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ICT LITPRO PORTAL

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Abstract

ICT LitPro Portal is a web based multimedia learning system for lower secondary level. ICT LitPro is designed to create an information rich environment of knowledge that is accessible and available. The users of the portal are categorized into 3 main groups mainly the Administrators, Registered Members and the Non-Registered Members.

The ICT LitPro Portal includes 6 modules which are the Authentication, User Management, Lesson Management, Test Management, Search Function and the Discussion Board.

ICT LitPro Portal will be developed using Microsoft Active Server Pages technology. The other development tools include Windows XP Professional, Microsoft Internet Information Server 5.0, Microsoft SQL Server 2000 and also Macromedia Dreamweaver MX.

Administrators will be maintaining the portal by tracking all activities in the portal. They will be supervising all the authentication process for login and logouts, the lessons management, test management and not to mention the discussion board.

Registered Members will be able to engage in User Management, where they will be able to edit their own user profile, get a temporary user id and password in case they forgot it. They will also be able to participate in the tests given out after following the lessons for a period of time. The lessons given will include Advanced Word Processing, Advanced Graphics and Presentation, Spreadsheet, the Internet and the World Wide Web.

Non-Registered Members will only be able to view the lesson plans provided for an overview of what the whole lessons are all about. They will only be able to join in as a

Registered Member after registering as a member and paying an amount of fee through credit card transaction.

All in all, it is hoped that this information gateway will be able to achieve its goals in meeting the rapid changing needs of today's education environment. Last but not least, it is important to stress that this project is not intended to take place of teachers. It is merely a teaching and self-learning aid that acts as a supplementary to the core curriculum supplied by schools.

Acknowledgement

I would like to take this opportunity to express my heartfelt gratitude and thanks to all the people who have given their guidance, helped and support throughout my preparation for this project.

First of all, I would like to take this opportunity to express my gratitude to my respected supervisor Puan Maizatul Akmar Ismail, moderator Puan Sri Devi Ravana for their guidance, invaluable advice and supervision throughout the project. Without their patience in guiding me, I certainly would not have been able to complete my project without any major glitches.

I would also like to express my thanks to my team mate Miss Tan Chiew Ping for her cooperation and helping hand throughout the project development.

Last but not least, a very special thanks to my beloved family for their support and encouragement during the struggle throughout the completion of this ICT LitPro Portal.

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Chapter 1: Introduction

1.1 Project Overview

In an environment characterized by rapid advance in ICT, globalization, liberalization, and greater reliance on knowledge for value creation, Malaysia plans to leapfrog into the post-industrial age by leveraging ICT as a strategic lever for national development and global positioning. In 1996, Malaysia launched a program called "Vision 2020", which laid out a plan to build a fully developed, knowledge-rich Malaysian society by the year 2020 through the development of the ICT sector and the use of ICT to increase global competitiveness. The intent behind Malaysia's Multimedia Super Corridor (MSC) has been to create a high-tech environment and infrastructure that can attract national and international investors and create spillover effects in the rest of the Malaysian economy. Specific sectors of focus include education, healthcare, government, commerce and manufacturing.

This project is developed due to the arising problems that cause the need for a better information portal. Information on ICT is developing so rapidly that the explosion of information cannot be accessed effectively. This portal will provide relevant and current computer skills to lower secondary students that will best prepare them for the future. It will also allow teachers to work with students using detailed lesson plans to provide students with essential computing knowledge.

Chapter 1: Introduction

1.1 Project Overview

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1.2 Project Motivation

It has become increasingly apparent that conventional instructional delivery system in education is having limited success in meeting the rapid changing needs of today's education system. Today's students are graduating into a world where success depends on their ability to use and understand technology. Regardless of where they work or the work they do, it will be necessary to utilize computers to gather, analyze and exchange information quickly and accurately. Students with the skills, knowledge and ability to convey ideas electronically, have a solid future.

Benefits of computers in education have been proven time and time again. It offers great potential to reduce the learning difficulties as well as accelerate the learning process. Advantages gained by using computers for teaching and learning include:

- Better understanding
- More control
- Better feedback
- More enjoyable
- Able to learn and work at own pace in own time

The fact that personal computers prices have dropped and as processors become more powerful, machine capable of delivering multimedia have become more widely available, not only in education but also in the home market.

It is important to stress that the project to be developed is not intended to take place of teachers. It is merely a teaching and self-learning aid that can act as a supplementary to the core curriculum supplied by schools.

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It is hoped that this project will bring the e-level of education one step further by providing the more effective way of teaching and learning in order to prepare students for greater challenges in the future.

1.3 Project Objective

The statement of project objectives outlines the end results towards which specify what is expected to be achieved in an endeavor to develop a new project. The main purpose of the project is to design and develop a web-based multimedia teaching and learning system for lower secondary students. Besides that, it is also:

- To develop an effective and interesting learning tool in order to retain students' interest and involvement

- To enhance knowledge among students

- An alternative to learn ICT in a simple and entertaining way

- An information portal where students can obtain and share their ideas or information of ICTs.

- To enable students to monitor their performance and progress by participating in the quizzes provided.

- To design and develop a user-friendly interface which is more interactive and attractive

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1.4   Expected Outcome of The System

The ICT LitPro Portal is expected to be:

- An interactive, interesting and user-friendly learning tool

- Able to promote the use of web learning as a preferred teaching approach

- Easier for teachers to rate progress and communicate with students.

- Easier for students to monitor their progress

- Appeal to students' interest and make learning fun

1.5   Project Scope

Several considerations will be made during the development of this project. The user scope will be:

- The lower secondary (Form 1, 2 and 3) students aged between 13-15 years old

- The lower secondary school teachers.

The system scope will be:

- Administration

- Members

- Public

1.6 Limitations

ICT LitPro Portal has certain limitations as follow:

- This system is meant for lower secondary students aged between 13-15

- The targeted users of this system are students and teachers that visit this website, which means they must have access to the Internet.

- Students and teachers must have basic knowledge in handling a computer

- Functionality of the portal is limited to certain functions and users because of time constraint

1.7 Project Schedule

Time management is important to all project developers. It is an important attribute in determining how deep a problem has been analyzed, how comprehensive should a solution be designed, how complete can a source code be implemented and how thoroughly can the program be tested.

A project development schedule is planed at the system studies and planning phase to ensure that effort is distributed within the prescribed time frame to make the best use of resource.

Task Name	June 2003	July 2003	August 2003	September 20	October 2003	November 200	December 200	January 2004	February 2004
System Study	▭								
Literature Review		▭							
System Requirement Analysis		▭▭▭							
Initial System Design			▭▭						
System Module Coding						▭▭▭▭▭			
Evaluation and Testing							▭▭▭▭		
Implementation									▭
Documentation		▭▭▭▭▭▭▭▭▭▭▭▭▭▭▭▭▭								
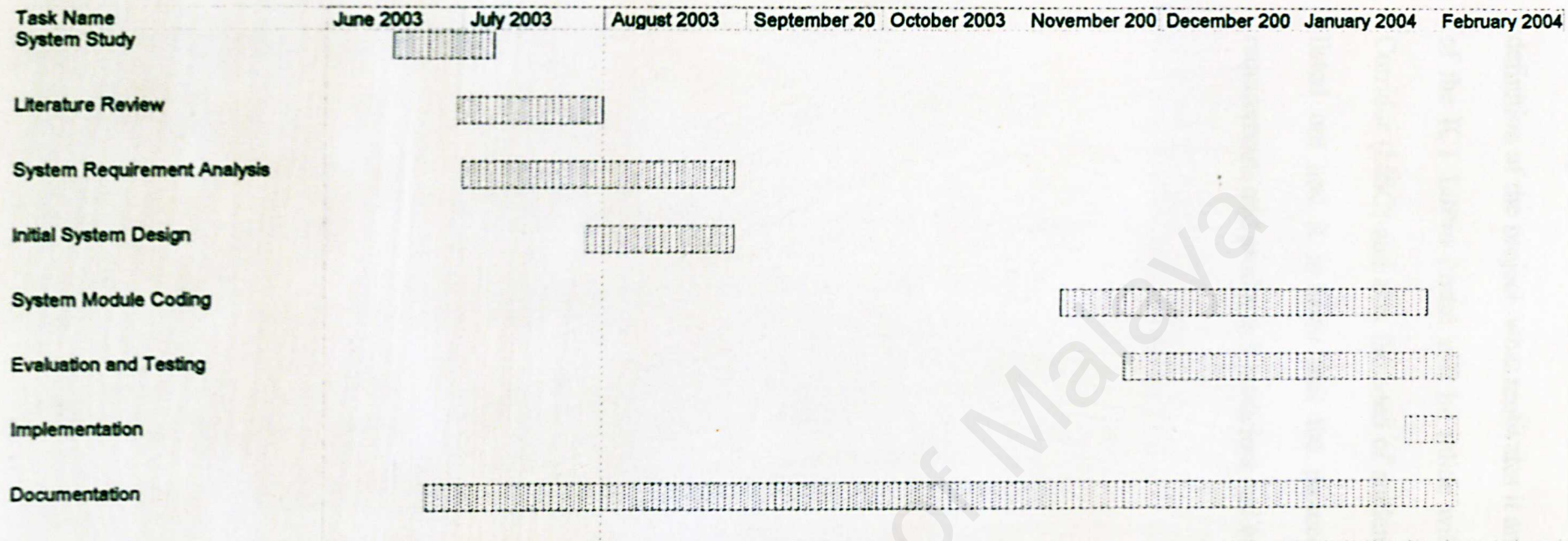
Figure 1.1 below depicts the project schedule for ICT LitPro Portal

Summary

Chapter 1 briefs on the fundamental understanding of this project. It explains the definition of the project, what motivates it and what the objectives are. The development of the ICT LitPro Portal will be inline with the demand from the Multimedia Super Corridor (MSC) and also the need of students and teachers. The scope of the project is listed out and it is hope that the project will turn out as expected, meeting the requirements and produces a proficient and quality product.

Chapter 2

Literature Review

Chapter 2: Literature Review

This chapter will present the outcome of further research undertaken by us regarding the project to be developed and the related topics. The issues covered here will be the definitions of some key terms, the approach used and also the findings that are related to our system.

2.1 Definition

A literature review is to sufficiently equip the project's developer with some knowledge of the strengths and limitations of several development tools. It helps to know some of the existing features offered by a similar system and to get the better understanding on the development tools and techniques that can be used in the development process.

This is also a background study of the related knowledge and information collected. This enables the developer to gain more knowledge on the development methodologies used in the project and have an overview of how to improve the weakness of the current system and fulfill the requirement needed.

2.2 Approach to Research

We undertook various approaches in researching numerous literatures with the aim of learning new things and to find more supporting facts in designing our ICT portal. The information found through this process will be implemented in the development of the portal.

- **Books**

  Reference books concerning issues like system architecture, analysis and design were referred in the process of designing the structure of the portal. This fact finding technique is conducted by studying the existing documentations. This gives us more information and understanding about the system that is going to be designed.

- **Search Engines**

  These are used to facilitate the searching of the information for review purposes. Among the search engines used are: Altavista, Yahoo, Catcha and also metasearch such as Metacrawler and Mamma.

- **Existing Websites**

  The existing websites on the internet provide the most useful review for our project before the development of the system starts. Aside from local websites, searching with various search engines revealed several websites which were also explored to gain better understanding of what is to be included in our portal.

- **Existing thesis**

    Thesis prepared by our seniors and lecturers provide a very useful resource in getting information and also guide us to what is the requirements for our final year project.

2.3 What Is A Portal?

Portal is a term, generally synonymous with *gateway*, for a World Wide Web site that is or proposes to be a major starting site for users when they get connected to the Web or that users tend to visit as an anchor site. There are general portals and specialized or niche portals. Some major general portals include Yahoo, Excite, Netscape, Lycos, CNET, Microsoft Network, and America Online's AOL.com. Examples of niche portals include Garden.com (for gardeners), Fool.com (for investors), and SearchNetworking.com (for network administrators).

A number of large access providers offer portals to the Web for their own users. Most portals have adopted the Yahoo style of content categories with a text-intensive, faster loading page that visitors will find easy to use and to return to. Companies with portal sites have attracted much stock market investor interest because portals are viewed as able to command large audiences and numbers of advertising viewers.

Typical services offered by portal sites include a directory of Web sites, a facility to search for other sites, news, weather information, e-mail, stock quotes, phone and map information, and sometimes a community forum. Excite is among the first portals to offer users the ability to create a site that is personalized for individual interests.

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The term *portal space* is used to mean the total number of major sites competing to be one of the portals.

2) In fantasy games, science-fiction, and some "New Age" philosophies, a portal is a gateway to another world of the past, present, or future, or to an expanded awareness.

3) In 3-D graphics development, *portal rendering* is a technique that increases the effect of realism and speeds up presentation.

2.4 Comparisons with Existing Systems

- http://www.fortunecity.com

Advantages:

Easy navigation

Modules arranged in a more systematic way

Disadvantages:

Unattractive interface

No notes

No multimedia elements

No tests or quizzes

Only suitable for extra information but not sufficient for virtual learning aspect

- http://myschoolnet.ppk.kpm.my/tutorial.htm

Advantages:

Supports multimedia elements

Tutorials prepared by experienced teachers in related fields

Existing *Do You Know* module that gives latest information related to education

sector

Disadvantages:

No notes

Unattractive interface

- http://www.tutor.com.my

Advantages:

Contain interactive modules like games, laboratory, discussion, chat and

wallpaper

Contains tutorials for all levels

Easy navigation from 1 page to the other

Disadvantages:

No notes

Unsystematic arrangements and unappealing interface

Multimedia elements not stressed upon

Summary

Chapter 2 briefs on the reviews of all the documents related to our system. This chapter gives a brief explanation on topics researched and studied that are relevant to our project. Besides that it also reviewed existing systems similar to the system being built and tries to compare and improve it accordingly to our system.

Chapter 3

Methodology

Chapter 3: Methodology

3.1 Introduction

A methodology is a problem solving approach to build systems. System development methodology is a very formal and precise system development process that defines a set of activities, methods, best practices, deliverables and automated tools for system development and project managers to use to develop and maintain most or all information system and software.

The way of software development process is an essential ingredient in order to build up and develop a good system. The ultimate goal of the software developer is to achieve and provide users with product that can meet their needs and expectations.

The process in software development involves three transformations. First, the transformation is from the needs from the real world to the problems and thus from the problem statement, it is transformed to a detailed implementation statement. After the implementation statement, it is transformed to an operational system. Operational system involves a lot of time and money such as in testing, maintenance and others.

3.2 Software Process Model

A software process is a set of activities and associated results which produce a software product. These activities are mostly carried out by software engineers. These may involve the development of software from scratch although it is increasingly the case that new software is developed by extending and modifying existing systems.

Software processes are complex and, like all intellectual processes, are reliant on human judgment. Because of the need for judgment and creativity, attempts to automate software processes have met with limited success.

One reason why there is limited scope for process automation is the immense diversity of software processes. There is no ideal process and different organizations have developed completely different approaches to software development. Processes have evolved to exploit the capabilities of the people in an organization and the specific characteristics of the systems which are being developed.

A software process model is an abstract representation of a software process. Each process model represents a process from a particular perspective so only provides partial information about that process.

3.3 V Model
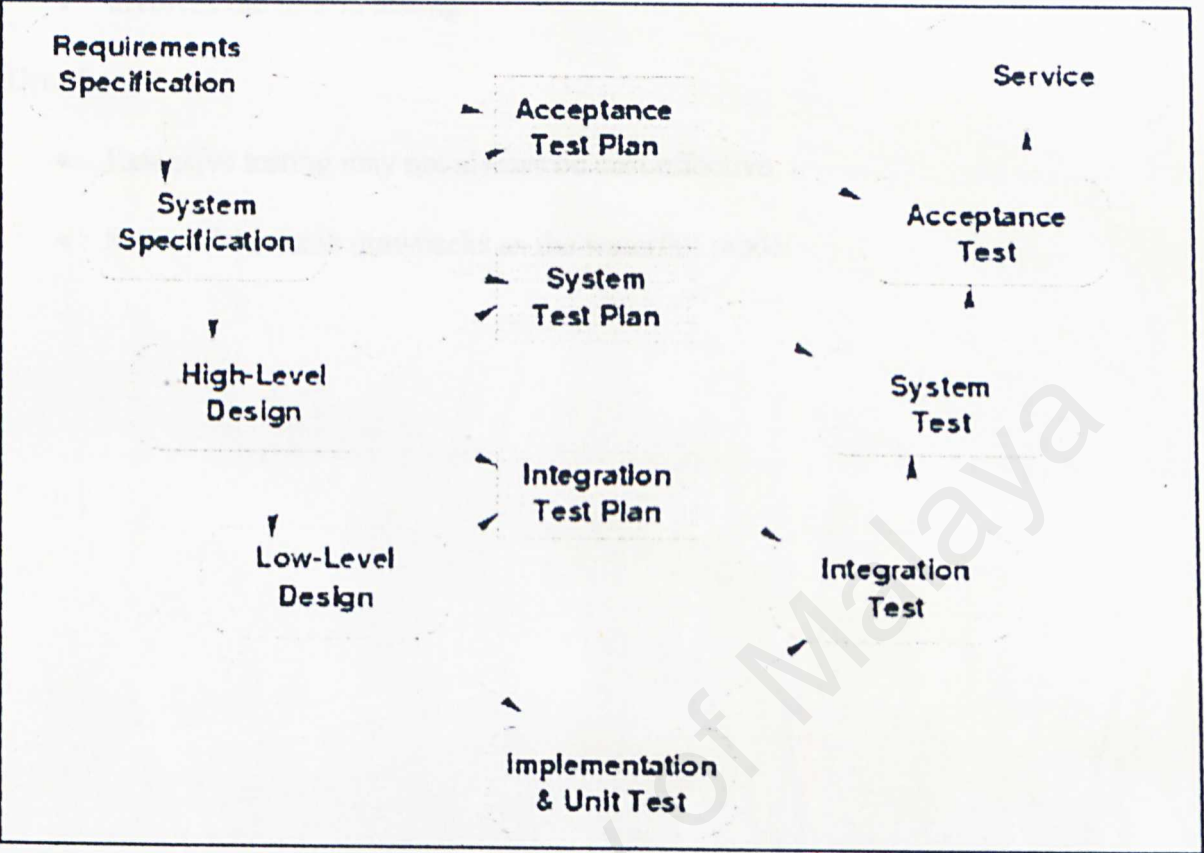
Figure 3.1: V Model

The V Model is a variation of the waterfall model that demonstrates how the testing activities are related to analysis and design. Coding forms the point of the V, with analysis and design on the left, and testing and maintenance on the right. Unit and integration testing addresses the correctness of programs and verify the program design. System testing should verify the system design, making sure that all system design aspects are correctly implemented. Acceptance testing which is conducted by the customer validates the requirements by associating a testing with each element of the specification.

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The benefits of the V model include:

- Better spells out the role of different types of testing

- Involves the user in testing

Drawbacks:

- Extensive testing may not always be cost effective

- Some of the same drawbacks as the waterfall model

Summary

Chapter 3 briefs on the methodology and also the software process model chosen, which is the V model. It is chosen due to the many benefits and also due to the suitability to this ICT LitPro Portal.

Chapter 4
System Analysis

Chapter 4: System Analysis

This part of the chapter presents the functional and non-functional requirements that are needed in developing this system. The functional requirements is divided into two parts mainly the administrator module and the users module. The non-functional requirements is made up of GUI, portability, usability, manageability, response time, reliability and robustness.

The later part of the chapter discusses the hardware and software consideration for this system. We try to analyze the different options that are available in the market and proceed to choose the most suitable tool for the purpose of this system. The database management system, development platform, web development technology, web application software and scripting language are among the topics touched here. The reasons and justifications for choosing the respective tools and technologies are also included.

4.1 Functional Requirements

According to Pfleeger (2001), a functional requirement is a core system service expected by the user and it describes an interaction between the system and its environment. From a technical viewpoint, functional requirements are functions that a system must offer specifically in order to fulfill the needs of the users. The functional requirements describe how the system should behave when initiated by certain stimuli or input. All of the functional requirements for the ICT LitPro Portal are presented as follows:

4.1.1 Administrator Module

The Administrator Module consists of several functions. Each function may have sub-modules. The functions include: user registration, presetting username and password, uploading lessons, setting questions, discussion board, and view and monitor registered users' results, and logout.

User Registration

Administrators will register users using the forms provided and insert the information into the database. Administrators will assign the username and password to the users while registering and also make the necessary updates to the data.

Change password

Administrators are allowed to change their password to make sure that their data is not being hacked by unauthorized users. After pressing the "Change password" button, a page will be displayed for administrators to input their username, old password and new password. Success message will be displayed after they succeed in changing their password and they will be redirected to the login page.

Upload Lessons

The administrators are given authorities to upload the lesson notes through the system. They will be able to update the materials that have been uploaded by commands like deleting particular notes, rename the notes as well as saving the notes.

Setting Test Questions

The administrators can set test questions directly into the system accordingly to the lesson plans and at the same time, provide answers for them. All of it will be stored in the database. He/She will be able to add, edit or delete the questions that have been set.

Discussion Board

Administrators can join discussion with other registered users through the system. This discussion board takes place by users placing notes and comments in the specific page or topic of discussion. He/She will be able to reply messages or questions regarding the courses sent by users. The administrator will monitor and moderate the progress of the discussions.

View and Monitor Results

The administrators will be able to view the registered users' results through the system. The system will display the grade of the students.

Login

Administrators can login into the system by pressing the "Login" button and keying in their username and password.

Logout

Administrators will be able to logout from the system by pressing "Logout" button and the last logout date and time will be stored in the database in order to increase security.

4.1.2 Users Module

This module is divided into 2 sub-modules which are: members module and non-members module. Each of these modules consists of several functions.

Members Module

Download Lessons

Users which are members can download all the lesson notes through the system. The lessons are divided into 4 kinds of courses which are Word Processing, Excel, Power Point and about the Internet.

Tests

Registered members are able to join tests provided by the system to evaluate their performance. They will be graded on a regular basis. The system will display the member's results and they will be able to check and see whether do they need any improvement.

Discussion Board

Registered members are given the opportunity compared to non-registered members to voice their comments and suggestions regarding the portal and also other matters pertaining to the portal. The feedback will be channeled to the portal administrators for the necessary action. Users can communicate with each other by posting notes on the bulletin board or by joining the discussion that are being held.

Search

The search feature or function that will be incorporated in the ICT LitPro Portal is to search for information outside of the portal itself. This means that this search is not for users to search for information contained in the site. The search feature will link users to a powerful search engine that can facilitate the search process required by users. We feel that due to the narrow scope and limited information in the portal, hyperlinks and headings are sufficient to guide users in the process of looking for the information that they need in the portal.

Update Personal Information

Members will be able to update their existing personal details by adding, edit or deleting it.

Login

Members who have already acquired their user id's will be able to login using the username and password provided by keying in the required fields and pressing the "Login" button.

Logout

Members can logout from the system by pressing the "Logout" button.

Non-Members Module

Register

Public users who are interested in following and joining the lessons provided in the system will be able to register by filling the appropriate forms provided. They will be given a user id and password shortly after and will be able to enjoy the services provided in the system.

View Lesson Plans

Public users will be able to view the lesson plans to give them an overview of the courses so that they can determine whether are they interested to join or not.

4.2 Non - Functional Requirements

Non-functional requirements describe a system's restriction that limits the choices for constructing a solution to the problem. (Pfleeger, 2001). In other words, these are the standards and constraints, which the system must operate under and be fulfilled as part of the system development. The following are the non-functional requirements for the ICT LitPro Portal.

Graphical User Interface

The ICT LitPro will incorporate an attractive and user-friendly interface with WIMP (Window, Icon, Menu, Pointing Device) features. The overall design uses a color scheme that is pleasing to the eye and contrasts are carefully planned so that the display is clear

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and interesting. This is to ensure that users will feel comfortable and at ease while reducing the possibility of frustration due to the difficulty in using the system. Menu-driven and hyperlink-driven mechanisms will provide a standard navigation interface for the users in a systematic way. The notification messages are also accurate, concise, clear and simple so that users understand the message and the implications of the options provided in the messages. This is especially important since most of the users are novice users and do not have much knowledge in this field.

Modularity and Maintainability

The system coding and design will be implemented by using modular approach so that it can be easily enhanced in the future.

Portability

ICT LitPro Portal must be able to operate across various platforms. This feature will make it much easier for the users to access the web portal without having to worry about the compatibility of the portal with their existing computers and system. Thus, the portal can operate on various proprietary platforms without any modification, recompiling, reconfiguration or redesign of any component.

Usability

The ICT LitPro Portal must prove to be useful and beneficial to its users. It must be able to provide the information and services that are needed quickly, and with minimum fuss.

It should not in any way hinder or limit the user from carrying out the desired operations, such as retrieving data form the database, as long as they are authorized to do so.

Understandability

In terms of the coding method used, it must allow other programmers to understand the logic of program flows, thus changes can be made easily upon the necessary program segments without modifying other users and users can user the system without difficulty.

Manageability

The hardware and software application of the ICT LitPro must be proficient to be managed effortlessly and easily operated. This is crucial to ensure that future maintenance and enhancements can be done on the system without having major problems.

Response time

The response time of the system should always be in the acceptable range even when there are many users using the system concurrently. One of the methods to ensure that the users are satisfied with the response time is by using better and faster hardware components. This will be discussed later in the hardware consideration section of this chapter.

Reliability

As with other systems, reliability of the system is one f the key things users look for when using the ICT LitPro. When the system is reliable, all the functions will be executed precisely and smoothly. High reliability will promote user confidence in the system and will encourage them to use the system more frequently, and the trust that the system will meet their needs efficiently. We will carryout thorough testing to ensure that the system reliability is not compromised in any way, at any time of the implementation or operation.

Robustness

The ICT LitPro Portal must be robust enough to handle any expected and unexpected system failures. Measures will be taken straight away to detect the failures and rectify the situation immediately. An error will be logged to inform the system administrators of the failure. This can be achieved through comprehensive testing.

4.3 Hardware and Software Consideration

This section contains the introduction to various hardware and software components used in the development of this system. Also included are the explanations and justifications of choosing the hardware and software that best suits this project.

4.3.1 Client/Server Computing

Until the mid-1980s, computing platforms were centralized. Corporations operated their systems on expensive, powerful mainframe computers running all the software and providing results through display terminals or printed reports.

The current computing architecture is mainly based on distributed processing with clients and servers. Most of the initial client/server success stories involve small-scale applications that provide direct or indirect access to transactional data in legacy systems. The business need to provide data access to decision makers, the relative immaturity of client/server tools and technology, the evolving use of wide area networks and the lack of client/server expertise make these attractive yet low risk pilot ventures. As organizations move up the learning curve from these small-scale projects towards mission-critical applications, there is a corresponding increase in performance expectations, uptime requirements and in the need to remain both flexible and scalable.

Architecture affects all aspects of software design and engineering. The architect considers the complexity of the application, the level of integration and interfacing required, the number of users, their geographical dispersion, the nature of networks and the overall transactional needs of the application before deciding on the type of

architecture. An inappropriate architectural design or a flawed implementation could result in horrendous response times. The choice of architecture also affects the development time and the future flexibility and maintenance of the application. Current literature does not adequately address all these aspects of client/server architecture.

Despite the massive press coverage of client/server computing, there is much confusion around defining what client/server really is. Client and server are software and not hardware entities. In its most fundamental form, client/server involves a software entity (client) making a specific request which is fulfilled by another software entity (server). The client process sends a request to the server. The server interprets the message and then attempts to fulfill the request. In order to fulfill the request, the server may have to refer to a knowledge source (database), process data (perform calculations), control a peripheral, or make an additional request of another server. In much architecture, a client can make requests of multiple servers and a server can service multiple clients.

It is important to understand that the relationship between client and server is a command/control relationship. In any given exchange, the client initiates the request and the server responds accordingly. A server cannot initiate dialog with clients. Since client and server are software entities they can be located on any appropriate hardware. A client process, for instance, could be resident on a network server hardware, and request data from a server process running on another server hardware or even on a PC. In another scenario, the client and server processes can be located on the same physical hardware box. In fact, in the prototyping stage, a developer may choose to have both the presentation client and the database server on the same PC hardware. The server can later

be migrated (distributed) to a larger system for further pre-production testing after the bulk of the application logic and data structure development is complete.

4.3.1.1 Architecture types

When considering a move to client/server computing, whether it is to replace existing systems or introduce entirely new systems, practitioners must determine which type of architecture they intend to use. The vast majority of end user applications consist of three components: presentation, processing, and data. The client/server architectures can be defined by how these components are split up among software entities and distributed on a network. There are a variety of ways for dividing these resources and implementing client/server architectures.

❖ **Two –tier Architecture**

In this implementation, the three components of an application (presentation, processing, and data) are divided among two software entities (tiers): client application code and database server. A robust client application development language and a versatile mechanism for transmitting client requests to the server are essential for a two tier implementation.

Presentation is handled exclusively by the client, processing is split between client and server, and data is stored on and accessed via the server. The PC client assumes the bulk of responsibility for application (functionality) logic with respect to the processing component, while the database engine - with its attendant integrity checks, query

capabilities and central repository functions - handles data intensive tasks. In a data access topology, a data engine would process requests sent from the clients.

Currently, the language used in these requests is most typically a form of SQL. Sending SQL from client to server requires a tight linkage between the two layers. To send the SQL the client must know the syntax of the server or have this translated via an API (Application Program Interface). It must also know the location of the server, how the data is organized, and how the data is named. The request may take advantage of logic stored and processed on the server which would centralize global tasks such as validation, data integrity, and security. Data returned to the client can be manipulated at the client level for further sub selection, business modeling, "what if" analysis, reporting, etc.

The most compelling advantage of a two-tier environment is application development speed. In most cases a two-tier system can be developed in a small fraction of the time it would take to code a comparable but less flexible legacy system. Using any one of a growing number of PC-based tools, a single developer can model data and populate a database on a remote server, paint a user interface, create a client with application logic, and include data access routines.

Most two-tier tools are also extremely robust. These environments support a variety of data structures, including a number of built in procedures and functions, and insulate developers from many of the more mundane aspects of programming such as memory management.

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Finally these tools also lend themselves well to iterative prototyping and rapid application development (RAD) techniques, which can be used to ensure that the requirements of the users are accurately and completely met.

❖ Three-tier Architecture

The three tier architecture attempts to overcome some of the limitations of the two-tier scheme by separating presentation, processing, and data into separate, distinct software entities (tiers). The same types of tools can be used for presentation as were used in a two-tier environment; however these tools are now dedicated to handling just the presentation.

When calculations or data access is required by the presentation client, a call is made to a middle tier functionality server. This tier can perform calculations or can make requests as a client to additional servers. The middle tier servers are typically coded in a highly-portable, non-proprietary language such as C. Middle-tier functionality servers may be multi-threaded and can be accessed by multiple clients, even those from separate applications.

Although three-tier systems can be implemented using a variety of technologies, the calling mechanism from client to server in such as system is most typically the remote procedure call or RPC.

Since the bulk of two-tier implementations involve SQL messaging and most three-tier systems utilize RPCs, it is reasonable to examine the merits of these respective request/response mechanisms in a discussion of architectures. RPC calls from

presentation client to middle-tier server provide greater overall system flexibility than the SQL calls made by clients in the two-tier architecture. This is because in an RPC, the requesting client simply passes parameters needed for the request and specifies a data structure to accept returned values (if any).

Unlike most two-tier implementations, the three tier presentation client is not required to "speak" SQL. As such, the organization, names, or even the overall structure of the back-end data can be changed without requiring changes to PC-based presentation clients. Since SQL is no longer required, data can be organized hierarchically, relationally, or in object format. This added flexibility can allow a firm to access legacy data and simplifies the introduction of new database technologies.

❖ N-Tier/ Multi-tier Architectures

Today, the industry appears to be rapidly moving toward N-Tier architecture. The majority of new IS development is typically being written as an N-Tier C/S system of some kind.

N-Tier architecture does not preclude the use of the two-tier or three-tier model. Depending on the scale of the application and the requirements for access to data, the two- or three-tiered model can often be used for departmental applications. It doesn't make sense to force a client's reporting needs to go through the application server when there is no requirement for transactional integrity in ad-hoc reporting. In this situation, the client should be able to access the data directly from the database server.

N-Tier computing is usually considered the most effective approach because it can provide integration of current information technology into this new, more flexible model.

Research estimates that the percentage of Client/Server applications using the N-Tier model will grow almost four-fold over the next two years.

4.3.2 Operating System Platform Consideration

4.3.2.1 Windows 2000 Server

What is Windows 2000 Server?

Windows 2000 Server is one of the latest operating system for server developed by Microsoft. It's the new version of Windows NT Server. The new Windows 2000 Server was built on NT technology. The interface of the software is similar to that of Windows 95/98. It's gaining market share due to the ease of use.

What are the advantages of Windows 2000 Server?

Windows 2000 Server is developed and sold by Microsoft. The company continually provides supports and updates. Users who are familiar with Windows will find themselves comfortably using Windows 2000 Server. Most people using Windows 2000 Server hosting utilize Active Server Pages (ASP) technology. This is the main reason why people are turning to Windows 2000 Server hosting. Users can develop web site using familiar interface of Microsoft tools such as Microsoft FrontPage, Visual Interdev, and Microsoft Access. With ASP users can develop a database-driven web site using Microsoft Access and Microsoft SQL as the database.

What are the disadvantages of Windows 2000 Server?

Unlike Unix, Windows 2000 Server requires more system resource. You need a powerful machine to run Windows 2000 Server. The Windows 2000 Server does not have a good reputation in term of server stability. The Windows 2000 Server needs reboot more

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frequent than Unix. If you are using Windows 2000 Server hosting services, you may find yourself investing a lot of money in the development tools. Most of them are Microsoft products. The costs of applications that can run on your web site are usually higher than that of Unix. For example, you can find a lot of free scripts to run web board, chat room, web stats, email (and more) for your Unix-based web site, but you won't find many free applications in Windows 2000 Server world.

4.3.2.2 Unix System

The UNIX operating system was designed to let a number of programmers access the computer at the same time and share its resources. The operating system coordinates the use of the computer's resources, allowing one person, for example, to run a spell check program while another creates a document, lets another edit a document while another creates graphics, and lets another user format a document -- all at the same time, with each user oblivious to the activities of the others.

The operating system controls all of the commands from all of the keyboards and all of the data being generated, and permits each user to believe he or she is the only person working on the computer.

This real-time sharing of resources makes UNIX one of the most powerful operating systems ever.

As an analysis of the operating system platforms above, comparisons of advantages and disadvantages between UNIX and Windows 2000 Server has been specified below:

Features	Unix	Windows 2000 Server
Compatibility with Web development tools	Incompatible with Web development because it does not offer much development tools	Compatible with Web development tools because it offers many development tools
User friendly	Not user friendly and because user interface is to cryptic	User friendly with windows based interface
Cost effective	Not cost effective because with certain modification, the whole operating system need to be recompiled	Cost effective operating system, budget is between RM 2000, a fully functional Internet Server is running in a matter of days
Security	Vulnerability is high because distribution of source code is widely available	Vulnerability is low because most of the application are not truly available in the Internet

Table 4.1: Comparisons between Unix and Windows 2000 Server

Hence, due to the above analysis and reasons, Microsoft Windows 2000 Sever is chosen as an ideal platform for developing our project due to its compatibility with most

of the Web development software, competitive price, scalability, robustness and its secure NTFS file system.

Besides, it gives developers their choice of languages, protocols, user interfaces and application architectures. This platform is also required if either Microsoft SQL Server or Internet Information Server of both are used in this project.

4.3.3 Web Server Consideration

A Web server is the server software behind the World Wide Web. It listens for requests from a client, such as a browser like Netscape or Microsoft's Internet Explorer. When it gets one, it processes that request and returns some data. This data usually takes the form of a formatted page with text and graphics. The browser then renders this data to the best of its ability and presents it to the user. Web servers are in concept very simple programs. They wait for requests and fulfill them when received.

Web servers communicate with browsers or other clients using the Hypertext Transfer Protocol (HTTP), which is a simple protocol that standardizes the way requests are sent and processed. This allows a variety of clients to communicate with any vendor's server without compatibility problems.

Most of the documents requested are formatted using Hypertext Markup Language (HTML). HTML is a small subset of another markup language called Standard General Markup Language (SGML), which is in wide use by many organizations and the U.S. Government.

A Web server is usually evaluated to overall performance compatibility and interoperability with other components (internal). The first selection criterion for a Web server is performance. Users have a short attention span and will surf away from a site if performance is unacceptable, never to return. Development is a close second among the influential factors, since the developer needs a platform where the initial content can be developed effortlessly and successive changes will not be overly difficult once the e-

commerce process is ongoing. A heterogeneous development/deployment platform is not unusual, but developers should be aware of the inherent risks.

With e-commerce websites, availability is a high priority. The Web server must have underlying operating system capability to sustain lengthy operations without interruption. The availability of the Web server to add functionality and to control the website's content is the second priority.

Web servers are often used in conjunction with development tools to add content and functionality to the site. Affinity of the development tools and the Web server will improve productivity of both the development and the operating teams.

4.3.3.1 Microsoft Internet Information Server 5.0

As the Internet becomes more woven into mainstream businesses, so grows the need to have Web services interwoven with mainstream business computing. To address that need, the Windows® 2000 Server operating system includes an updated version of Internet Information Services (IIS), called IIS 5.0. Internet Information Services runs as an enterprise service within Windows 2000. It uses other services provided by Windows 2000, such as security and the Active Directory service.

This version improves the Web server's reliability, performance, management, security, and application services. Many of these improvements result from the way IIS 5.0 incorporates new operating system features provided in Windows 2000.

With IIS 4.0, Microsoft focused on security, administration, programmability, and support for Internet standards. IIS 5.0 builds on the features and capabilities needed to deliver Web sites required in an increasingly Internet-centric business environment. And it makes it even easier to use the technologies delivered in prior versions. In particular, IIS 5.0 features improvements in the following four major areas:

Reliability and performance

A number of features make IIS more reliable and better performing. To make it faster and easier to restart IIS, the reliable restart feature of IIS 5.0 allows an administrator to restart Web services without rebooting the computer. To improve reliability, Application Protection provides the ability to run applications in a pool, separate from the Web services. The new CPU Throttling and Socket Pooling features in IIS 5.0 can also improve reliability. For application developers, Web site performance can be improved through new features such as scriptless Microsoft Active Server Pages (ASP) processing, ASP self-tuning, and performance-enhanced ASP objects.

Management

IIS 5.0 is easier to install and maintain. A number of features support this increased ease-of-maintenance, including a simplified installation process, new security task wizards, and the ability to account for time used by processes, more flexible remote administration, and the ability to create custom error messages.

Security

IIS 5.0 adds support for important industry-standard security protocols, including Digest Authentication, Server Gated Cryptography, Kerberos V5 authentication protocol, Transport Layer Security, and Fortezza. In addition, three new task wizards make it easier for administrators to manage a site's security settings. Information on steps you can take to harden your IIS server from being exploited by hackers will also be presented.

Application environment

Developers will find that IIS 5.0 expands the Web server's application development environment by building on new technologies included in Windows 2000 Server. These include Active Directory and the expanded Component Object Model (COM+). In addition, enhancements to IIS Active Server Pages, such as scriptless ASP processing, as well as improved flow control and error handling, let developers write more efficient Web-centric applications.

4.3.3.2 The Apache Web Server

The Apache server, available free at www.apache.org, reliably and quietly serves more than 60% of the currently posted websites. The fact that it is free serves more than a partial explanation for its popularity. It is available on many platforms in both binary and source code format and has earned the reputation of being the most reliable Web server available.

Unfortunately, the production version of the Apache server's management is not easy to figure out. Its textual user interface is not user-friendly and remains an impediment to even greater success. In view of this weakness, an effort is under way to provide a graphical user interface to the configuration process.

As an open-source Web server, the Apache server benefits from many contributions form Web developers. They are available in the form of modules and are supported in many commercial distributions. While no software is bug-free, bug fixes are rapid in this open-source environment, and the product development cycle is timely. The server gets a growing number of features from numerous initiatives such as Jakarta, Tomcat, XML-Apache, Java-Apache, mod-perl, Apache::ASP, and mod-php.

Due to the ability to deliver high performance easier management and excellent security, Microsoft Internet Information Server 5.0 is chosen to be the web server for this project. IIS 5.0 is the best platform for integrating with existing solutions as well as for delivering a new generation of web application. The reasons on choosing this web server are due to its scalability, robustness and support for ASP and ISAPI (Internet Server Application Programming Interface), light integration with Microsoft Windows 2000 Server security system.

In order to provide real industry strength database services, IIS 5.0 requires close integration with Microsoft SQL Server 2000 database management system. This is also part of the reason why Microsoft SQL Server 2000 was chosen in our project as the backend database.

4.3.4 Database Server Consideration

4.3.4.1 Microsoft Access 2000

Microsoft Access 2000 is a relational database management system created by Microsoft for small offices or home user to use for storing data in relational format. With data access interface paradigm such as Remote Data Object (RDO) and Data Access Object (DAO), Microsoft Access can be used as a database in a client/server or an N-tier architecture system. It provides intuitive and user-friendly interface to create a database easily. However it is quite slow in processing transaction compared to Microsoft SQL Server 2000.

4.3.4.2 SQL Server 2000

Microsoft has made significant enhancement to SQL Server 7.0 with version 2000 release. It is also for more scalable than the previous version, not only will it run on large, enterprise level, NT Server Systems and Windows 2000 operating system but it can also run on a stand-alone (non-networked) laptop computer running Windows 95/98 as well as on everything else in between SQL Server 2000 platforms.

SQL Server is the most robust database for the Windows family, the relational database management system (RDBMS) of choice for the broad-spectrum of corporate customers and independent software and high-performance database management system. Besides meeting the requirements of enterprise's client/server computing, it is

also designed with the Internet and Intranet in mind to provide high-performance access to information on a web page. It is capable of supporting thousands of concurrent users, processing millions of transactions per day.

SQL Server 2000 is a suitable database engine for powering a Website. Combined with Microsoft Internet Information Server and the SQL Server Internet Connector, customers have complete Internet database publishing capabilities. It supports for heterogeneous replication to non-SQL Server databases including Microsoft Access, ORACLE and so on, SQL Server's replication users ODBC as the connection mechanism.

The database is the heart and soul of any company's business infrastructure. Small to medium-size businesses planning to make this critical investment must consider their specific business needs, support requirements and budgets. The solution that offers the best value with the least administrative hassle is Microsoft SQL Server 2000.

Microsoft SQL Server 2000 is chosen as the database for our project because it provides high performance in transaction processing and also of its integration with NT security file system. Obviously from here that by choosing Microsoft SQL Server as the database server, Windows 2000 Server must be chosen as well as Microsoft SQL can only run on NT platforms.

Microsoft Access 2000 falls into the desktop category and works best for individuals and workgroups managing megabytes of data. In comparison with SQL Server 2000, Access uses file server architecture, rather than client/server architecture. Access 2000 has many restrictions in comparison with SQL Server 2000 and cannot be used in the case where you want to build stable and efficient system with many concurrent users.

As an analysis of the database servers above, comparisons of advantages and disadvantages between Access 2000 and SQL Server 2000 has been specified below:

Feature	Access 2000	SQL Server 2000
SMP Support	Not supported	Supported
Tables	Relational tables	Relational tables, Temporary tables
Triggers	Not supported	AFTER triggers, INSTEAD OF triggers
Procedures	Not supported	Microsoft T-SQL statements
User-defined functions	Not supported	Scalar functions, inline table-valued functions, multistatement table-valued statements
Views	Not supported	Supported
Transaction logging	Not supported	Supported

Recovery	Recovery to last backup	Recovery to last backup, recovery to point of failure, recovery to a specific point in time
Integration with Windows NT Security	Not supported	Supported

Table 4.2: Comparisons between Access 2000 and SQL Server 2000

4.3.5 Web Technology Consideration

4.3.5.1 Active Server Page (ASP)

Active Server page (ASP) is a specification for a dynamically created Web page with an ASP extension that utilizes ActiveX scripting. Usually implemented with VBScript or Jscript, the code is interpreted when a browser requests an ASP. The Web server generates a page with HTML code and then sends it back to the browser. Thus, ASPs are similar to CGI scripts, but they enable Visual Basic programmers to work with familiar tools. As CGI scripts, they suffer from some performance degradation when multiple concurrent requests hit the Web server. Once limited to the Microsoft Windows platform, small companies such as Chili-Soft and Halcyon have recently ported the ASP solution to others (UNIX, Linux).

ASP lets multiple users simultaneously run a program on your Web server. ASP lets you use the power of a Web server to process user requests and provide dynamic, individualized, content based on logic, file and database data, and also process the user's individualized data. ASP provides:

- A way to save individualized data for each user
- Access to the file system
- Access to databases
- A means to launch and control any component Object Model (COM) component

In short, ASP allows you to build multiuser applications, which means you can leverage ASP to provide application scalability. If planned carefully, ASP applications can scale from a single-server application that can handle 30-100 simultaneous users and a few thousand hits per day to multi-server (Web farm) applications handling thousands of simultaneous users and millions of requests per day.

ASP isn't a single technology. Using ASP effectively requires that you learn a collection of tools, languages, techniques and technologies.

ASP does better than other web application tools. It leverages existing skills and knowledge, data sources, components and application to quickly bring them to the web. ASP is based upon the leading industry standards, making it easy to build, maintain and evolve powerful interactive web applications.

4.3.5.2 ColdFusion

ColdFusion is a rapid application development tool that enables the rapid creation of interactive, dynamic and information-rich web sites. ColdFusion does not require coding in traditional programming languages. Instead, applications can be created by extending the standard HTML files with high-level formatting functions, conditional operators, and database commands. These commands are instructions to the ColdFusion processor and form the blocks on which to build industrial-strength applications. With the current version of ColdFusion MX, it consists of a web server and a development studio suite.

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ColdFusion uses ColdFusion Markup Language (CFML), a set of special tags that are typically placed inside HTML pages and interpreted by ColdFusion server. CFML includes over 60 tags for database connectivity, conditional logic, input and output, and integration with other Internet and file services. Over 200 additional functions handle items such as date and time, mathematica functions and string manipulations. CFML also presents alternatives to presentation using HTML. ColdFusion was first developed in 1995 by JJ Allaire and is currently up to version MX.

As an analysis of the web development technologies above, comparisons of advantages and disadvantages between Asp and ColdFusion has been specified below:

Criteria	ColdFusion	ASP
Operating System support	Windows and Sun Solaris	Windows and Sun Solaris
Web Server Capability	Windows Web Server and Netscape Web Servers	Windows Web Server and Netscape Web Servers
Scripting Language	CFML	VBScript, Jscript, JavaScript and Perl
Hardware Requirement	None	None
Software Requirement	None	None
Learning Issues	Easier to learn	Easy to learn
Greatest advantage	Designed especially for publishing database	Rapid application development in a team setting
Limitation	Highly database center,	Highly IIS dependent

	limits by ColdFusion tag	compatibility with other web server
Recommendation	Good for application accessing database like an e-commerce site	Good for almost any kind of application

Table 4.3: Comparisons between ColdFusion and ASP

ASP is used due to the obvious advantage as stated above. The main disadvantage for ColdFusion is the need for developers to pick up the specific languages needed for each technology. In order to realize the full potential of these tools, a thorough understanding of the languages is needed before hand.

4.3.6 Programming Language Consideration

4.3.6.1 Hypertext Markup Language (HTML)

HTML was first proposed in 1989. It took shape as a subset of SGML (Standard Generalized Markup Language), which is a higher-level markup language that has long been a favourite of the Department of Defense in the United States and many other organizations with a truly astounding volume of documents to manage. Like HTML, it describes formatting and hypertext links, and it defines different components of a document. HTML is definitely the simpler of the two, and although they are related, few browsers support both.

Because HTML was conceived for transmission over the Internet (in the form of Web pages), it is much simpler than SGML, which is more of an application-oriented document format. While it's true that many programs can load, edit, create, and save files in the SGML format (just as many programs can create and save files in the Microsoft Word format), SGML is not exactly ideal for transmission across the Internet to many different types of computers, users and browser applications.

HTML is more suited to this task. Designed with these considerations in mind, HTML lets you, the designer, create pages that can be connected to the Web. Even users who are unable to view your graphics, for instance, can experience the bulk of what you're communicating if you design your HTML pages properly.

At the same time, HTML is simple enough that typical computer users can generate HTML documents without the benefit of a special application. Creating

Microsoft Word-format document by hand would be rather difficult (including all the required text sizes, fonts, page breaks, columns, margins, and other information) even if it weren't a proprietary0that is, non-public-document format.

HTML is a public standard, and it's simple enough that you can get through a book and have a very strong ability to create HTML documents from scratch. This simplicity is part of a trade-off because HTML-format documents don't offer nearly the precision of control or depth of formatting options that a WordPerfect- or Adobe PageMaker-formatted document would.

4.3.7 Scripting Language Consideration

4.3.7.1 What is Scripting Language?

To Microsoft, script is any ActiveX programming language that exposes an interface compatible with the Windows Scripting Host. The two most common scripting languages for Microsoft applications are VBScript and JScript or JavaScript, although there are other compatible scripting languages-PerlScript for example. To Netscape, script means JavaScript. To Sun Microsystems, script means JavaScript that runs on the server as JavaServer Pages (JSPs), a recent ASP knock-off.

To almost everyone, script means a small, relatively limited interpreted language. Script languages are small only in comparison with full-featured languages.

We need to know what interpreted code is to understand the previous sentence. Computers don't understand code as we write it. There are two ways to make the translation. You can translate the code at runtime, which means the computer reads a line or block of code from your code file, makes the translation, and then executes the code. That process is called interpreting the code, and it's done by a program called an interpreter.

Alternatively, we can translate the code and store the resulting machine code in a file. When we execute the file, the computer reads the machine instructions directly. That kind of translation is not performed at runtime; a program called a compiler translates the code before the computer begins to execute it. The compiler and the interpreter do much of the same thing, but the compiler is more efficient because it isn't under any time

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constraints. It compiles the code offline. The interpreter is less efficient, because it has to translate the code to machine instructions and run it almost instantaneously.

4.3.7.2 VBScript

VBScript, or by its full name, the Microsoft Visual Basic Scripting Edition language, is a simplified version of the Visual Basic and Visual Basic for Applications family of programming languages. It is also considered to be closely related to the BASIC programming language.

VBScript is a scripting language. Or more precisely a "scripting environment", which can enhance HTML Web pages by making them active, as compared to a simple static display. Specifically, VBScript was created by Microsoft to use either as a client-side scripting language for the Microsoft Internet Explorer (versions 3.0 and later) or as a server-side scripting language with the Microsoft Internet Information Server (versions 3.0 and later). A primary advantage for using the server-side approach is that the VBScript is processed by the server before it is transmitted to the client. Therefore, the client only receives an HTML page and we do not have to concern ourselves as to whether the browser can interpret the VBScript.

In contrast, by using the client-side approach, you purposely transfer the work load to the browser in order to reduce the work load of the server. Unfortunately, older or non-Microsoft browsers may not be able to correctly interpret and display the transmitted file. In addition to this, the source code is exposed to the browser user. On the brighter

side, a client-side program can produce a more- responsive application, since user input can be processed on the client machine, and not sent back to the server for processing. The true importance of VBScript is that it is the default language of Active Server Pages (ASP).

4.3.7.3 JavaScript

JavaScript is a major scripting language developed by Netscape. Often mistaken as a relative to Sun's Java, JavaScript does not have much in common with Java, apart from the marketing gimmick of name association. JavaScript enables Web authors to design interactive sites. Although it shares some of the philosophy and structures of the Java language, JavaScript was developed separately and is purely an interpreted language. Its code is embedded and can interact with HTML source code, enabling Web authors to animate their sites with dynamic content.

Endorsed by a number of software companies on multiple platforms, JavaScript is an open language that anyone can use without purchasing a license. Recent browsers from Netscape and Microsoft support it, though Internet Explorer supports only a variant, which Microsoft calls Jscript. Microsoft Jscript is a scripting language targeted specifically at the Internet that fully conforms to ECMAScript, the Web's only standard scripting language. ECMAScript, the European version of JavaScript, has received the endorsement of the European Computer Manufacturers Association (ECMA) standardization agency.

4.3.7.4 PERL

Practical Extraction and Report Language (PERL) is a programming language, especially designed for processing text. Because of its strong text processing abilities, it has become one of the most popular languages for writing CGI scripts. PERL is an interpretive language, which makes it easy to build and test simple programs. It evolved in recent years to become a powerful tool used on the server side of many UNIX-based e-commerce sites. While the language interpreter has been ported to other operating systems and Microsoft Windows, in particular, PERL is still dominant on the UNIX server side.

PERL is a fairly straightforward, comprehensive, widely known in the UNIX community, and well-respected scripting language. It is used for a variety of tasks, including the equivalent of DOS batch files and C shell scripts. One advantage of PERL is the community of dedicated and talented developers who have contributed scripts to the public domain. This offers the opportunity to learn PERL by example. Users can also download and modify thousands of PERL scripts for their own use. One of the disadvantages of PERL is that much of this free code is impossible to understand, a problem somewhat alleviated by number of publications on the topic.

Due to the comparisons on the constraints, limitations and advantage of the programming languages, it is decided that ASP technology with VBScript are chosen as main server-side scripting language for our project. The approach choice is due to the fact that it is simple to implement and no extra addition software requirements are needed besides Windows 2000 Server and Internet Information Server 5.0.

4.3.8 Development Tools Consideration

4.3.8.1 Microsoft FrontPage 2000

FrontPage 2000 is Microsoft's tool for creation and designing web pages, and it lets you do this without actually having to program the HTML. It allows you to create web pages in the same way you would create documents in Word or Spreadsheet in Excel. It generates the HTML, "underneath the covers" without you having to raise a finger.

4.3.9 The Server and Client Requirements

The minimum server and client requirements for the development of the portal are listed below:

Description	Requirements
Processor	Intel Pentium IV 2.2 GHz
Memory	256 MB RAM
Hard disk	550 MB available hard disk
Operating System	Windows 2000 Server
Web Server	Internet Information Server 5.0

Table 4.4: Requirements for the server

Description	Requirements
Processor	Intel Pentium 200 MHz
Memory	64 MB RAM
Hard disk	30 MB available hard disk
Operating System	Windows 98
Web Server	Internet Information Server 5.0

Table 4.5: Requirements for the client

4.3.10 Summary of Hardware and Software Consideration

This subchapter summarizes the hardware, software and tools that will be used in the proposed ICT LiTPro Portal. The complete list of software tools and technology are as follows:

Software	Description
Microsoft Windows 2000 Server	Operating System Platform
Microsoft Internet Information Server 5.0	Web Server
Microsoft SQL Server 2000	Database Server
ASP	Main Programming Framework
HTML, VBScript	Programming and Scripting Language
Microsoft FrontPage 2000	Web Application Software
Internet Explorer	Web Browser

Table 4.6: Summary of software consideration

Summary

Chapter 4 discuss about the functional requirements, non-functional requirements and also the hardware and software consideration. This chapter gives a brief explanation on topics researched and studied that are relevant to our project. By comparing several tools and technologies that are useful for our system, we were able to get more ideas and information for the development of our project. From here, we will know whether the tools and technologies reviewed are suitable to our system or not.

Chapter 5
System Design

Chapter 5: System Design

This chapter will see the translation of the requirements examined in the previous stage into system characteristics.

System design is an integrated part of developing any piece of application or software, and of course the ICT LitPro Portal is no exception. The elicited requirements from the literature review and fact-finding techniques are translated into the system characteristics to fulfill the user and the system requirements. This process is a structured yet creative one, involving the transformation of problem into a solution that includes a complete description of the function and interactions involved. Even though the system design only describes the appearance and functionality of the proposed system, it is the key factor in determining the level of success and acceptance of the overall project.

5.1 System Architecture

The choice of system architecture will affect aspects of software design and engineering of a development project. Any inappropriate or flawed architectural design could result in an increase of development cost, poor response time, intricate future flexibility and thorny maintenance of the application (Gallaugher, 1995).

For this ICT LitPro Portal, the three-tier client/server architecture is chosen as the development environment.

In the three-tier client/server architectures, a middle tier is added between the user system interface client environment and the database management server environment. (As shown in Figure 4.2) There are a variety of ways of implementing this middle tier,

such as transaction processing monitors, message server, or application servers. The middle tier can perform queuing, application executing, and database staging. For example, if the middle tier provides queuing, the client can deliver its request to the middle layer and disengage because the middle tier will access the data and return the answer to the client.

This client/server architecture has been shown to improve performance and flexibility for groups with a large number of users (in the thousands). A limitation with three-tier architectures is that the development environment is reportedly more difficult to use than the visually oriented development two-tier applications.
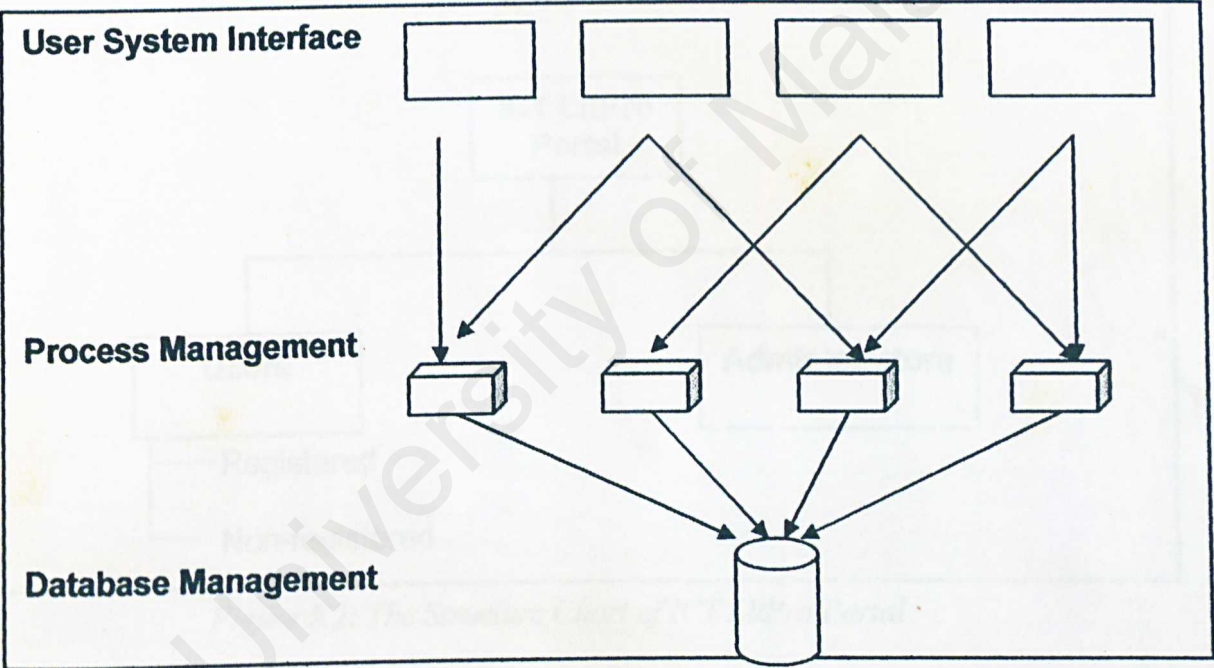
Figure 5.1: Three-tier Distributed Client/Server Architecture Design

5.2 System Structure Chart

This is used to depict high level of abstraction of a specific system. The use of structure chart is to describe the interaction between independent modules. Major functions form the initial component part of the structure chart, which can be broken into detailed sub-component. ICT LitPro is divided into 2 major components which are Users and Administrators.
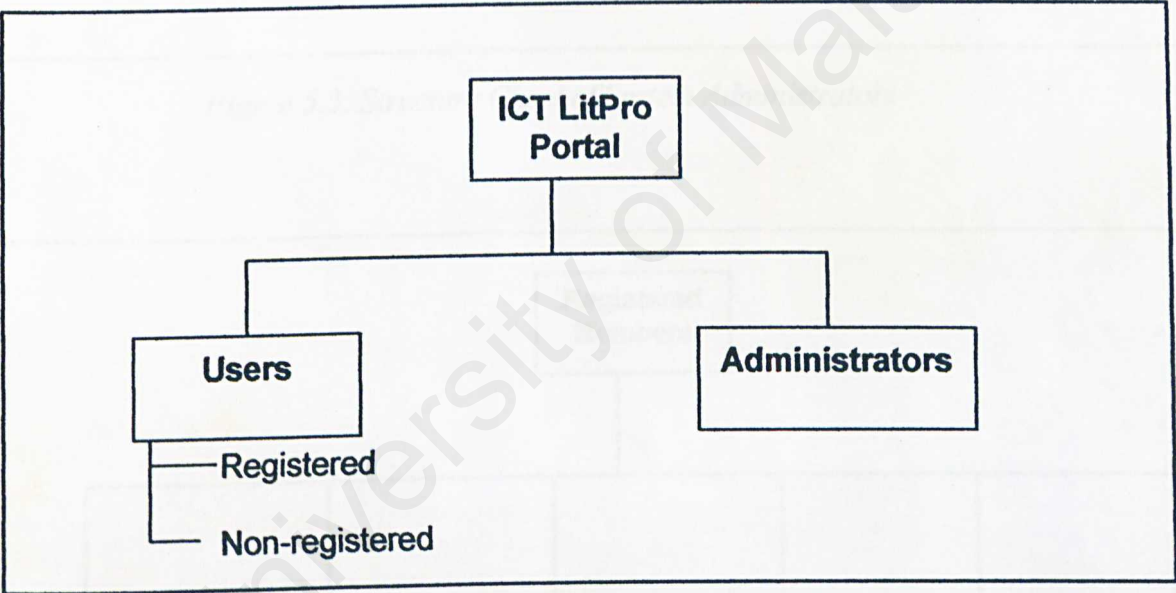
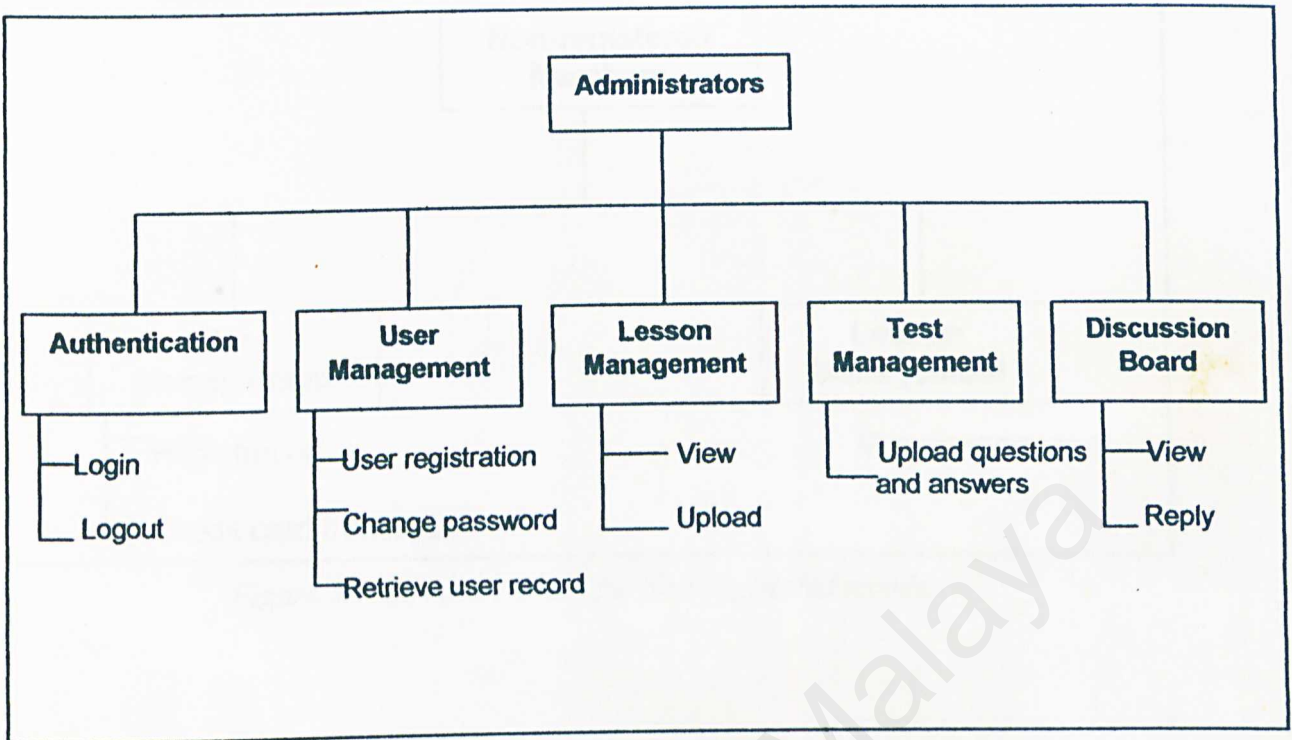*Figure 5.2: The Structure Chart of ICT LitPro Portal*
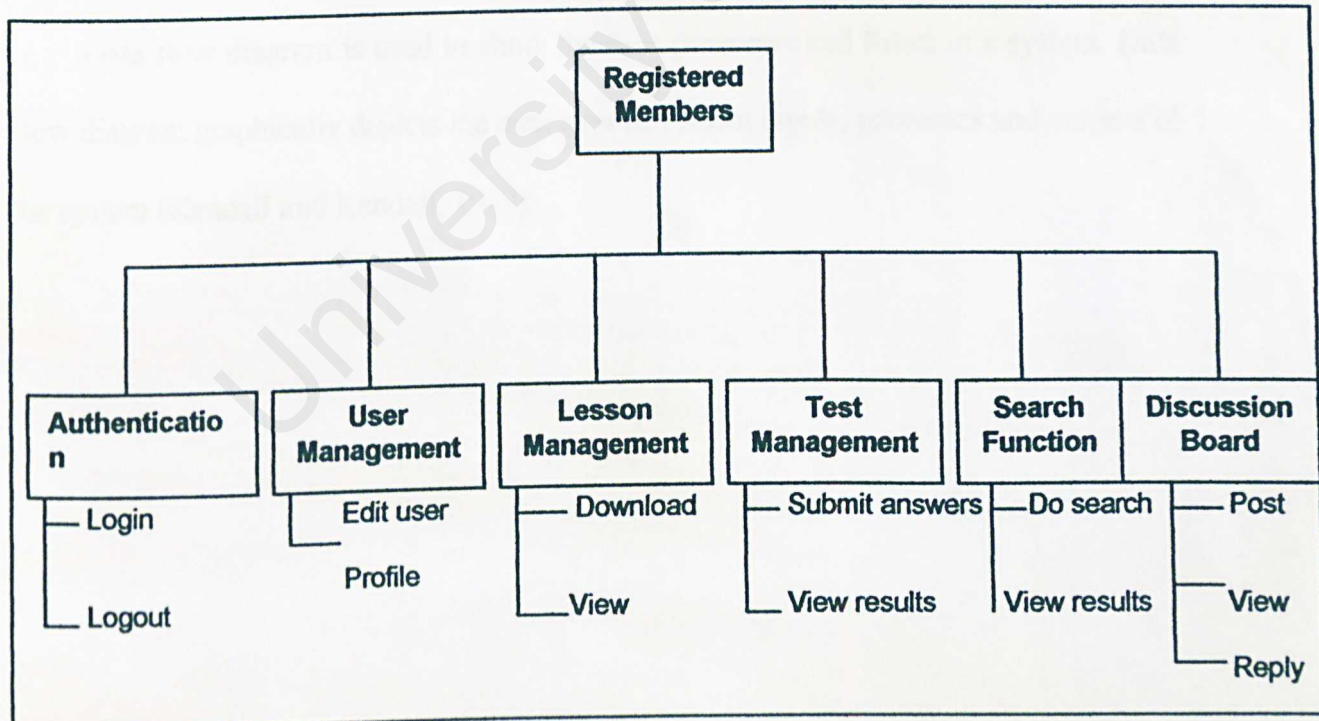
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Figure 5.3: Structure Chart of System Administrators

Figure 5.4: Structure Chart of Registered Members
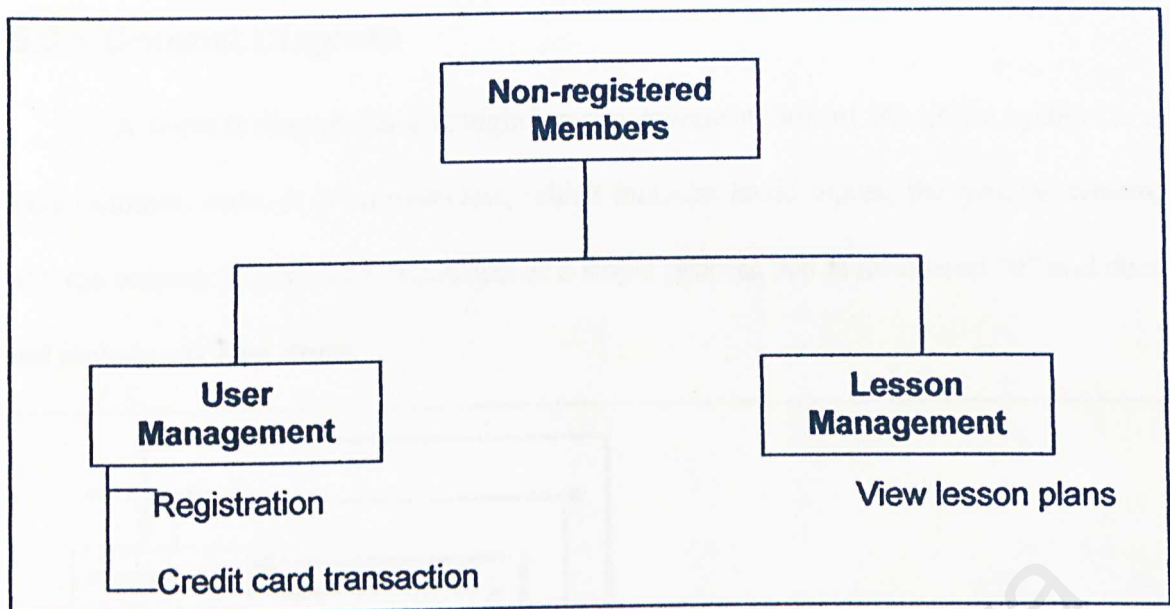
Figure 5.5: Structure Chart for Non-registered member

5.3 Data Flow Diagram

Data flow diagram is used to show the data processes and flows in a system. Data flow diagram graphically depicts the overview of system inputs, processes and outputs of the system (Kendall and Kendall, 1999).

5.3.1 Context Diagram

A context diagram is a straightforward representation of the entire system in a very common state. It is an overview, which includes basic inputs, the general system, and the outputs (Figure 5.6). It consists of a single process that is numbered "0" and does not include any data stores.
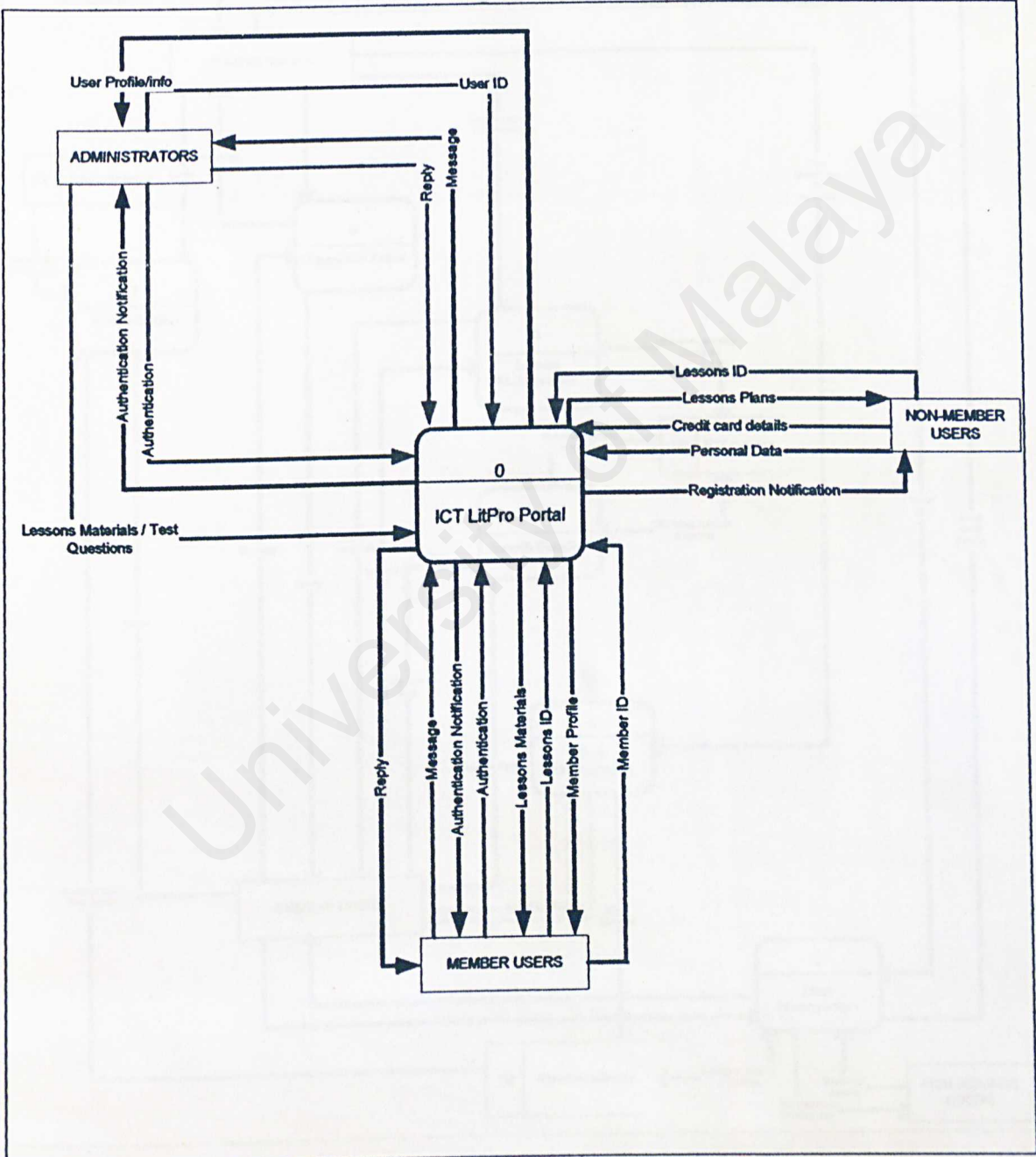
Figure 5.6: Context Level Diagram for ICT LitPro Portal

5.3.2 Diagram 0

Diagram 0 is the detailed description or explosion of the context diagram. It shows all the major processes, data movement and data stores of the highest level of detail. Figure 5.7 illustrates the diagram 0 of the propose ICT LitPro Portal.
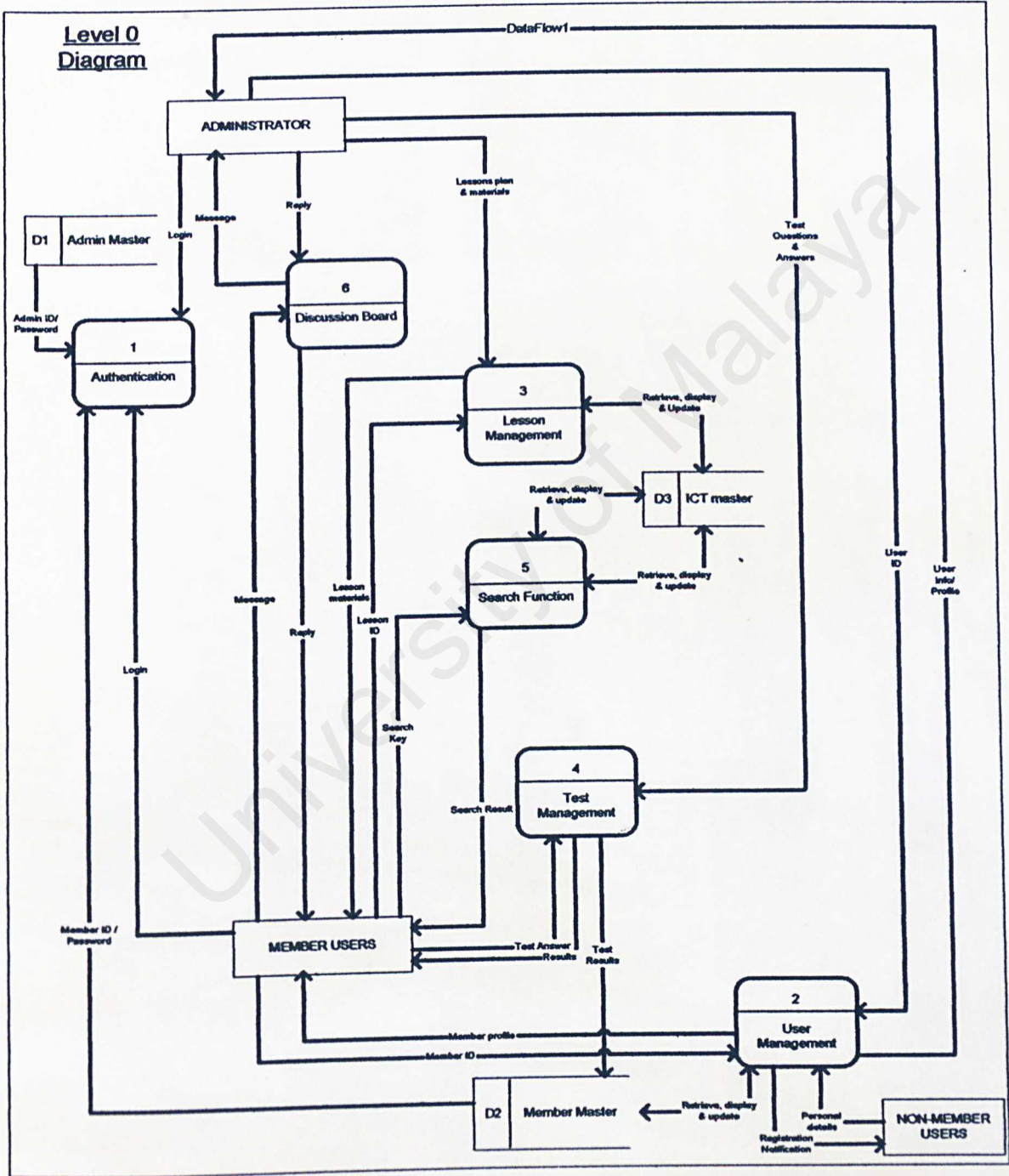
Figure 5.7: The Diagram 0 of ICT LitPro Portal

5.3.3 Child Diagram

A child diagram is a further detailed representation of sub-processes originating from the higher level of processes in Diagram 0.
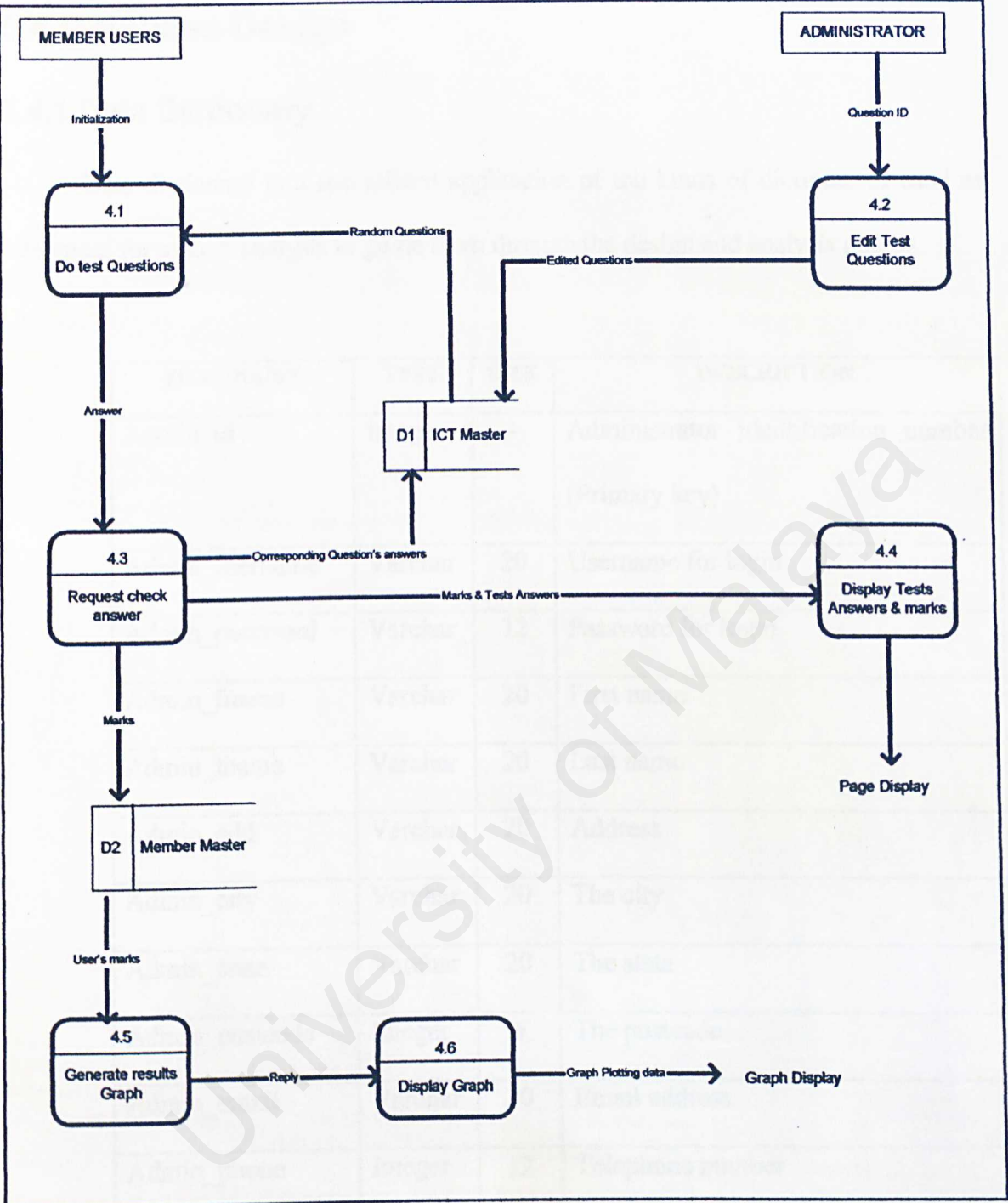
Figure 5.8: Child Diagram for Test Management Process

5.4 Database Design

5.4.1 Data Dictionary

Data dictionary is a specialized application of the kinds of dictionaries used as references for system analysts to guide them through the design and analysis phases.

FIELDNAME	TYPE	SIZE	DESCRIPTION
Admin_id	Integer	-	Administrator identification number (Primary key)
Admin_username	Varchar	20	Username for login
Admin_password	Varchar	12	Password for login
Admin_fname	Varchar	20	First name
Admin_lname	Varchar	20	Last name
Admin_add	Varchar	20	Address
Admin_city	Varchar	20	The city
Admin_state	Varchar	20	The state
Admin_postcode	Integer	6	The postcode
Admin_email	Varchar	30	Email address
Admin_phone	Integer	12	Telephone number

Table 5.1: Administrators Table (TblAdmin)

FIELDNAME	TYPE	SIZE	DESCRIPTION
Mbr_id	Integer	-	Member identification number (Primary key)
Mbr_username	Varchar	20	Username for login
Mbr_password	Varchar	12	Password for login
Mbr_fname	Varchar	20	First name
Mbr_lname	Varchar	20	Last name
Mbr_add	Varchar	20	Address
Mbr_city	Varchar	20	The city
Mbr_state	Varchar	20	The state
Mbr_postcode	Integer	6	The postcode
Mbr_email	Varchar	30	Email address
Mbr_phone	Integer	12	Telephone number
Mbr_results	Varchar	50	Test results

Table 5.2: Members Table (TblMbr)

FIELDNAME	TYPE	SIZE	DESCRIPTION
Lesson_id	Integer	-	Lessons identification number (Primary key)
Lesson_title	Varchar	100	Lessons title
Lesson_plan	Varchar	1000	Lessons plan
Lesson_content	Varchar	10000	The content

Lesson_image	Image	-	The image to accompany the text.

Table 5.3: Lessons Table (TblLes)

NOTE: This Lesson Table applies to all the lessons with a naming system to separate each lesson in different table.

FIELDNAME	TYPE	SIZE	DESCRIPTION
Search_keyword	Varchar	100	Search key words (Primary key)
Search_title	Varchar	100	Search title
Search_links	Varchar	500	Search links
Search_results	Varchar	10000	The content

Table 5.4: Search Table (TblSearch)

FIELDNAME	TYPE	SIZE	DESCRIPTION
Msg_id	Integer	-	Message identification number (Primary key)
Msg_title	Varchar	100	Message title
Msg_post	Varchar	1000	Message content
Msg_reply	Varchar	1000	Reply content
Msg_username	Varchar	20	Message author's name
Msg_Date	Varchar	20	Message date

Table 5.5: Message Board Table (TblMsg)

FIELDNAME	TYPE	SIZE	DESCRIPTION
Test_id	Integer	-	Test sets identification number (Primary key)
Test_title	Varchar	20	Test title
Test_questions	Varchar	2000	Test questions
Test_answers	Varchar	2000	Test anwers
Image	Image	-	Image as illustrations

Table 5.6: Test Table (TblTest)

NOTE: This Lesson Table applies to all the lessons with a naming system to separate each lesson in different table.

FIELDNAME	TYPE	SIZE	DESCRIPTION
Mbr_id	Integer	-	Member identification number (Primary key)
Test_id	Integer	-	Test identification number
Test_questions	Varchar	2000	Test questions
Mbr_results	Varchar	100	Test results
Test_date	datetime	8	Date tests taken

Table 5.7: Result table (TblRes)

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FIELDNAME	TYPE	SIZE	DESCRIPTION
Ques_id	Integer	-	Question identification number (Primary key)
Test_id	Integer	-	Test identification number (Primary key)
Test_questions	Varchar	2000	Test questions
A	Varchar	2000	Answer choice A
B	Varchar	2000	Answer choice B
C	Varchar	2000	Answer choice C
D	Varchar	2000	Answer choice D
E	Varchar	2000	Answer choice E
Ques_ans	Varchar	10	Answer

Table 5.8: Question Table (TblQues)

5.4.2 ER Diagram
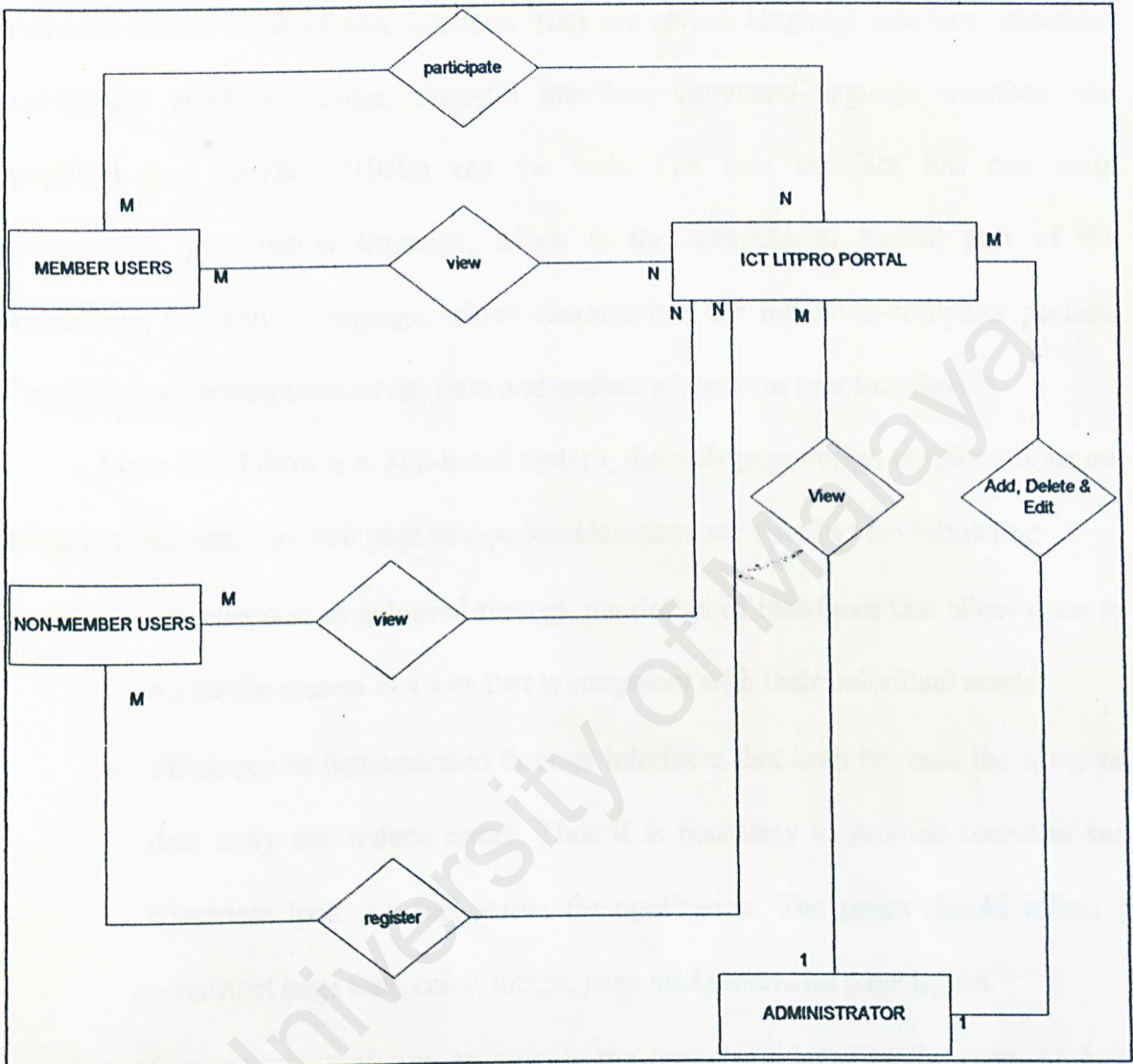
Figure 5.9: ER Diagram for ICT LitPro Portal

5.5 User Interface Design

The interface is the system for most users. According to Kendall and Kendall, there are several kinds of user interface. They are natural-language interface, question-and-answer interface, menus, form-fill interface, command-language interface and graphical user interface (GUIs) and the web. The user interface has two main components: presentation language, which is the computer-to human part of the transaction, and action language, which characterizes the human-to-computer portion. Together, both concepts cover the form and content of the term user interface.

Since ICT LitPro is a web-based system, the web page design considerations are taken into account. The web page design considerations are stated as the following:

- Effectiveness as achieved through the design of interfaces that allow users to access the system in a way that is congruent with their individual needs

- Efficiency as demonstrated through interfaces that both increase the speed of data entry and reduce errors. Thus it is necessary to provide common and consistent look and feel across the application. The pages should reflect a consistent page font, color, image, page background nd page layout.

- Give navigational way to provide the proper guidance to the users in their journey, make sure the users are informed where they are going during the navigation.

- Provide the users with a path at all times. Do not create dead-end pages.
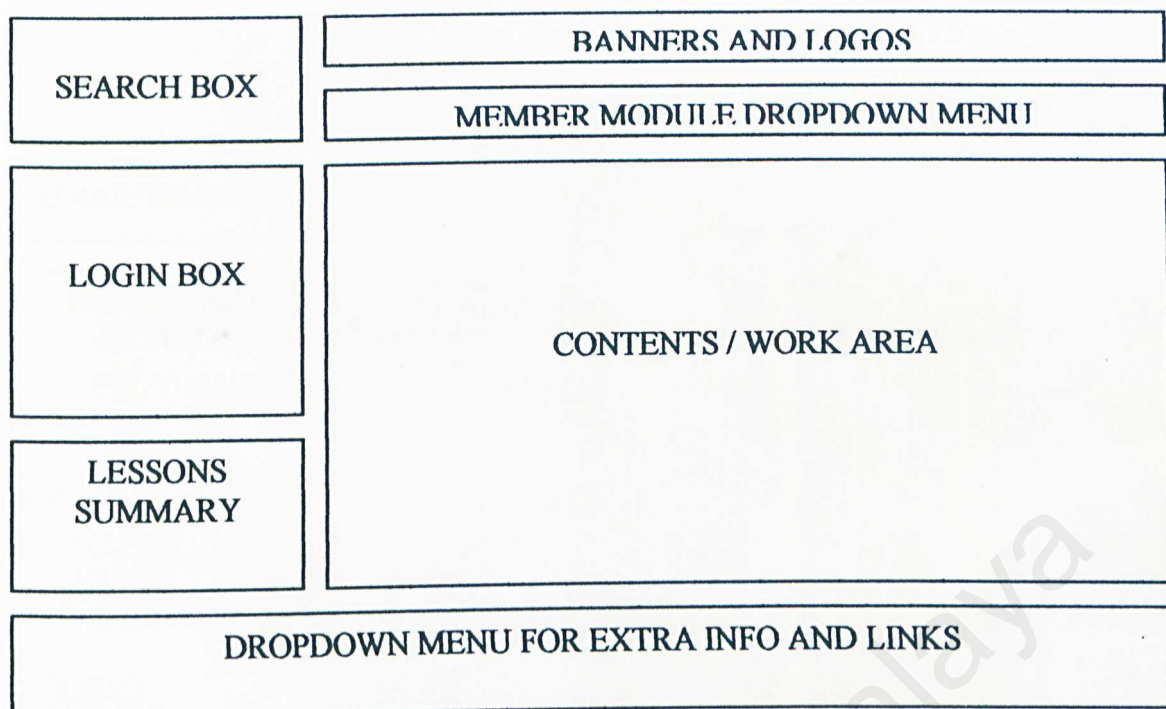
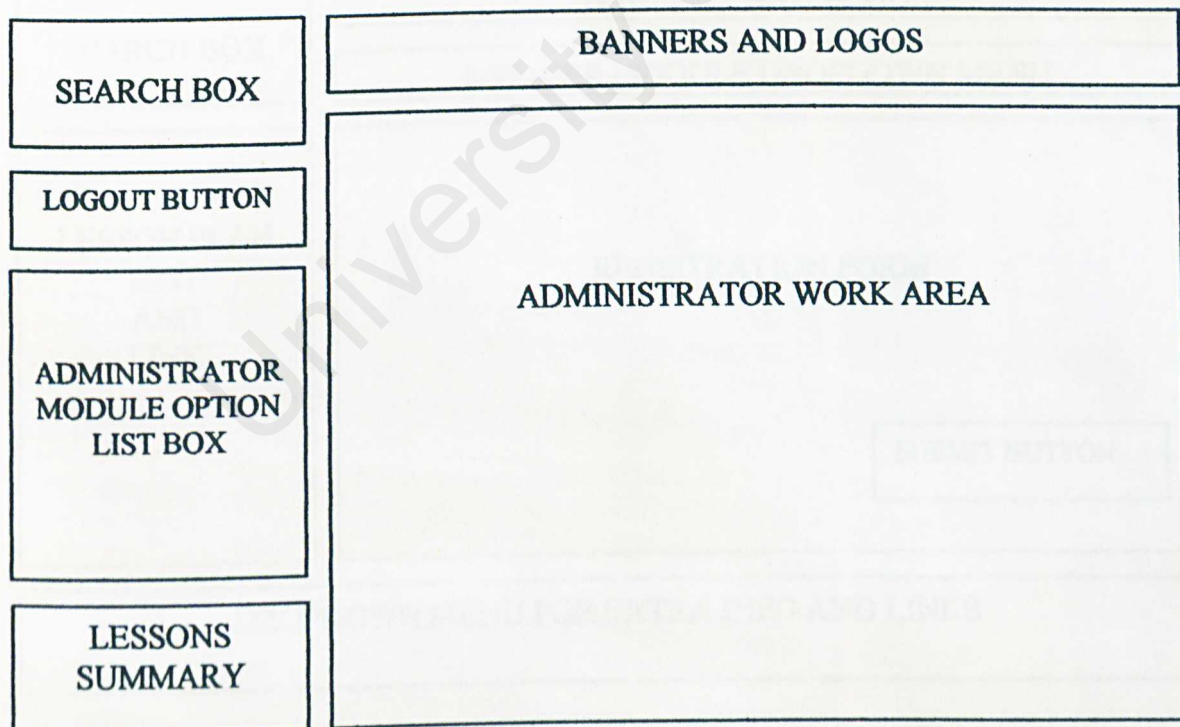*Figure 5.10: Main page Design Skeleton*
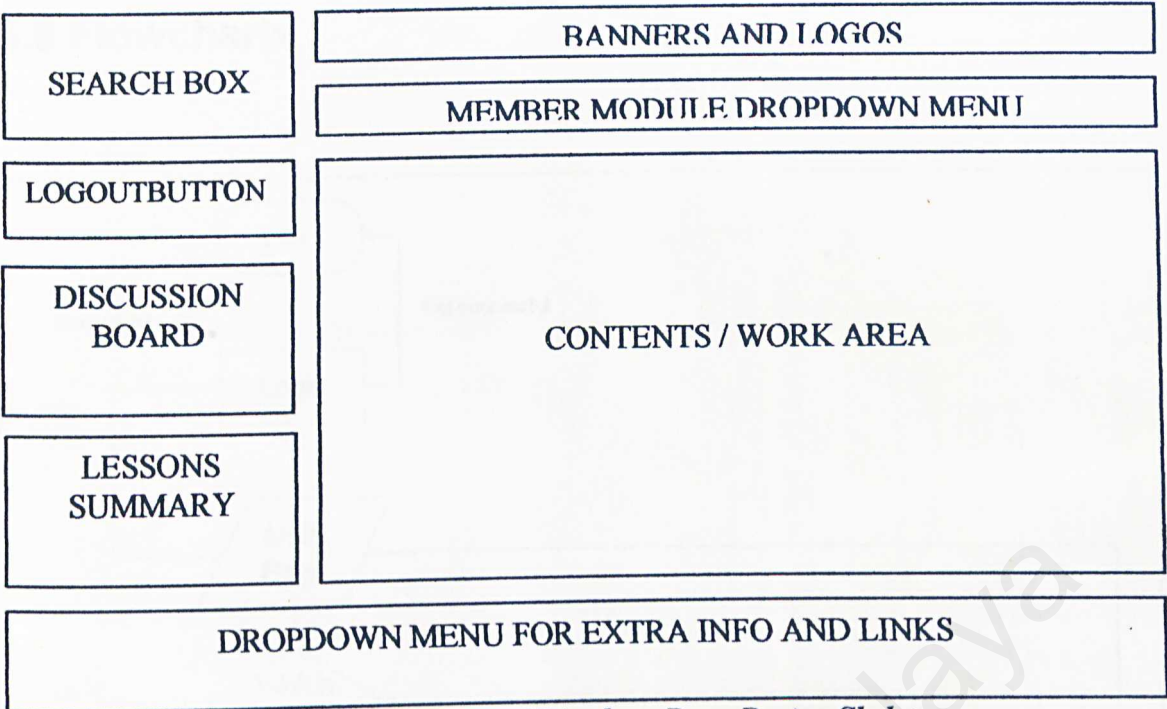

Figure 5.11: Administrators Page Design Skeleton

SEARCH BOX	BANNERS AND LOGOS
	MEMBER MODULE DROPDOWN MENU

LOGOUTBUTTON	
DISCUSSION BOARD	CONTENTS / WORK AREA
LESSONS SUMMARY	

DROPDOWN MENU FOR EXTRA INFO AND LINKS

Figure 5.12: Registered Members Page Design Skeleton

SEARCH BOX	BANNERS AND LOGOS
	MEMBER MODULE DROPDOWN MENU

LESSON PLAN LIST AND LINK	REGISTRATION FORM
	SUBMIT BUTTON

DROPDOWN MENU FOR EXTRA INFO AND LINKS
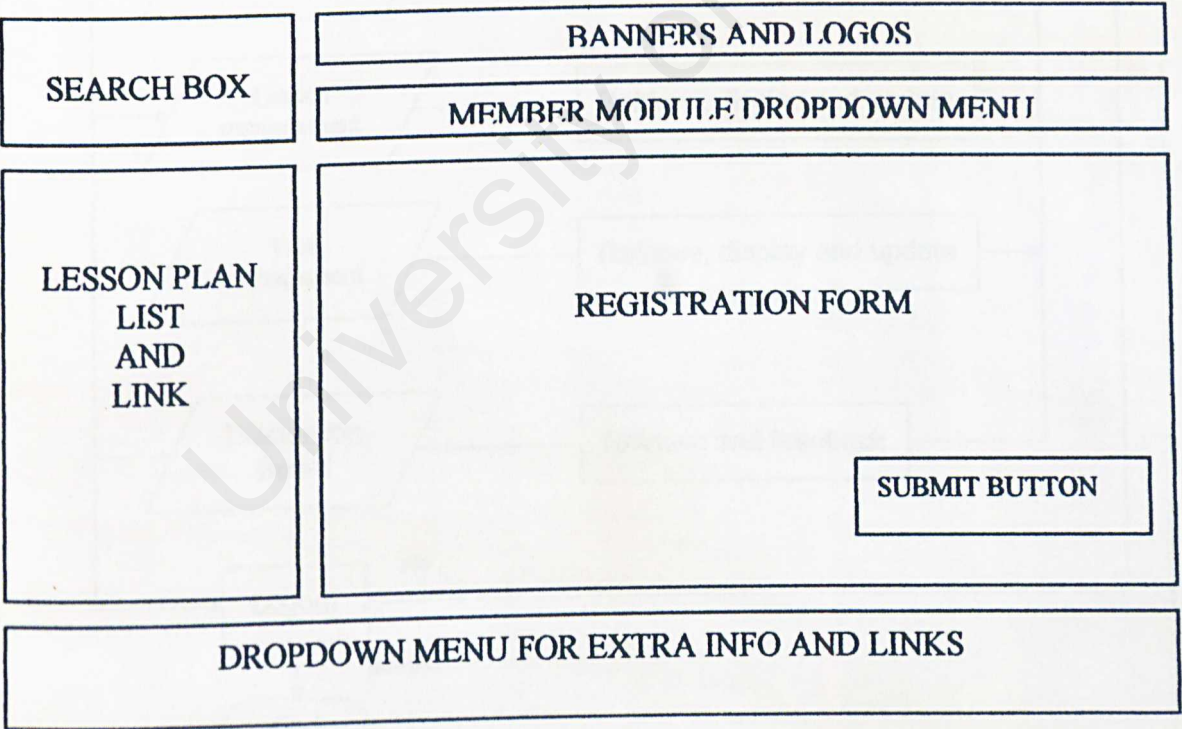
Figure 5.13: Non-Registered Members Page Design Skeleton

5.6 Flowcharts
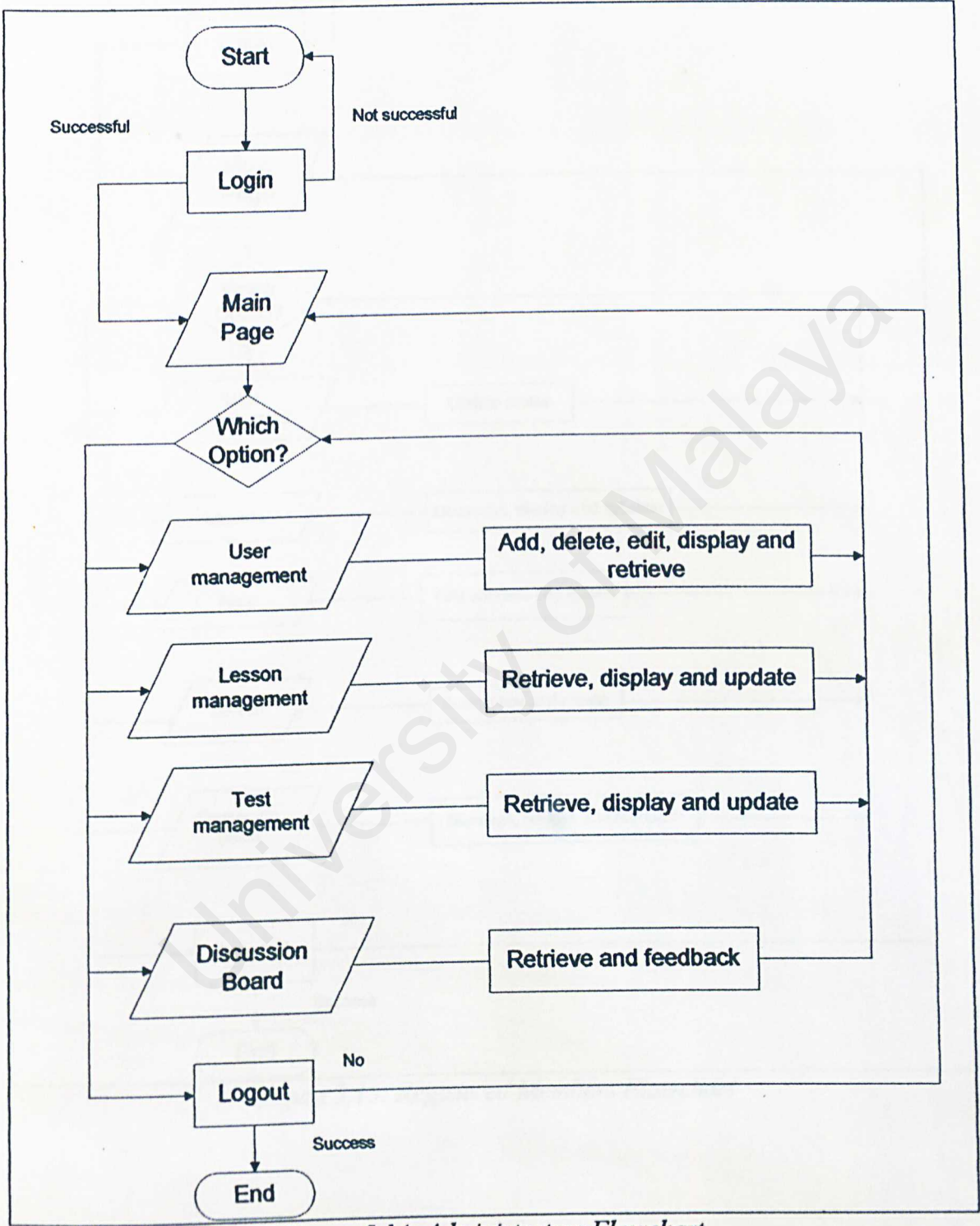
Figure 5.14: Administrators Flowchart
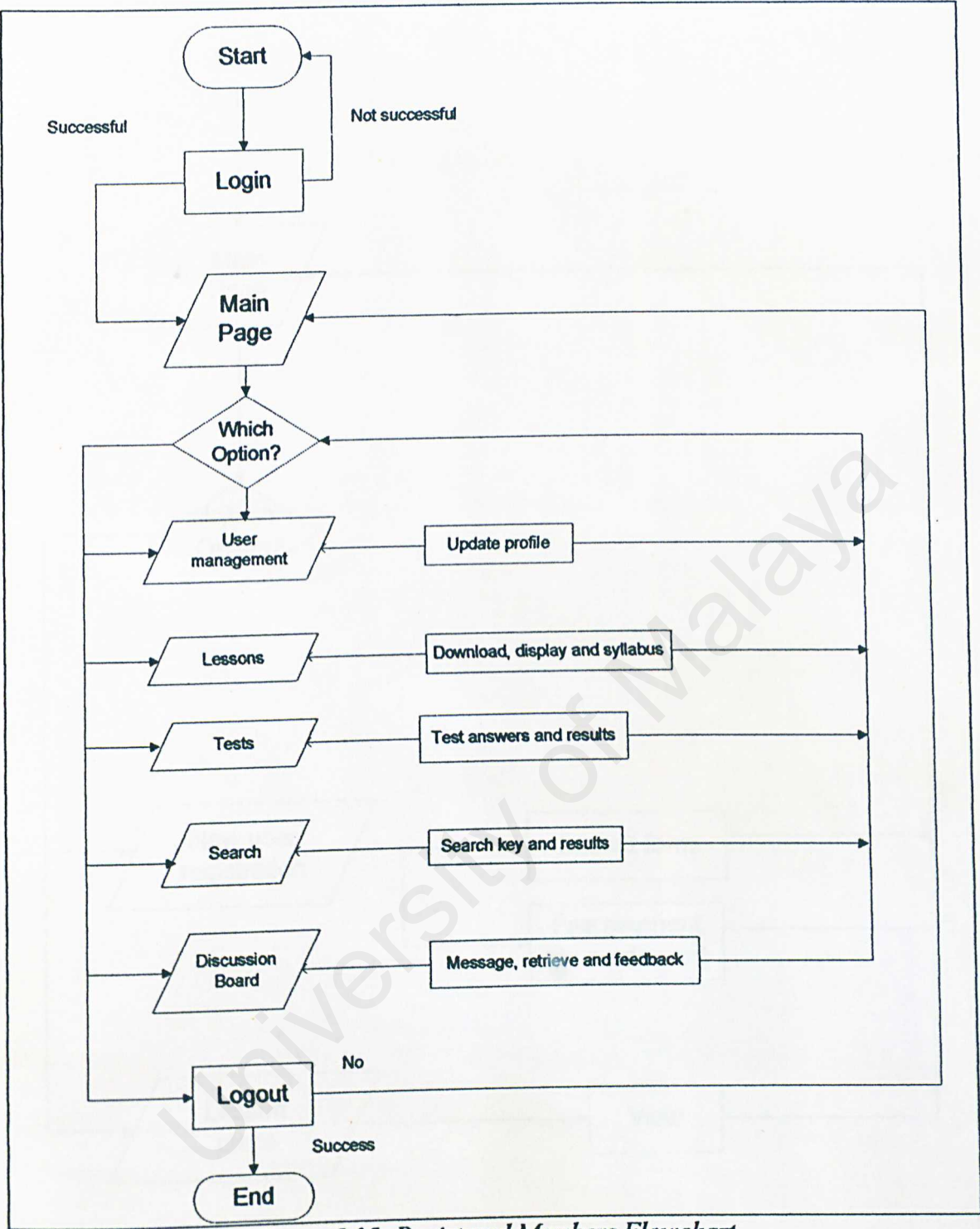
Figure 5.15: Registered Members Flowchart
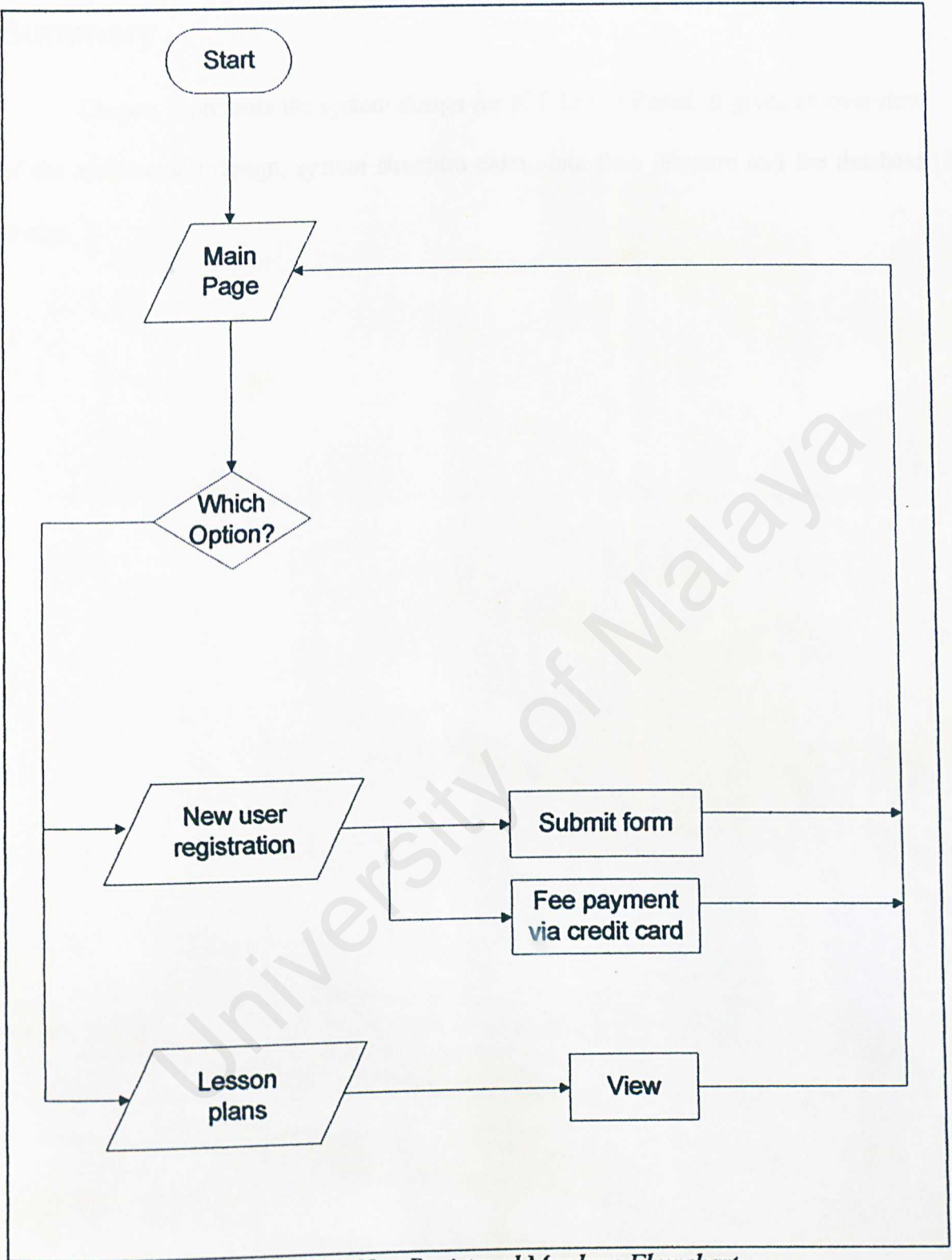
Figure 5.16: Non-Registered Members Flowchart

Summary

Chapter 5 presents the system design for ICT LitPro Portal. It gives an overview of the architectural design, system structure chart, data flow diagram and the database design.

Chapter 6

System Implementation

Chapter 6: System Implementation

System implementation is a process that converts the system requirements and system designs into workable program codes. The initial stage of system implementation involves setting up the development environment which involved installing proposed development tools to facilitate the system implementation.

6.1 Development Environment

The development environment has a momentous influence on the development of a system. System development can be paced up significantly by utilizing the appropriate hard and software.

6.1.1 Hardware in the Development Environment

The hardware configured for the development environment is the element of the whole system. The hardware used in the system implementation phase plays an important role in realizing the final system architecture.

The hardware configuration of the development environment is listed as follows:

    a) Processor – at least Intel Pentium IV 2.2 GHz

    b) Memory – at least 256 MB RAM

    c) Hard Disk Space – 550 MB available hard disk

    d) Other standard PC compliant requirements

6.1.2 Software in the Development Environment

Hardware and software form a tightly coupled cohesion that operates in unison to perform programmed tasks. Without software, the fastest, biggest or most powerful computer will also be inoperable and useless.

The software tools utilized in the development environment are listed as follows:

    a) Operating System – Windows XP Professional

    b) Web Server – Microsoft Internet Information Server 5.0

    c) Database Server – Microsoft SQL 2000 Server

    d) Web Development Tool – Macromedia Dreamweaver MX

    e) Coding Languages

        User Interface – HTML

        Server Side Scripting – ASP

        Client Side Scripting – JavaScript

    f) Web Browser – Microsoft Internet Explorer 6.0

6.2   Development of the System

6.2.1 Database Development

The database for the system is created using SQL Enterprise Manager that comes with installation of the Microsoft SQL Server 2000. Besides creating the database, SQL Enterprise Manager is also used to create objects such as tables, views, diagrams and others. Maintenance tasks such as database backups and restorations are also done using the Enterprise Manager.

The database created is based on the database model designed during the system design phase. Database development began with the creation of a database named ICT, using SQL Enterprise Manager. It was followed by the creations of all the tables needed by the system, as well as specifying all the fields and the property for each table. After that, the tables are linked to each other by means of relationship so as to enforce referential integrity. Referential integrity is vital in that it helps to constraint a relationship so as to ensure consistency between the linked or related tables.

6.3 Program Implementation

The process of assuring that the information systems and networks are operational and then allowing users to take over its operation for use and evaluation is implementation. For ICT LitPro Portal to be implemented, the information system is the last phase of its system development. It includes installation of the equipment for the information system.

The first approach for ICT LitPro Portal to be implemented concerns the movement of computer power to individual users by setting up and shifting the computer power with the help of distributed computing. Through the use of the client/server model (as stated in Chapter 2:Literature Review), ICT LitPro Portal will set up its database server and web server within the LAN in Faculty of Computer Science and Information Technology, University of Malaya.

6.3.1 Coding Approach

Top-down coding method is selected to code the ICT LitPro Portal. Top-down coding method is based on the principle of coding the higher-level modules first and leaving the lower level; modules called in skeleton form, to be filled in later. The lower modules are only a shell, with an entry and an exit. In other words, as the higher module is being coded, references are made to the lower modules as if their coding is available. But in fact, a call to that still-incomplete module will result in an empty action. This approach is used to allow testing to begin on some of the modules while others are still being coded. By using this approach, the most serious types of errors are identified early.

This technique is essential for developing a well-structured program. Besides that, ASP is used as the core programming language in developing the system because we take into consideration the capabilities and advantages for ASP. Therefore, for this system, separating between data presentation and implementation is one of the strategies used while coding.

6.3.2 Coding Style

Coding style is an important attribute of source code. An easy way to read code makes the system easier to maintain and enhance. Elements taken into considerations while coding are internal documentation, standard naming convention and standard graphical user interface. Internal documentation is achieved by using comments while coding, providing a clear guide to programmers for future enhancements. Statements of purpose indicating the functions of modules and descriptive comment are embedded into source code to describe the processing functions.

A standard naming convention and also a standard usage of graphical user interface components is deployed in developing the system making. Standard naming convention provides programmers with easy identification of variables. While a standard in usage of graphical user interface components provides the users an environment that will not generate much surprise to them. Usage of these standards performs as a mean towards coding consistency and standardization.

❖ **Include Scripts Files**

The use of the Include Script File is significant when the program development reached a stage where a large amount of ASP pages have been created. This is because Include Scripts Files avoid the need of modifying the same section or segment on each and every ASP or HTML page. Only the include instruction syntax are inserted to the pages with the same elements to make use of the Include Scripts Files.

The include instruction syntax is as follows:

<!--#include file = *"the source of the Include Scripts File"*-->

This means that updates are only made to the Include Scripts Files, which will then automatically update the pages that have the Include Scripts Files. This helps to ease the tiresome work of updating all the affected ASP pages whenever there are changes made. Besides, the size of the codes is also significantly reduced.

6.3.3 ASP Coding (Server-Side Coding)

FUNCTION	CODE
Create a record set	Set myRecordSet =Server.CreateObject("ADODB.RecordSet")
Fill record set with records from database	myRecordSet.open 'select *from table", myconnection, 2, 3
Count records	myRecordSet.recordcount
Read records	Do while not myRecordSet.EOF myValue = myRecordSet ("field") myRecordSet.movenext loop
Add a record	myRecordSet.addnew
Modify a record	myrecordSet ("field") = "value"
Delete a record	myRecordSet.delete
Update a record set	myRecordSet.update
Close connection	myRecordSet.close myConnection.close

Table 6.1: Some of the ASP Script Used in ICT LitPro Portal

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6.3.4 JavaScript Coding (Client-Side Scripting)

The following is the example of a Javascript code for validating a form.

```
<script language="JavaScript">
<!--
function MM_reloadPage(init) {  //reloads the window if Nav4 resized
  if (init==true) with (navigator) {if
((appName=="Netscape")&&(parseInt(appVersion)==4)) {
    document.MM_pgW=innerWidth; document.MM_pgH=innerHeight;
onresize=MM_reloadPage; }}
  else if (innerWidth!=document.MM_pgW || innerHeight!=document.MM_pgH)
location.reload();
}
MM_reloadPage(true);
// -->
</script>
```

Summary

Chapter 6 briefs on the development environment, the development of the system, and the program implementation. This chapter explains the hardware and software environment necessary as well as the coding approaches executed in order to get the ICT LitPro Portal up and running smoothly without any glitches.

Chapter 7
System Testing

Chapter 7: System Testing

Testing is an important process in developing a system. All of the system's newly written or modified application program as well as new procedural manuals, new hardware, and all system interfaces must be tested thoroughly. Testing of a system does not actually come at the end of the system development but should be carried out during the development phase.

The purpose of testing is to ensure that the resulting component of program as well as the program as a whole fulfills the requirements specification and to eliminate faults in the program. Due to the errors that have been done during the system development or system design, faults and failures may happen even when the entire system has been developed. Therefore, the main idea of testing is to demonstrate correctness of the program, identify the errors in the system coding or the system design. The faults that are discovered during the testing procedures will be corrected.

7.1 Types of Testing

Although the testing process involved a lot of methods and testing levels, but basically there are 4 major stages of testing involved in the ICT LitPro Portal system.

7.1.1 Unit Testing

The unit testing technique is used to ensure that the ICT LitPro Portal is bug-free and without side effects. Normally, after one new module is developed, it is usually tested independently in order to assure their accuracy and to find faults in the modules.

Strategies carried out for unit testing:

❖ **Code Reviewing**

I reviewed the code before passing it to my team member in the project. The codes are examined line by line in order to make sure that many uncovered semantic errors during implementation can be revealed. In reviewing the code, the correction of coding was identified by comparing it to the original design of the program flow. When the logic and flow of the program were identified, the code was commented so that it can be traced in the future. The code is examined and debugged in order to identify any faulty coding. It is easier to debug the error using nodes formula. We can trace the nodes formula code line by line using the available debugger and it will highlight the error areas. After the testing, the final system is in accordance with the system specification.

❖ **Test Cases**

Besides reviewing the codes, we used some test cases to test the system. This approach is used as some set of structural input is given and output is observed. In this testing, we input different login ID and password to test the program. With this, the reaction of the program to the input data could be tested. Each component is tested independently, without other system components. This can identify the program's faults which probably happen in normal conditions.

7.1.2 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.

The test is dynamically done. Dynamic test require modules to be executed on a machine. To do this, white-box testing is conducted. White box testing is a test case design method that uses the control structure of the procedural design to derive test cases. It can be conducted in parallel for multiple modules.

The steps for module testing are:

a) Manually examine the code simply just from reading through it, trying to spot algorithm and syntax errors.

b) Comparing the codes with the specification defined and also with the design is necessary to ensure all relevant cases are considered.

c) Compile the code and eliminate remaining syntax faults.

d) Develop test cases to show that the input is properly converted to the desired output.

The following section discusses some examples of the modules testing in detail:

a) Users Module

- Login as a valid user with correct login ID and password. Validated users are allowed to access the tests, search and the discussion board.

- Login as users or administrators with either incorrect login ID or password. The program will alert the users that either the login ID or password is incorrect.

- Login as administrator is allowed to access the administrative services such as add, delete and edit functions.
- Test if the forgotten password is successfully sent from the database to the valid user

b) Administrator Module

- Try to view all existing records in the database according to the categories. Try to execute functions like editing, deleting and adding new records to these records.
- Test on all validation controls by inputting invalid values like an invalid email address and so on.
- Test, if the retrieval of data from the database produces the same data wanted by the administrator.
- Test for any broken links within the module itself.

c) Discussion Board Unit

- Test if the module enables postings and adding new title to the discussion. The limit of words is tested to maintain the module's functionality.
- Test if the date and time inserted automatically for each posting are correct.
- Make sure that logging in as administrator has special features for them to maintain the discussion board.

d) Tests Module

- Test if users have already taken a quiz the results is automatically inserted into his/her account. Test if users are unable to do a same quiz set twice.

- Test if administrator can do all the maintenance on the quiz module such as deleting questions, adding new questions and adding sets and so on.

7.1.3 Integration Testing

Integration testing is carried out after module testing process has been done. When individual components or modules are working in satisfactory and meeting the system objectives during the module testing, those modules are then combined into a whole working system. Several independent modules combined into a single system may cause some unpredicted and unexpected errors that relates to the integration of those modules. Therefore, integration testing is a systematic approach for constructing the application while conducting tests to uncover errors associated with interfacing of different components or modules.

7.1.4 System Testing

After all modules are completed, the entire system must then be validated. Carrying out the system testing process does the validation of the system. Testing the whole system is very different from module and integration testing. When system testing process is carried out, the major difference compared to module and integration testing is

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that one needs to work with the entire environment of the system such as the hardware, software, database and the computer system. The objectives of the system testing are to verify and validate the functional and non-functional requirements of the system.

7.1.5 Acceptance Testing

Acceptance testing is the final sage in the testing process, before the system is accepted for operational use. The system is tested with data supplied by end users rather than simulated test data. Acceptance testing reveals errors and omissions in the system requirements definition because real data exercises the system in different ways from the test data. Acceptance testing also reveals requirements problems where the system's facilities do not really meet the users' needs or the system performance is unacceptable. The testing process continues until the system developer and client agree that the delivered ICT LitPro Portal is an acceptable implementation of the system requirement.

Summary

Chapter 7 represents the system testing in terms of the type of testing conducted for the system. Unit testing is conducted in the first stage followed by module testing. After that, integration testing is carried out so that to uncover errors associated with interfacing of different components or modules. System testing is carried out after integration testing to make sure that the whole system is working with the entire environment of the system. Lastly, the end users of the ICT LitPro Portal perform the acceptance testing.

Chapter 8

System Evaluation

&

Discussion

Chapter 8: System Evaluation & Discussion

After having gone through the testing and implementation phase, system evaluation is the final phase of developing this system – ICT LitPro Portal. In this phase, system evaluation involves determining the problem or difficulties which rose during and after the program coding phase, recognizing the system strengths and weaknesses, and finally draft out the system limitations and also its future enhancements.

8.1 Problems Encountered
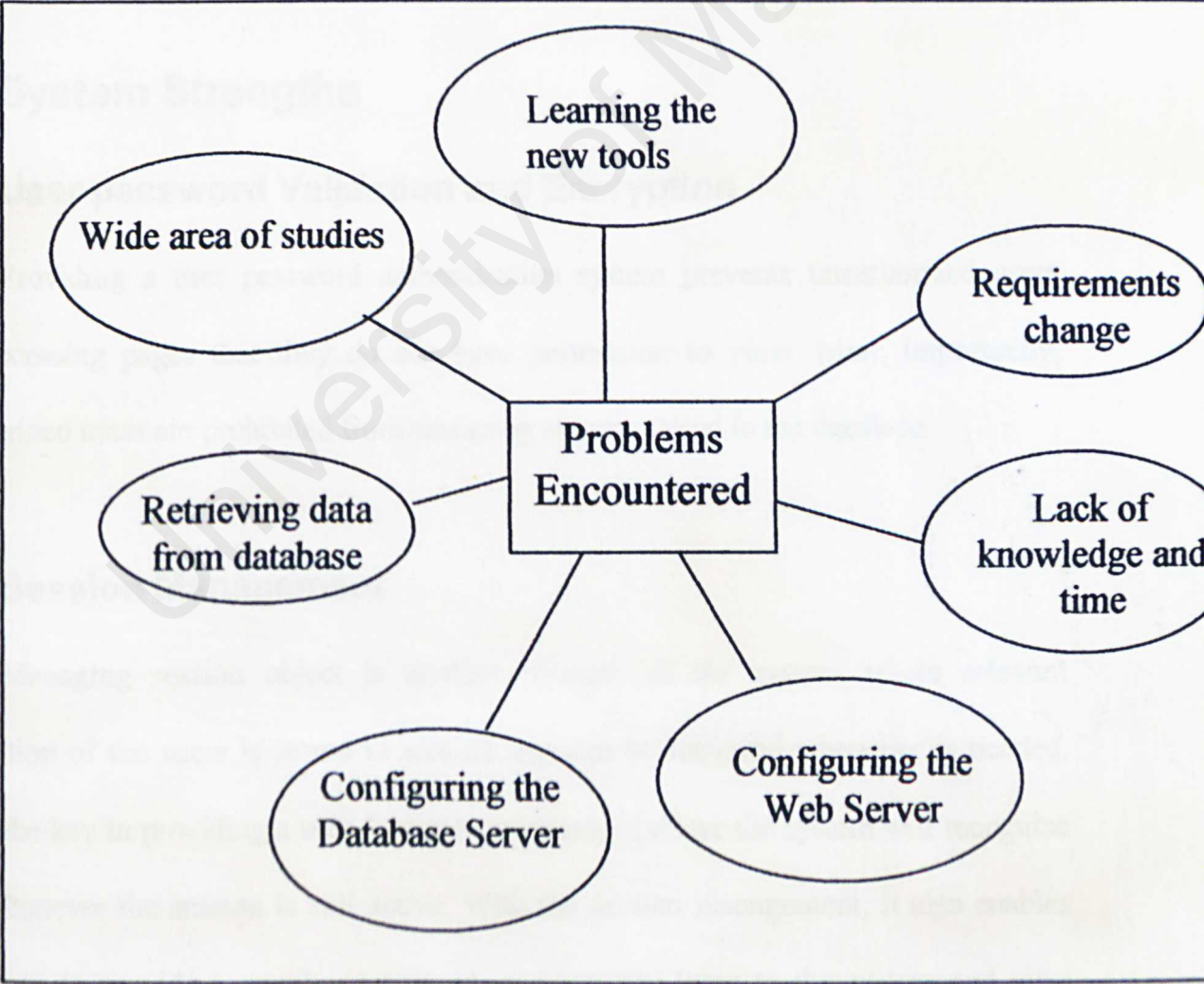
Figure 8.1: Problems Encountered during developing ICT LitPro Portal

While developing ICT LitPro Portal, there were several problems encountered as shown in Figure 8.1. The most difficult problem that occurred is requirement change from the user. In fact, it is very hard to design, develop and implement the system when the requirement frequently changes because the coding need to be changed a lot in order to accustom to the new requirement. Besides that, setting up of the server is critical for the operation of the application developed. However, the setup process took a long time because of the lack of experience in setting and configuration of the SQL 2000 Server. The repeated failure of the server required re-installation of the server as a remedy and this consumed time and effort.

8.2 System Strengths

8.2.1 User password Validation and Encryption

Providing a user password authentication system prevents unauthorized users from accessing pages that they do not have permission to view. More importantly, unauthorized users are prohibited from accessing records stored in the database.

8.2.2 Session Management

Managing session object is another strength of the system where relevant information of the users is stored in session and can be retrieved whenever is needed. This is the key in providing a user-focused environment where the system will recognize them whenever the session is still active. With the session management, it also enables the system to provide a member's area where users can login to the system and view information regarding themselves.

8.2.3 Easy Interaction User Interface

This system is considered to have a easy interaction user interface whereby graphical user interface components such as buttons, combo box and navigation buttons are used to minimize the user actions while performing certain tasks. It was designed to let the users feel comfortable, easy to use and can navigate around information without any problem. The learning curve of users in using the system is foreseen to be short and they should be able to get familiar and use the system within minutes of usage.

8.2.4 Scalability

Hardware and software applications can be easily added to the existing system. This is because the system is not hardware dependent.

8.2.5 Web Enabled

The ICT LitPro Portal implementation is based on web technology. This means that the current implementation is deployable over the Internet. Employing the client server approach allows loads to be shared between the client and server, thus reducing the burden on the server and allowing it to provide better service.

8.3 System Constraints and Limitations

Each newly developed system has its own constraints and limitations. No system is perfect and so is ICT LitPro Portal. There are a few constraints and limitations to ICT LitPro Portal. These constraints and limitations are mainly due to the system where it is not able to implement some methods or features and will not affect users while using this system in a serious manner. Some of the constraints and limitations are listed as following:

8.3.1 No SSL (Secure Sockets Layer) Support

SSL, which is an encryption method to increase the security during the transmission of data between the server and users, cannot be implemented in ICT LitPro Portal. This is mainly because it has to liaise with a Certificate Authority (CA) to get a server digital certificate. This digital certificate then has to be bought from the CA along with other information submission like the URL for the system, and the information of the company that runs the system.

8.3.2 Browser Limitation

Because of the language using the newly technology, the web system is best to be viewed with Internet Explorer 4.0 and above.

8.4 Future Enhancements

Future enhancement of the system will see part of the limitations above to be eliminated or improved. Besides turning a limitation into a future enhancement of the system, there are also some other fields or services that can be provided to server the users better.

8.4.1 Support Multiple Language

The current system is only limited to one language which is English. It needs to be enhanced so that it can support more than one language. This is due to different people using different languages.

8.4.2 Online Helpdesk

Provide a platform where users who encountered any problems at all can be solved. Equipped with more details and useful material, it is hoped that this will be able to guide users and solve their queries.

8.5 Knowledge and Experience Gained

Much knowledge had been gained during the whole process of developing ICT LitPro Portal.

1) Internet Technology.

Learned how to configure the Web Server (IIS), Database Server (Microsoft SQL 2000)

2) Technique to handle and fix error when occurred.

3) Improved skills in finding information and problem solving

4) How to manage a database. Learned how to use Microsoft SQL 2000 to manage data and structured Query Language (SQL), which is important in developing a system related to database.

5) Learning ASP, HTML, and JavaScript

6) Apply theories and knowledge gained throughout studies. Theories and knowledge gained throughout the course of IT studies were literally put into practice.

Summary

This chapter is the final chapter that concludes the overall system. This includes all problems and solutions occurred during development of this system, system strengths, system limitations, future enhancement and also the knowledge and experience gained from the project.

Conclusion

Conclusion

This system has successfully achieved its objective in meeting the requirements specified during the initial stage. This system is easy to learn and use. A lot of effort and time had been consumed to make this project successful. After considering the minimum requirement and time constraints, only the most important function and features that were needed in this project were implemented. The eventual product of the project is a working prototype, which is simple yet workable. Although there were several limitations, with future enhancements, this system will be more reliable and able to incorporate more features.

Much experience has been gained, new knowledge acquired and opportunities to practice some project management and communication skills. In addition, the development of the proposed system has enabled me to learn how to design, plan and schedule the tasks that needed to be implemented according to one's capability. The full system development life cycle is much clearer now. I also realized that my writing and communication skills had also changed for the better after spending months on this project.

Throughout the whole project, and the knowledge attained over the 3 years had been put to full use. Seven months of intense hard work, in turn, presented me with a great opportunity to learn more new things from this project. During the whole period, I had learned, absorbed, failed, and grown more than I had ever realized! I definitely agree that without this final year project, students wouldn't go anywhere!!!

Overall, developing this project has indirectly helped me in developing skills useful in the advancement of my career in Information Technology. Last but not least, I

have discovered that there is still room for me to improve my programming (definitely!) and requirement analysis skills. I hope that in the near future, there will still be the chance for me to sharpen these skills.

References

1. Chaudhury, Abhjit&Kulboer, Jean-Pierre. 2002. "e-Business and e-Commerce Infrastructure Technologies supporting the e-Business Initiative"McGraw-Hill Book Co.

2. Pfleeger, S.H. (2001). Software engineering theory and practice. (2nd Ed.) New Jersey: Prentice-Hall Inc.

3. H.M.Dertel, P.J. Deitel and T.R.Nieto (2002). Internet and Worldwide Web How to Program. 2nd Edition. New Jersey: Prentice-Hall

4. Ian Sommerville (2001)Software Engineering. 6th Edition. Addison-Wesley.

5. Gallaugher, J (1995). The Critical of Client Server Architecture: A Comparison of Two ad Three-Tier Systems.

   Available at http://www.bc.edu/~gallaugher/research/ism95/cccsa.html

   Accessed: 2003, June 15

6. http://www.planetklik.com.my

   Accessed: 2003, June 23

7. http:// www.sibertuisyen.com

   Accessed: 2003, June 23

8. http:// www.tutor.com.my

   Accessed: 2003, July 14

9. http://www.fortunecity.com

   Accessed: 2003, July 20

10. http://myschoolnet.ppk.kpm.my/tutorial.htm

    Accessed: 2003, August 4

Appendix

User Manual

To Install the System

1. Install the IIS (Internet Service Provider)

Used Windows 2000 or Windows XP Professional

1. Put in the installation CD for windows 2000 or Windows.
2. Go to control panel.
3. Add / Remove program
4. Add/Remove Windows component
5. Tick on the IIS (Internet Service Provider)
6. Click install.
7. Type http://localhost/localstart.asp to test the IIS whether working or not.

2. Restore the database in SQL Server

1. Install the SQL Server 7.0
2. Add new database and the name of the database is ict.
3. Right click the ict databse.
4. Click All Task → Restore database
5. Click Restore: from device
6. Click select device.
7. Click add
8. Choose the backup database.
9. The backup database is "project", which has been paste in the D drive.
10. Click Ok.
11. Click Ok again.
12. Go to 'Option'
13. Click 'force restore over existing database'.
14. Click Ok.

3. Set the ODBC

1. Go to control panel
2. Administrative tools → ODBC Data Sources
3. Click on system DSN
4. Click ADD
5. Choose SQL Server → Click Finish.
6. The data source name = project.
7. Choose the SQL server that you wish to connect.
8. Click Next.

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9. Choose → with Windows NT authentication using the network login ID.
10. Click on change to default database to:
11. Choose the ict database in the SQL server.
12. Click next.
13. Click Finish.

4.   ICT folder

1. Paste the ICT folder in D:/ drive. This is because for the upload file I have set the coding to D: / drive. Right click the folder.
2. Click sharing → Web Sharing
3. Type ict for the sharing name.
4. Open the web browser and type http://localhost/ict.
5. All the files in ICT folder will be shown.
6. Click on the mainpage.asp.
7. login = abc and password = abc or
8. Click sign up as member to register as new member.
9. login id for administrator is login = abc and password=abc

Lesson
1. If you want to upload new lesson, you have to upload to the lesson folder in the ict folder.

2

Getting Started with ICT LitPro Portal

In order to access the main page, users are required to use the web browser to access the

ICT LitPro website: http//localhost/ict/mainpage.asp
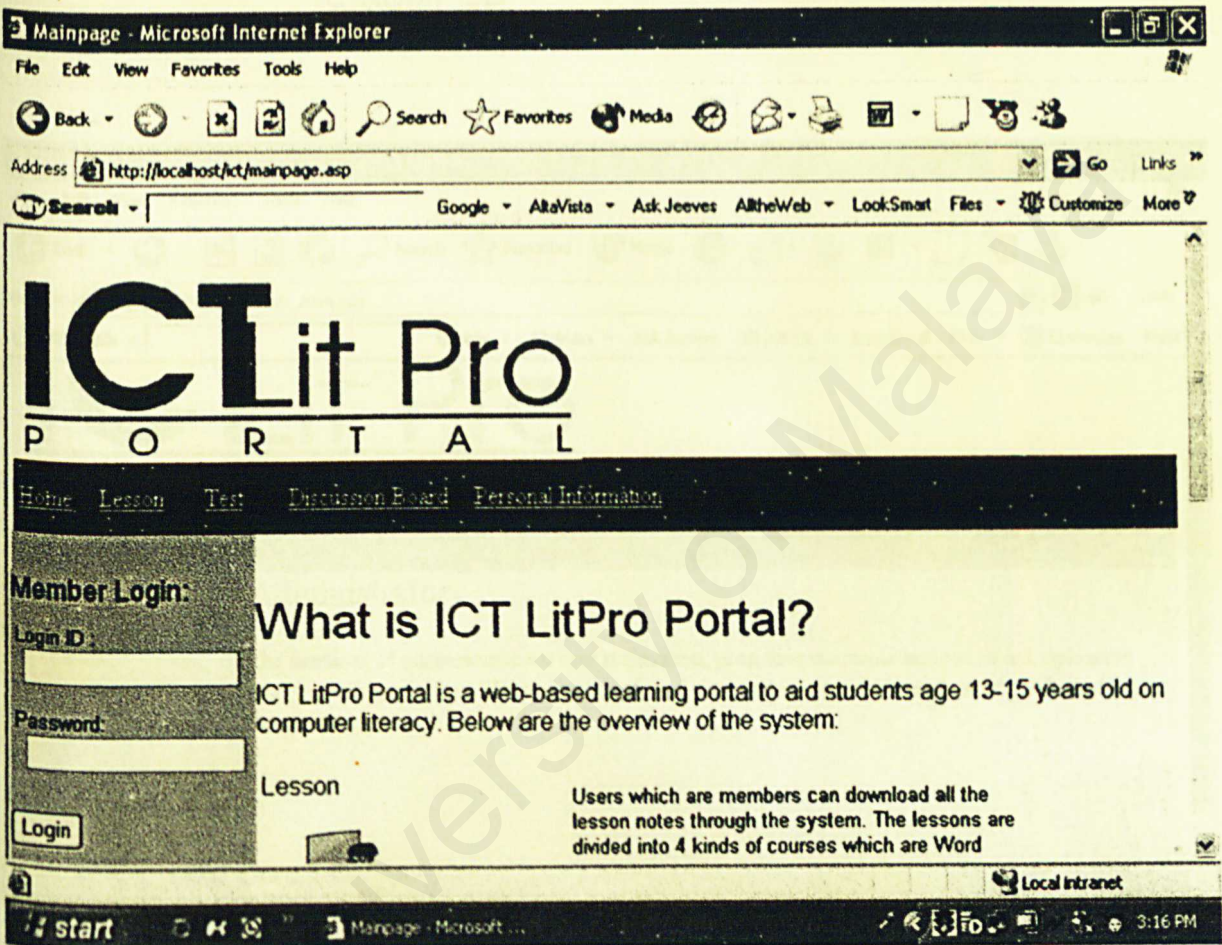
Main Page

Before user (Administrator, Member) can access to ICT LitPro Portal, he/she must login

first from the main page as shown above.

Administrator Module

Access to the Administrator Main Page

The default user ID and password for the System Administrator (SA) is:

User ID: abc

Password: abc
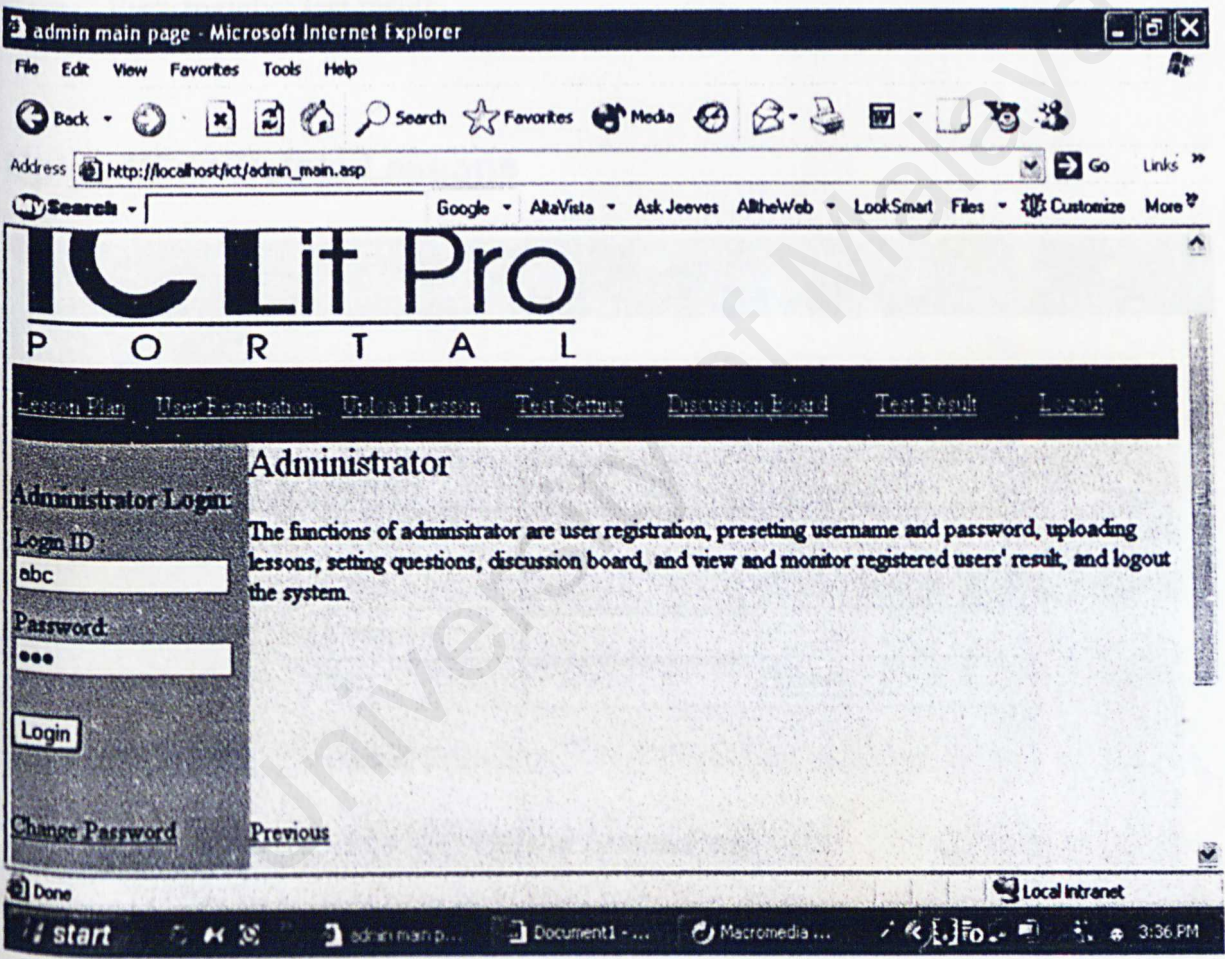
Administrator Main Page

The main functions that the SA can do are:

- Upload/Edit/Delete lessons

- Add/Edit/Delete lesson plans

- Upload/Edit/Delete test questions

- Discussion Board

- Change password

- View member test results

Upload/Edit/Delete Lessons

Upload Lesson Page

This module enables the SA to:

1. Add, update and delete lessons. Click on the related lesson's hyperlink and the following page will show the list of lessons.

Add/Edit/Delete Lesson Plans

Lesson Plan Page

- SA may add/edit/delete lesson plans whenever necessary

Add/Edit/Delete Test Questions
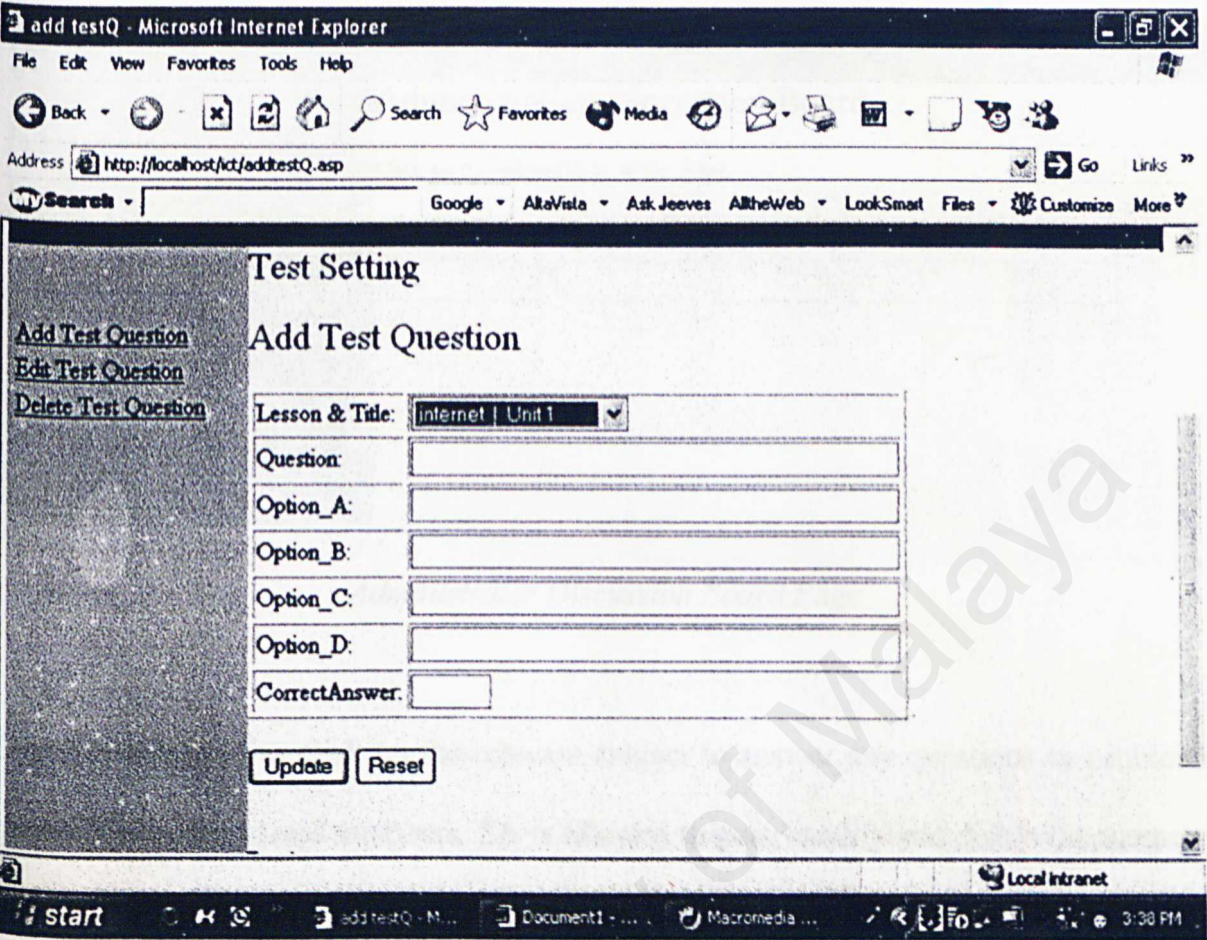
Add Test Questions Page

The SA can add/edit/delete test questions by clicking on the appropriate hyperlinks. Here, the SA will have to key in the test questions one by one and will also have to key in the right answer.

Discussion Board

Administrator Discussion Board Page

The SA will have to click on the relevant subject to answer any questions or problems posted by the registered members. SA is allowed to post, modify and delete the message on the board.

Change Password
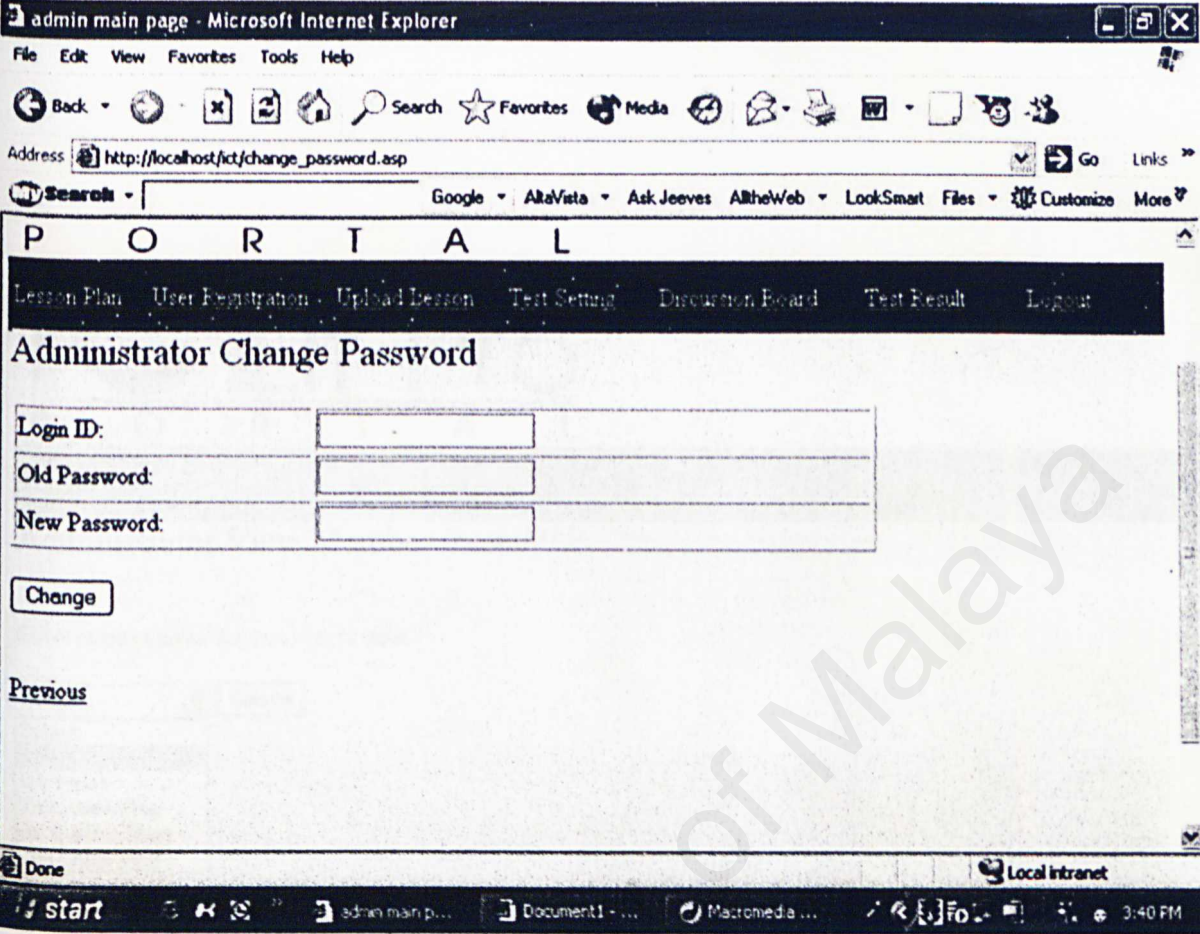
Change Password Page

The SA can change the default password from time to time for security purposes.

However, the SA will not be able to change the member password.

View Member Test Results

View Member Results Page

The SA will be able to monitor any member's results on this page.

Users Module

Registered Members

Once in the Main Page, he/she who wants to use the services provided by the portal will have to sign up first. They will have to fill in the Member Registration Form and submit it online.

Member Register Page

Once accepted, they will be provided with a user ID and password immediately. Here, their email address will be used as the user login ID and their IC no will be assigned as the password.

Your login ID and password is as below:

Login ID:	koko@hotmail.com
Password:	123456789111

[Next]

Given Login ID and password

If the users forget their given password, they will be prompted by a secret question which they have to answer while filling the member registration form. If answered correctly, they will be reminded of their login ID and password.

Forgot Password

Key in your name, secret question and secret answer.

Name:	
Secret Question:	What is your age? ☑
Secret Answer:	

[Next]

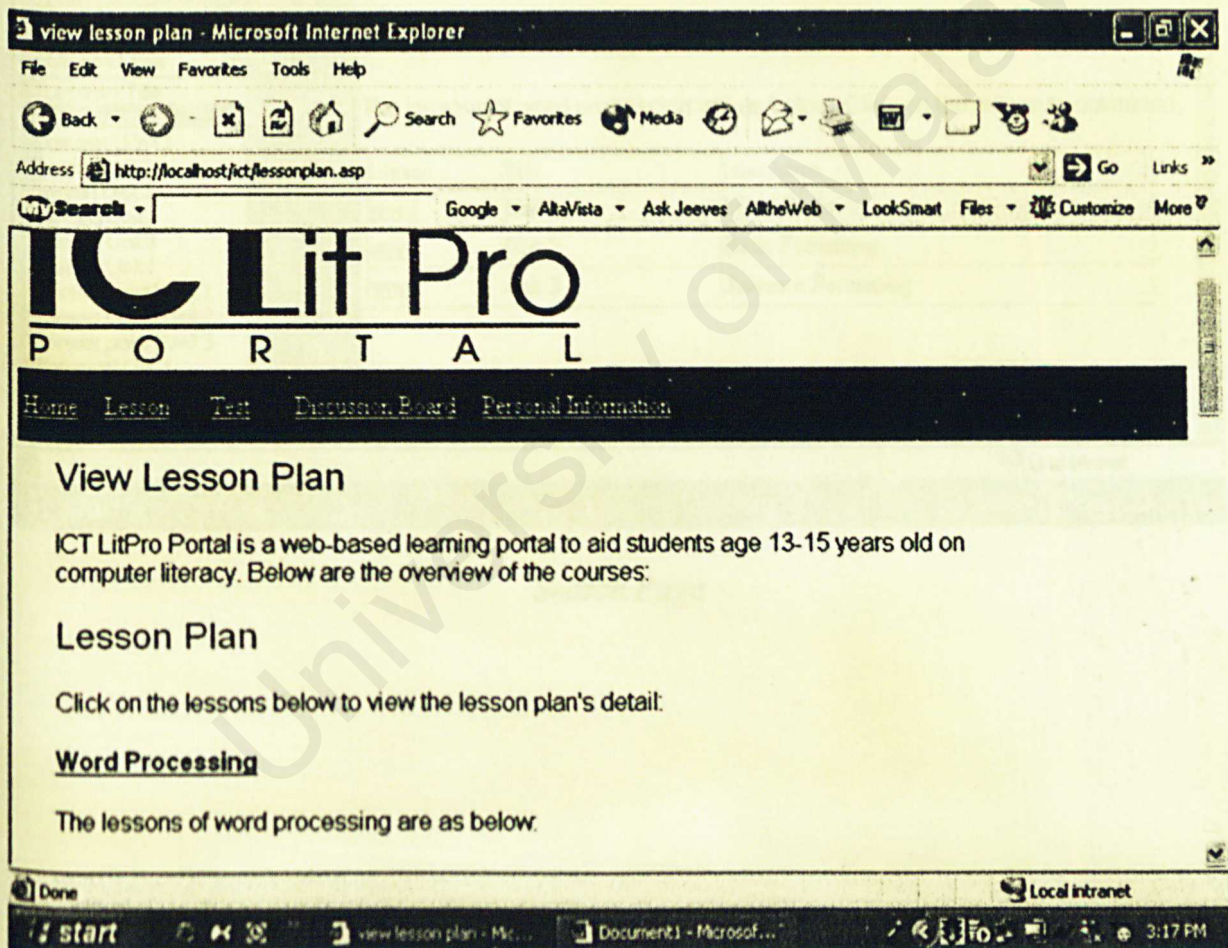Previous

Forgot Password Page

Download Lessons

Members can view the view the lesson plans first to get an idea of the lessons before downloading the necessary lessons. There are 4 types to choose from namely:

- Word Processing

- Power Point Presentation

- Excel

- The Internet

View Lesson Plan Page

Members can search for their lessons by using the search function. Here, they can choose

the chapters by clicking the scroll down box.

Search Page

Choose the lessons by clicking the hyperlinks.

File download Page

Test Questions

Members can choose the chapters they want to test on and answer it on the spot. They will be graded and given the results and correct answers on the spot.
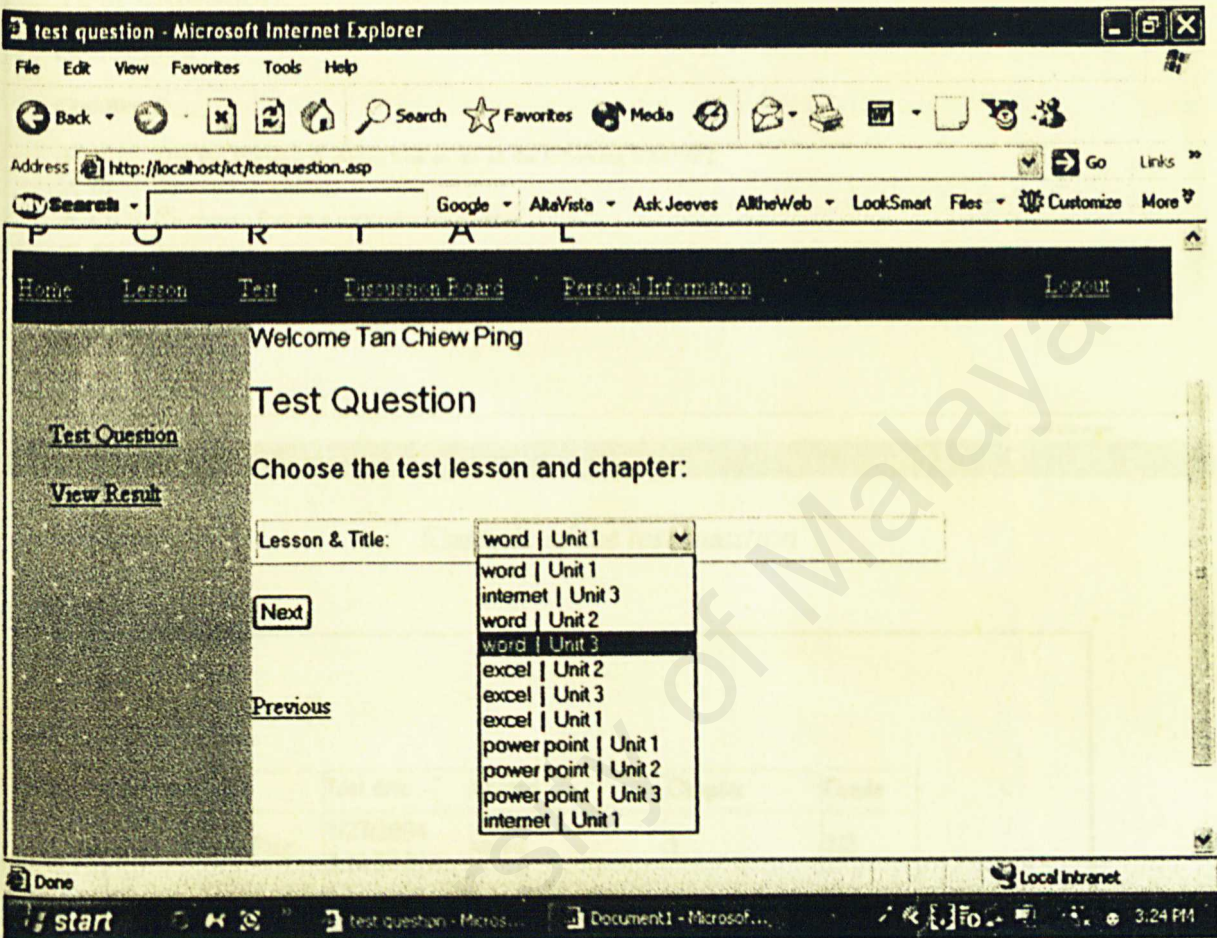
Test Questions Page

Test Question

Lesson: word

Chapter: 2

No:1	Use the Paragraph dialog box to do all the following EXCEPT:
A ⦿	Specify line spacing
B ○	To change font in a particular paragraph
C ○	Indent text
D ○	Create a "block quote" effect

[Next]

Example of the test question

Test Result

Name	Test date	Lesson	Chapter	Grade
Tan Chiew Ping	1/27/2004 3:10:37 PM	word	1	1/2
Tan Chiew Ping	2/11/2004 3:24:40 PM	word	2	0/4

Previous

Test Results Page

Discussion Board

This message board will be a discussion forum on various topics of interest. However, in order to participate in the discussion, one needs to be a member first by registering with the portal. A member is allowed to read and post messages on the board. Members can discuss matters either with other members on the Bulletin Board or ask the SA questions on the Discussion Board on the right.
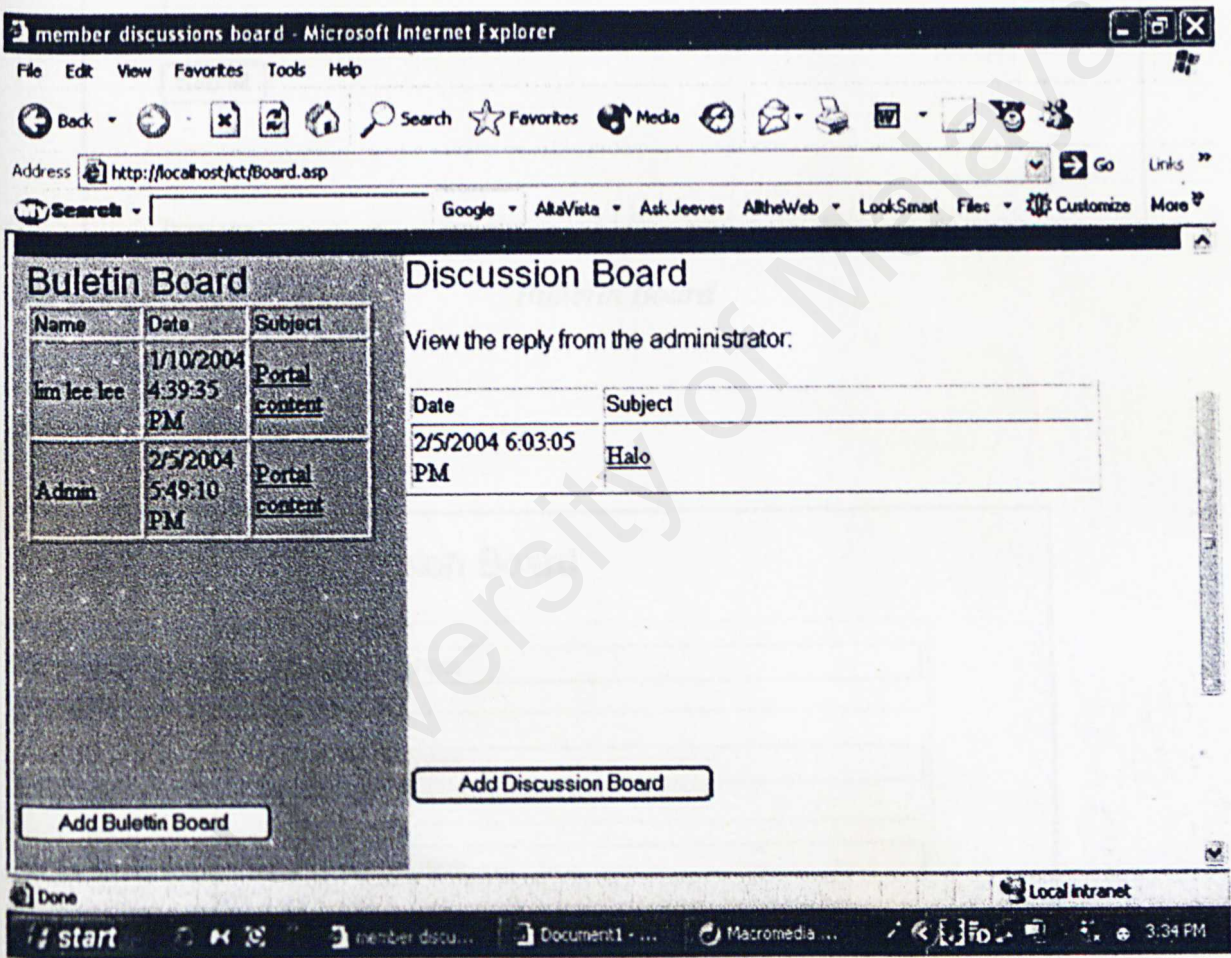
Discussion Board Page

Bulettin Board

Add new Bulettin:

Subject: [   ]

Comment/
Suggestion: [   ]

[Submit]

Previous

Bulletin Board

Discussion Board

Subject: [Halo   ]

Comment/
Suggestion: [y???   ]

Answer: [iiooo   ]

[Delete]

Previous

Discussion Board

Coding Sample

Coding Sample for Edit Test Question

```asp
<%
error=request.querystring("error")
if error="1" then msg="Record Successfully Update!" end if %>
<html>
<head>
<title>Edit testQ</title>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1">
<script language="JavaScript">
<!--
function MM_reloadPage(init) {  //reloads the window if Nav4 resized
  if (init==true) with (navigator) {if
((appName=="Netscape")&&(parseInt(appVersion)==4)) {
    document.MM_pgW=innerWidth; document.MM_pgH=innerHeight;
onresize=MM_reloadPage; }}
  else if (innerWidth!=document.MM_pgW || innerHeight!=document.MM_pgH)
location.reload();
}
MM_reloadPage(true);
// -->
</script>
</head>

<body bgcolor="#FFFFFF" text="#000000">
<div id="Layer1" style="position:absolute; left:8px; top:30px; width:766px;
height:168px; z-index:1; background-color: #E1FDFF; layer-background-color:
#E1FDFF; border: 1px none #000000">
  <div id="Layer7" style="position:absolute; width:301px; height:120px; z-index:7; left:
0px; top: -1px"><img src="ict02_01.jpg" width="377" height="118"></div>
  <div id="Layer5" style="position:absolute; left:-3px; top:117px; width:760px;
height:49px; z-index:5; background-color: #003399; layer-background-color: #003399;
border: 1px none #000000">
    <table width="101%" border="0" height="47">
      <tr>
      <td width="12%"><font color="#FFFFFF"><a href="admin_lessonplan.asp"><font
color="#FFFFCC">Lesson
        Plan </font></a></font></td>
      <td width="16%" ><font color="#FFFFFF"><a
href="admin_user_register.asp"><font color="#FFFFCC">User
        Registration</font></a></font></td>
      <td width="15%"><font color="#FFFFFF"><a href="uploadlesson.asp"><font
color="#FFFFCC">Upload
        Lesson</font></a></font></td>
```

```html
    <td width="13%"><font color="#FFFFFF"><a href="addtestQ.asp"><font
color="#FFFFCC">Test
        Setting </font> </a></font></td>
    <td width="18%"><font color="#FFFFFF"><a href="adminboard.asp"><font
color="#FFFFCC">Discussion
        Board</font></a></font></td>
    <td width="14%"><font color="#FFFFFF"><a href="viewresult.asp"><font
color="#FFFFCC">Test
        Result</font></a></font></td>
    <td width="12%"><font color="#FFFFFF"><a href="logout.asp"><font
color="#FFFFCC">Logout</font></a></font>
    </td>
  </tr>
 </table>
 </div>
</div>

<div id="Layer3" style="position:absolute; left:4px; top:194px; width:162px;
height:461px; z-index:3; background-color: #99CCFF; layer-background-color:
#99CCFF; border: 1px none #000000">
</div>
<div id="Layer4" style="position:absolute; left:162px; top:194px; width:612px;
height:464px; z-index:4; background-color: e6e6e6; layer-background-color: e6e6e6;
border: 1px none #000000">
 <p> <font size="5" color="#FF0000">Test
    Setting</font></p>
 <p><font size="5" color="#FF0000">Edit Test Question</font></p>
 <p><font face="Gulim" size="4" color="#CC0000"><%=msg%></font></p>
 <p><font color="#0000CC">Choose the lesson and title:</font></p>
 <form name="form2" method="post" action="edittestQ1.asp">
      <%
      dim newObj, sql
      Set con=Server.CreateObject("ADODB.Connection")
      set newObj = Server.CreateObject("ADODB.Recordset")
      con.open "project","",""
      sql = "select * from lesson"
      newObj.open sql,con,1,2%>


  <table width="75%" border="1">
  <tr>
   <td width="130"></td>
  </tr>
   <tr>
    <td width="130"><font color="#0000CC">Lesson &amp; Title:</font></td>
    <td width="286">
```

```
      <select name="lesson">
      <%do%>
      <option
value="<%=newObj("lesson_id")%>"><%=newObj("lesson")%>  | 
      <%=newObj("title")%></option>
      <% newObj.movenext
            loop until newObj.eof
            %>
    </select>
  </td>
 </tr>
</table>
  <p>
   <input type="submit" name="Submit3" value="Update">
   <input type="reset" name="Reset" value="Reset">
  </p>
</form>
<p><font face="Gulim" size="3" color="#000033"><br>
  </font></p>
<p> </p>
<p> </p>
<p><font color="#0000CC" face="Gulim" size="3"><a href="javascript:history.go(-
1)">Previous</a></font></p>
</div>
<div id="Layer2" style="position:absolute; left:7px; top:239px; width:148px;
height:116px; z-index:5">
 <table width="99%" border="0">
  <tr>
   <td><font color="#CCCCCC"><a href="addtestQ.asp">Add Test
Question</a></font></td>
  </tr>
   <tr>
   <td><a href="edittestQ.asp">Edit Test Question</a></td>
  </tr>
   <tr>
   <td><font color="#CCCCCC"><a href="deltestQ.asp">Delete Test
Question</a></font></td>
  </tr>
 </table>
</div>
</body>
</html>
```