the search function in all the online used book center, indicating that this feature is essential in order to provide an effective online used book center searching. The search function eases the users who are looking for a particular book in the site by saving their time of browsing the site.

Classification of books is also another important feature in almost all online used book center, so that to ease users who search books by topic or subject. Book description and preview will provide the information about the book to user before user purchases or orders it. However, the book preview feature only appears in a few sites, like *Powells.com* and *The Books Garden Gallery*.

Only a few of the sites trade in used books from the users, which are the *Powells.com*, *LNF Books.com* and *TomFolio.com*. This is because trade in books from users might be unreliable since the sites' owner cannot know the condition of books.

Mailing List is another common feature in the online used book center system. At the same time, the Help Desk & FAQ features provide users with information regarding the website, the services provided, as well as the terms and regulations of using the services offered. Users were able to find out the way business goes, how the payment goes, and how secure were the transactions.

2.4.1 Features Description and Analysis of Studied Used Book Centers

Table 2.1 Description and Analysis of Used Book Centers

Website Name	Reference URL	Features	Comments
Book Away	http://www.whatbok.com/default.htm	Search function, Online purchase books service, Books details& description, Shopping cart, E-payment, Payment method using credit card, Shipping services	The Book away is a normal used bookstore using the shopping cart technique. There is no categorization of books and it will be complex for users if they want to browse books by category or subject.
The Book Garden Gallery	http://www.bookgarden.com	Search function, Online purchase books service, Books preview (image), Books detail and description, Shopping cart, Mailing list, Listing of new arrival used books, Help desk and FAQ, E-payment, Payment method using	The site has a systematic classification of books that ease users who wanted to browse books by category. It also provides the friend referencing service that allows users to notify their friend about the existing service. Preview and detail of books cater the users' preference who likes to preview the books before buying.

		credit cards, Shipping services	
Recollection Used Books	http://www.eskimo.com/~recall/index.html	Books classification, Books grading, Payment method using credit cards number sends via email, Shipping services	The Recollection Used Books is a site that only publishes the used books available in the bookstore. The books listed in the page are not in order. It only has the books classification feature. Users who want to order books have to email the site administrator to make order. Credit card's information is also send to the site administrator via email.
Powells.com	http://www.powells.com/home.html	Members registration and login authentication, Search function, Online purchase books service, Online selling books service, Books preview (image), Books detail and description, Books classification,	The Powells.com is an online bookstore that sells used, antiquarian and rare books besides new books. The site provides rich collection of used books with classification that ease the users of the site. Preview and details of books cater the users' preference who likes to preview the books before buying. This complete site provides useful function for book lovers who intended

		Shopping cart, Mailing list, Listing of new arrival used books, Help desk and FAQ, E-payment, Feedback, Payment method using credit cards, check and money order, Shipping services	to look for used books online.
No Garbage Books	http://www.nogarbagebooks.com	Members registration and login authentication, Search function, Online purchase books service, Books preview (image), Books classification, Shopping cart, Mailing list, E-payment, Payment method using credit cards, Shipping services	The No Garbage Books is a simple used bookstore with the purpose of selling used books online. The site only provides the basic function that is the search and purchase of used books.
Rereadables Used Books	http://www.rereadables.com	Search function, Online purchase books service, Books classification,	This simple site performs basic used book center task, the searching and purchasing functions.

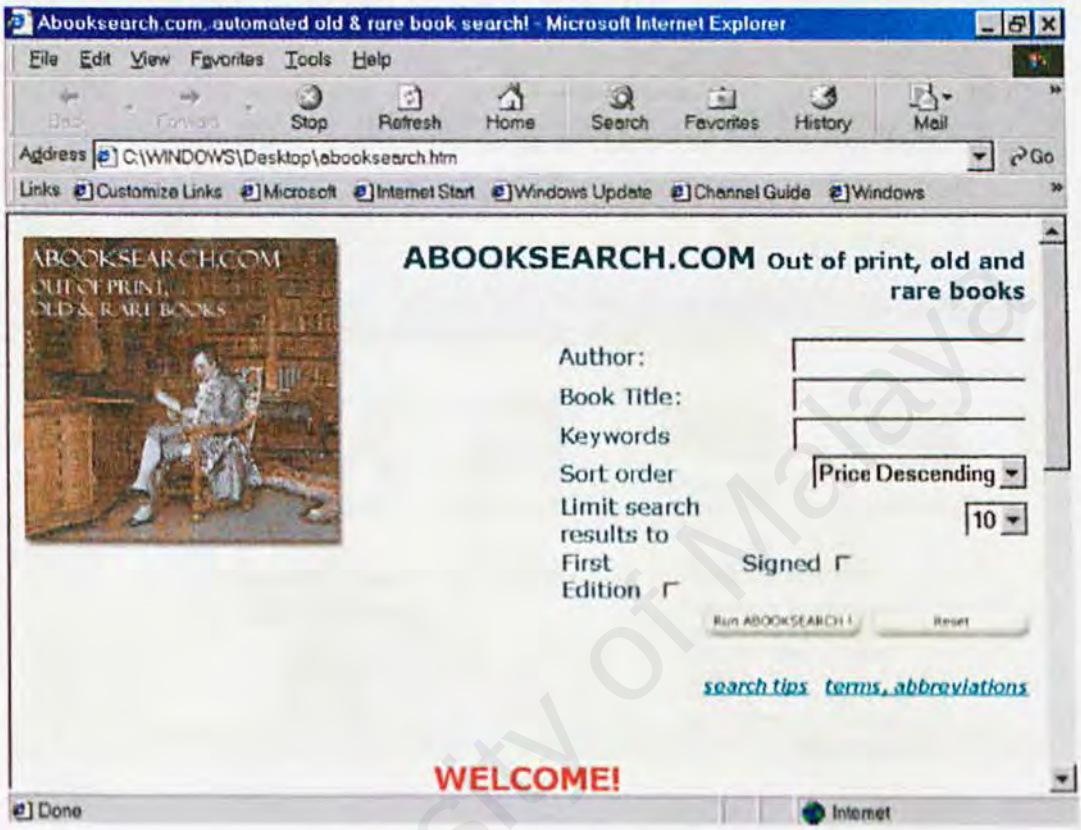
		Shopping cart, E-payment, Feedback, Payment method using credit cards and check, Shipping services	
TomFolio.com	http://www.tomfolio.com	Members registration and login authentication, Search function, Online purchase books services, Online selling books services, Books detail and description, Books classification, Shopping cart, Mailing list, Help desk and FAQ, E-payment, Feedback, Payment method using credit cards and direct payment, Shipping services	This site has a detail classification of books that ease the user to browse books online. It also provides a detail search function for users.
AbookSearch.com	http://www.abooksearch.com/inde	Search function, Online purchase books service,	This simple site only performs the used book center basic task, the searching and buying

	x.htm	Books details and description, Shopping cart, E-payment, Payment method using credit cards, Shipping services	features.
LNF Books.com	http://www.lnfbooks.com	Members registration and login authentication, Search function, Online purchase books service, Online selling books service, Books detail and description, Books classification, Shopping cart, Mailing list, Help desk and FAQ, E-payment, Feedback, Payment method using credit cards, check, and money order, Shipping services.	This site has a complete of books classification that eases the users when browsing for books by category. It also provides a search service, in which the user can place their list of wanted books in a form, and the staff of the book center will search for the books in the book center. However, charges are required for users who use this service.
21 North	http://www.21northmai	Members registration and login	This simple site allow user to search used books. However,

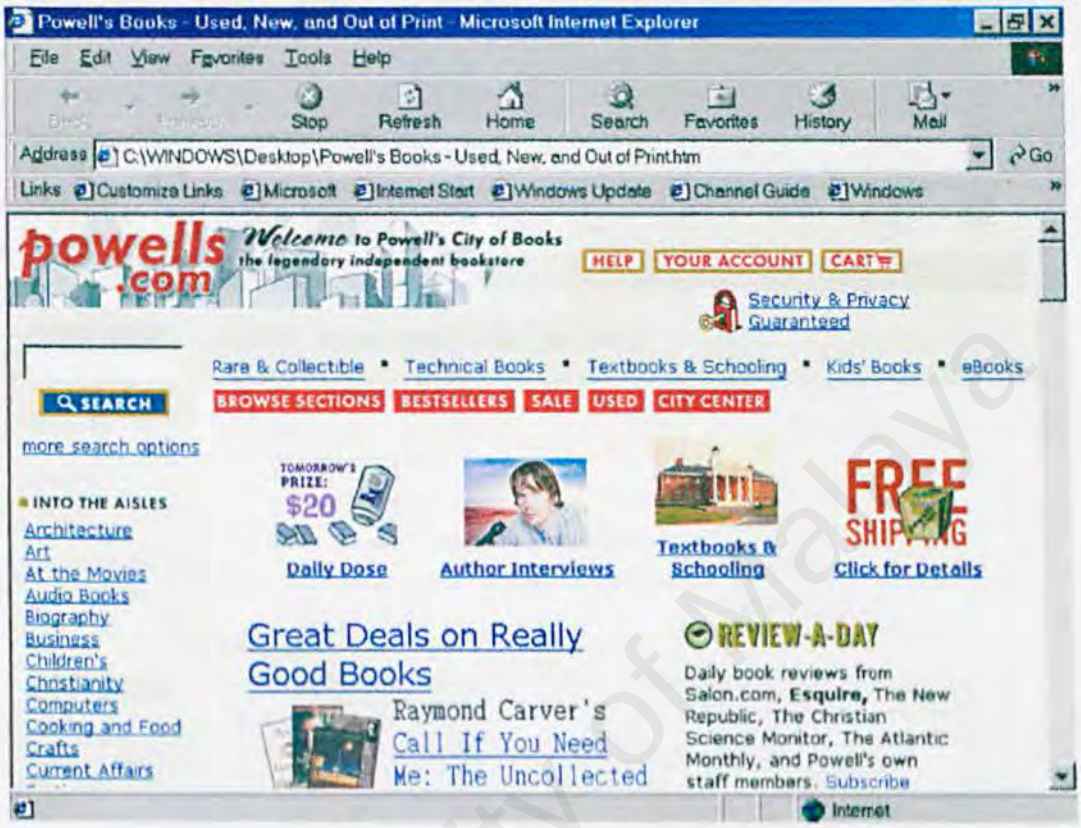
Main	n.com	authentication, Search function, Online purchase books service, Books detail and description, Books classification, Shopping cart, Mailing list, Help desk and FAQ, E-payment, Feedback, Payment method using credit cards, Shipping services.	only registered users can purchase books online. It has an advanced search function that allowed users to search used books on the site.

2.4.2 Sample screenshots of the studied used book center

i) AbookSearch.com



ii) Powells.com



iii) TomFolio.com

CHAPTER 3

METHODOLOGY & SYSTEM ANALYSIS

3.1 Target Group Definition

3.2 Fact Finding Techniques

3.3 User Requirements Specifications and Analysis – Functional and Non-Functional

3.4 Platform, WebServer and Tools Consideration

3.5 Hardware and Software Requirements

Chapter 3 – Methodology and System Analysis

A computerized system that perfectly meets the user's need can only be achieved by proper product engineering. The goal of product engineering is to translate the customer's desire for a set of defined capabilities into a working product **(Pressman, 2001)**. The overall requirements of a product shown in Figure 3.1 are elicited from the customers or users. These requirements encompass information and control needs, product function and behavior, overall product performance, design and interfacing constraints and other special needs. In this chapter, a thorough analysis and in-depth study of the system and users' requirements is carried out.

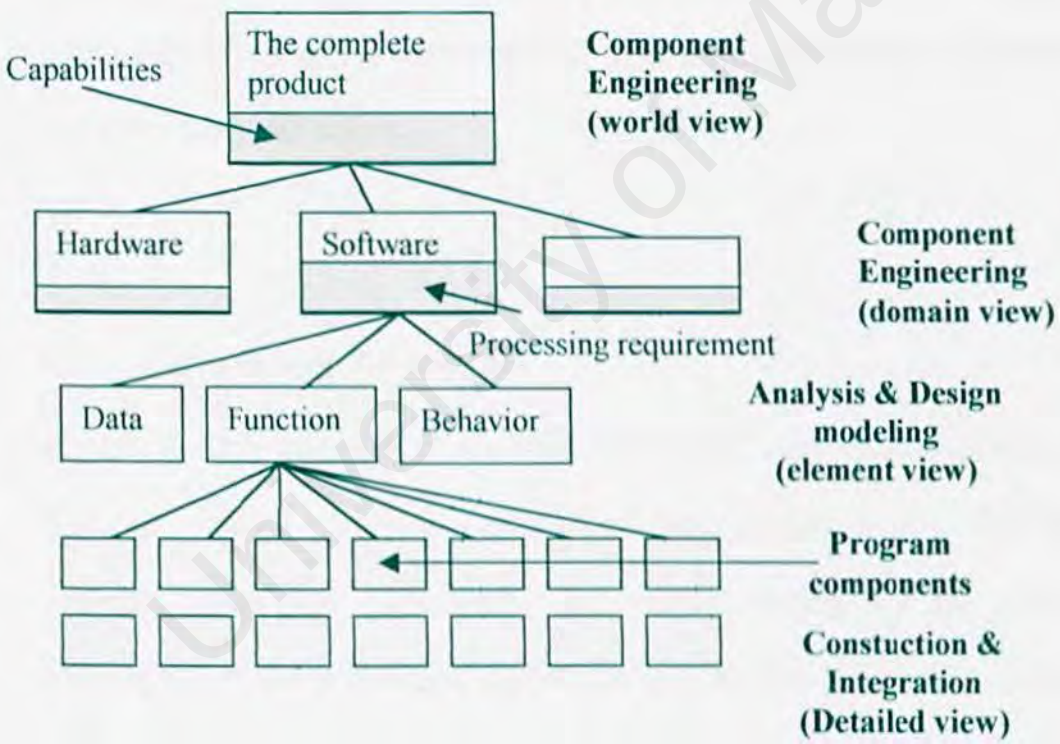


Figure 3.1: Diagram Shows the Product Engineering Hierarchy

3.1 Target Group definition

Before we further understand what the users want, analyzing need, assessing feasibility, negotiating a reasonable solution, specifying the solution unambiguously, validating the specification and managing the requirements, a potential user group has to be identified. These targeted user group are defined as the largest group from the target population **(Kingsman, 1994)**.

For the Online University Used Book Center, the valid user will be the administrator and the registered users. The public only can view the page without using the facility such as purchasing and trade in. Administrator's level of accessibility will be restricted which cannot login by users. The user interface will be more user friendly to enable the users and administrator get online.

3.2 Fact Finding Techniques

In order to understand and obtain what information users need to perform their job effectively, several retrieving methods have been chosen, such as through reading materials, survey and questionnaire and internet surfing. All the information of requirements retrieved from the various sources were processed and analyzed to get a precise picture on how the proposed project should look like and perform.

3.2.1 Internet Browsing and Material Reading

The "information superhighway" or Internet is a dynamic tool that assists researchers in completing research work. The Internet can provides access to a vast collection of databases that includes books, articles, essays, reports, statistical information, and government documents.

To define the system requirements and definitions, the Internet is chosen to get the information about the related topics, such as the electronic payment system, the World Wide Web, etc.

Materials reading are another method chosen to get information regarding related topics. The materials read including books, articles from magazines, newspaper and the existing examples of thesis in the document's room FSKTM. The sources of books are from library, pals and bookshops.

For example, the OUUBC is a web-based application, e-commerce site and a storefront model. Books referencing is done to understand these terms. By understanding the related terms, it helps the researchers to have a precise planning of the project and get to track the required phases that needed to undergo in bringing out this project. With the basic understanding about the project, proceeding to other stages of the project is easier.

3.2.2 Survey and Questionnaire

In order to identify the users' reaction towards the online used bookstore, a survey is conducted. A set of questionnaire is prepared to be answered by the respondent.

Group of respondent from different status (undergraduate students, graduate students or working people) are select so that to get the different opinions from different users level. Due to time consuming, the questionnaire is distributed via email. The respondent then return their answered questionnaire via email.

There is a weak point in this survey. The respondents selected might not be able to cover all the categories of users in Malaysia. Therefore, the data will not be representative enough.

3.2.3 Observation and Current System Analysis

To understand and find out how an online university used book center function, the analysis and observation of current existing system is done. Ten of the existing online used bookstores are selected to do the analysis, regarding their features, value added services, and the interface.

The criteria considered while selecting the site including the functionalities exist in the site, and the interface design. This is because those two criteria are important for an electronic commerce site in order to attract users to visit to the site.

After selecting the sites, the functionalities exists in the sites, such as the searching wizard and the payment system is observe.

3.3 User Requirements Specifications and Analysis – Functional and Non-Functional

After we have gone through the results of internet browsing base on the findings in chapter 2, it is believed that information technology is not yet fully applied in online university used book center in any country, especially in Malaysia.

Therefore the proposed OUUBC would be built by using the latest technology, with easy-to-use interfaces, and all standard, expected and exciting features.

After few the survey in the Internet and library, a thorough understanding on existing website was gained. Their requirements and expectation toward the features provided by to-be-developed OUUBC were obtained and classified as functional and non-functional requirements of the proposed system.

3.3.1 Functional Requirements Analysis

a) The Administrator Module

- **Administration Features**

  The administrative features allow administrators to maintain and manage the site. These include managing the users, books and transaction in OUUBC.

b) The User Module

- **Membership**

  The OUUBC offers membership to privileged visitors. Either the users can choose to accept or to reject the membership offered. If they accept it, they have to provide their particulars to OUUBC. Only members of OUUBC are allowed to purchase in university used books. A login authentication is the gateway for users who visit to OUUBC.

- **Search Function**

  There are search functions in OUUBC, the search for author, search for book and search the entire database. Users can do a quick search using keywords. Internal search engine performs the books searching in the OUUBC database and returns the search results in a list to users with the image of the books displayed. Further detailed description about the book will be display.

- **Online Purchasing**

  Member is able to purchase used books in OUUBC. This function includes the shopping cart technology. Members can select the books they want and dump

into the shopping cart. They have to pay for the amount required when they check out of the site.

3.3.2 Non-Functional Requirements Analysis

Non-functional specifications are the constraints under which a system must operate and the standards which must be met by the delivered system **[Sommerwille, 1995]**. The OUUBC must ensure certain web application qualities like user-friendliness, correctness, functionality, reliability, flexibility, efficiency as well as maintainability.

a) User-Friendliness

User interfaces design creates an effective communication medium between a human and a computer. Therefore, it is very important to make sure that the interfaces fulfill user-friendliness so that it would not cause trouble to users. The Golden Rules **[Mandel, 1997]** coins three rules:

- Place the user in control

  This will define interaction modes in a way that does not force a user into unnecessary or undesired actions. Besides, it also provides flexible interaction for different users for instance via mouse movement and keyboard commands.

- Reduce the user's memory load

One of the principles that enable an interface to reduce the user's memory load is by reducing demand on short-term memory. The interface should be designed to reduce the requirements to remember past actions and results.

- Make the interface consistent

  The interface design should apply to consistent fashion where all visual information must be organized according to a design standard that is maintained throughout all screen displays. Apart from that, input mechanisms are constrained to a limited set that are used consistently throughout the application. Lastly, mechanisms for navigating from task to task are consistently defined and implemented.

b) Correctness

A program or system must operate correctly or it provides little value to its users. Correctness is the degree to which the software performs its required function. To ensure this application quality, lots of testing and trial-and-errors will be carried out.

c) Functionality

The functionalities stressed here are the searching and retrieving capability, which is very important in any web application that deal with data retrieval from existing database. Besides, navigation and browsing features as well as application domain-related features will be taken into account.

d) Reliability

Reliability is the extent to which a program can be expected to perform its intended function with required precision **[Pressman, 2001]**. It is closely related to correct link processing, error recovery and user input validation and recovery.

e) Robustness

The system must be able to retain operating in the occurrence of failures or unexpected errors. For instance, the user errors can be detect by validating the data input from user before it is send to the server for processing.

f) Efficiency

Undeniable, efficiency is the key for implementing the OUUBC website. Efficiency is understood as the ability of a process procedure to be called or accessed unlimitedly to produce similar performance outcomes at an acceptable or credible speed **[Sommerwille, 1995]**. Efficiency is measured base on response time performance, page generation speed and graphics generation speed.

g) Maintainability

The maintenance work of the OUUBC site should take place from time to time. This is to ensure that the site always provide up-to-date information to users. The administration modules are designated to accomplish this task, in which authorized administrators are allowed to maintain the database of OUUBC.

h) Security

The OUUBC will have the security access to each page in the site. Different level of users will have different accessibility to different pages. The security access prohibits unauthorized users access to pages in the Web site.

3.4 Platform, WebServer and Tools Consideration

3.4.1 Platform Technology

In computers, a platform is an underlying computer system on which application programs can run. The personal computers, Windows 98 and the Macintosh are examples of two different platforms. The enterprise servers or mainframes, IBM's S/390 are example of platforms. A platform consists of an operating system, which is designed to work with a particular processor set of instructions.

3.4.1.1 Similar In-Market Platform Technology

a) Windows 95/98/NT/2000

Windows is a popular system platform especially for home use. As part of the components of the Windows Family, Windows NT Workstation 4.0 and Windows NT Server 4.0 are suitable for business. For home use, Windows 95 and Windows 98 are the popular choices. For company use, Windows 2000 Server is the right solution for workgroup file, print, and communication servers. It comes together with IIS and provides a much better performances.

b) Macintosh

The Macintosh is another example of platform that has its own operating system, Mac OS and is originally built on Motorola's 68000 series microprocessors, Mac versions today are powered by the PowerPC microprocessor, which was developed jointly by Apple, Motorola, and IBM.

While Mac users represent only about 5% of the total numbers of personal computer users, Macs are highly popular and almost a cultural necessity among graphic designers and online visual artists and the companies they work for.

3.4.1.2 Chosen Development Platform and Operating System

For the OUUBC, Windows is chosen as the development platform. Microsoft's Windows 98 is built to work with a series of microprocessors from the Intel Corporation that share the same or similar sets of instructions.

The main reason for choosing Microsoft's Windows 98 as the development operating system is because Windows 98 is based on the popular Microsoft Windows 95 Operating System, and is designed for the consumer market. Windows 95/98 were designed for backward compatibility with older DOS and 16bit programs, as well as providing a platform for the newer (back in 1995) 32 bit programs.

Windows 98 works better by making it simple to access the Internet and by providing better system performance along with easier system diagnostics and maintenance. With Windows 98, users' system plays better as well with support for the latest graphics, sound, and multimedia technologies, the ability to easily add and remove peripheral devices with support for Universal Serial Bus (USB), and it also enables users to watch TV on PC. Besides that, Windows 98 is compatible with more software (including games) and hardware.

3.4.2 Database Management System

Database technology is used in almost all variety of applications, which some serve only a single user whereas others are for multi-users. Database Management System is a tool that enables effective communication with database. Examples of database management systems are MYSQL, Oracle 8i, PostgreSQL, Sybase, Informix and also Microsoft Access.

3.4.2.1 Similar In-Market Database Management System

a) Comparison between MySQL and PostgreSQL

MySQL is more suitable for developing OUUBC because it has more advantages to use MySQL compared with PostgreSQL.

Table 3.1 : MySQL vs. PostgreSQL

Features	MySQL	PostgreSQL
Speed	Faster	Slower
Stablelity	Very stable	Less stable
Performance on Windows	Very good	Not stable
Upgrading	Easy to upgrade	Difficult to upgraded

b) Comparison between MYSQL and Oracle

Oracle is much more expensive compared with MySQL. Oracle also more suitable to be used to develop a large project and used by large company. Since OUUBC is a medium-sized e-commerce project, MySQL is more suitable to develop OUUBC.

3.4.2.2 Chosen Development Database Management System

In order to develop OUUBC, MySQL is most suitable and compatible database server to be used.

Besides that, MySQL is chosen as database server to develop OUUBC because the following features:

- **Fast** - MySQL is about three to four times faster than many other commercial databases.
- **Ease-of-use** - MySQL is easy to manage.
- **Cost advantages** - MySQL is an open source relational database and free of cost.
- **Large tables** - MySQL stores each table in the database as a separate file in the database directory. The maximum size of a table can be between a minimum of 4GB.

One advantage to use MySQL with PHP is can manage database easily using phpMyAdmin, a browser based MySQL administration page written in PHP4.

phpMyAdmin has features : (see Appendix A-Figure 9.1, Figure 9.2):

- Create/Delete/Edit/View Databases.
- Create/Delete/Edit/View/Describe Tables.
- Edit Table Columns Add/Delete Rows.
- Backup/Restore Databases.

3.4.3 Web Server

A Web server is a program that uses the client/server model and the World Wide Web's Hypertext Transfer Protocol (HTTP), serves the files that form Web pages to Web users

(whose computers contain HTTP clients that forward their requests). Every computer on the Internet that contains a Web site must have a Web server program. The most popular Web servers are Microsoft's Internet Information Server (IIS), which comes with the Windows NT server; Netscape FastTrack and Enterprise servers; and Apache, a Web server for UNIX-based operating systems

b) Comparison between Apache and Personal Web Server

PWS is a scaled-down version of IIS and more suitable to develop personal home page. PWS also less features compared with Apache which more suitable to develop OUUBC site.

3.4.3.2 Chosen Development Web Server

After compared with IIS and PWS, Apache has been chosen as web server for OUUBC because Apache is :

- **Powerful** - Apache server is robust, stable and powerful.
- **Feature-Rich** - The Apache server includes features: XML support, Server-Side Includes (SSI), powerful URL-rewriting, and virtual hosting.
- **Extensible** - Apache is open source. Source code can be found on internet and has various online resources for reference.
- **Popular** - Apache holds a smidge under 60 percent of the web server market.
- **Free** - Apache is free. Easy to get, just download from internet.

Besides that, Apache is the most compatible web server to run PHP. PHP can perform very well on Apache compared with other web server like IIS and PWS.

3.4.4 Web Development Technology

3.4.4.1 Similar In-Market Web Development Technology

a) Comparison Between PHP and ColdFusion

Table 3.3 : PHP vs. ColdFusion

	ColdFusion	PHP
Language	Primitive and does not support standard operator syntax or user-defined functions.	Strong and very flexible.
File-System Support	Adequate, not feature-rich.	Comprehensive.
Cost	Free	High cost

b) Comparison between PHP and JSP

Table 3.4 : PHP vs. JSP

	JSP	PHP
Platform	Support only platform that have a virtual machine available.	Support all major platforms (UNIX, Window,) and any 32-bit or better platform.

Performance	Slow	Fast, as much as 3.5 times faster than JSP.
Scripting Language	Complex, difficult to learn.	Easy to learn and maintain.

c) Comparison between PHP and ASP

Table 3.5 : PHP vs. ASP

	ASP	**PHP**
Speed	Slow	Fast
Memory Management	Load all the files.	Load include files that are required.
Hidden Cost	Need to buy ASPEncrypt for encryption, need to buy ServerObject's QMail fro email management and need to buy Software Artisans SA-FileUp for file uploading.	Free, no hidden cost.

3.4.4.2 Chosen Web Development Tool

As a conclusion, PHP is chosen as programming language to develop OUBCC. ColdFusion is usually used by large company to develop large-sized project. JSP is more difficult to learn compared with PHP. It is time-consuming to master JSP for developing OUBCC. PHP is free and can run faster than ASP. After compared with ColdFusion, ASP and JSP, PHP is the most suitable programming language to develop OUBCC.

The advantages to use PHP are:

- Speed – high speed of execution and will not slow down the rest of machine
- Stability – the possibility of system crash is very low, very stable because PHP uses its own resource management system, and has a sophisticated method for handling variables.
- Security -- PHP provides many levels of security which can be set in the .ini file to the desired level.
- Simplicity – easy to learn especially programmers with previous experience of C.
- Open Source – do not neither dependent on a manufacturer to fix things that don't work, nor pay for upgrades every year.
- Lots of database interfaces - PHP currently will work with MySQL, MS SQL, Oracle, Informix, PostgreSQL and many others.
- Run on (almost) any platform – can run on UNIX, Windows(95/98/NT/2000) and Macs.

3.4.5 Authoring Tools

3.4.5.1 Similar In-Market Authoring Tools

a) Comparison between EditPlus and Microsoft Visual InterDev

Since PHP as a programming language to develop OUUBC, Microsoft Visual InterDev is not suitable to be chosen as authoring tool because it does not support PHP. EditPlus can be considered as authoring tool because it support PHP.

b) Comparison between EditPlus and Notepad

EditPlus and Notepad are web authoring tools that support PHP. Notepad has the simplest user interfaces and lack of powerful features and templates to help web authors or developers in developing web sites. EditPlus has rich and powerful features for web authoring, such as customizable syntax highlighting for HTML and other programming language, useful document templates and efficient user tools.

3.4.5.2 Chosen Authoring Tools

As a conclusion, EditPlus is the most suitable authoring tool for HTML and PHP editing because of its efficient, rich-features, flexible and powerful authoring tools and it supports PHP.

Adobe Photoshop also chosen as designing tools to create button and layout for the online product catalog of OUUBC.

Besides that, Macromedia Dreamweaver is chosen as visual web editing tool to create web site in OUUBC because its excellent visual design features coupled with great source-code editing.

Macromedia Dreamweaver 4.0 is the most latest version with full features include:

- Integrated Text Editor

  Can do editing in Design View and Code View. Using new Split View to see both Code and Design views simultaneously. The Code View's new live syntax coloring, tag balancing, and auto indenting make coding a snap.

- Layout View

  Easily design complex pages using the new Layout View. Draw table cells directly on the page and then specify how the layout changes as the page is resized. Easily drag cells around or group cells together to create a nested table. Powerful visual design features include drag-and-drop tables, images, and layers. Standard View provides a rich WYSIWYG environment for editing pages.

- Macromedia Flash Text and button

  Create editable vector graphics directly in Dreamweaver with the new Macromedia Flash Buttons and Macromedia Flash Text features. By using Macromedia Flash vectors instead of bitmaps for buttons and text, graphics are scalable, smaller in file size, and look great when printed.

- Javascript Debugger

Debug client-side JavaScript directly in browser. The new JavaScript Debugger execute in Netscape Navigator or Internet Explorer.

- Edit Non-HTML Documents

Use Dreamweaver as a text editor for non-HTML documents. Edit JavaScript, XML, and other text files directly in Code View.

3.5 Hardware and Software Requirements

3.5.1 Hardware Requirements

The hardware specifications are as listed below :

Table 3.6 : Hardware requirements

Processor	Pentium II
Random Access Memory	128 MB RAM
Hard Disks Space	1 GB
Others	Other peripherals devices

3.5.2 Software Requirements

The selections of software are as listed below :

Table 3.7 : Software requirements

Category	Tools/Software To Use
Operating System	Windows 98
Web Server	Apache v1.3
Database Server	MySQL
Server-side language	PHP4
Markup Language	HTML
Scripting Language	Javascript
Editing Tools	EditPlus v2.01
Web Authoring Tools	Macromedia Dreamweaver 3.0
Designing Tools	Adobe Photoshop 6.0

CHAPTER 4

SYSTEM DESIGN

Chapter 4 - System Design

4.1 The Architecture of Online University Used Book Center

The software architecture of a program or computing system is the structure or structures of the system, which comprise software components, the externally visible properties of those components and the relationships among them **(Bass, 1998; Clements, 1998; Kazman, 1998)**. The architecture is not the operational software but a representation that enables a software engineer to analyze the effectiveness of the design in meeting its stated requirements, to ensure design changes can be done relatively easy and to reduce the risk associated with the construction of a system.

For the to-be-built OUUBC, the 3-tier architecture that uses client/server computing model is chosen as the development system architecture. A typical 3-tier application consists of three separate parts, which are distributed to a different place or places in a network. With three tiers or parts, each part can be developed concurrently by different team of programmers coding in different languages from the other tier developers. Because the programming for a tier can be changed or relocated without affecting the other tiers, the 3-tier model makes it easier for an enterprise or software packager to continually evolve an application as new needs and opportunities arise.

4.1.1 Three-Tier architecture for Online University Used Book Center

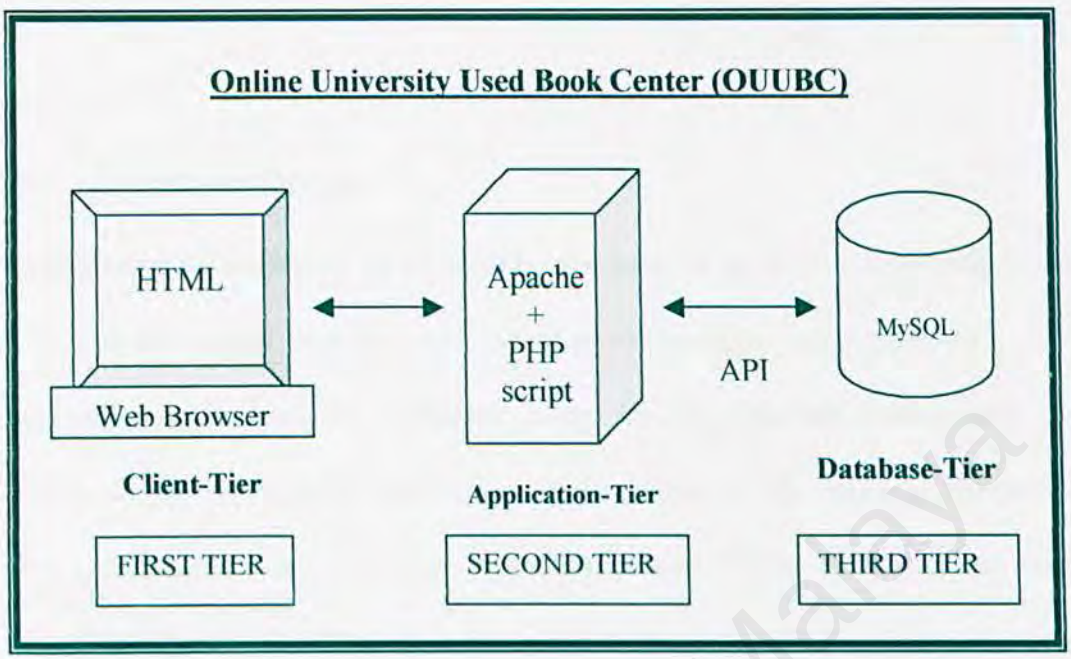


Figure 4.1 3-Tier Architecture of Online University Used Book Center

The conceptual architecture of the three-tier application applies when we split an application across three tiers are split into three logical components of the application: user interface, computational logic and data storage. In reality, the three-tier Web applications generally consist of a Web browser for the user interface, a Web server connected to a "middle tier" application, and a persistent store that is frequently a relational database. (Refer to Figure 4.1)

The main purpose of having a three-tier architecture is to assign main functionality to each tier to ensure no function overlapped. Different people could handle each tier using

different languages. Therefore, whenever there is error or system fault occurs, the problems can be detected and fixed easily without interfering other tier.

4.2 Database Design

Data storage is considered by some to be the heart of an information system (Kendall, 1996). It is a central source of data meant to be shared by many users for a variety of applications. The heart of a database is the DBMS (database management system), which allows the creation, modification and updating of the database; the retrieval of data and the generation of reports. The main objective of database design is to make sure that data is available when the user wants to use it. Apart from that, the accuracy, consistency and integrity of data must be assured from time to time, to provide efficient data storage as well as efficient updating and retrieval.

In 1976, Peter Chen had introduced the use of the entity-relationship model (E-R Model). An E-R diagram contains many entities, many different types of relations, and numerous attributes. The benefits of Entity Relationship modeling are mentioned below:

i. Databases need to be designed and entity relationship (ER) modeling is an aid to design.

ii. An ER model is a graphical representation of the system and is a high-level conceptual data model.

iii. Supports a user's perception of data and is independent of the particular DBMS and hardware platform.

4.3 Process Design

Online University Used Book Center is designed based on structured design technique. These structure charts make sure all the small functionalities are clearly stated therefore the system programs are easy to implement and maintain.

4.3.1 Data Flow Diagram (DFD)

A graphical representation of data processes throughout the OUUBC can be put together in a data flow diagram (DFD). Logical data flow approach is applied in drawing DFD. By using the combination of only four symbols, a pictorial depiction of processes that will eventually provide solid system documentation can be created (Kendall, 1996).

4.3.2 Program Design

Program design explains the modules OUUBC in detail using diagrams. There are mainly two main components in the OUUBC system, the administration functions and the non-administrative functions. Each of the components is sub-divided into modules that made up the OUUBC. Detail views of the modules are shown in Figure 4.2.

The administrators are those who maintain the database and the site. The registered members are those who use the facilities available in the university used book center, such as searching and buying.

The context diagram in Figure 4.2 gives an overview to the OUUBC system. It includes the basic inputs, the general system, the major data flow to and from, and the outputs, that representing the entire system.

Figure 4.3 shows the context diagram for OUUBC. The child diagrams for each function are shows in Figure 4.4 to Figure 4.9 in the following parts. The child diagrams give a clear picture of how each data flows in each function.

Flow chart for the online purchase is shown in Figure 4.10.

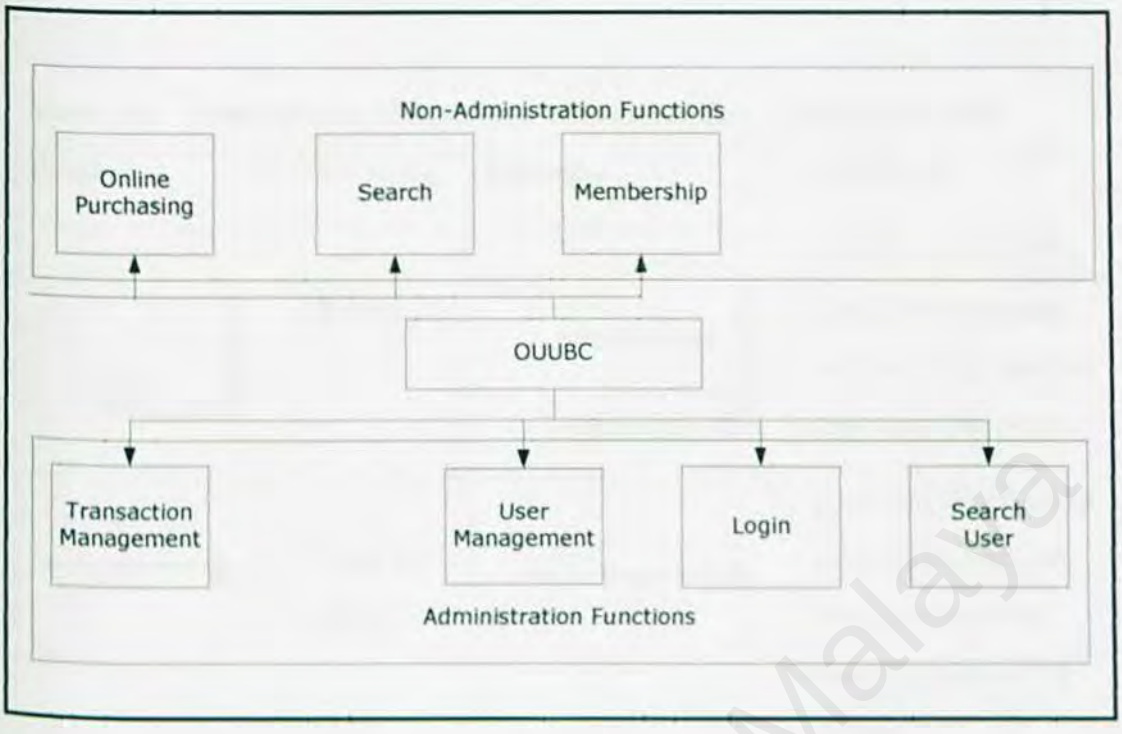
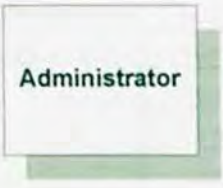
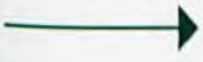
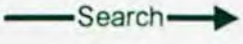
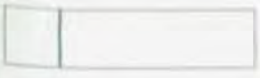
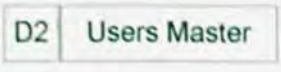


Figure 4.2 The overview of all the main modules and related sub-modules for proposed Online University Used Book Center.

Before providing a more detailed data flow diagram such as diagram O and child diagrams, a brief explanation on the 4 symbols used in DFD is displayed in a table form, as stated in Table 4.1.

The Data Flow Diagram Symbols

Table 4.1 Descriptions of functions of the data flow diagram symbols

Symbol	Meaning	Example	Functions
	**Entity**		Depicts an external entity that can send data to and/or receive data from the system
	**Flow of Data**		Represent the flow of data or information from one point to another point of the system
	**Process**		Used to show occurrences of a transforming process. Processes will always denote a change in data input. Processes represent work being performed within the system
	**Data Store**		Represent data Store and holds data for a given time within the system.

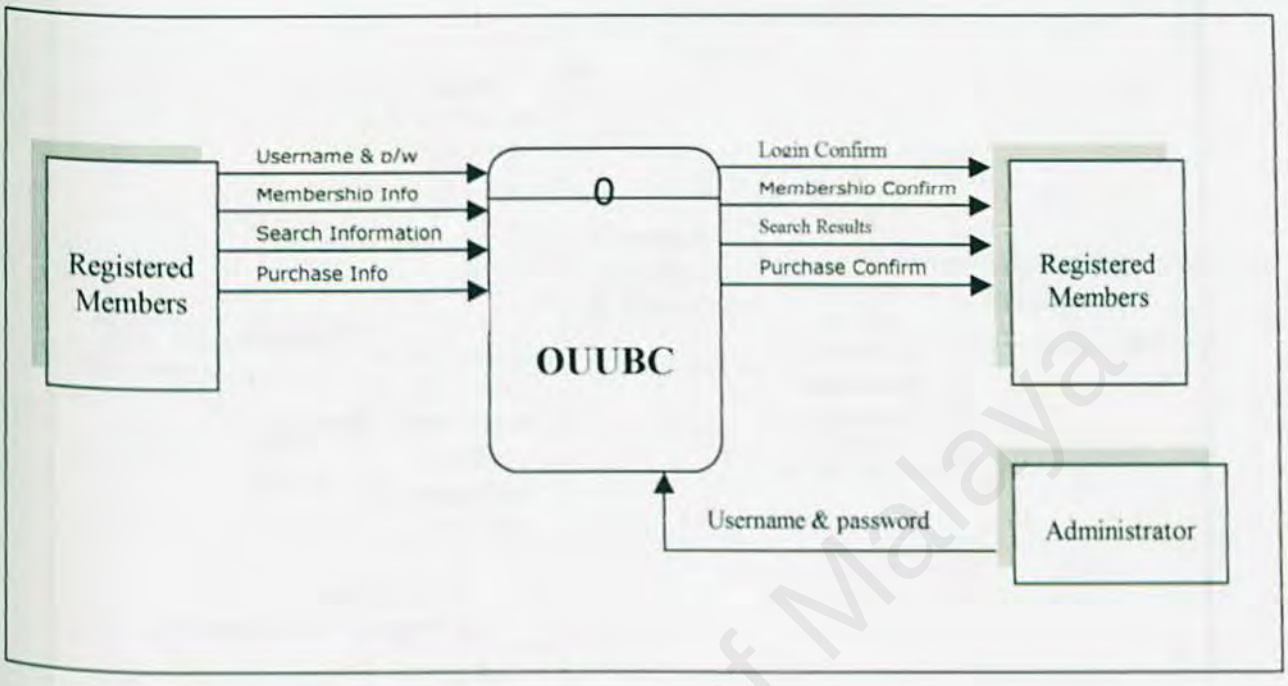


Figure 4.3 Context Diagram for OUUBC

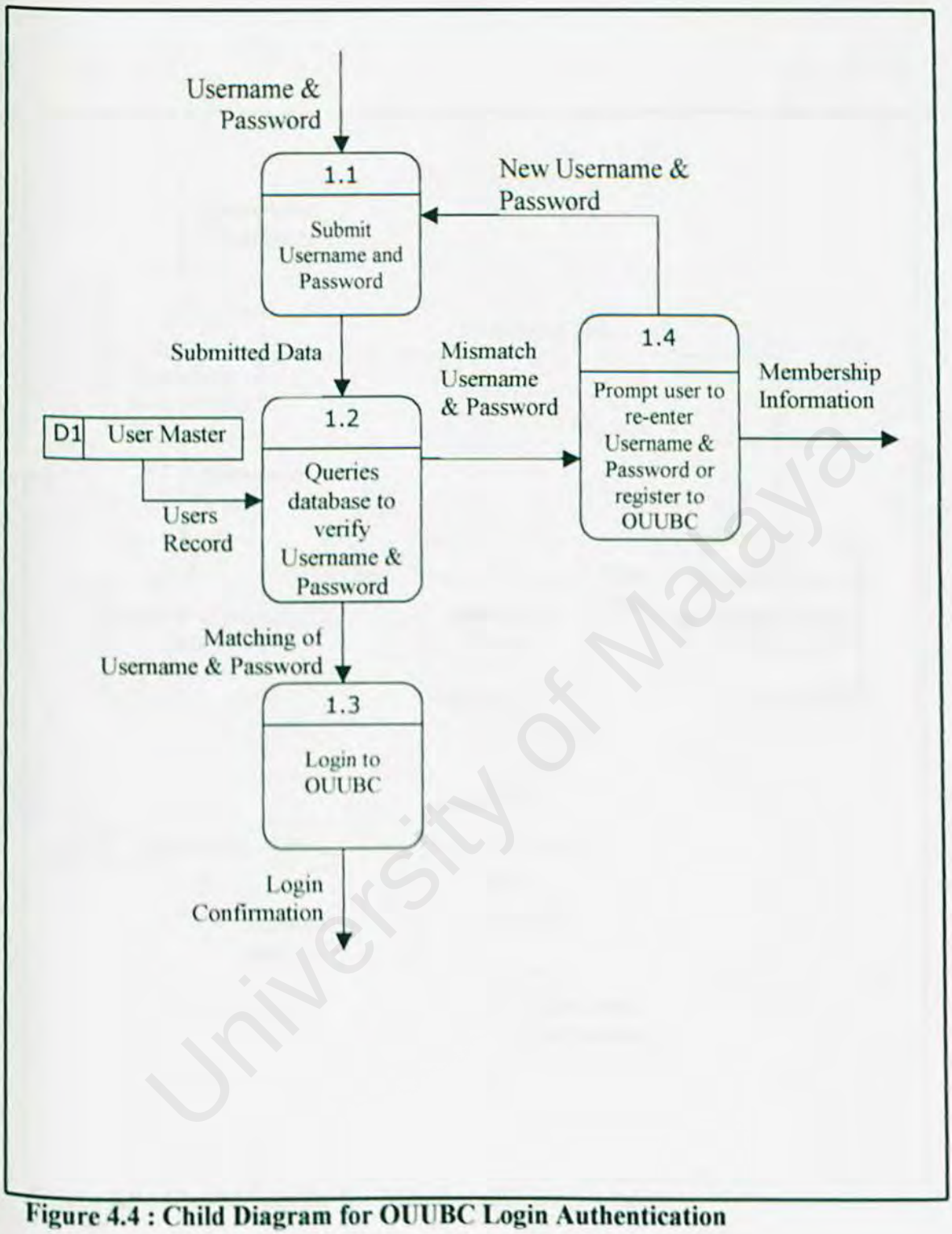


Figure 4.4 : Child Diagram for OUUBC Login Authentication

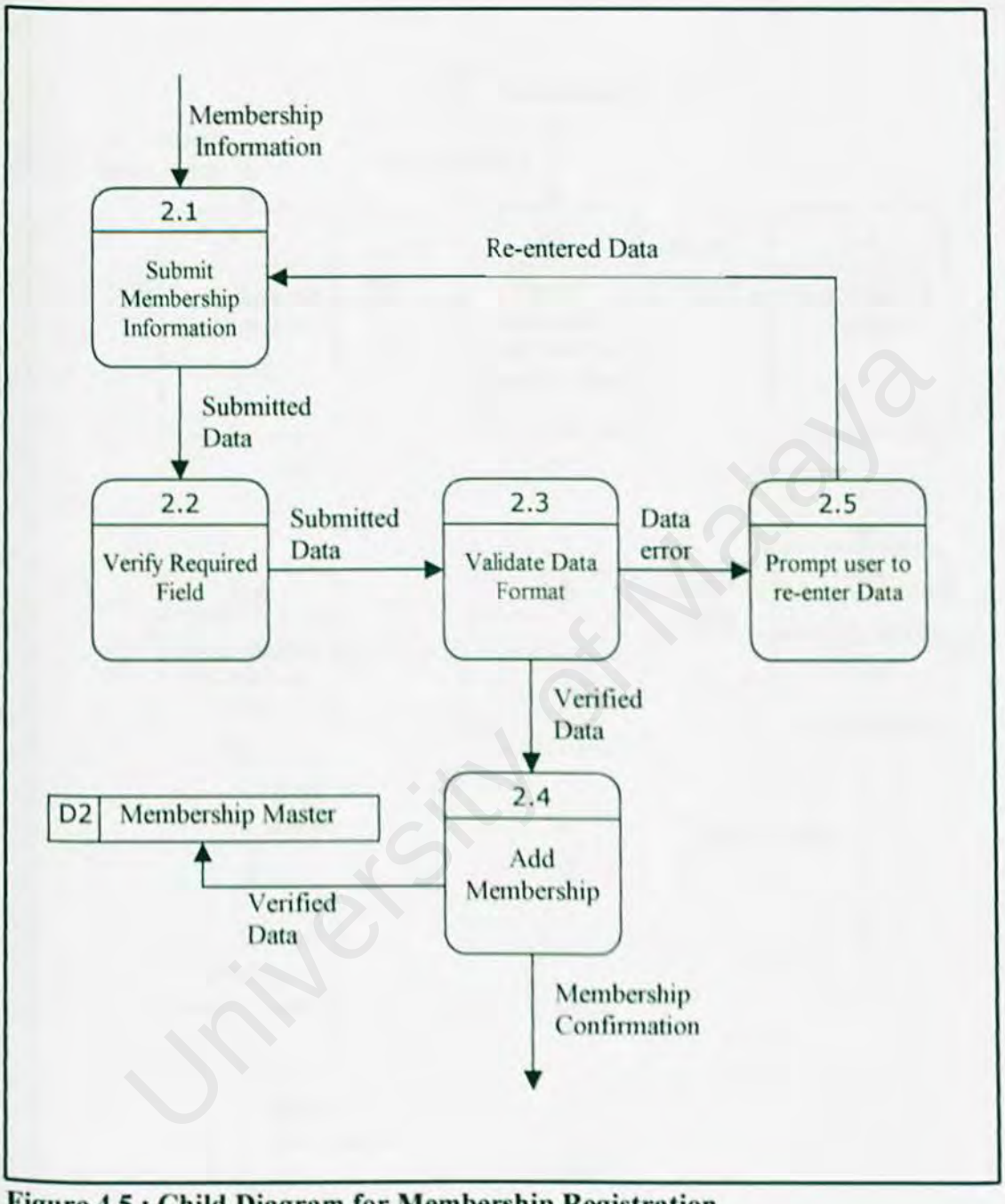


Figure 4.5 : Child Diagram for Membership Registration

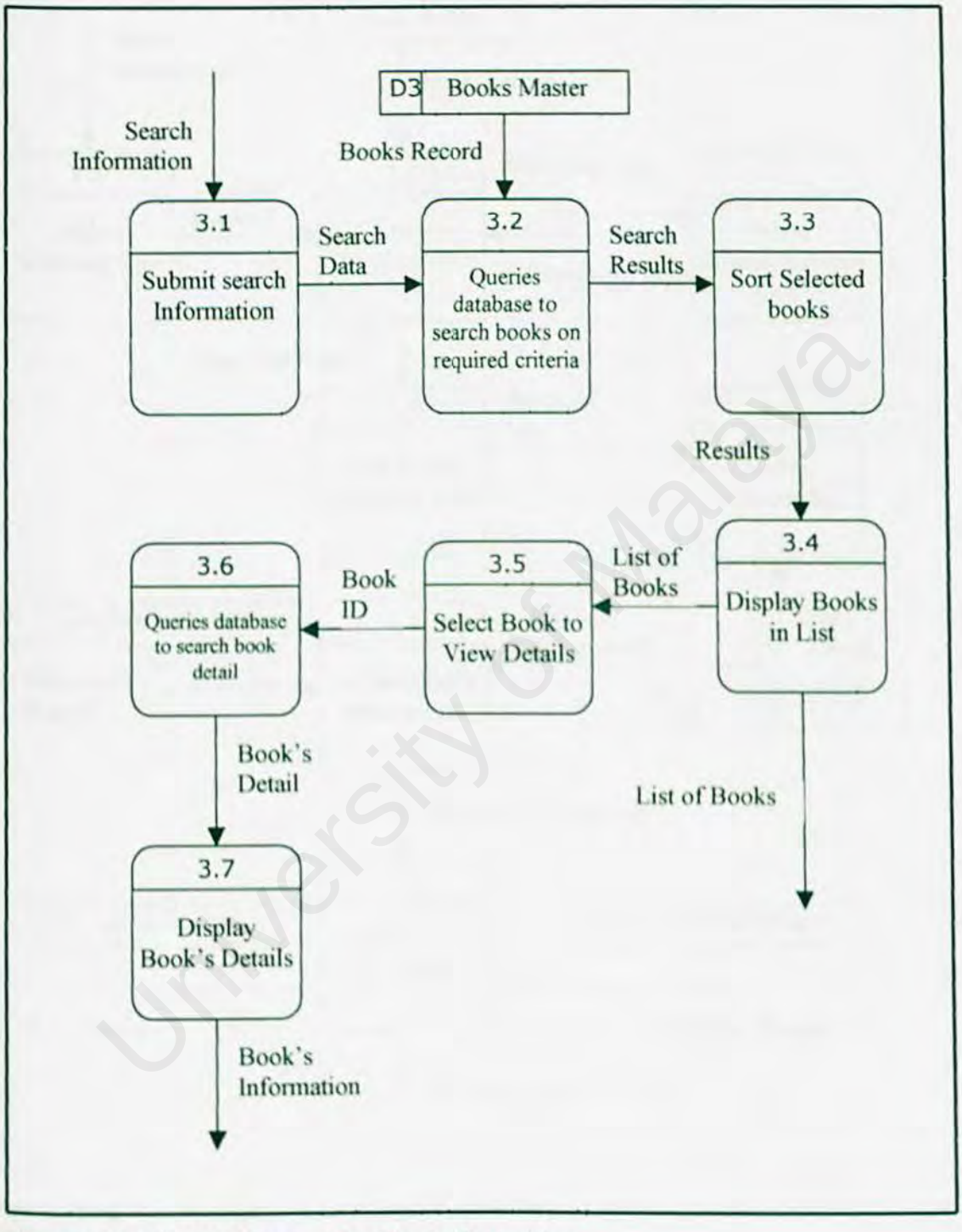


Figure 4.6 : Child Diagram for Books Searching

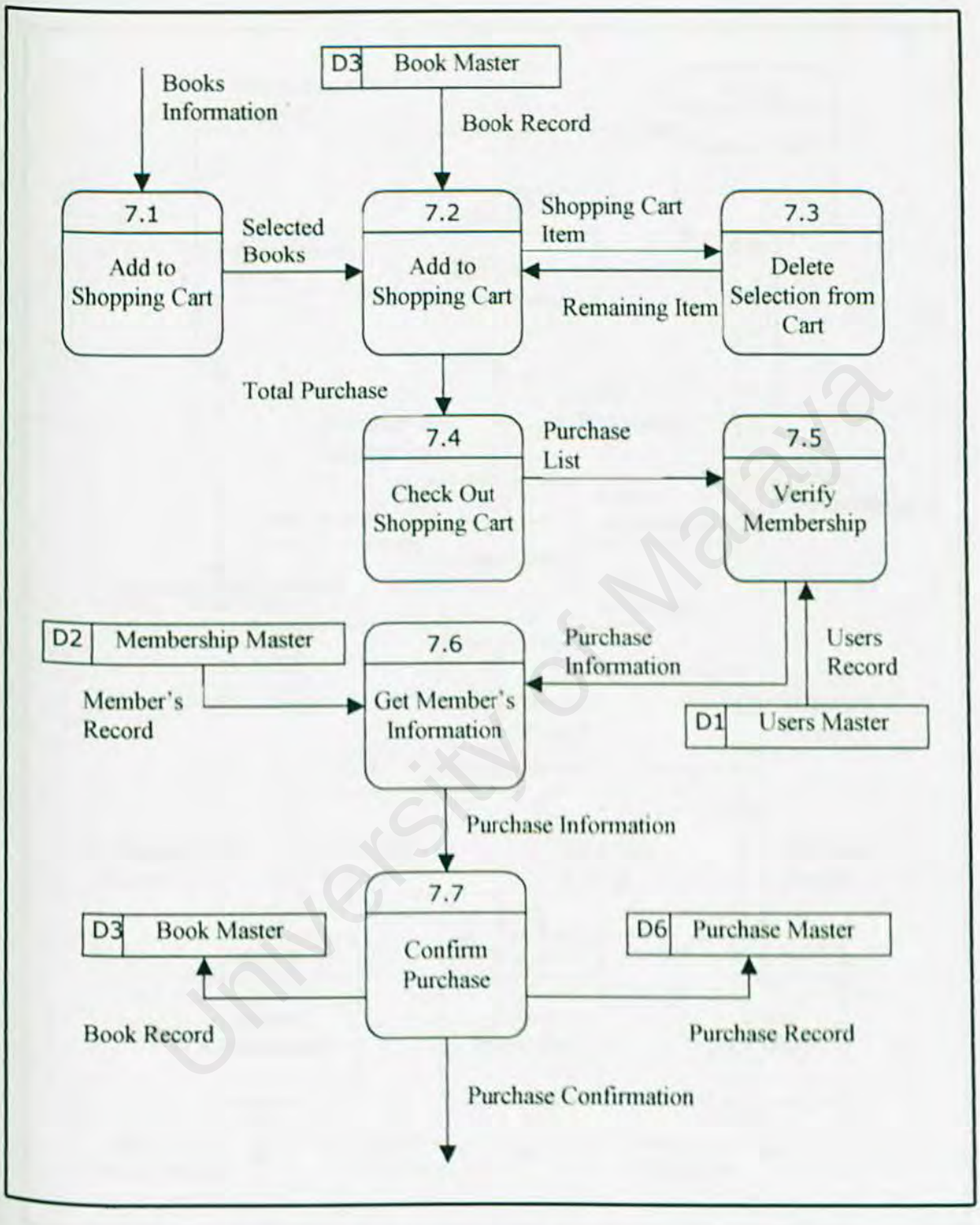


Figure 4.7 : Child Diagram for Online Purchase

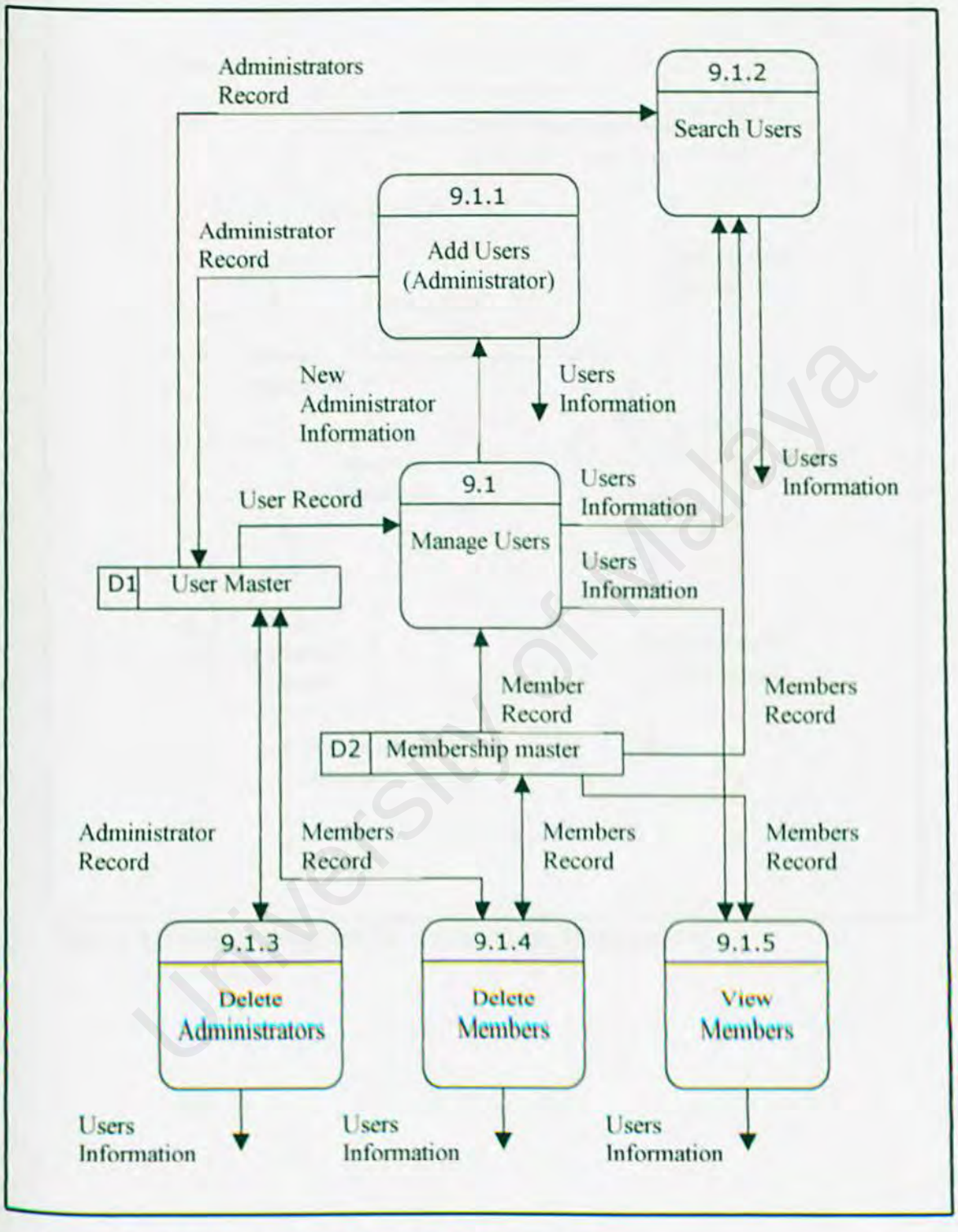


Figure 4.8 : Child Diagram for User Management

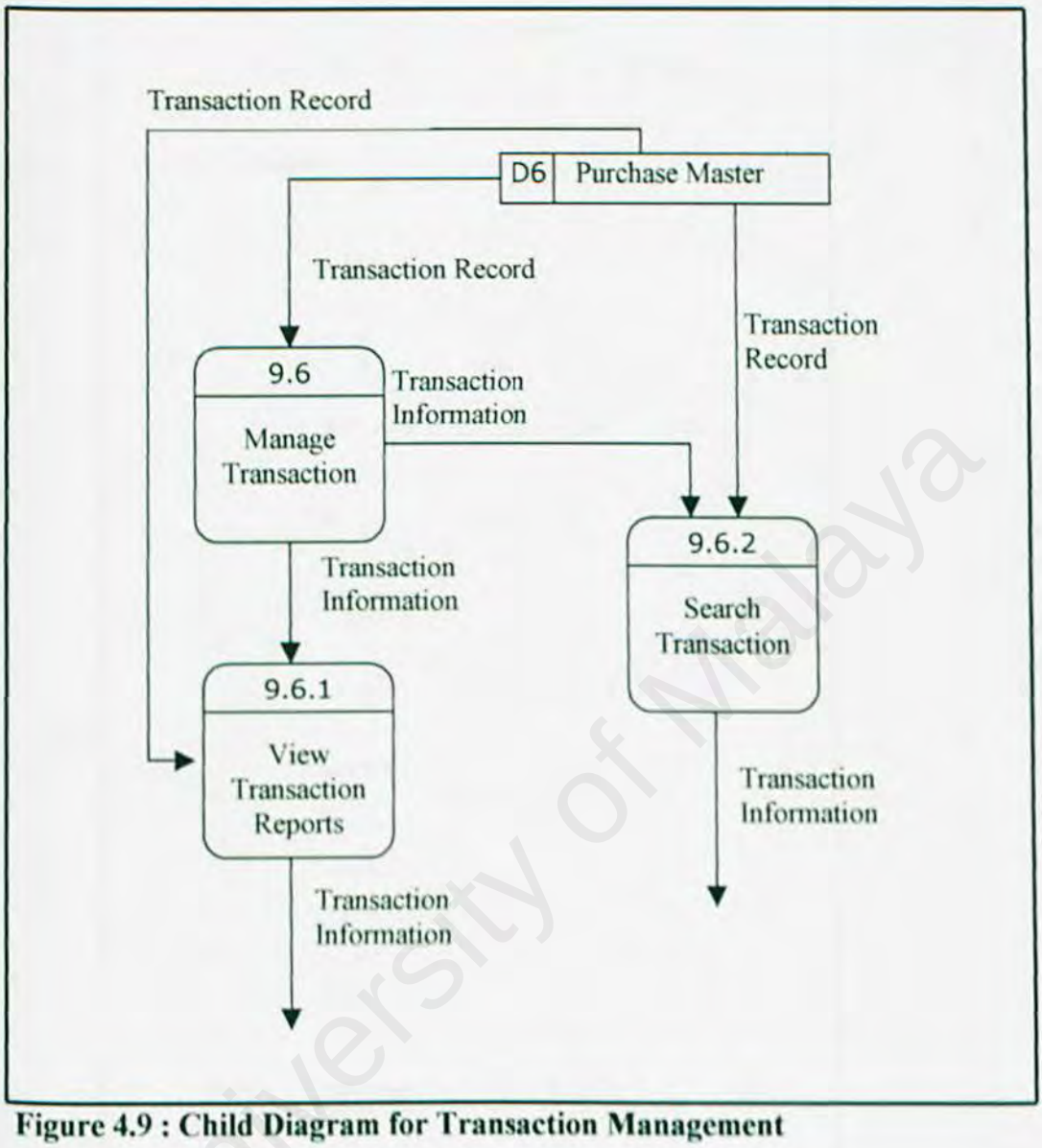


Figure 4.9 : Child Diagram for Transaction Management

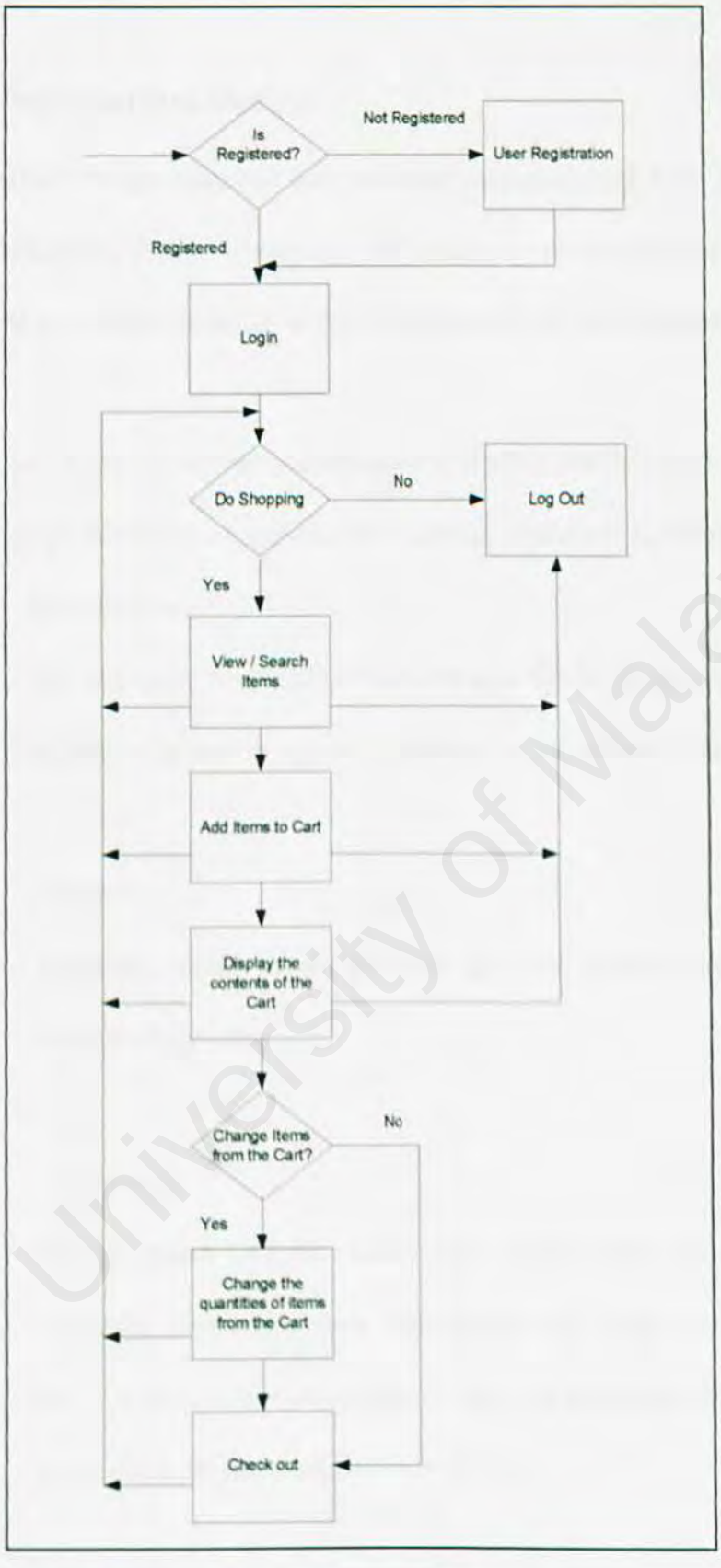


Figure 4.10 : Flow Chart for Online Purchase

4.4 User Interface Design

User interface design describes how software communicates with the human user who uses it (Mundher, 1994). It provides an effective communication medium between a human and a computer in order to get user's input to produce desired output.

As interfaces stand as the representation of a system, the designed input forms, screens and interactive Web fill-in forms should meet the objectives as mentioned below:

a) Effectiveness

All the input forms, input screens and fill-in forms will meet the system's objective by serving specific purposes in the information system.

b) Accuracy

Accuracy refers to design that produce proper completion. It ensures correctness of data.

c) Consistency

The proposed OUUBC takes into consideration the consistency of the interfaces to provide user friendliness and easy-to-use feature to system users. In this case, consistency is required especially in data grouping which is similar from one application to the next.

d) Simplicity and attractiveness

Simplicity refers to keeping hose same designs purposely uncluttered in a manner that focuses the user's attention, whereas attractiveness implies that users will enjoy using the input screens, input forms and fill-in Web forms through their appealing design.

e) User consideration

As interfaces will act as the communication layer that interact directly with users, therefore appropriate feedback will be provided to inform users the status and achievement of a particular process.

4.4.1 Site Layout Design : For Administrator

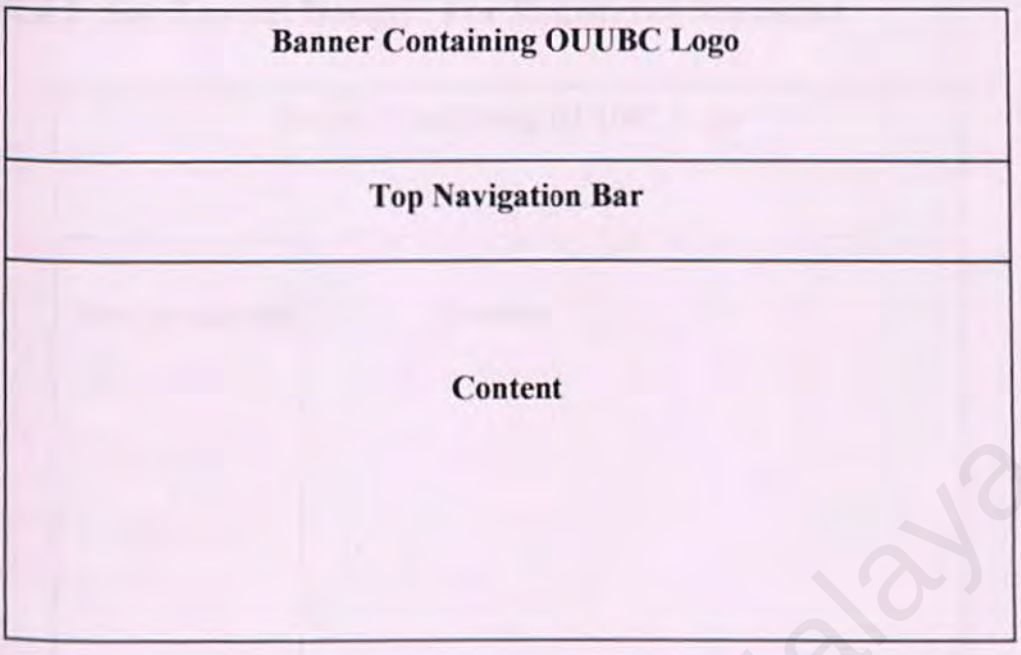


Figure 4.11 : Site Layout Design for Administrator

Logo	The logo part contains the logo for OUUBC.
Top Navigation Bar	The navigation bars for users to access to different pages in OUUBC. They are 'User Records', 'User Management', 'Search for User' and 'Logout' links.
Content	This is the part where all the application/ content for every page is placed.

4.4.2 Site Layout Design : For Registered Members

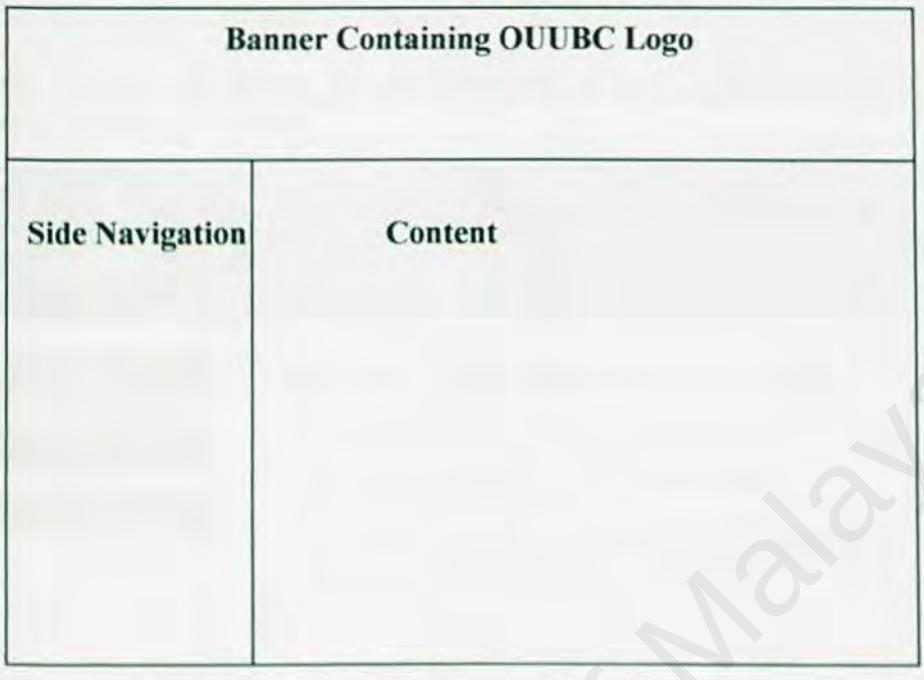


Figure 4.12 : Site Layout Design for Registered Members

Logo The logo part contains the logo for OUUBC.

Side Navigation Bar The navigation bars for users to access to different pages in OUUBC. They are 'Search', 'Book Shop' and 'Logout' links.

Content This is the part where all the application/ content for every page is placed.

4.4.3 Example of User Page

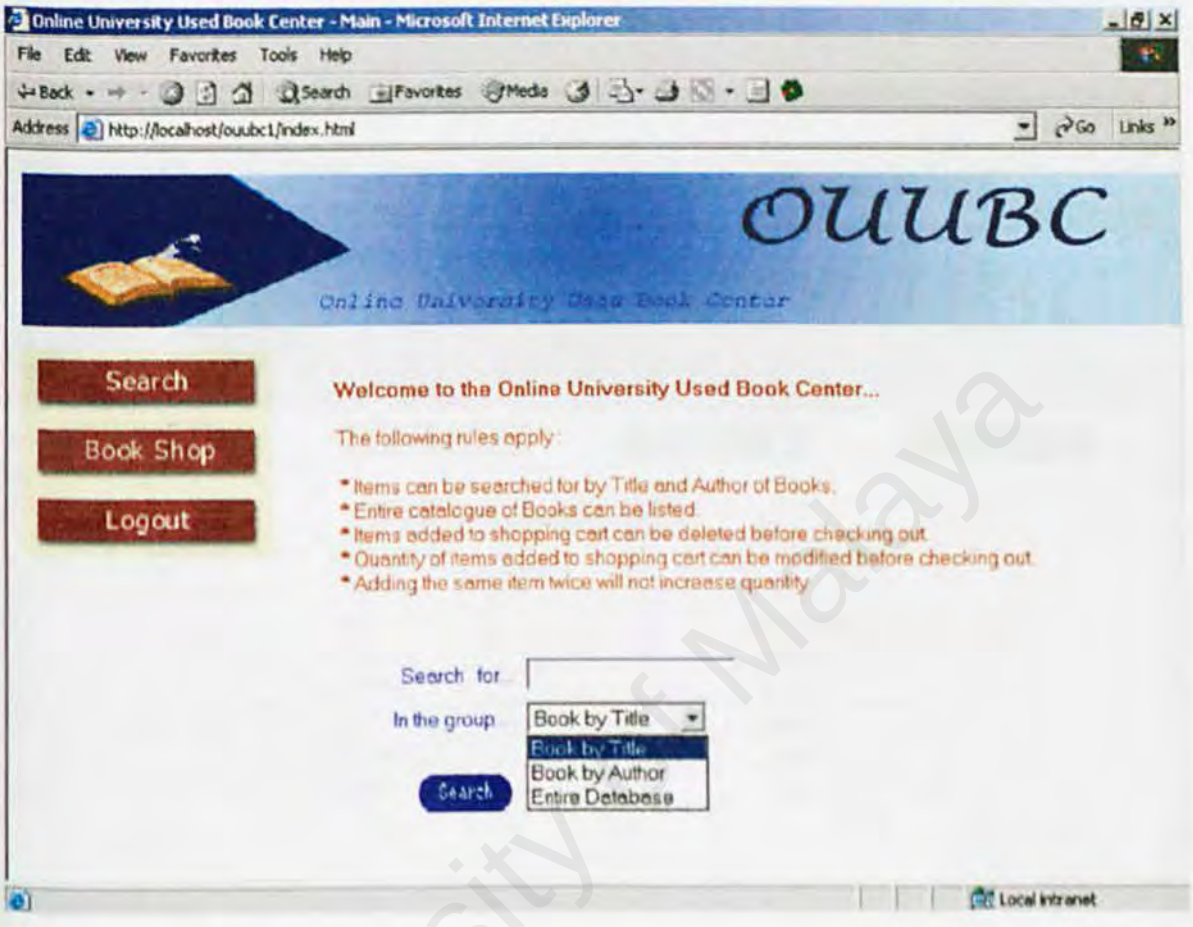


Figure 4.13 : User Page Design

4.4.4 Example of Administrator Page

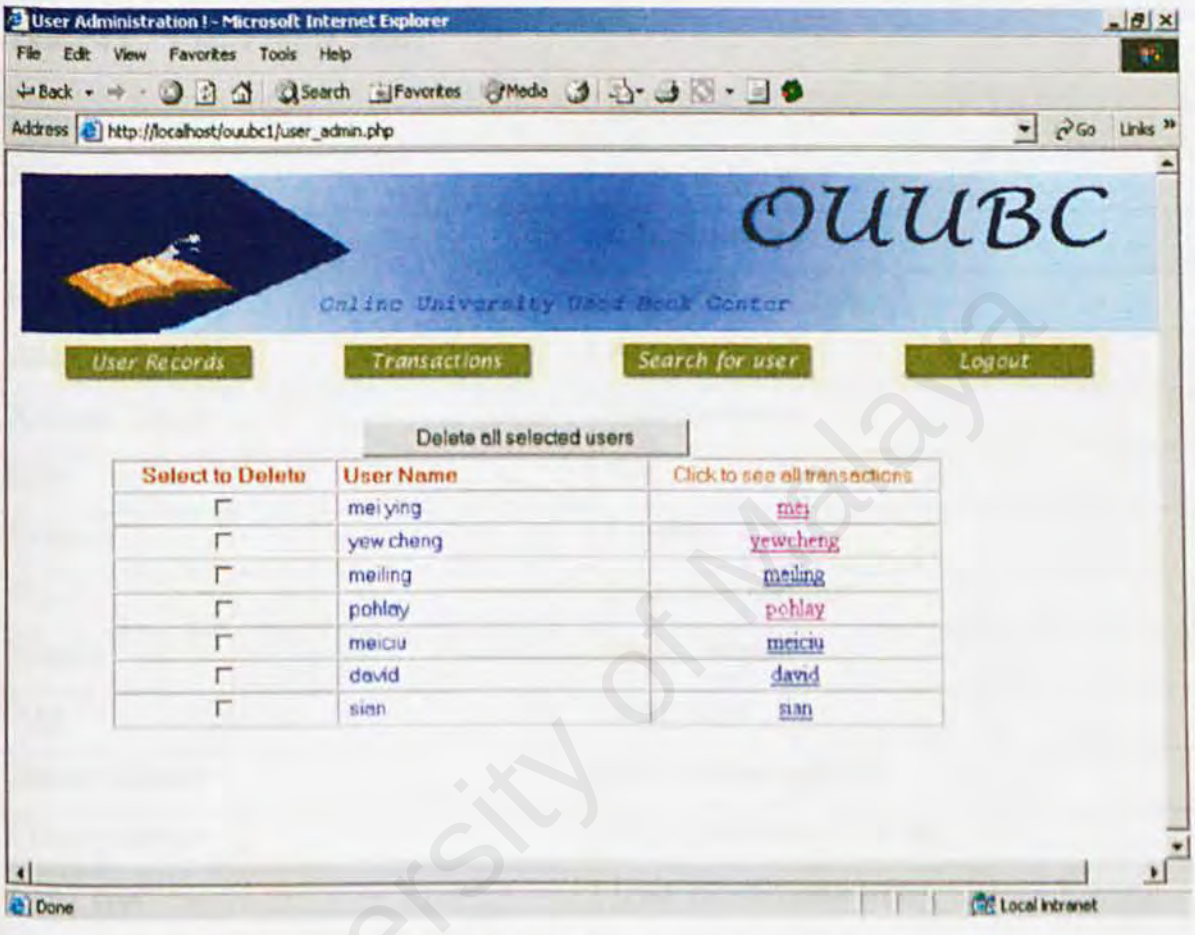


Figure 4.14 : Administrator Page Design

4.5 OUUBC Database Design

Table 4.2 User Profile Table

Column Name	Description
Name	Name of the user
User_id	Unique user-id
Password	Password
Address_line 1	Address Line 1
Address_line 2	Address Line 2
City	City
Country	Country
Pin	Post code number
Gender	Male / Female
Age	User's age
Email_address	User's email address
Phone_number	Phone number of the user
Card_type	User's credit card type
Card_no	User's credit card number
Expiry date	Expiry date of the credit card

Table 4.3 Book Shop Table

Column Name	Description
item_no	Unique identifier for the book
item_type	Book
Title	Title of the book
Author	Author
Price	Price

Table 4.4 Transaction Table

Column Name	Description
order_no	Unique identifier for the user's transaction
user_id	User Id of the User
item_no	Unique identifier, identifying the item.
Quantity	Number of item_no items ordered by the user
Status	Status of the item – shipped / pending

4.6 Expected Outcome

The OUBCC is an online system that serves local users for buying used books. From the system design, it is expected that the sites will do the following:

- Login authentication
- User registration
- Search books
- Purchase online shopping cart
- Managing the site's database

The processes of each stated above are shown in previous sections. It is expected that each of the modules will work according to the requirements that shown in their child diagram.

Besides, the sites should also be able to differentiate different level of users who access to OUUBC and therefore allow accessing to pages that only allow to those users. For instance, the administrators will have the right to access to administrators pages and registered members are allowing purchasing online.

The system will also have a set of database that is well organized to manage various type of information needed by the sites. The process of updating the database will be done by

the administrator, in which they will login OUBCC administrators page to do the updating works.

Finally, OUBCC will has a user-friendly interface that ease the users who are using the site. The system will also provide a security transaction to consumers, and fulfill the non-functional requirement in the requirement specifications.

CHAPTER 5

SYSTEM IMPLEMENTATION

5.1 Introduction

5.2 System Coding – Coding Approach, Style and Scripting Language

5.3 Summary

Chapter 5 - SYSTEM IMPLEMENTATION

5.1 Introduction

System implementation in software development is a process to convert system requirements into program codes. The initial stage of system implementation involves setting up the development environment. This includes setting up development tools to facilitate the system implementation.

Generally, the development environment is suited according to different development phases, which can be categorized into system design, system development and report writing process.

5.1.1 System Design

Microsoft Visio 5 is used in preparing data flow diagrams (DFD), entity-relationship diagram (ER diagram) and flow charts for the developed system. Although system design is clearly stated in chapter 4, nevertheless, during the initial stage of system development, a number of considerations and adjustments were done to the initial system design in order to match the actual needs and requirements.

5.1.2 System Development

The basic tools used for the system development are:

- Apache (Web Server)
- Microsoft Window 98 (Operating System)
- MySql (Database Management System)
- EditPlus2 (Editor for HTML, PHP)
- Adobe Photoshop 6 (Image creation Tool)
- Macromedia Dreamweaver 4 (Editor and interface creation tool)
- Microsoft Internet Explorer 5.5 (Web browser)

5.1.3 Report Writing

Microsoft Word 2000 and Microsoft Visio 5 are used for preparing proposal and other requirement representations. All the problems encountered, together with solutions found throughout the processes (from system implementation until system evaluation) were recorded as well as result from system testing and system integration.

5.2 System Coding – Coding Approach, Style and Scripting Language

5.2.1 Coding Approach

The selection for coding approach is essential for aiding in quality assurance of system projects. The top-down approach and the modular approach are selected for the coding purpose.

Top-down design means looking at the large picture of the system and then exploding it into smaller parts or subsystems (Kendall & Kendall) It allows the system analyst to ascertain overall system objectives first, as well as how they are best met in an overall system. Then the system analyst moves to divide the system into subsystems and the system requirements.

Once the top-down design approach is taken, the modular approach is useful in programming. This approach involves breaking the programming into logical, manageable modules. It works well with top-down design because it emphasizes the interfaces between modules and does not neglect them until later in system development. Each individual module should be functionally cohesive, so that it is charged with accomplishing only one function.

The top-down design is selected because it avoids the chaos of attempting to design system "all at once". Besides, it also prevents the system analyst from getting so mired in detail that he lose sight of what the system is supposed to do.

The modular program design makes modules easier to write and debug because they are virtually self-contained. Tracing an error in a module is less complicated, since a problem in one module will not cause problems in others. Modules are also easier to maintain since modification usually will be limited to a few modules and will not spread over an entire program. Modules are also easier to grasp, since they are self-contained subsystems. This means that a reader can pick up a code listing of a module and understand its function.

As shown in Figure 5.1 the OUUBC Top-down design, OUUBC is divided into two main parts, that is the administrator functions and the non-administrator functions. The administrator function is then sub-divided into four parts, the transaction management, user management login and search user. The non-administrator function has three parts, the registration and login, search and purchase books.

Each main part is divided into small parts using the modular approach according to the design requirements as describe in the chapter 4.

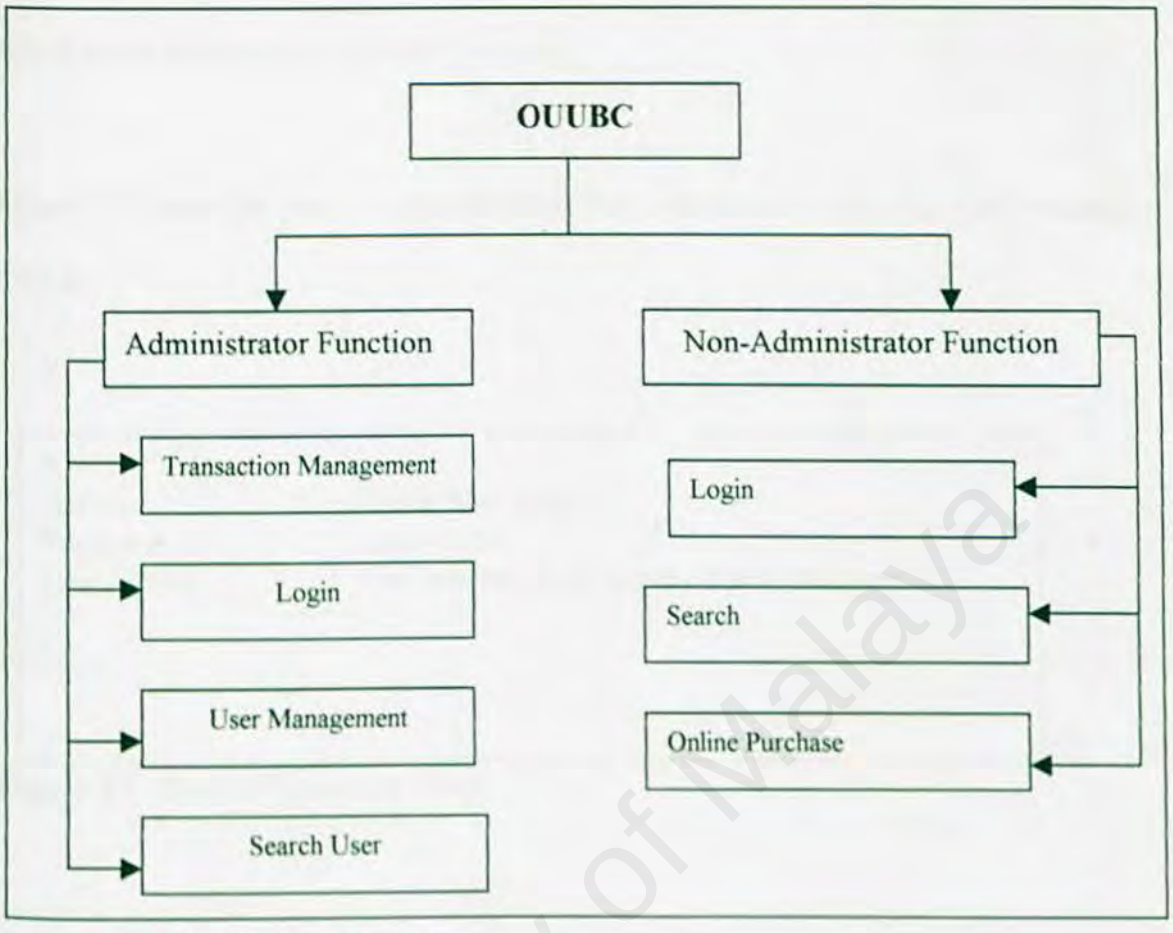


Figure 5.1 OUUBC Top-down Design

5.2.2 Coding Style

The coding styles are important to increase the code maintainability and readability.

(i) Internal Documentation

The internal documentation contains information directed at someone who will be reading the source code of the programs. Usually, this information is placed at the

beginning of each component in a set of comments called the header comment block, which act as an introduction to the program.

Figure 5.2 shows the header comment block that is included in every application page in OUUBC.

```
<!--
Author          : Chang Mei Ying
Filename        : logout.html
Description     : This program is to display logout message.

-->
```

Figure 5.2 Header Comment Block

(ii.) The PHP coding

For all the .php files, there are some include files written at the upper part of the program. The include statement means read and execute code from a specified file. The advantage of using include files is no need to duplicate writing the same codes in each .php files. If any error found on that particular file, the system just need to change one file instead of all the files. The include files in the module as shown below:

```
<?
        include ("shared/connect.php");
        include ("shared/common.php");
        include ("shared/error.php");
        include ("shared/validate.php");

        ……
?>
```

Figure 5.3 Include Files

All the include files are stored in a folder named 'shared'. The connect.php is created to connect to the MySQL database server.

```
if(!($link = mysql_pconnect ($db_server, $db_login, $db_password)))
{
        DisplayErrMsg(sprintf("Internal error %d:%s\n", mysql_errno(),
        mysql_error()));
                return 0;
}
```

Figure 5.4 Connect.php

The common.php file is created to define the variables used in particular files. So, we do not need to define in each file.

```
$db_server = "localhost";       //database server name
$db_login = "fsktm";            //database login name
$db_password = "mysql";         //database password
$db = "Ouubc";                  //database containing the tables
$Ouubc = "Ouubc";
$http_host = "localhost/ouubc1";          //HTTP host
```

Figure 5.5 Common.php

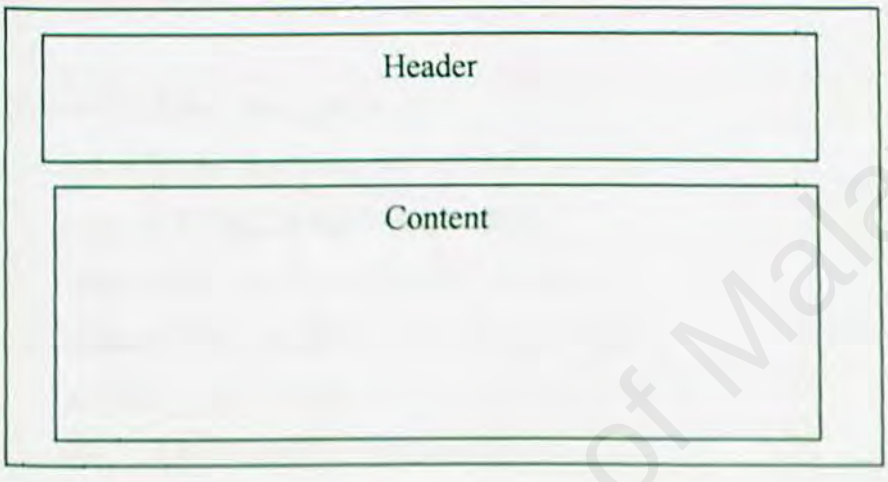
The ouubc1_main.php includes coding of the user interface design. This system has used <table></table> to control the different parts in the web site, as shown below:

```
<HTML>
<BODY>
    <TABLE> Header is here </TABLE>
    <TABLE> Content is here </TABLE>
</BODY>
</HTML>
```

Figure 5.6 Interface style

This method is easier to control and create dynamic content. Each time user click button to view another page of that site, changes will only occurred in the second table. This can also solve the problem of slow loading of pages.

The layout structure of the web site:



DisplayErrMsg function is defined in error.php files that is one of the include files.

```
function DisplayErrMsg($message) {
        printf("<blockquote><blockquote><blockquote><h3><font
color=#cc0000>%s</font></h3>\n", $message);


}
```

Figure 5.7 Error.php

Once the new account has been created, a database will be generated to the new member. After the database has been generated, 3 tables will be created under the database: user_profile, book, and transaction. The PHP coding is showed below:

```
CREATE DATABASE Ouubc ;

connect Ouubc ;

CREATE TABLE user_profile (
    name VARCHAR(40) NOT NULL,
    user_id VARCHAR(20) NOT NULL,
    password VARCHAR(20) NOT NULL,
    address_line1 VARCHAR(40) NOT NULL,
    address_line2 VARCHAR(40) DEFAULT NULL,
    city VARCHAR(20) NOT NULL,
    country VARCHAR(20) NOT NULL,
    pin VARCHAR(20) NOT NULL,
    gender VARCHAR(20) NOT NULL,
    age VARCHAR(20) NOT NULL,
    email_id VARCHAR(20) NOT NULL,
    phone_number VARCHAR(20) NOT NULL,
    card_no VARCHAR(20) NOT NULL,
    expiry_date VARCHAR(20) NOT NULL,
    card_type VARCHAR(20) NOT NULL,
    PRIMARY KEY(user_id));

CREATE TABLE book (
    item_no VARCHAR(20) NOT NULL,
    item_type VARCHAR(20) NOT NULL,
    title VARCHAR(60) NOT NULL,
```

```
    author VARCHAR(60) NOT NULL,
    price float NOT NULL,
    PRIMARY KEY(item_no));

CREATE TABLE transaction (
    order_no INT NOT NULL primary key auto_increment,
    user_id VARCHAR(20) NOT NULL,
    item_no VARCHAR(20) NOT NULL,
    quantity INT NOT NULL DEFAULT 0,
    status VARCHAR(20) NOT NULL);
```

5.2.3 Scripting Language

The scripting language that OUUBC used to develop the system consists of server-side scripting language and client-side language. Server-side programming language is PHP and for client-side is JavaScript. OUUBC use PHP in major part of the system and used JavaScript only for form validation.

(i) PHP

PHP is HTML embedded scripting language, means it can be used together with the HTML. In HTML, PHP script is enclosed with special PHP tags. (see example below)

```
<HTML>
    <BODY>
        <?  //PHP code start here  ?>
        ..............
        ..............
    </BODY>
</HTML>
```

Figure 5.8 PHP script

To print lines, use *echo*. To add comment to line, use // or /* */.

```
<?      /* This is Hello file*/
        // to Hello
        echo ("Hello World");    ?>
```

Figure 5.9 Echo

All the PHP files must be saved as .php file type.

(ii) JavaScript

For JavaScript, it is also a HTML embedded scripting language and can used together with HTML and PHP. In HTML, JavaScript script is enclosed with special JavaScript tags (see example below).

```
<script language="JavaScript">
        JavaScript statements
</script>
```

Figure 5.10 Java Script

The script tag is placed in the head of an HTML document so that all the JavaScript definitions have been made before the body of the document is displayed.

```
<HTML>
    <HEAD>
        <script language="JavaScript">
            JavaScript statements
        </script>
    </HEAD>
        <BODY>
        ..........
        </BODY>
</HTML>
```

Figure 5.11 Java Script in HTML

5.3 Summary

The system implementation of OUUBC is presented in Chapter 5. This includes the coding approach, programming styles, and scripting languages used .

The coding approach assure for the system's quality while the programming styles increase the system maintainability and readability. Data manipulation allowed interaction between OUUBC application and database. The scripting language is used for client side validation and hence reduces the redundant between client and server.

Overall, the primary goal of this phase is to produce a simple, clear source code with internal documentation that will ease the processes of a verification, debugging, testing, modification and further enhancement.

The next chapter discusses about the testing of the project and the system evaluation is discussed in Chapter 7.

CHAPTER 6

SYSTEM TESTING

Chapter 6 – TESTING

6.1 Introduction

The main function of testing is to establish the presence of defects in a program and to judge whether the program is usable in real application. Nevertheless, testing can only demonstrate the presence of errors. It cannot show that there is no error in the program. Therefore, a more suitable approach must be chosen to reduce the possibility of errors in a program.

Bottom-up approach is adopted in system testing for OUUBC. Each module at the lowest level of the system hierarchy is tested individually. Then, all the tested modules would be related to the next module testing. This approach is repeated until all the modules are tested successfully.

6.2 Testing Process

Testing takes place throughout the process of system implementation. Although testing is tedious, it is essential series of steps that help to assure the quality of the eventual system. Testing is done on many different levels at various intervals.

In developing a system, testing involves several stages as shown in Figure 6.1 below.

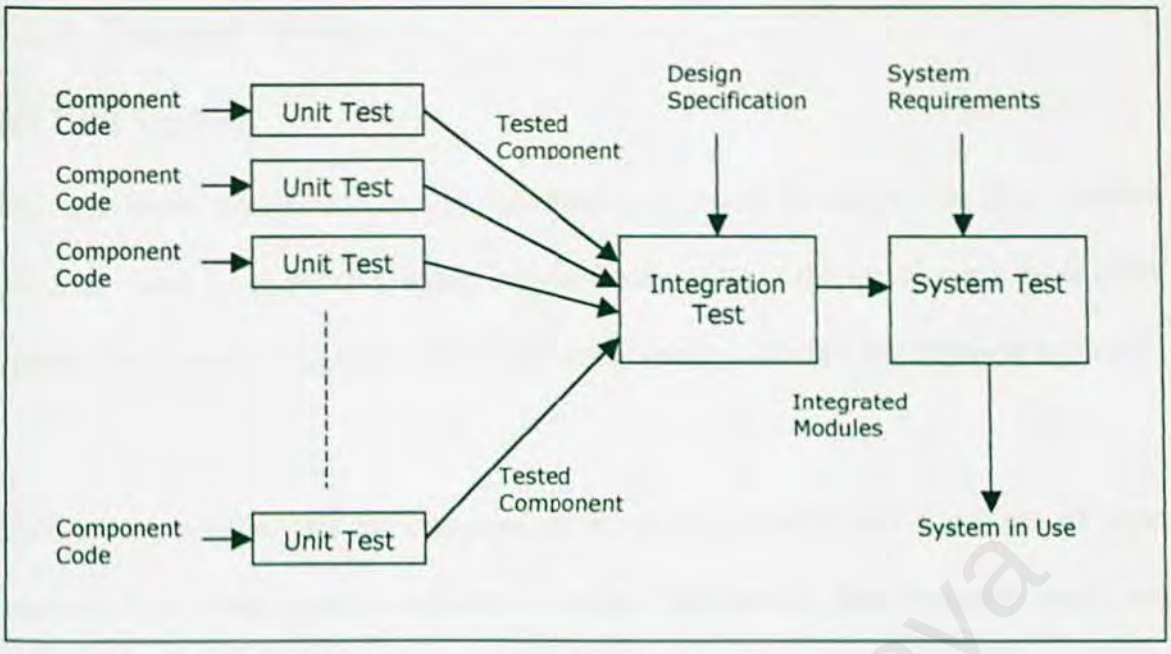


Figure 6.1 Testing Steps

First, unit testing or module testing is carried out in which each program component is tested on its own, isolated from the other components in the system.

When collections of components have been unit tested, the next step is to ensure that the interfaces among the components are defined and handled properly. Integration testing is the process of verifying that the system components work together as described in the system and program specifications.

Finally, the system is tested to assure that it has the desired functionality.

6.2.1 Types of Testing

(a) Unit Testing

Unit test is the process to test the individual component to ensure that they function properly. Each component is tested independently without the interference from other system components. Unit test is performed concurrently with the development process.

Unit testing verifies that the components functions properly with the types of input expected from studying the component's design. The internal data structures, logic, and boundary conditions for the input and output data are also tested.

To test a component, input data and conditions were chosen to allow the component to manipulate the data, and the output is observed. The input is selected so that the output demonstrates something about the behavior of the code.

Both valid and invalid data were created to test data. These data are then run to see if base routines work and also to catch errors. Created data also test possible maximum and minimum values, as well as variations in formats and codes. Throughout the process, the output is checked for errors.

For example, the new member's registrations form. The username, password, verify password, email, address and post code fields must not be left empty, while the email must be in correct format and the username, password and verify password fields does not allow for space and special character. Test data with wrong format is created to test

whether the units can detect the fault data. Some of the form fields are left empty when submitting the form, and to check whether the system can detect the empty fields.

Two important features in this new member's registrations form is no duplicating username and the matching of the user password and verify password. In this unit testing, these two features are tested too by using test data.

Connection of unit to others pages or link is also tested here. When completing the new member's registrations form, the data is submitted and if the registration success, users will be directed to the registration successful acknowledgement page. This is test by using a set of test data that is no fault.

(b) Module Testing

Module testing is performed without other system modules. A module consists of a collection of dependent components to perform a particular task or function. Different possible test cases are applied to the module and the test results would be verified. Unusual results will be analyzed and they would help in debugging sub-modules in order to produce the desired output.

For example, in testing the Search module, for any item searched by users, if there is no result for the search query, an interface with "Results not found" will be displayed. If there are results, then the results will be displayed appropriately.

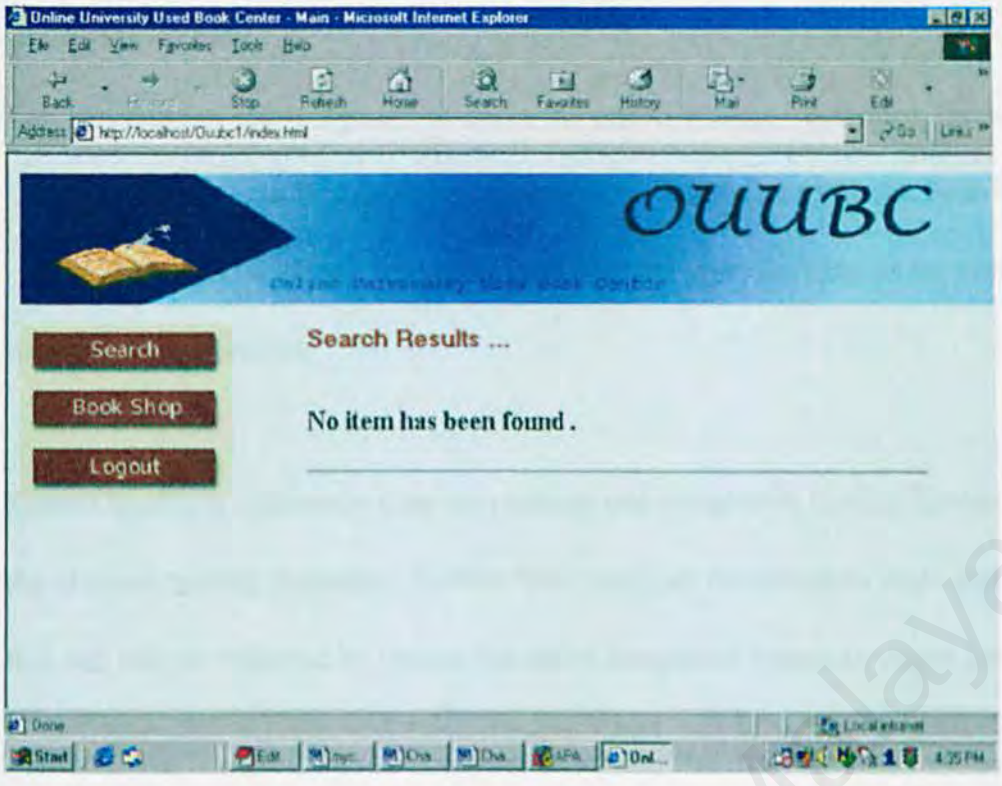


Figure 6.2 Page for Search Results Not Found

(c) Integration Test

Integration test is needed when all the two main modules, which are Admin Module and User Module as well as all the sub-modules, are integrated. The main focus in integration test is to exercise the interfaces repeatedly to detect any interface mismatch problem.

Several important aspects are checked to ensure that the flow of the data in OUUBC is well organized and are user friendly to all the system users.

(d) System Test

The sub-systems are integrated to make the entire system. Therefore, the main purpose in system testing is to find errors that result from unanticipated interactions between sub-systems. Besides, it is used to validate whether the system meets its functional and non-functional requirement.

System testing is difference from unit testing and integration testing. System testing is the ultimate testing procedure. System tests study all the concerns issue and behaviors that can only be exposed by testing the entire integrated system or major part of it.

(i). Security Testing

The security testing is to verify the protection mechanism in the system against improper penetration. The system security is tested as two differences way as below:

- **Password Case Sensitive**

  Password to access to the store back office is set to case sensitive, means that if password is pohlay1 and user enter the password with POHLAY1, it will prompt error message.

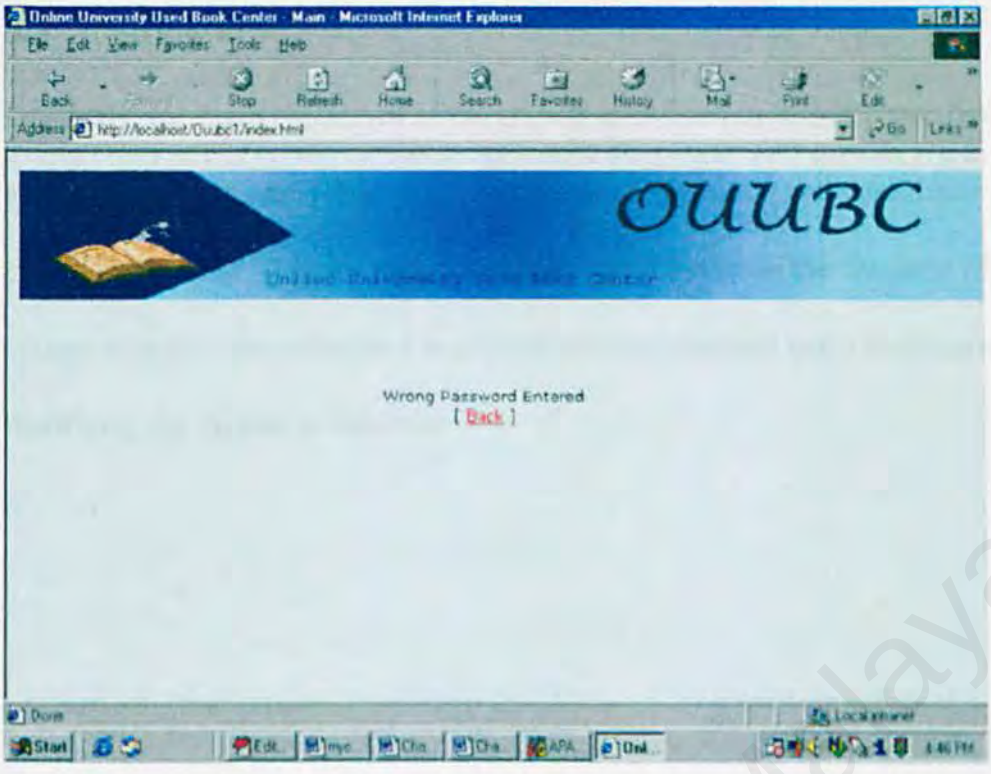


Figure 6.3 Page for Wrong Password Entered

- **Set Cookies**

The username cookie and password cookie will be set when user log in. The cookies will be checked to avoid user accessing the page without logging in to the system. The illegal action page will be prompt to ask user log in again. The cookies will be deleted when user logout.

6.3 Summary

Generally, the main objectives of the project as defined in earlier phase have been achieved. The system is able to handle the user registration and create new account for each new member. Besides that, it can handle and maintain the database for admin. This system also provides safeguard to prevent the unauthorized users from accessing or modifying the system or database.

CHAPTER 7

CONCLUSION

Chapter 7 – SYSTEM EVALUATION AND CONCLUSION

7.1 Introduction

Evaluation is the ultimate phase of developing a system and an important phase before delivery the system to the end users. Evaluation was related to user environment, attitudes, information priorities and several other concerns that are to be considered carefully before effectiveness can be concluded. At all phases of the system approaches, evaluation is a process that occurs continuously, drawing on a variety of sources and information.

7.2 Problems encountered and solution

7.2.1 Difficulties in choosing a Programming Language

In the market, there are several popular programming language used for web development. Choosing a suitable programming language was a critical process as all tools have their own strengths and weakness.

In order to solve this problem, I search information from Internet and study on the strengths and weaknesses of each programming language. I have chosen a programming language that support all the requirements defined in my system. The information in the Internet helps me a lot in making up the decision.

7.2.2 Lack of mastery of knowledge

In the market, do not have any debugger for PHP and all have to be done by manually. I have faced some debugging problems in tracing the errors in my system and I found I have used much time in debugging code.

The solution is to copy and learn the codes that done by other programmer from Internet. Besides that, I also join some forum on web to increase my knowledge on PHP. This problem can be decreased after I have experience on writing PHP program.

7.2.3 Using Windows 98 instead of Windows 2000 for VIVA

As defined in the 3181 report, I have used Windows 98 to develop my system. However, I was sharing a PC with my other friends who use Windows 2000 and the lab assistance mention that the it is secure to use Windows 2000 to log in as we have already booking the PC.

Therefore, I have used Windows 2000 for VIVA presentation. This do not cause any crash in my system because I just transfer my end system from Windows 98 to Windows 2000 for demo purpose.

7.2.4 Lack of resources

There is a limitation of using the resources available in the faculty since there are only limited numbers of PC available.

To use a PC, one will need to share it with more than three students. To solve this problem, a group of five students is formed and a PC is shared among these five students. Then arrangement of time for using the PC is made.

The PC in the lab is needed for the purpose of transferring and testing the system, and prepared it for viva session.

7.2.5 Hardware limitations

There is a hardware limitation when implementing and testing the system. a scanner is needed to scan picture of books and save it to the OUUBC folder.

When developing the application, there is no scanner used. Therefore, to create test data, books information and pictures were downloaded from the Internet.

However, in actual when maintaining the site, the administrator will need a scanner to perform the task of managing books in OUUBC.

7.3 Evaluation by End User

Evaluation by end user was collect feedback and comments from the users after they test on my system. Evaluation can be positive and negative. Through this evaluation, I can know that how is my system meet their need in business, which part is the most

attractive part and which parts need to be improved. I have found end users to test on my system and answer my questionnaire (appendix).

End users responses are important because the end users are the people who interact with the system. The end users can provide comment and suggestions that are useful to enhance and improve the services.

From the response return by end users, improvement and modifications are made to the system.

7.4 System Strengths

7.4.1 Easy-to-use Application

Ease-of-use is most important aspect in developing this system. The system provides easy-to-use application to dealers to manage their stock in the shortest time and lowest cost.

7.4.2 No Geographical Barrier

Users does not have to worry about the geographical barrier when using the OUUBC System. Business can be deal between users from any states in Malaysia through Internet.

7.4.3 User-friendly Interface

OUUBC system designed with user-friendly Graphic User Interface (GUI) components, such as interactive button, hyperlink to other pages, etc. This is used to minimize the user actions when performing certain task.

7.4.4 Custom password validation

A custom password-authentication system is created to prevent unauthorized users from accessing the page if they do not have any permission to view. More importantly, the authorized users are prohibited from accessing the functionality, which is out of their privilege.

7.5 System Constraints

OUUBC has the system constraints as described below:

- Since OUUBC is still a new establish business, the target market can only be limited to the Internet users in Malaysia due to expensive cost of delivery.

- Due to the time constraint, all the data are retrieved from the database through MySQL statements and not using the stored procedure. This means that in the real situation, the performance speed might be slower. For instance, instead of having to access the database twice by using MySQL statements to get information, a stored procedure that runs steps at one time will be used and it will immediately return the information to users. This would increase the

processing time especially when there are a huge amount of text to be processed at the same time. Therefore, it has become one of the recommended future enhancements.

7.6 Future Enhancements

In future, OUUBC can be enhancing in several perspective as described below:

- When OUUBC meets its stable and maturity stage, it can expand its business by widen the target market, not only to local Internet users.

- Meanwhile, OUUBC rely on the product, the used books. In future, OUUBC could add the product line by selling not only used books, but also old magazines, and even old Cassette and Compact Disc. Furthermore, OUUBC can also sell new books.

- Later when OUUBC is implemented as real system, the electronic payment system can be create to function in real time. This could be done when OUUBC has registration with a merchant account. Thus, the OUUBC electronic payment system could be connected to the merchant so that to perform the monetary transactions.

- Whenever possible, all the related MySQL statements should be replaced by the use of the stored procedures.

7.7 Knowledge and experience gained

Upon completion of this project, lots of knowledge and experiences were gained. From the beginning till the end of the project, a student is expose to the seven phases involves in bringing out the system.

Students had learned about the process of analyzing, designing, implementing, testing and evaluating a system. These experiences are very helpful in future when handling a project.

Furthermore, when developing the system, students can improve knowledge towards in using tools such as the programming languages, the scripting language, the databases and the designing tools.

From the development also, students can understand how a shopping cart functions. Students also learned how to build a shopping cart.

Besides, students also learned the technique and skill in developing a project, the right manner of documenting the system and the right way to implement a code and system.

7.8 Summary

The evaluation towards the system including the problems faced and the solutions, the system evaluation by end users, system strengths, system constraints, future enhancements and the knowledge and experiences gained.

The system strengths indicate the positive values of OUUBC while the system constraints show the limitation of OUUBC. However, the system constraints can be improved in the future with the enhancements to the system.

Finally, upon completion of this project, student has gained lots of knowledge and experiences.

7.9 Conclusion

Online University Used Book Center is an electronic used bookstore establish in Malaysia. The objective of OUUBC is to build an online used book center application that sells used books.

The development of OUUBC involves seven phases, project definitions, literature review, system analysis, system design, system implementation, testing and system evaluation.

Thorough researches have been carried out to develop OUUBC. These include researching the existing system, the tools, the functional and nonfunctional requirements, methodology, the coding approach and programming styles, and the testing approach. The system was designed based on the results of the researches.

Although this system probably cannot be considered advanced or complex, the successful development of the OUUBC is the first step towards more comprehensive and innovative system development in future. The problems and experiences gained during the system development definitely provide very useful foundation in my future endeavors.

REFERENCE

http://www.zend.com/zend/aboutphp.php

http://wmf.dyndns.org/scn.php

http://www.intranetjournal.com/articles/200002/dream_index.html

http://www.pewebopedia.com

http://www.whatbok.com/default.htm

http://www.powells.com/home.html

http://www.bookgarden.com

http://www.nogarbagebooks.com

http://www.eskimo.com/~recall/index.html

http://www.rereadables.com

http://www.lnfbooks.com

http://www.abooksearch.com/index.htm

http://www.21northmain.com

http://www.tomfolio.com

David M.Kroenke, *Database Processing*, Seventh Edition, pg 15, Prentica Hall, Inc., 2000.

Eaglewood Cliffs, N.J, *Structured Systems Analysis and Design Tools and Techniques*, Prentice Hall, Inc., 1979.

Jesus Castagnetto, Harish Rawat, Sascha Schemann, Chris Scollo, Deepak

Veliath, *Professional PHP Programming*, pg 124, Wrox Press Ltd., 1999.

Kalakota Ravi and Whinston B. A. Electronic Commerce: A manager's guide. United States of America: Addison Wesley Longman Inc, 1997.

Kendall, Kenneth E. and Kendall, Julie E. (1996). *System Analysis and Design*. 4th edition. California: Prentice-Hall, International, Inc.

Laudon C.K and Laudon P.J. Management Information System: Organization and Technology in the Networked Enterprise. New Jersey: Prentice Hall.

Mandel, T. (1997) *The Elements of User Interface Design*, Wiley.

Mundher, G.(1994). *The Design of the User Interface for an Information System. Information and Software Technology.* Volume 36 (12): 773-742

Oxford Advanced Learner's - English-Chinese Dictionary Third Edition (1987). Oxford University Press.

Pressman, Roger S. (2001) *Software Engineering: a practitioner's approach* – 5th edition. McGraw-Hill.

Sommerwille, I. (1995). *Software Engineering*. 5th edition. Reading: Addison-Wesley Ltd.

Shari Lawrence Pleeger, *Software Engineering*, Second Edition, pg 51, Prentice Hall, Inc., 2001.