UNIVERSITY OF MALAYA

Online Medical Knowledge FAQ Database

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ABSTRACT

Online Medical Knowledge FAQ Database is a web-based application system that provides frequently asked questions about health and medical knowledge for the public. Search function will be provided in the system as well as interaction between the users and medical consultants. The objectives of this system are to provide the public with an easily accessible online reference resource about common medical knowledge, to create public awareness in the matters of health and to distribute medical knowledge that caters for all levels of Malaysian society. The main system is divided into six modules which are Registration Module, User Group Module, Administrator and Moderator's Module, Search Module, Help Module and Feedback Module. Waterfall model is the methodology that is being applied by developer in developing this project. After doing a thorough literature review, the project developer has decided to choose Hypertext Preprocessor (PHP) as the server-side scripting language. The combination of PHP, MySQL and Apache will be set up as the back-end software technology of the system. The system will be developed on the Windows NT environment. Other related software and development tools such as Internet Explorer 5, Adobe Photoshop 6 and Macromedia Dreamweaver 4 will also be used to develop the system.

ACKNOWLEDGEMENT

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Chapter 1

Introduction

1.1 Project Overview

The health issues are always being the greatest interest of the society. However, there are not many web-based medical related systems which fulfil the requirements of Malaysian society in the matters of health. On the other hand, the similar systems developed by overseas medical centres are not suiting the needs and condition of the local consumers. Therefore, an easily accessible Malaysian web-based medical related system is essential to be developed in order to distribute medical knowledge that caters for all levels of local society.

1.1.1 Project Definition

This project (Online Medical Knowledge FAQ Database) aims at compiling Frequently Asked Questions (FAQ) about health and medical knowledge into a database and provides friendly user interface to allow consumers access to the information in the database. Search function will be provided as well as interaction between the users and medical consultants.

1.1.2 Background to Current Problems

Most of the current online medical web sites in the market do not match the needs of the common consumers. This is due to the deficiencies in those systems.

i) **Information limitation**

- The scopes of information covered by current medical related sites are too broad. Most consumers found that they are spending more time hunting for medical related materials rather than using the information found in those materials.
- Many medical related web sites are lacking of up-to-date information, as the sites are not been updated regularly. Individuals often cannot retrieve the latest information at the right time.
- Besides that, the language used to explain medical concepts is often very technical in nature and it is quite difficult for laymen without medical knowledge to understand.

ii) **Lacking of efficient method of searching and retrieving information**

- Some of the online medical web sites do not have search engine. Usually, people with no experience in medical field will expect a search engine on the main page when they are looking for something which they are not sure about. Without any searching method, people find that they cannot make use of these sites.
- On the other hand, the methods of searching and retrieving information in other sites are too rigid. This tends to give too many irrelevant search results.

iii) **Limited Interactivity**

- Many consumers would like to obtain personal advice from medical consultants and seeking answers for individuals' specific cases rather than reading the general medical information given in the medical related site page by page. But

they often find that those sites are lacking of interactive features, which allow further communication between consumers and the medical consultants.

1.1.3 Benefits of the Project

- Quick dissemination of information

Internet offers a way to spread the information throughout the world quickly irrespective of the barrier of the physical locations. The public can easily share the information just at fingertips.

- Facilitate the process of educating consumers

Educating consumers about the common medical knowledge and tips is an essential service, which need to be provided to the public. Online Medical Knowledge FAQ Database is a useful site that plays the role to facilitate the process of educating consumers.

- An easy guide for consumers

Online Medical Knowledge Database provides an easy guide to consumers with curiosity in certain medical issues. Users would be able to search for the brief medical information in a more proficient manner.

1.2 Objectives

The general objectives are stated to give a clear perspective of usage and advantage of the project.

- *To provide public with an easily accessible online reference resource about common medical knowledge.*

  Enable easy access and retrieval of medical information from this site. Searching of information will be eased. With the Internet, information would be spread quickly and effectively.

- *To create public awareness in the matters of health.*

  The spread of general medical knowledge among the society is essential in the effort to cultivate the public awareness on health care matters.

- *To distribute medical knowledge that caters for all levels of society.*

  The information contained in this site will cater for the laymen. The medical information will be conveyed from laymen's view to help those users without medical background to understand the information clearly.

1.3 Project scope

The scope of the project defines the overall requirements of the project and the aspects that are included in the project. This is used as a guide for the system development.

As stated at the previous section, the content in this medical related system only covers common medical information, which is frequently mentioned by the public. However, some specific and useful medical information will be added into the database also according to the judgement and decision of the medical consultants who are responsible to moderate the interactive discussion boards. The medical questions being discussed in the discussion boards will be the main sources for the system moderators in the process to compile and update the frequently asked medical questions in the database.

The information of this site will attempt to provide information pertinent to Malaysian. In order to foster a better understanding of the medical knowledge among the Malaysian surfers, the information in this site will be expressed in two languages, which are English and Malay. To avoid any ambiguity caused by the mixing usage of these two different languages, all of the topics will be only stated in English. Meanwhile, both of the languages are used together in further explanation and description on the medical topics.

In general, the content of the information will focus on the general practice, men's health, woman's health, children's health, dental, pharmacy, nutrition and life style. The online medical knowledge FAQ database is consisting of six modules:

i) **Registration Module**

- The system requires registration of members. Only registered members can access most functions of the site.

ii) **Administrator and Moderator's Module**

- This module only allows the authorized users to access the administrative page and enable them to manage the interactive module in the system.
- He/ she will have the rights to answer the questions that are posted by users in the discussion boards as well as to delete or modify the contents in those boards.

iii) **User Group Module**

- This module is divided into two sub modules.
- One of the sub modules consists of series of pages that can be read by the public users.
- The other sub module consists of discussion boards, which categorized into different heath topics. Only registered users can discuss about their health problems, request medical consultation from the board moderators and comment about the services of the web site in these boards.

iv) **Search Module**

- This module provides a search method for the users to look for the required information.

v) **Help Module**

- The purpose to set up this module is to guide the users in order to help them to surf within the system.

vi) **Feedback Module**

- Users will be able to send their feedback about the services of the system through this module.

1.4 Project Limitation

As mentioned earlier in Project Scope, this project is aimed to provide common medical knowledge that are frequently requested by the consumers without higher medical education background, therefore

- The medical topics covered by this site are limited according to the public's favourite.
- The medical information in this system will not cover the detailed and specific description in a professional manner. The information is going to be conveyed from a layman's view.
- Graphical enhancement will not be emphasized in this project.

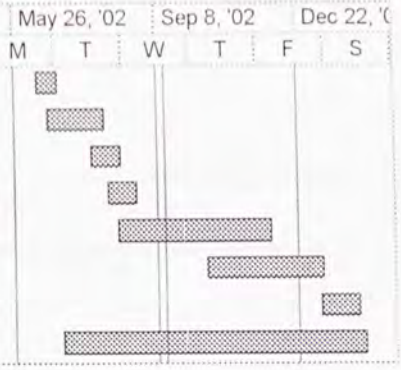
1.5 Project schedule

Project scheduling involves time management of the project developer. A Gantt chart is an easy way to schedule tasks. It is a graphical representation of the project that illustrates each task or activity as a horizontal bar whose length is proportional to its time for completion. Figure below is an example of Gantt chart where time is indicated in horizontal dimension and description of activity makes up the vertical dimension.

This is the project schedule of the proposed system:

Table 1.1: Project Schedule

ID	Task Name	Duration	Start	Finish
1	Project Definition	11 days	Wed 6/12/02	Wed 6/26/02
2	Literature Review	31 days	Wed 6/19/02	Mon 7/29/02
3	System Study and Analysis	17 days	Mon 7/22/02	Sat 8/10/02
4	System Design	16 days	Sat 8/3/02	Thu 8/22/02
5	System Development	81 days	Sat 8/10/02	Fri 11/29/02
6	System Testing	62 days	Mon 10/14/02	Tue 1/7/03
7	Maintenance	20 days	Tue 1/7/03	Mon 2/3/03
8	Documentation	164 days	Sat 6/29/02	Fri 2/7/03



1.6 Expected Outcome

Online Medical Knowledge FAQ Database is a web-based application system that provides frequently asked questions about health and medical knowledge for the public.

The outcome of this web-based system is expected to fulfill the following functions and features:

- **Search function**

Search function is including in this system in order to provide users with an efficient way in seeking and retrieving medical information.

- **User-friendly interface**

The system shall have an attractive and user-friendly interface, which can help the capable of reducing learning curves. Users can communicate with the system easily through the friendly interface.

- **Interactive feature**

The system is equipped with a discussion board module to let users exchanging their opinions about health care issues, requesting medical consultation from the medical officer and commenting about the services of the system.

- **Secure system**

Online Medical Knowledge FAQ Database provides logging-on service and logging-off service to improving the security of the system by restricting access to the database. Only authorized users can enter into the system to view or edit the information in the database. Besides that, this system also allows users to change their passwords from time to time.

1.7 Overview of the Chapters

Chapter 1: Introduction

This chapter gives a brief introduction to the project, the objectives of Online Medical Knowledge FAQ Database and its features. Summary of the project scope, project schedule and expected outcome are also provided here.

Chapter 2: Literature Review

This chapter includes the project studies, technologies to develop this project and the various sources of data that form the content. Analysis of different sources of medical information such as web sites, books, magazines and newspapers are also included in this chapter.

Chapter 3: System Methodology

This chapter puts emphasis on the system development strategies. This includes the methodology used to develop the system.

Chapter 4: System Analysis

This chapter describes the results of the analysis including the functional and non-functional requirements specification.

Chapter 5: System Design

This chapter mainly describes the design of the system including database design and interface design.

Chapter 6: System Implementation

This chapter discusses about the steps and methods taken to implement the system that was design earlier in the previous chapter.

Chapter 7: System Testing

This chapter emphasizes on system testing which plays a significant and critical role in ensuring the system fulfills the user's requirements and assures the quality of the delivered system.

Chapter 8: Evaluation and Conclusion

Evaluation is a process that occurs continuously at all phases of the system development. Evaluation phase was to determine the extent to which the system's expected outcomes have been realized, and the prescriptive value of the process where extraneous factors were taken consideration. Lastly, conclusion will be making for this system.

Chapter 2

Literature Review

A literature review of a project is needed to develop good understanding of the system and its problems. With the efforts to dig deeper for information about the current similar existing systems, and various software development techniques and tools, the developer can get a clearer picture about the problem domain of the system and its solution.

2.1 Internet and World Wide Web

The Internet is an international network of computer networks that are both commercially and publicly owned (Loudon & Loudon, 2001). The very name Internet comes from the concept of inter-networking, where multiple computer networks are joined together. In the business arena, electronic mail (e-mail), file transfer, and chat rooms take place through the Internet, while commerce and considerable information dissemination take place through the World Wide Web (WWW). Together they comprise a world of cyberspace.

2.1.1 History of Internet

The Internet began in 1969 as ARPANET, an effort by the United State Department of Defense to enable defense researchers at various sites across the country to communicate and collaborate. Many of these sites were large universities, and academics at which the use of the Internet begins, especially e-mail, to communicate about nondefense matters.

Other features of the Internet included discussion groups, access to databases, and file transfers. In 1973 ARPANET began to get connected to more and more networks in other countries, and it evolved into the Internet. In the late 1980s, the National Science Foundation built its own network, and by 1990 ARPANET ceased to exist, although its functions lived on. Its history clearly shows that the Internet was never intended to be a commercial network, and until 1991, when the World Wide Web was developed.

2.1.2 History of World Wide Web

World Wide Web (WWW) is a system with universally accepted standards for storing, retrieving, formatting, and displaying information in a networked environment (Loudon & Loudon, 2001). The World Wide Web began in 1991 at CERN (www.cern.ch/Public), the European Laboratory for Particle Physics, as a way for physicists to exchange formatted academic and technical papers. While all had access to the Internet, a compatible software format was needed. In 1990 Tim Berners-Lee at CERN developed and named the World Wide Web program, which became available for universal use on the Internet a year later. It was not until the early 1990's that e-commerce was taken seriously by the business world.

2.2 Medical Information Sources

The common sources of medical information include printed media such as books, journals/magazines, newspapers and also online media which refer to the medical information web sites.

2.2.1 Medical Information Web Sites

Today, more than 300 hundred million people from more than 200 countries around the world are using Internet to exchange information (Loudon & Loudon, 2001). Internet offers people a faster, easier and direct way to look up for medical information. There are many medical or health care related web sites which serve for different purposes operating in the World Wide Web. Those websites can be categorized as below:

i) Web sites that held by pharmaceuticals or other companies which mainly focus on promoting their products. The health care information provided in these web sites is only relevant to their products.

Examples:

- Inner Relief - Australian Natural Health Products
  http://www.crohns-colitis.com/
- Bio-X Healthcare s.a.
  http://www.bioxhealthcare.com/

ii) Web sites that enclosing one or few topics only, such as AIDS, Diabetes Mellitus and so on. Most of these sites are developed by non-profit organizations such as Malaysian AIDS Council, medical professional associations or foundations founded by government or private sector. The content scopes in these web sites are small but compensated by their depth.

Examples:

- Web site of Persatuan Diabetis Malaysia

http://www.geocities.com/mydiab2001/

- Web site of Malaysian Pharmaceutical Society

  http://www.mps.org.my/

iii) Websites owned by private or government hospitals which provide further communication details and certain medical information. However, the health care information provided in these web sites are often very limited.

Examples:

- Web site of Tung Shin Hospital

  http://www.tungshinhospital.com/

- Web site of Melacca Genaral Hospital

  http://www.geocities.com/Pentagon/9042/

- Web site of Subang Jaya Medical Centre

  http://www.simenet.com/sjmc/

iv) E-news on healthcare and medical issues which provide updated news and trends on health care and medical field. It is on global perspective and maybe not relevant to everyone.

Examples:

- Public Health Foundation E-News

  http://www.phf.org/E-News.htm

- Health E-News

  http://www.stjohnsmercy.org/healthinfo/newsletters/default.asp

v) Web sites that act like medical libraries which enclose substantial collection of health care information. Search engine is provided but it tends to generate too many irrelevant search results.

Examples:

- WebMD Health

  http://my.webmd.com

- InteliHealth

  http://www.intelihealth.com/

All of these medical related web sites are current existing systems that are similar to the proposed system, therefore there will be a further elaboration on the review of those similar systems in the section **2.3.1**.

2.2.2 Books and Encyclopedias

The books and encyclopedias in the medical and health care area are available in the markets, and libraries. They are the main medical knowledge resources for the medical professionals and public consumers. These printed materials cover a wide range of medical subjects from the both laymen and professional view. Some of these books may touch on the general health care issues like weight management, nutrition and healthy life style; while the others maybe discuss on specific medical subjects like endocrinology and cardiology.

Below are few examples of the books in medical and health subject:

i) Emergency Medicine: A Comprehensive Study Guide

Publisher: McGraw-Hill Professional Publishing

- This is a comprehensive clinical reference for students, residents, and practitioners.
- It discusses the Emergency Medicine Management in various conditions.

ii) Your Child's Health: The Parents' Guide to Symptoms, Emergencies, Common Illnesses, Behavior and School Problems

Publisher: Bantam Books

- This is an easy-to-use, practical "encyclopedia" of childhood emergencies, common illnesses, and behavior problems from birth through adolescence.
- It helps parents decide when to call the doctor, what to do at home before getting help, and what they can do alone.

iii) The Obvious Diet: Your Personal Way to Lose Weight Fast Without Changing Your Lifestyle

Publisher: Arcade Publishing

- This book offers sound advice, suggested menus, and the encouragement of dozens of famous people who have found that diet works.
- It explains how to devise an eating regimen based on avoiding your own particular weaknesses, rather than imposing a rigid plan.

2.2.3 Journals/ Magazines

Health care magazines or journals report the updated medical issues. However the contents of these publications are often conveyed in professional manner. Moreover, the language used in explaining medical concepts is often very technical in nature and it is quite difficult for laymen without any medical knowledge to understand.

Below are some of the healthcare/magazines in the market.

i) Malaysian Journal of Pharmacy

- The official journal of the Malaysian Pharmaceutical Society.
- An annual publication.
- Covers areas related to Pharmacy in the form of General articles, Reviews, Research papers and Book Reviews.

ii) Consumer Reports: On Health

- This magazine provides the latest in news from medical researchers for the laymen concerning with improving and maintaining their health.
- Monthly publication.

iii) Clinical and Experimental Allergy

- The official journal of the British Society for Allergy and Clinical Immunology.
- Monthly publication.
- Covers Reviews, Research papers, and Statistics about Allergy.

2.2.4 Newspapers

Local newspapers have their own health related columns once a week:

- The Star – on Sunday
- New Strait Times – on Thursday
- Berita Harian – on Sunday
- Utusan Malaysia – on Sunday
- Sin Chew Jit Poh – on Friday
- Nanyang Siang Pau – on Thursday

Almost every local newspaper has a section that focus on health care issues every week. The healthcare columns in those newspapers have limited space and thus the issues being touched on are very limited. Therefore it may not seem to be of relevance to readers in each publication. Moreover, most of the readers are not capable of spending too much time cutting down the healthcare sections in those newspapers every week. Therefore, it is not a very practical way to get the medical information from newspapers.

2.3 Review of Similar Existing Systems and Previous Projects

2.3.1 Review of Similar Existing Systems

In order to have a better understanding on the currently existing medical related web sites, few of them had been selected and evaluated. All of the information and data collected from these web sites give ideas and the whole concept of what a medical information web site should have.

Below are some examples of the medical related website:

2.3.1.1 Big Folks Health FAQ

- Available at http://www.faqs.org/faqs/fat-acceptance-faq/health/
- A subsection of **Internet FAQ Archives** website http://www.faqs.org/faqs/
- Covers the frequently ask questions about health and fitness.
- Advantages:

  - The health information is conveyed in layman's manner.

- Disadvantages:

  - The information provided in this we bsite is insufficient.
  - Lacking of up-to-date information
  - Interface is less attractive.
  - Lacking of interactive features for further communication between web surfers and medical consultant.
  - Does not have a search function.

2.3.1.2 WebMD Health

- Available at http://my.webmd.com/
- A healthcare information website.
- Covers wide topics of healthcare and illness.
- Advantages:

  - Provides broad medical information that covers both layman and professional views.
  - Provide latest news regarding various health topics.
  - Provides search engine function.

- Provides medical consultation to users.

- Support by a large group of medical professionals from different fields.

- Disadvantages:

  - The scope of topics is too broad.

  - The search engine comes up with many irrelevant search results.

2.3.1.3 HealthWeb

- Available at http://www.healthweb.org/
- A collaborative project of the health sciences libraries of the US Greater Midwest Region (GMR) of the National Network of Libraries of Medicine (NN/LM) and other members of the Committee for Institutional Cooperation.
- Provides links to twenty over libraries of medicine regarding various topics of illness, health and medicine.

- Advantages:

  - Provides search engine function.

  - Support by a large group of medical libraries.

- Disadvantages:

  - Interface is less attractive.

  - Does not contain medical information. It only provides links to other medical libraries.

- Does not provide medical consultation via interactive features such as discussion board or chat room but instead, taken surfers to other parties for further inquiry.

2.3.1.4 The Weaknesses of Similar Existing Systems

Most of the current online medical web sites in the market do not match the needs of the common consumers. This is due to the weaknesses in those systems.

i) **Information limitation**

- *The scopes of information covered by current medical related sites are too broad.*

  e.g. The **WebMD Health** web site provides users with too many categories and links about healthcare information in a single web page.

- *Many medical related web sites are lacked of up-to-date information, as the sites are not been updated regularly.*

  e.g. **Big Folks Health FAQ** is a website that provides people with frequently asked questions about health knowledge, but the contents in this website are not been updated more than one year.

- *The language used to explain medical concepts is often very technical in nature and it is quite difficult for laymen without any medical knowledge to understand.*

  e.g. The medical terminologies used by the medical consultants of **WebMD Health** in answering the questions posted by consumers in the discussion boards are very difficult for average consumers to understand.

ii) **Lacking of efficient methods of searching and retrieving information**

- *Some of the online medical web sites do not have search engine.*

  e.g. **Big Folks Health FAQ** does not provide user with search function.

- *On the other hand, the methods of searching and retrieving information in other sites are too rigid. This tends to give too many irrelevant search results.*

  e.g. The search results generate by the search engine of **WebMD Health** are too broad but most of them do not match the needs of the users.

iii) **Limited Interactivity**

- *lacking of interactive features for further inquiry or discussion.*

  Many consumers would like to obtain personal advice from medical consultants and seeking answers for individuals' specific cases rather than reading the general medical information given in the medical related site page by page. But they often find that these sites are lacked of interactive features, which allow further communication between consumers and the system's moderators (medical consultants).

  e.g. The **Big Folks Health FAQ** site and **HealthWeb** site do not provide interactive features to allow further communication between users and system administrator.

2.3.2 Review of Similar Previous Projects in FSKTM

2.3.2.1 Web Based Healthcare Management System

System Developer: Ooi Kwee Lun (WEK 98083)

Web Based Healthcare Management System which developed by Mr. Ooi Kwee Lun is a website about general healthcare management. This system is divided into four main sections, which are General Healthcare Section, Common Diseases Section, Contact List of Major Medical Institutions, Search Engine Module and User Feedback Section. The targeted users of this web site are local residents, therefore the contents covered by this website are focus on Malaysian healthcare topics.

Advantage of the system:

- Provides users with contact information of the local major hospitals and healthcare societies.

Disadvantages of the system:

- Does not have search engine.
- Does not provide users with any interactive feature (such as discussion board) for further discussion or further inquiry about health care issues.
- Does not have support from any medical professional (such as Medical Officer or pharmacist).

2.3.2.2 A Web Based -The Healthcare Management System

System Developer: Muhammad Farid Abdullah (WET 98139)

The Healthcare Management System developed by Mr. Muhammad Farid is more or less the same with the system developed by Mr. Ooi Kwee Lun which has been discussed in

section **2.4.1.** This web-based system is divided into five modules which are Forum (Discussion Board), Help Module (User Manual), Discussion Room, Message Board, and Database. The main health care categories covered by this system include Men's Health, Women's Health, Children's Health, Nutrition, Mental Health, Life Style, Alternative Medicine, and latest medical news.

Advantages of the system:

- Provides search engine.
- Web site is enhanced with multimedia features such as image and animation.
- Provides forum board to let users exchange opinions about various health care problems and medical issues.
- Provides linkages to other relevant medical websites for further reference.
- Provides current health and medical news.

Disadvantages of the system:

- Does not have support from any medical professional (such as Medical Officer).
- The design of the system structure is untidy, which may lead to difficulty in the process of maintenance.

2.3.2.3 Online Pediatrician

System Developer: Koh Yung Sing (WEK 98114)

Online Pediatrician is a web-based multimedia system that provided information on the health care of children for parents. This system would mainly provide answers to

common and general health of Asian children from birth up to 5 years of age. The topics covered by Online Pediatrician are general healthcare information, immunization, nutrition and fitness, general infection and ailment, growth and development, and first aid and safety. Search engine and advance search engine are provided in this web site to enhance the quality of information seeking. This site will also facilitate friendly and interactive user interface. Graphics and animation will accompany text and data displayed to foster an expeditious grasp of the facts being conveyed.

Advantages of the system:

- Provides search engine and advance search engine to enhance the information searching quality.
- Web site is enhanced with multimedia features such as image and animation.

Disadvantages of the system:

- The scope of this project is narrower compared to other health care websites as it only focuses on children between the age from 0 to 5.
- Does not provide users with any interactive feature (such as discussion board) for further discussion or further inquiry about health care issues.
- Does not have support from any medical professional (such as Pediatrician).

2.3.3 Synthesis

After doing a thorough review on the currently similar existing systems and the previous projects done by the undergraduates of Faculty of Science Computer and Information

Technology, the strengths and weaknesses found in these systems will be taken into consideration in the process to develop Online Medical Knowledge FAQ Database. The good features that should be included in the proposed project are:

i) Support from medical professional

Support from the Medical Officer is essential in order to make sure the medical information and consultation given in the web site are accurate and relevant.

ii) Updated content

The system administrator should update the content in the web site regularly so that the public users can obtain the latest medical information on the right time.

iii) Search Engine

Search engine should be provided in the system so that novice users can have a direct and easier way to look for something that they are not sure about.

iv) Interactive features

Interactive features such as discussion board should be included in this web-based system so that users can have further communication with the medical consultant.

v) Medical information expressed in laymen's view

The language used to explain medical concepts should be conveyed in layman's manner so that public consumers can have better understanding to the medical content in this web site.

vi) User-friendly interface

The system shall have an attractive and user-friendly interface, which can help the capable of reducing learning curves. Users can communicate with the system easily through the friendly interface.

Other good features like latest news about health care, contact list of local medical institutions and so on are not necessary to be included in the proposed system because this system is mainly focus on the common medical and health questions that often asked by the public. Adding too much features into the website will made the surfers loss their direction and concentration.

2.4 Technology Consideration

2.4.1 Server-side Programming Technology

2.4.1.1 Hypertext Preprocessor (PHP)

PHP (recursive acronym for PHP: Hypertext Preprocessor) is an open-source server-side scripting language for creating dynamic web pages for e-commerce and other web applications (Zend.com, 2002). This technology is quite similar to Allaire's ColdFusion, JSP (Java Server Page) and ASP (Active Server Page). PHP scripts are often embedded in the HTML code of page, and then get parsed on the server-side. This would only allow the browser to see plain HTML only.

PHP's syntax is similar to that of C and Perl, making it easy to learn for anyone with basic programming skills. Its elegant design makes PHP significantly easier to maintain and update than comparable scripts in other languages (Zend.com, 2002). The PHP language is a mix between the two, taking the best features from both and adds features to solve common problems that programmers often encounter when programming for the Web.

As an open source product, PHP enjoys the support of a large group of open-source developers. The community gives excellent technical support to users, and bugs are found and repaired quickly. The code is continuously updated with improvements and language extensions to expand PHP's capabilities (Zend.com, 2002). For noncommercial purpose, users can download both the source code and executables for PHP and install them on their computer for free. Therefore users are not dependent on a manufacturer to fix things that don't work or forced to pay for upgrades every year to get a working version.

2.4.1.2 Active Server Page (ASP)

Active Server Page (ASP) is a server-side scripting environment that can use to create and run dynamic, interactive, high-performance Web server applications. ASP is server-generated page that can call other programs to do things like access databases, serve different pages to different browsers. ASP is almost as efficient as writing code directly to the server's application program interface, and it's a lot more efficient than Common

Gateway Interface (CGI) because it runs as a service and can take advantage of multithreaded architectures.

Active Server Pages is an open, compile-free application environment in which can combine HTML, scripts, and reusable ActiveX server components to create dynamic and powerful Web-based business solutions. Active Server Pages enables server-side scripting for Internet Information Server (IIS) with native support for both VBScript and Javascript. However, most ASP pages are creating using VBScript. VBScript has the most English like syntax, which many web developers have experience with (Mitchell & Atkinson, 2000).

2.4.1.3 Common Gateway Interface (CGI)

Common Gateway Interface (CGI) is a mechanism for creating scripts on the server, which can then be used to create dynamic applications. It has been around for quite a bit longer than ASP, and right now the majority of dynamically created pages on the web are created using CGI and a scripting language.

However, CGI has some shortcomings. The major one is that it adds extra level to the browser-server model of interaction: namely, it is necessary to run a CGI program to create the dynamic page, before the page is processed on the server. Also, the format in which CGI receives and transmits data means that this data is not easily manipulated by many programming language, so a programming language that has good facilities for manipulating text and communicating with other software have to be used. Besides, CGI

programs take more time to write and debug; thus frequent 'down' time for web sites. CGI also uses a greater amount of server resources degrading performance of servers and sites.

It is incorrect to assume that CGI does the same job as ASP. Rather, CGI allows the user to invoke another program (such as Perl script) on the web server to create the dynamic web page, and the role of CGI is to pass the user-supplied data to this program for processing. However, it does provide the same end-results - a dynamic web application.

2.4.1.4 Java Server Page (JSP)

Java Server Page (JSP) is a web-scripting technology that is used for creating dynamic Web-based content using server-side (middle-tier) processing. JSP simplifies the process of creating these dynamic pages by separating the application logic from the page design and encapsulating logic in portable, reusable Java components. Besides it also simplifies the task of building web applications that work with a wide variety of web servers, application servers, browsers and development tools (Karl *et al*, 2000).

JSP technology has evolved from the powerful servlet technology (Hall, 2000). Servlets are Java technology-based, server-side applications. JSP extends the servlet technology in many ways, making it easier and faster to build, deploy, and maintain server-side applications that communicate with web-based clients.

JSP technology builds on the strength of the Java family and the multivendor Java community, extending the core capabilities of the Java platform to create powerful, flexible, and easy-to-maintain dynamic Web pages. JSP technology inherits all of the benefits of the Java language, including platform- and server-independence, a modular and reusable component architecture, and access to the rich family of Java APIs (including JDBC, JavaMail, and Java Transaction Service). (Damon *et al*, 2001)

2.4.2 Client-side Programming Technology

2.4.2.1 Hypertext Markup Language (HTML)

Hypertext Markup Language (HTML) is the lingua franca for publishing hypertext on the World Wide Web, which is one of the most widely used computer languages in the world (Devguru, 2001). Meanwhile, hypertext transfer protocol (http), the http we see at the beginning of a web address, is the way of exchanging HTML files. The popularity and importance of HTML is due to the fact that it is the coding technology used to publish content on the World Wide Web (commonly also referred to as the Internet). It is a standard recommended by the World Wide Web Consortium (W3C) and adhered to by the major browsers, such as Microsoft's Internet Explorer and Netscape's Navigator. As a conclusion, HTML is the most important language that must be included in every web page.

2.4.2.2 VBScript

VBScript is the newest member of the Visual Basic family (a slimmed-down version) of programming languages that brings active scripting to a wide variety of environments,

including Web client scripting in Microsoft Internet Explorer version 3.01 and Web server scripting in Microsoft Internet Information Server version 3.0. The syntax is very much the same with Visual Basic.

Visual Basic Scripting Edition (VBScript) was introduced by Microsoft to allow web page developers to leverage their existing Visual Basic skills then creating client-side script. It inherits its syntax and structure from Visual Basic programming language.

VBScript is an alternative to JavaScript in the client-side scripting language. However, only Microsoft Internet Explorer supports this language. Netscape Navigator users require a Netscape Plug.in called ScriptActive, developed by third party developer NCompass in order to enable VBScript. VBScript provides the ability similar to JavaScript. It can be used to validate form data, displaying status bar messages, working with cookies and ActiveX contol.

2.4.2.3 JavaScript

JavaScript is a cross-platform scripting language, which is simple, interpreted, and object-oriented. It can be used to add simple interactive behaviors to an HTML page by means of a script of keywords inserted into a Web page. Its originate from LiveScript that developed by Netscape to provide a way to interface with Java. Sun, the developer of Java, helped Netscape rework LiveScript and called it JavaScript.

JavaScript is different from Java. It is also not derivative of Java. It lacks of power of a full-featured programming language. JavaScript is a compact, object-based scripting language, the main roles JavaScript play in the web pages are form validation,

responding to input, dialog boxes, using cookies to keep visitor information, date and time information, integrating with Java, basic graphics and dynamic HTML. JavaScript statements can be embedded directly in an HTML page. These statements can recognize and respond to user events such as mouse clicks, form input, and page navigation.

2.4.3 Database Consideration

2.4.3.1 MySQL Database

MySQL is also called as My Ess Que Ell. It is provided by MySQL AB, a commercial company provides services around the MySQL database. MySQL is Open Source SQL database software that there is possible for anyone to use, modify and download from the Internet and use it without paying anything.

MySQL is a database management system (DBMS) can be vast amounts of information in a corporate network. The DBMS such as MySQL is needed to add, access, and process data stored in a computer database. It also is Relational Database Management System (RDBMS) that can stores data in separate tables rather than putting all the data in one big storeroom. This increases speed and flexibility.

The advantages of MySQL are:

- **Very fast, reliable, and easy to use**

  MySQL was originally developed to handle very large databases much faster than existing solutions and has been successfully used in highly demanding production environments for several years.

- **Client/server system**

It consists of a multi-threaded SQL server that supports different backend, several different client programs and libraries, administrative tools, and several programming interfaces.

- **Has a lot of contributed software available**

  User will find that many favorite or famous application or language already supports MySQL.

2.4.3.2 Microsoft Access

The Microsoft access is one of the easiest ways to create a database. Access provides two different modes. The first is an easy to use menu driven interface that let user issues commands without an in depth understanding of Access. Program mode lets the user to store instruction in a file such as Visual Basic file and execute them with one command.

Access allows user to indicate how tables should be related to each other. A table that has referential integrity allows only one parent record for each child record. User can add, delete, and rearrange fields in the table structure. User can also control how the data will be entered in a table using the properties sheet of a field (Sellappan, 1999).

The advantages and many disadvantages of Access are Access is a desktop database package. It is not design to compete with system such as Oracle or SQL Server – full database servers – whose engines are superior in terms of speed and multi-user capabilities. It does not provide a good performance when run across the network and more than a handful person using it at once. But its performance capability is good with limited multi-user capabilities. In addition, it can and does make a good front-end

package larger engine such as Oracle and SQL Server. Access integrated well data transfer between Access and the other Office components that is relatively easy.

2.4.3.3 MS SQL Server 2000

SQL Server 2000 is the data management and analysis backbone of the Microsoft .NET Enterprise Servers. SQL Server 2000 provides agility to data management and analysis, allowing organization to adapt quickly and gracefully to derive competitive advantage in a fast-changing business environment.

SQL Server 2000 is the record-holder of important benchmark awards for scalability and speed. It is a fully web-enabled database product, providing core support for Extensible Markup Language (XML) and the ability to query across the Internet and beyond the firewall.

Ms SQL Server is outperformed than MS Access and Informix SQL because it includes a superset the ASNI standard SQL language elements that couldn't be find in MS Access and Informix.

The advantages of SQL Server 2000 are:

i) Fully Web-Enabled

SQL Server 2000 provides extensive database programming capabilities built on Web standards. Rich XML and Internet standard support provide the ability to store and retrieve data in XML format easily with built-in stored procedures.

ii) Highly Scalable and Reliable

With scale up and scale out capabilities, SQL Server meets the needs of demanding e-commerce and enterprise applications.2000 takes advantage of symmetrical

iii) Fastest Time-to-Market

SQL Server 2000 is the data management and analysis backbone of the Microsoft .NET Enterprise Servers. SQL Server 2000 includes tools to speed development from concept to final delivery.

2.4.4 Web Server

2.4.4.1 Microsoft Internet Information Server (IIS)

Microsoft Internet Information Server (IIS) is the largest web servers available from Microsoft. It is a web server that enables to publish information on a corporate intranet or on the Internet. IIS transmits information by using the Hypertext Transfer Protocol (HTTP) and it can also be configured to provide File Transfer Protocol (FTP) and gopher services.

IIS is built on the Windows NT security model. Windows NT security helps to protect the computer and its resources by requiring assigned user accounts and passwords. IIS provides a graphical administration tool called Internet Service Manager that can use to monitor, configure, and control the Internet services. Internet Service Manager is the central location from which user can control all of the computers that running IIS in organization.

IIS can run on any computer that is running Windows NT Workstation or Windows NT Server and that is connected through the network to the web server. With remote administration, user can administer web servers from the server computer itself, from a management workstation on the corporate local area network (LAN), or even over the Internet.

2.4.4.2 Microsoft Personal Web Server (PWS)

Microsoft Personal Web Server (PWS) is packaged together with IIS (Information Internet Server) as parts of the freely downloadable Windows NT 4.0 Option Pack. PWS is a scaled-down version of the commercial Information Internet Server (IIS) included with the Server edition of Microsoft Windows NT. It is designed for Windows 95 and Windows NT Workstation users. PWS is a great entry-level web server that makes it easy to publish personal home pages, serve small web sites, and share documents via a local intranet.

The advantage to using PWS over IIS and similar high-end web servers is the client's ease of use. PWS is one of the best servers available for helping to start up and running quickly. Wizards are included to guide user through the process of setting up home pages and sharing files. Besides, the PWS administrator reduces the complexity of actually running the web server itself.

PWS does include support for Active Server Pages (ASP), script debugging, and Internet Service Manager, a comprehensive administration tool used in IIS as part of the

Microsoft Management Console. On the other hand, it does lack some of the more advanced features found in IIS such as Index Server, Certificate Server, and Microsoft Site Server Express tools.

Most large enterprises will likely bypass Microsoft's Personal Web Server for the high-end Internet Information Server. However, PWS still remain as one of best available options for individuals wanting to serve their own personal home pages and for small organizations.

2.4.4.3 Apache

Apache is UNIX web server and available free of charge. It can also run on Windows NT platform. Apache can be obtained from the Internet. All of the core and module source codes can be modified to suit developers' needs. Hosting multiple IP addresses on an Apache server can be done with little configuration.

There are many good features in Apache. Apache supports

- **Dynamic Shared Object (DSO) support**

  Apache modules may now be loaded at runtime; this means that modules can be loaded into the server process space only when necessary, thus overall memory usage by Apache will be significantly reduced.

- **Support for Windows NT/95**

  Apache supports the Windows 95, 98, ME, Windows NT, and Windows 2000 operating systems.

- **Support for NetWare 5.x**

  Apache now experimentally supports the NetWare 5.x operating systems.

- **Re-organized Sources**

  The source files for Apache have been re-organized. The main difference for Apache users is that the "Module" lines in Configuration have been replaced with "AddModule" with a slightly different syntax. For module authors there are some changes designed to make it easier for users to add their module.

- **Reliable Piped Logs**

2.4.4.4 Netscape Enterprise Server (NES)

Netscape Enterprise Server (NES) is produced by Netscape Web Server. It supports Oracle, Informix, Java, LDAP and use to convert .pdf file to HTML. NES can run either in UNIX or Windows NT Server. It has a direct link to a database management system and automatic directory tree.

This server allows users to serve several different web sites using the same server on a same machine. It uses the standard NCSA log format and has built-in image maps (NCSA) and supports the Windows CGI interface.

This web server has full-text search features, such as automatic index updates which allow immediate search access to newly changed data, and search by content or by document attributes, such as author, title, and modification date.

Besides, Enterprise Server also supports stored procedures, multiple database connections and persistent transactions. This commercial server is one of the most expensive available today.

2.4.5 Operating System

2.4.5.1 Microsoft Windows 98

Microsoft Windows 98 is one of the Microsoft products. It is perfectly capable of administering a small site but unfortunately it is unable to handle high loads due to the unavailability of certain features like load balancing, which is available in Windows NT.

Windows 98 is able to serve web pages due to the inclusion of Personal Web Server on the Windows 98 CD. Installation of this utility would enable Windows 98 to function as a web server for small networks thus no need to pay for the higher fee that is required to run a copy of Windows NT Server on a machine. Windows 98 has a better File Allocation Table format called FA T32. Besides, Windows 98 also supports a wide range of hardware and peripherals.

2.4.5.2 Microsoft Windows NT Server 4.0

Microsoft Windows NT Server 4.0 is a powerful server operating system. It was designed from the ground up to be the most integrated, comprehensive, and easy server operating system and to provide several premises such as scalability, reliability, and manageability necessary for mission-critical applications. And it provides total solutions

in Intranet and Internet services and to mission-critical applications support and all these services are built into the operating system.

Besides, it has fault tolerant feature by supporting Redundant Array of Inexpensive Disks (RAID) technology that provides data protection. Furthermore, tight integration of Internet Information Server (IIS) with Windows NT server 4.0 provides a fast and secure platform for HTTP, FTP, WWW and Gopher services. Windows NT Server also provides an outstanding platform for a wide range of services. It also includes features designed to make it easier to install, use, and manage.

Window NT Server 4.0 also includes a web-based administration tool that makes the features of the NT administrative tool suite available through any Web browser. For security, a web browser that supports either direct NT log-in (such as Internet Explorer) or one that supports secure socket layers (SSL) communications is used.

The advantages of Window NT are:

- **Interoperability**

  Windows NT Server interoperates with a broad range of server operating systems including: NetWare, UNIX, Banyan, Microsoft LAN Manager, Path works, SNA, and Macintosh.

- **Protocols**

  Windows NT Server includes support for protocols than any other network operating system.

- **File sharing**

Windows NT Server is the only network operating system that supports file sharing via NCP, X-Open SMB, and HTTP. Windows NT Server supports POSIX application interfaces, conforming to the open systems guidelines of the U.S government.

2.4.5.3 Microsoft Windows 2000 Server

Microsoft Windows 2000 Server operating systems are the next generation in the Windows NT Server series of Operating System. In addition to providing a comprehensive Internet and applications platform, Windows 2000 Server builds on the strengths of Windows NT Server 4.0 by delivering increased reliability, availability, and scalability with end-to-end management features that reduce operating costs.

The most critical new features and enhancements offers by Windows 2000 Server are those that relate to Internet capabilities. The Windows 2000 Server operating system builds on the solid Internet technologies delivered in Windows NT Server 4.0 to provide an agile, powerful Internet platform.

The advantages for Windows 2000 Server is the ideal platform for building and running rich Web-based applications and services:

- **Scalability and flexibility**

  Host lots of Web sites and more Terminal Services users while getting better use of bandwidth and high performance even on the fastest networks

- **Security**

With flexible authentication and authorization options, strong encryption services and flexible and secure network access, rest assured that only the right people have access

- **More system uptime and less unplanned downtime**

Reboot up to 90% less often! Increased server and network availability - It is resilient to application failures and allocates resources to preserve availability Easy to deploy, configure and use

- **Centralized management**

A lower cost of ownership to play well with existing infrastructure: other operating systems, servers, mainframes, applications, directories, network devices and peripherals Supports the newest networking devices and technologies. Windows 2000 Server supports upgrades of NT4.0 server meaning all applications and settings will be saved. In the other word it replaces NT4.0 Server and having mostly probably all the features of it.

2.4.5.4 Microsoft Windows 2000 Professional

Microsoft Windows 2000 Professional is built on Windows NT technology and has an easy-to-use, and familiar Windows 98 user interface. Its integrated Web capabilities and broad support for mobile computers and hardware devices makes it an easy way for business users to connect to the Internet anywhere and anytime. And its rock-solid reliability and improved manageability simplify the desktop management for IT professionals.

The combined features of Windows 2000 Professional create the mainstream operating system for desktop and notebook computing in all organizations. It has the best business features of Windows 98 Plug and Play, easy-to-use user interface, and power management.

The advantages of Windows 2000 Professional Server are:

- **Windows File Protection**

  Protects core system files from being overwritten by application installs. In the event a file is overwritten, Windows File Protection will replace that file with the correct version.

- **Driver certification**

  Provides safeguards to assure that device drivers have not been tampered with and reducing the risk of installing non-certified drivers.

- **Full 32-bit operating system**

  Minimizes the chance of application failures and unplanned reboots.

- **Microsoft Installer**

  Works with the Windows Installer Service, helping users install, configure, track, upgrade, and remove software programs correctly, minimizing the risk of user error and possible loss of productivity.

- **Windows Logo Program**

  Provides assurance that applications have met a comprehensive set of standards developed by Microsoft in cooperation with customers and third-party developers.

- **Dramatically Reduced Reboot Scenarios**

Eliminates most scenarios that forced you to reboot in Windows NT 4.0 and Windows 9x. Many software installations also will not require reboots.

2.4.5.5 UNIX

UNIX is one of the popular operating systems worldwide because of its large support base and distribution. It was originally developed as a multitasking system for minicomputers and mainframes in the mid-1970s, but it has since grown to become one of the most widely used operating systems anywhere. Anyway, it sometimes has confusing interface and lack of central standardization.

UNIX is a multitasking, multi-user operating system. This means that there can be many people using one computer at the same time, running many different applications.
In addition, each UNIX system has a hostname assigned to it. The hostname is used to identify individual machines on a network, but even if the machine isn't networked, it should have a hostname.

2.4.5.6 Linux

Linux is a free, UNIX work-alike designed for Intel processors on PC architecture machines. Linux is not UNIX, as UNIX is a copyrighted piece of software that demands license fees when any part of its source code is used. Linux was written from scratch to avoid license fees entirely, although the operation of the Linux operating system is based entirely on UNIX and it shares UNIX's command set.

Linux supports a wide range of software, from TeX (a text fonnatting language) to X (a graphical user interface) to the GNU C/C++ compilers to TCP/IP networking. It is well suited to function as a development environment for web applications Its superior stability is a feature that cannot be beaten even by Windows. Linux is capable of running 24 hours 7 days a week without system failures or crashes. Memory management is dynamic and used memory is released after a particular application ends unlike Windows.

In addition Linux has the following features:

- It is capable of multitasking.
- Has support for Netware clients and servers.
- Includes a LAN Manager/Windows Native (SMB) client and server.
- It multi-platform, that is it can run on any processor.
- Many networking protocols supported.
- Has memory protection between processes ensuring that a program cannot crash the entire system.

Linux's only weakness is a lack of support for hardware making it a little difficult to setup a machine with Linux.

2.4.6 Web Application Development Tools

2.4.6.1 Microsoft FrontPage 2000

Microsoft FrontPage 2000 provide a comprehensive solution for publishing and managing workgroup Web sites. FrontPage 2000 helps users create the sites they want

whether in creating a personal web page or a corporate Internet or intranet site. Besides it makes sites updating easier, and works well with Microsoft Office.

In addition, Office 2000 users can now save HTML documents directly to FrontPage-based sites, while features such as shared Office menus and toolbars make Office users feel immediately comfortable with FrontPage 2000.

Microsoft FrontPage is in the combined Editor and Explorer mode, which makes finding and launching pages faster. Another striking difference is its ability to create pixel-precise layouts using Cascading Style Sheets. The pixel precision makes most popular browser to view the finished pages.

2.4.6.2 Macromedia Dreamweaver 4.0

Macromedia Dreamweaver is a professional HTML editor and very powerful Web design tool for visually designing and managing web sites and pages. Dreamweaver is filled with a large number of coding tools and advanced features that will help to add impact and interactivity to web pages quickly and efficiently. Dreamweaver allows the creation of interactive effects such as animations and mouseovers, and writes powerful JavaScript code.

There are some good features in Dreamweaver :

- **Format Text** - The text can lie out in multiple columns and apply a variety of effects.

- **Select and Place Images** - Select between the GIF and JPEG formats and how to precisely position these images on your pages.
- **Include Hyperlinks and Image Maps** - Build hyperlinks to other pages on site and to pages on other sites. In addition, construct image maps that take the user to different pages depending on which part of the image is clicked.
- **Build HTML Tables** - HTML tables are invaluable both for displaying data and for enabling complex text and graphics layouts.
- **Develop and Validate Forms** - It also provides easy-to-use tools that allow creating forms quickly and easily. In addition, validate forms before they are submitted, decreasing the load on server.
- **Add Colours and Backgrounds** - Dreamweaver provides both the complete and browser-safe palettes, making it easy to assign colours to backgrounds, links, text, table cells, and more.
- **Use Layers** - Dreamweaver can build the site in separate layers. These layers can contain any HTML elements, including text, images, and links.
- **Take Advantage of Dynamic HTML Effects** - Dreamweaver makes it easy to implement JavaScript and Dynamic HTML (DHTML) special effects, including rollover images.

2.4.6.3 Adobe Photoshop 6.0

Adobe Photoshop is hands down, the most popular program for creating and modifying images for the web. Photoshop is available on a wide array of platforms; it also has

intuitive user interface, a complete set of tools, and a large number of reference books around.

Photoshop is the software that allows designers and photographers to create original artwork, correct colour, retouch and composite scanned images, and prepare professional-quality separations and output with more flexibility. It is also enhanced with a wealth of powerful painting and selection tools, multiple layers, special effects filters, and lighting effects.

Photoshop succeeds at being very adept at a focused range of functions by offering unparalleled abilities in dealing with photos and other scanned graphic sources.

Chapter 3

System Methodology

Methodology represents a particular approach or philosophy for building system. A methodology is a systematic way of accomplishing certain task and may be defined as a collection of procedures, techniques, tools and documentation aids. (Sellappan, 2000) There are several methodology models such as Waterfall Model, V Model, Prototyping Model, Spiral Model and the like, which prescribe the software development activities in a variety of contexts.

Waterfall Model is chosen by the system developer as the software process model to be applied in this project.

3.1 Waterfall Model

In software engineering, the waterfall model describes a development method that is linear and sequential. Waterfall development has distinct goals for each phase of development. Once a phase of development is completed, the development proceeds to the next phase and there is no turning back.

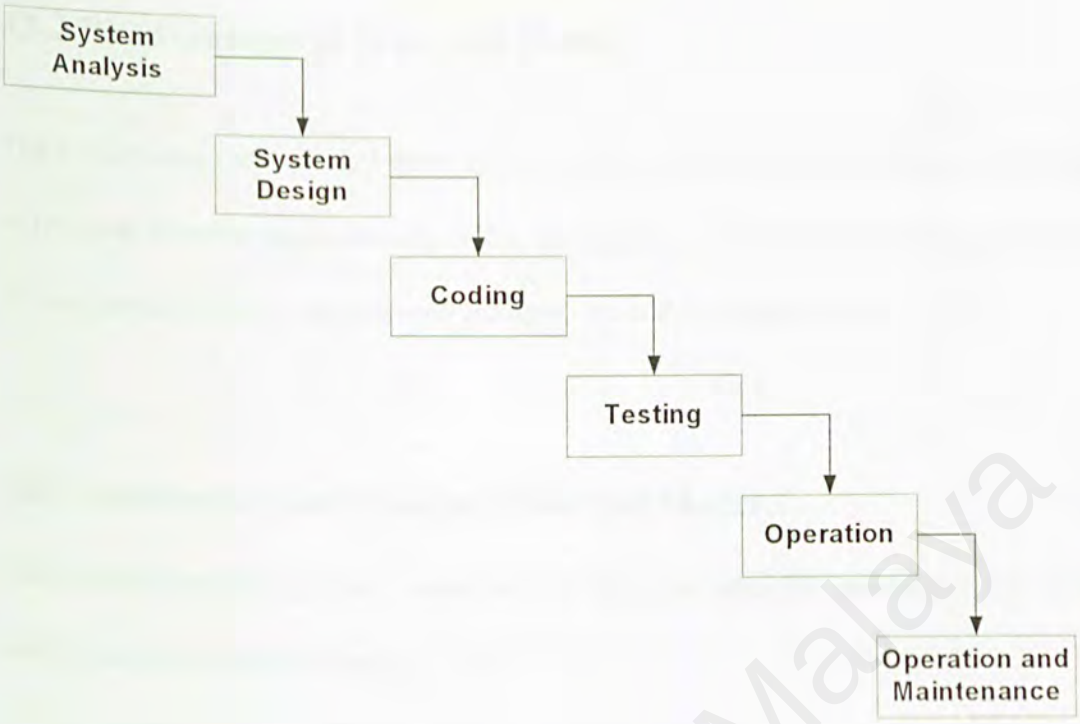


Figure 3.1 Waterfall Model

3.1.1 Advantages of Waterfall Model

The advantage of waterfall development is that it allows for departmentalization and managerial control. A schedule can be set with deadlines for each stage of development and a product can proceed through the development process like a car in a carwash, and theoretically, be delivered on time. Development moves from analysis, through design, implementation, testing, installation, and ends up at operation and maintenance. Each phase of development proceeds in strict order, without any overlapping or iterative steps.

3.1.2 Disadvantages of Waterfall Model

The disadvantage of waterfall development is that it does not allow for much reflection or revision. Once an application is in the testing stage, it is very difficult to go back and change something that was not well thought out in the concept stage.

3.1.3 Justification for Choosing Waterfall Model

The justification for project developer to choose waterfall model as the system methodology are listed as below :

- It encourages proper planning before starting any phase in the project.
- Misinterpret of the system may surface early. Error found during operation might cost one hundred times or more to fix than it caught during software requirements review.
- The waterfall model presents a very high level view of what goes on during development, and it suggests to developers the sequence of events they should expect to encounter.
- Its simplicity makes it easy to explain to various stakeholders.

3.1.4 The Life Cycle of Waterfall Model

The waterfall model approach that will be adapted in the proposed project encompasses several stages which are system analysis, system design, coding, testing and implementation. Each of the stage is discussed as below:

i) Analysis

The main activity at this stage is to understand the proposed system and determine the system requirements. This will involve data gathering and system analysis. Other task is observing other currently existing similar systems with the intention to mimic or enhance the functions and features of those systems. Thus, the accuracy of the proposed system is specified correctly. Furthermore, many development techniques, web based programming languages, software and hardware technologies have been studied to determine the finest and most suitable technique to be applied in this project. Both users and system developer will define the result of the analysis in a manner that is understandable.

ii) Design

The system design process partitions the requirements to either hardware or software systems. It establishes overall system architecture. Software design involves representing the software system functions in a form that may be transformed into one or more executable programs.

iii) Coding

This stage translates and implements the detail design representation of the system into programming realization. Hypertext Preprocessor (PHP) will be used in the most of the programming process including the coding of the rule base, which will be inferenced to parse and search for some keywords from HTML code. Server-side scripting language such as JavaScript and HTML are used in coding together with PHP during handling requests from the users via Internet. Macromedia Dreamweaver is the proposed web-authoring tool that will be used to create web pages while MySQL will be used to develop the database of the system.

iv) Testing

Testing is a critical step in assuring the quality of project development. In this stage, the individual program units or programs are integrated and tested as a complete system to ensure that the software requirements have been met. First, unit testing will be performed to verify each program module. Next, integration testing is performed. It is to integrate unit-tested program modules and conduct tests that uncover errors or bugs associated with the interfacing of those modules. Validation test succeeds when the system functions in the manner that is reasonably expected.

v) Implementation

Implementation is done during the end of the system development life cycle. The system will deploy into the target environment. During this stage, the software design is realized as a set of programs or program units.

vi) Operation and Maintenance

It is an ongoing process where the system is installed and put into practical use. Maintenance involves correcting errors which were not discovered in earlier stages of the life cycle, improving the implementation of system units and enhancing the system's services as new requirements are discovered.

3.2 System Modeling Technique

3.2.1 Unified Modeling Language

Unified Modeling Language (UML) is a graphical language for visualizing, specifying, constructing, and documenting the artifacts of a software intensive system. It helps the participants in a software development efforts build models that will enable them to visualize the system, specify the structure and behavior of the system, construct the system, and document the decisions made along the way. (Scott, 2001)

Every complex system is best approached through a small set of nearly independent views of a model; single view is not sufficient to visualize the overall aspects of a system. Every model may be expressed at different levels of fidelity.

The UML defines nine graphical diagrams to model both of the static structure and dynamic behavior of the system.

1. Class diagram (Static)
2. Use case diagram
3. Behavior diagram (dynamic)
    - 3.1 Interaction diagram
        - 3.1.1 Sequence diagram
        - 3.1.2 Collaboration diagram
    - 3.2 State chart diagram
    - 3.3 Activity diagram
4. Implementation diagram
    - 4.1 Component diagram
    - 4.2 Deployment diagram

3.2.1.1 Use Case Diagram

Use case modeling is one of the UML modeling technique that use by system developer to capture the goals of the users and the responsibility of the system to the users. In other words, use cases are scenarios for understanding system requirements. (Bahrami., 1999) Every use case is a sequence of actions that an actor performs within a system to achieved a particular goal (Scott, 2001). Use case modeling is being applied in this project to capture the functional requirements of the system.

3.2.1.2 Sequence Diagram

UML Sequence Diagrams are an easy and intuitive way of describing the behavior of a system by viewing the interaction between the system and its environment. Sequence Diagrams are interaction diagrams which capture the behavior of a single use case, showing the pattern of interaction among objects. (Bahrami, 1999) A sequence diagram shows an interaction arranged in a time sequence. Sequence diagram is being applied in this project to capture the behavioral aspects of the proposed system.

3.2.2 Data Modeling

3.2.2.1 Entity Relationship Diagram (ERD)

Entity Relationship Diagram (ERD) is a data-modeling tool that depicts the association among different categories of data within a business model or information system. It does not imply how data is created, implemented, modified, deleted or used. ERD represent logical groups of data that are entities and relationships. It provide a clear and system view of the system process.

3.2.2.2 Enhanced - Entity Relationship Diagram (EERD)

The ER modeling concepts discussed are insufficient for representing many database schemas for "traditional" database applications, which mainly include data-processing applications in business and industry. Since the late 1970s, newer applications of database technology have become common place. These types of databases have more complex requirements than do the more traditional applications. To represent these requirements as accurately and clearly as possible, designers of database applications

must use additional semantic data modeling concepts. Various semantic data models have been proposed in the literature. (Elmasri & Navathe, 2000)

Enhanced-Entity Relationship Diagram (EERD) is special designed to include the semantic data modeling concepts. It is extension to the ER model that improves its representational capabilities. EER (Enhanced-Entity Relationship) model incorporates the concepts of *class/subclass relationships, type inheritance, specialization* and *generalization* into the ER model.

Enhanced-Entity Relationship modeling is being applied in the database design of the proposed system.

Chapter 4

System Analysis

System analysis is an essential and important phase in software life cycle that is used to determine and clearly to find out what a system does and to analyze the system needs (Kendall & Kendall, 2001). It always starts with data collection. Several resources to find out the useful information are library and bookshop, Internet, newspaper and magazines, documents room and through the interview.

4.1 System Requirements

The system requirements need to be drawn out before develop a system. A requirement is a feature of the system or a description of the system that is capable of doing in order to fulfil the system purpose (Pfleeger, 2001). There are two types of system requirements, which are:

- Functional requirement
- Nonfunctional requirement

4.1.1 Functional Requirements

A functional requirement describes an interaction between the system and its environment (Pfleeger, 2001). It also describes how the system should behave when given a certain stimuli.

UML use case modeling is being applied in this project to capture the functional requirements of the system. The following use case diagram shows the scenarios for understanding functional requirements.

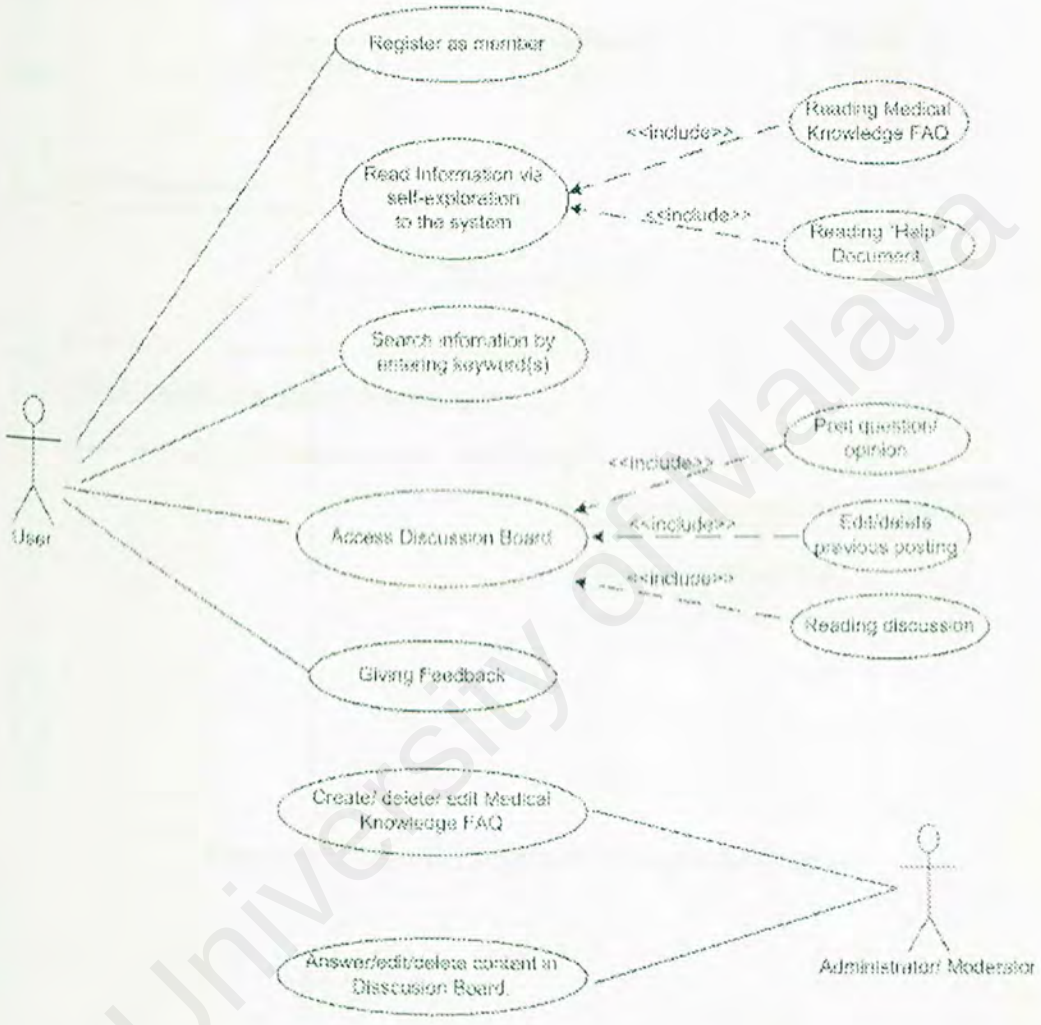


Figure 4.1: Use Case Diagram of Online Medical Knowledge FAQ

The following UML Sequence diagrams will further depict the behavioral aspects of the proposed system.

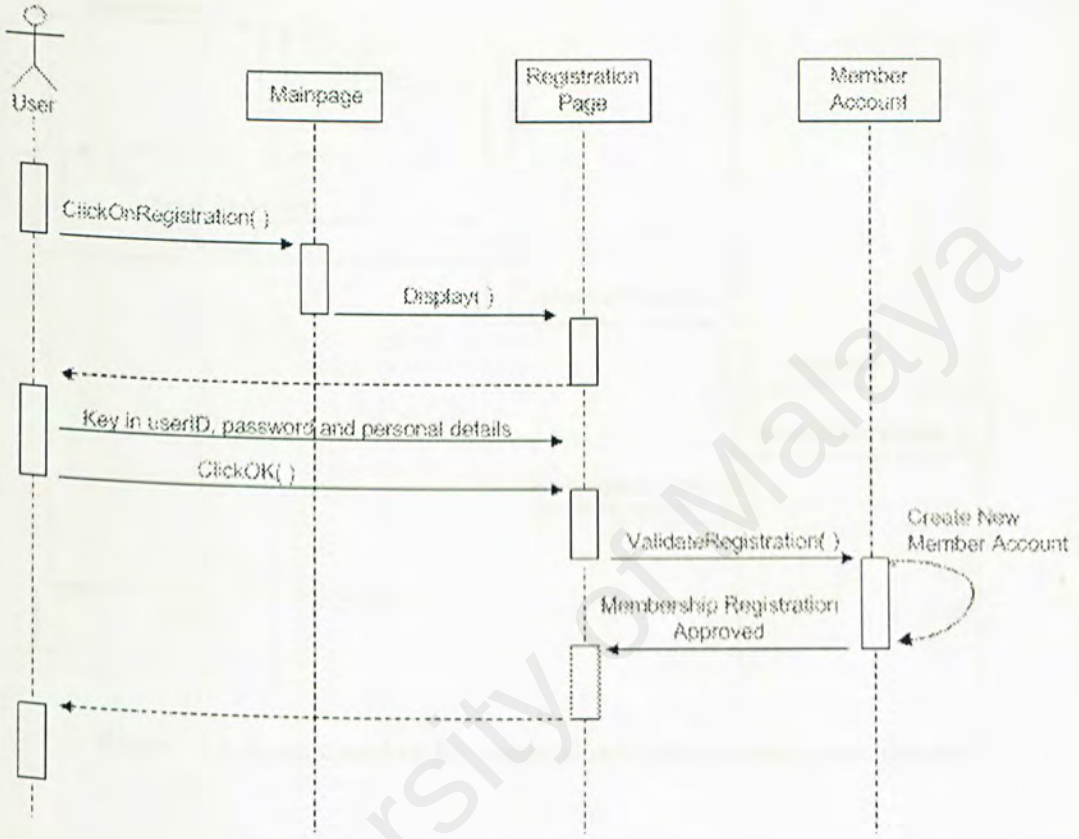


Figure 4.2: Member registration sequence diagram

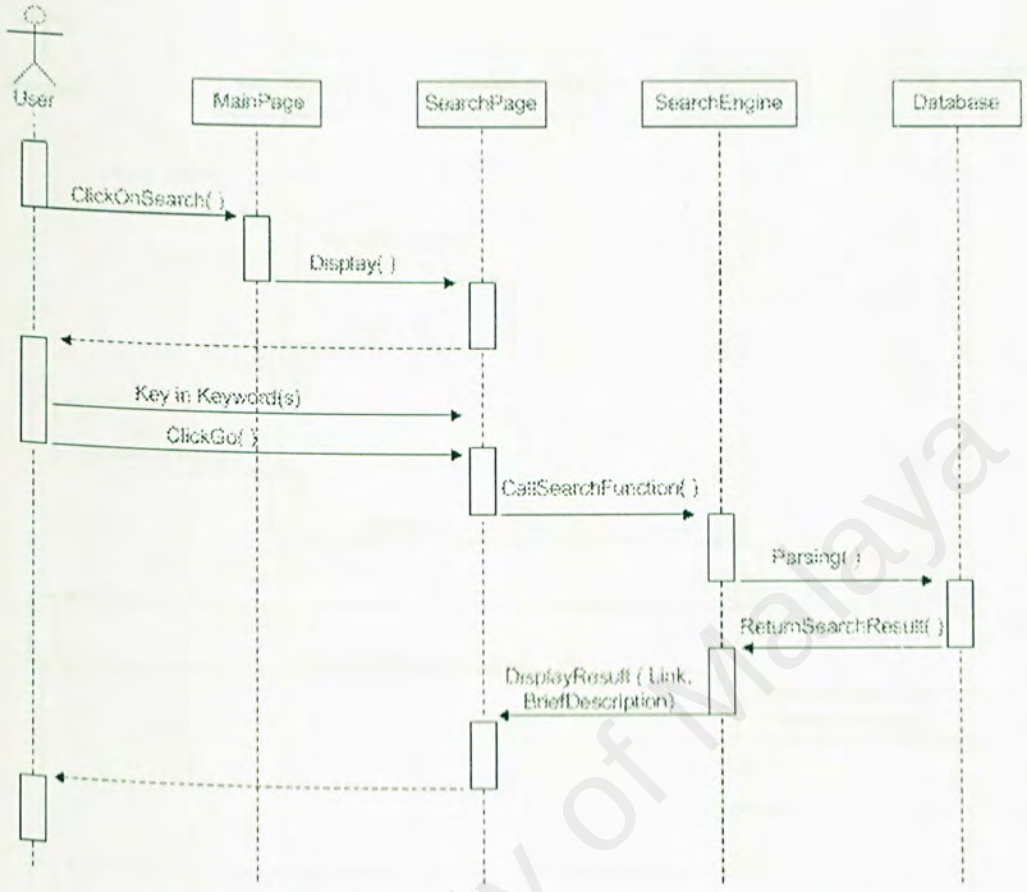


Figure 4.3: User searches for medical information sequence diagram

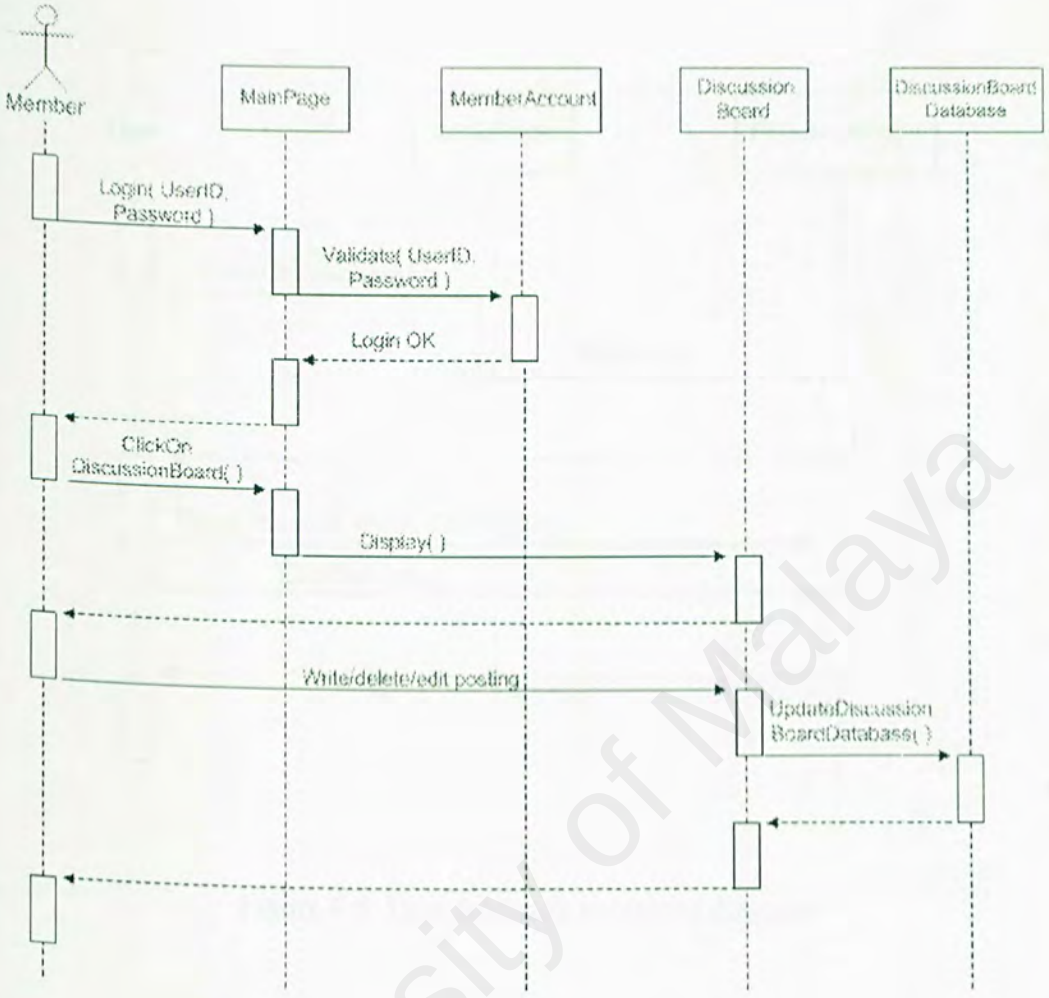


Figure 4.4: User accesses discussion board sequence diagram

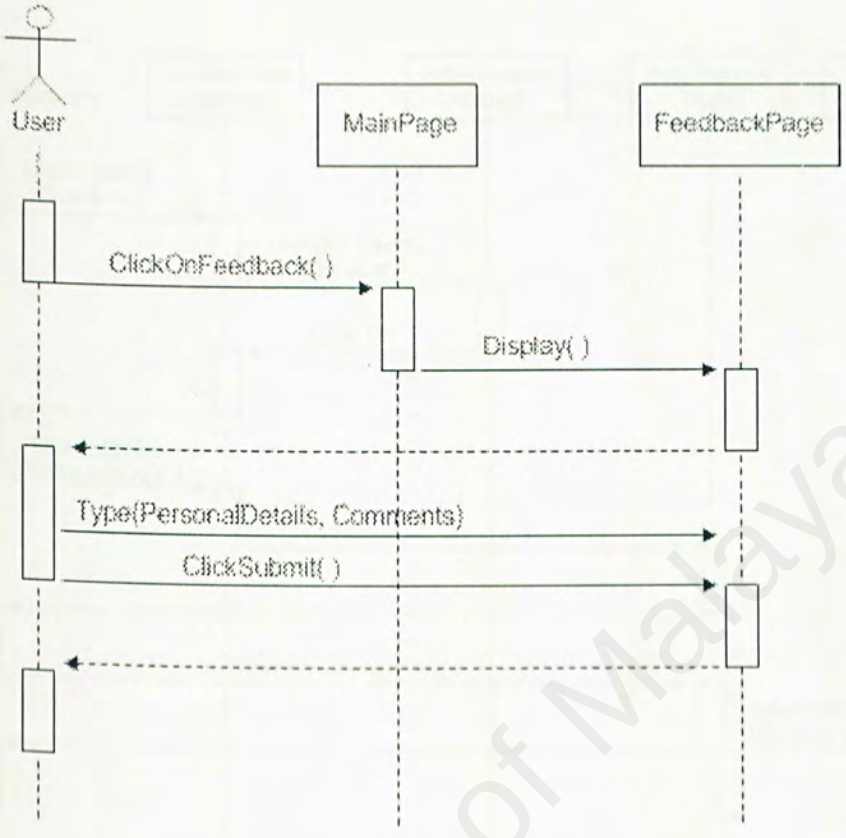


Figure 4.5: User feedback sequence diagram

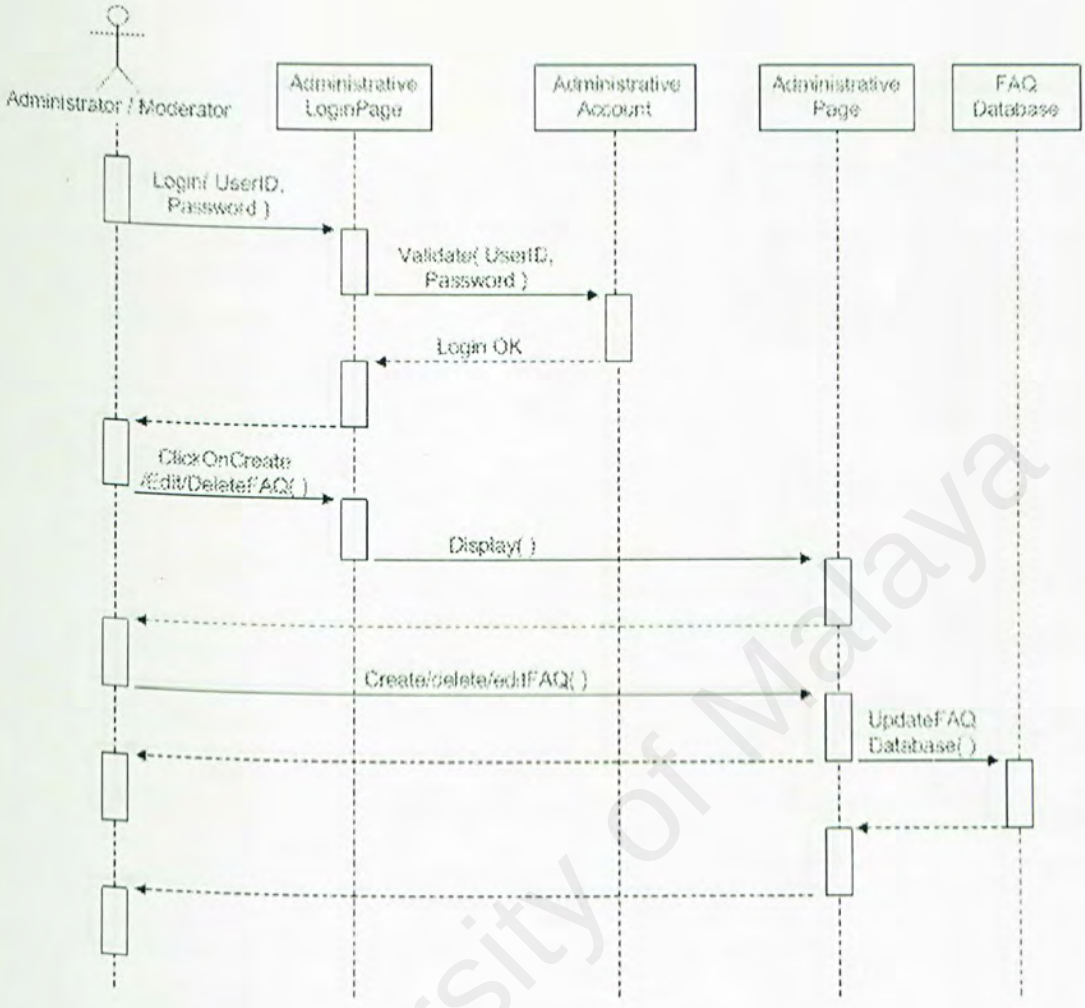


Figure 4.6: Administrator/moderator creates/edits/deletes medical knowledge FAQ sequence diagram

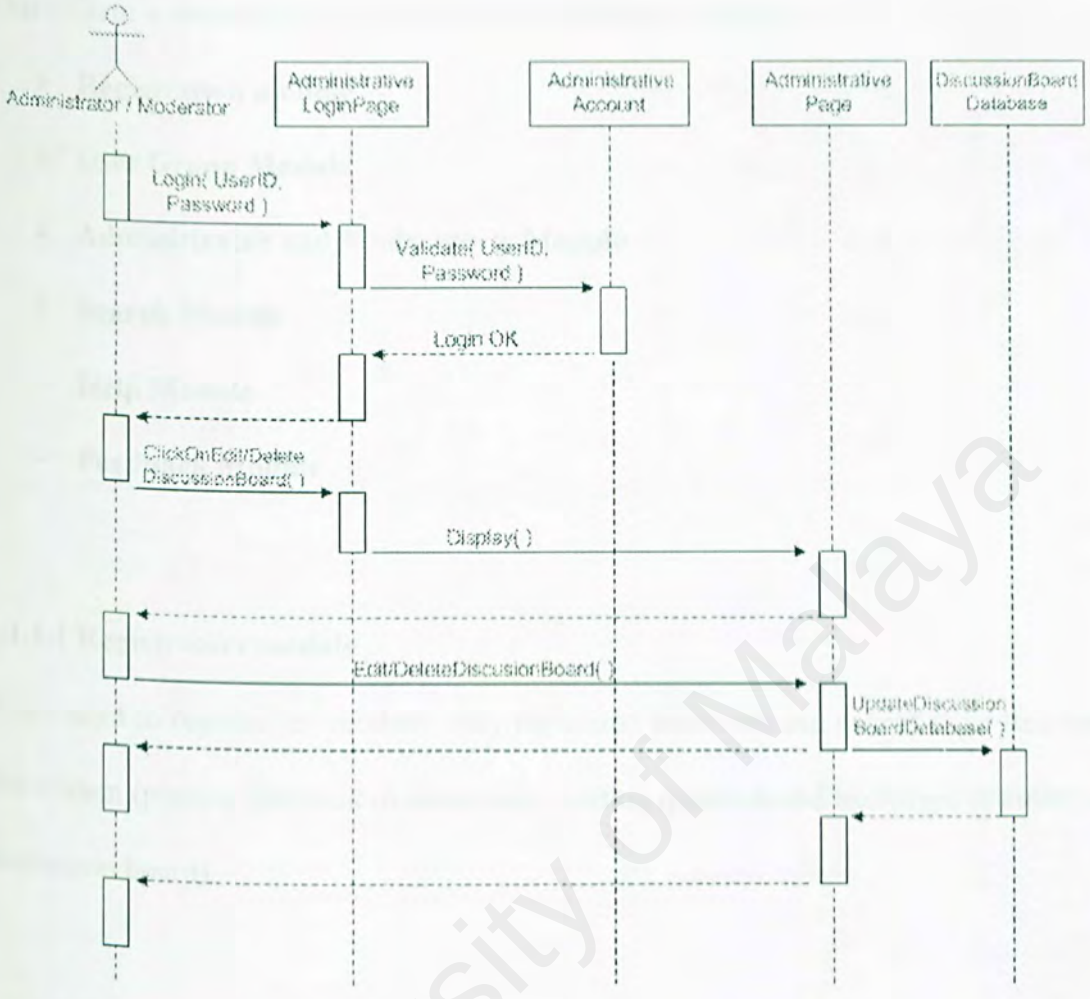


Figure 4.7: Administrator/moderator edits/deletes discussion board sequence diagram

This system is divided into six modules with different functions:

- **Registration module**
- **User Group Module**
- **Administrator and Moderator's Module**
- **Search Module**
- **Help Module**
- **Feedback Module**

4.1.1.1 Registration module

Users need to register as member. Only registered members can access most functions in this system (posting feedback to moderator, posting question and exchange opinions in the discussion board).

4.1.1.2 User Group Module

This module is consisting of two section:

i) **Medical knowledge FAQs**

- This sub module is a series of pages which contain frequently asked questions about medical knowledge.
- Public users without membership are allowed to access this sub module.

ii) **Discussion boards**

- These boards will be categorized into different health topics.

- Only registered users can access these boards, including post questions and opinions, edit previous posting, and delete previous posting.
- Registered members can discuss about their health problems, request medical consultation from the Medical Officer (system moderator) and comment about the services of the web site in these boards.

4.1.1.3 Administrator and Moderator's Module

- These modules only allow the authorized users (system administrator and system moderator) to access the administrative page and enable them to moderate the user group module in the system.
- The developer of the system will play the role as system administrator while few medical officers will be assigned as the system moderators.
- The system moderators (medical officers) will have the rights to answer the questions that are posted by users in the discussion boards as well as to delete or modify the contents in those boards.
- The system moderators also have the rights to create/delete/edit the medical knowledge FAQ in the database.
- The system administrator have the same rights with the system moderators but he/she won't interfere in the roles playing by system moderators, instead he/ she will mainly focus on the technical parts of the system.

4.1.1.4 Search Module

- This module provides a search method for the users to look for the required information. By typing the keyword in the "Search Box" and clicking the "Go" icon, the system will generate a list of relevant data for users.
- Users can search the related medical materials according to the topics of common heath issues.

4.1.1.5 Help Module

- This module provides information to guide the users in order to help them to surf within the system.
- It also gives users the information on solving their problems in using the search engine provide by this system.

4.1.1.6 Feedback Module

- Users will be able to send their feedback about the services of the system through this module.

4.1.2 Nonfunctional Requirements

A nonfunctional requirement is a description of other features, characteristics and constraints that define a satisfactory system (Pfleeger, 2001). Below are the non-functional requirements of the system:

i. *Maintainability*

Maintainability is the degree to which the system can be cost-effectively made to perform its functions in a possibly changing operating environment. The system are easy to modify and test in updating process to meet the new request, correct errors, or move to a different computer system.

ii. *Reliability*

This system should reliable and should not cause unnecessary downtime of the overall environment. It should have set up the acceptable failure rate. However, It must be easily to be maintained simplicity and effective. The system should be consistent when functioning. It should run smoothly although there are many web users using the system simultaneously. The system should not produce dangerous or costly failures when it is used in a reasonable manner.

iii. *Response Time and Performance*

All desirable information should be available to users at any point of time or reasonable time. The requirement for up-to-date or timely information is also

important. Slow response time will create annoyance to users. Therefore users should not be kept waiting for a long time for the output.

iv. *User friendliness*

The system shall have an attractive and user-friendly interface, which can help capable of reducing learning curves. User interface design principles such as user familiarity and consistency shall be taken into consideration throughout the system design in order to reduce users' confusion during the usage of the system.

v. *Security*

The system should be equipped with sufficient security. Each access to different level of system should be authenticated by the system.

4.2 Technology Conclusion

The system development technology which will be applied in the proposed project are listed as below:

4.2.1 Software Requirements

Table 4.1: Software requirements which will be applied in the proposed project.

Application platform	Microsoft Windows Professional 2000
Web server	Apache
Database management system	MySQL
Server-side scripting	Hypertext Preprocessor (PHP)
Web Authoring Tools	• Microsoft Frontpage 2000 • Macromedia Dreamweaver 4.0 • Adobe Phototshop 6.0
Web browser	Microsoft Internet Explorer 5.0

4.2.2 Hardware Requirements

- Server with not less than 166 Mhz processor
- At least 64 MB memory
- 4 GB of free hard disk space
- Other standard computer peripherals

4.2.3 Justification for the Chosen Technology

4.2.3.1 Operating System

Microsoft Windows professional 2000 is chosen as the operating system for the proposed project because it doesn't have complicated installation procedures compared to UNIX, LINUX and Microsoft Windows Server 2000. Unlike Windows 2000, UNIX or LINUX is not an end-user-oriented operating system known for its user friendliness. In a production environment, this is not very desirable because valuable time will be wasted on learning intricate details of various applications.

4.2.3.2 Server-side Scripting Language

The following are the reasons for the developer to choose PHP (Hypertext Preprocessor) as the server-side scripting technology to develop the proposed project:

i) Open source - enjoys technical support of a large group developers.

As an open source product, PHP enjoys the support of a large group of open-source developers. The community gives excellent technical support to users, and bugs are found and repaired quickly. The code is continuously updated with improvements and language extensions to expand PHP's capabilities.

ii) PHP offers excellent connectivity to most of the common databases.

Unlike other scripting languages for Web page development, PHP offers excellent connectivity to most of the common databases (including Oracle, Sybase, MySQL, Informix, Microsoft SQL Server, ODBC and many others). PHP also offers integration

with various external libraries, which allows the developer to do anything from generating PDF documents to parsing XML.

iii) PHP is today's fastest-growing technology for dynamic Web pages.

According to the authoritative Netcraft survey of what technology is actually in use on the Web, PHP can now be found on more that 5 million domains, and is growing at a rate of up to 15% each month. PHP is available on over 36% of Apache Web servers, the most common server on the Web. With the open-source trend gaining popularity, PHP is expected to continue to pick up momentum.

iv) Cross-platform compatibility

The greatest advantage of PHP compared to other scripting languages such as ASP or ColdFusion, is that it is open-source and cross-platform, suitable for today's heterogeneous network environments. PHP is the natural choice for developers on Linux machines running Apache server software, but runs equally well on any other UNIX or Windows platform, with Netscape or Microsoft Web server software. PHP also supports HTTP sessions, Java connectivity, regular expressions, LDAP, SNMP, IMAP, COM (under windows) protocols. It also supports WDDX complex data exchange between virtually all Web programming languages.

v) Easy-to-use scripting language

PHP offers a simple and universal solution for easy-to-program dynamic Web pages. The intuitive interface allows programmers to embed PHP commands right in the HTML page. PHP's syntax is similar to that of C and Perl, making it easy to learn for anyone with basic

programming skills. PHP code is significantly easier to maintain and update than comparable Perl or ASP code.

4.2.3.3 Database

MySQL has been chosen by the developer to develop the database of the system. The advantages of MSQL are:

i) MySQL is open source database that there is possible for anyone to use, modify and download from the Internet and use it without paying anything

ii) MySQL was originally developed to handle very large databases much faster than existing solutions and has been successfully used in highly demanding production environments for several years.

iii) MySQL consists of a multi-threaded SQL server that supports different backend, several different client programs and libraries, administrative tools, and several programming interfaces.

iv) The integration between PHP and MySQL provide more complete set of web-based system features compared to the others.

4.2.3.4 Web Server

Apache has been chosen as the web server of the proposed system. This is because the good features of Apache.

i) Good combination with PHP and MySQL

The integration between PHP and MySQL and Apache provide a more complete set of web-based system features compared to the others.

ii) Support for Windows NT/95

Apache supports the Windows 95, 98, ME, Windows NT and Windows 2000 operating systems.

iii) Dynamic Shared Object (DSO) support

Apache modules may now be loaded at runtime; this means that modules can be loaded into the server process space only when necessary, thus overall memory usage by Apache will be significantly reduced.

4.2.3.5 Web Application Development Tools

Web Application Development Tools is the entire tools that will assist the developer in the process of developing the proposed project

- **Microsoft FrontPage 2000**

  It is a comprehensive solution for publishing and managing workgroup Web sites and also helps users create the web sites and pages.

- **Macromedia Dreamweaver 4.0**

  It is a professional HTML editor and very powerful web design tool for visually designing and managing web sites and pages.

- **Adobe Photoshop 6.0**

  Adobe Photoshop is the most popular program for creating and modifying images for the web.

Chapter 5

System Design

Design is the creative process of transforming the problem into a solution (Pfleeger, 2001). The system design phase is the phase in which requirements produced in the system analysis phase are translated into a representation of the system. This phase will be focused on architectural design, user interface design and database design.

5.1 Architectural Design

The structure chart shows all the relation between modules in the Online Medical Knowledge FAQ Database and is used to identify the activities that make up the system. It is used to model the program structure. Structure chart is used to depict high-level abstraction of a specified system. The use of structure chart is to describe the interaction between independent modules.

The main system is divided into six major components:

- Registration module
- User Group Module
- Administrator and Moderator's Module
- Search Module
- Help Module
- Feedback Module

The further description about each module can be referred to **section 4.1.1**.

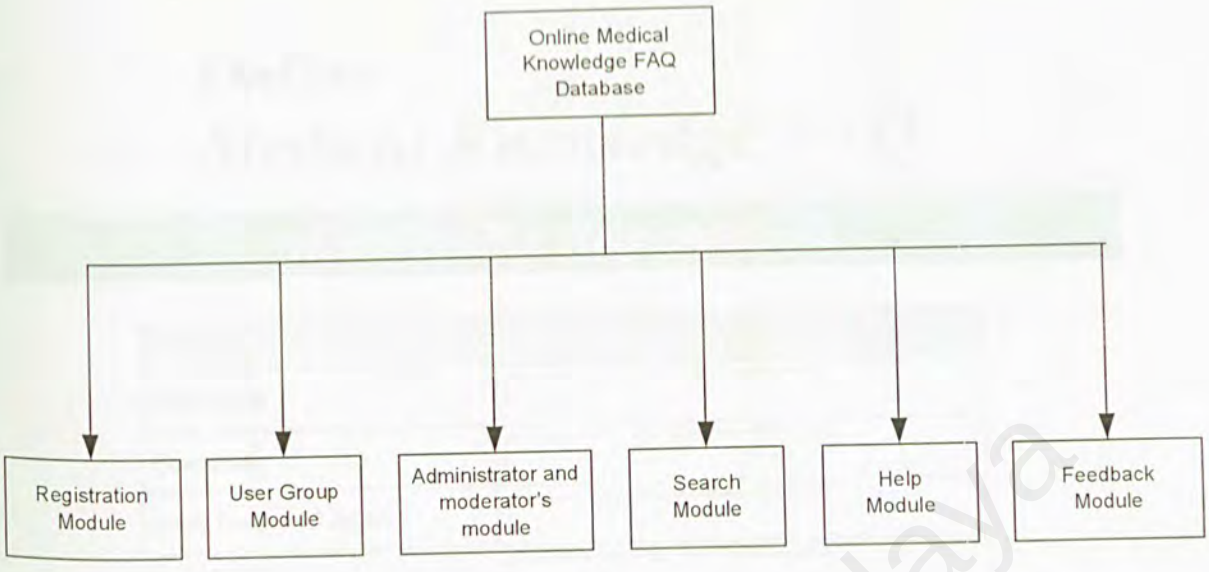


Figure 5.1: Structure chart for Online Medical Knowledge FAQ Database

5.2 User Interface Design

The goal of interface design is to provide the best way for the users to interact with the system, which is to obtain the information they needed in and out of the system., or what is commonly known as Human-Computer Interface (HCI). These HCI general principles among others are consistency, recoverability, confirmation and verification message, reverse action and responsiveness.

The following diagrams show some of the interfaces of the web pages in Online Medical Knowledge FAQ Database:

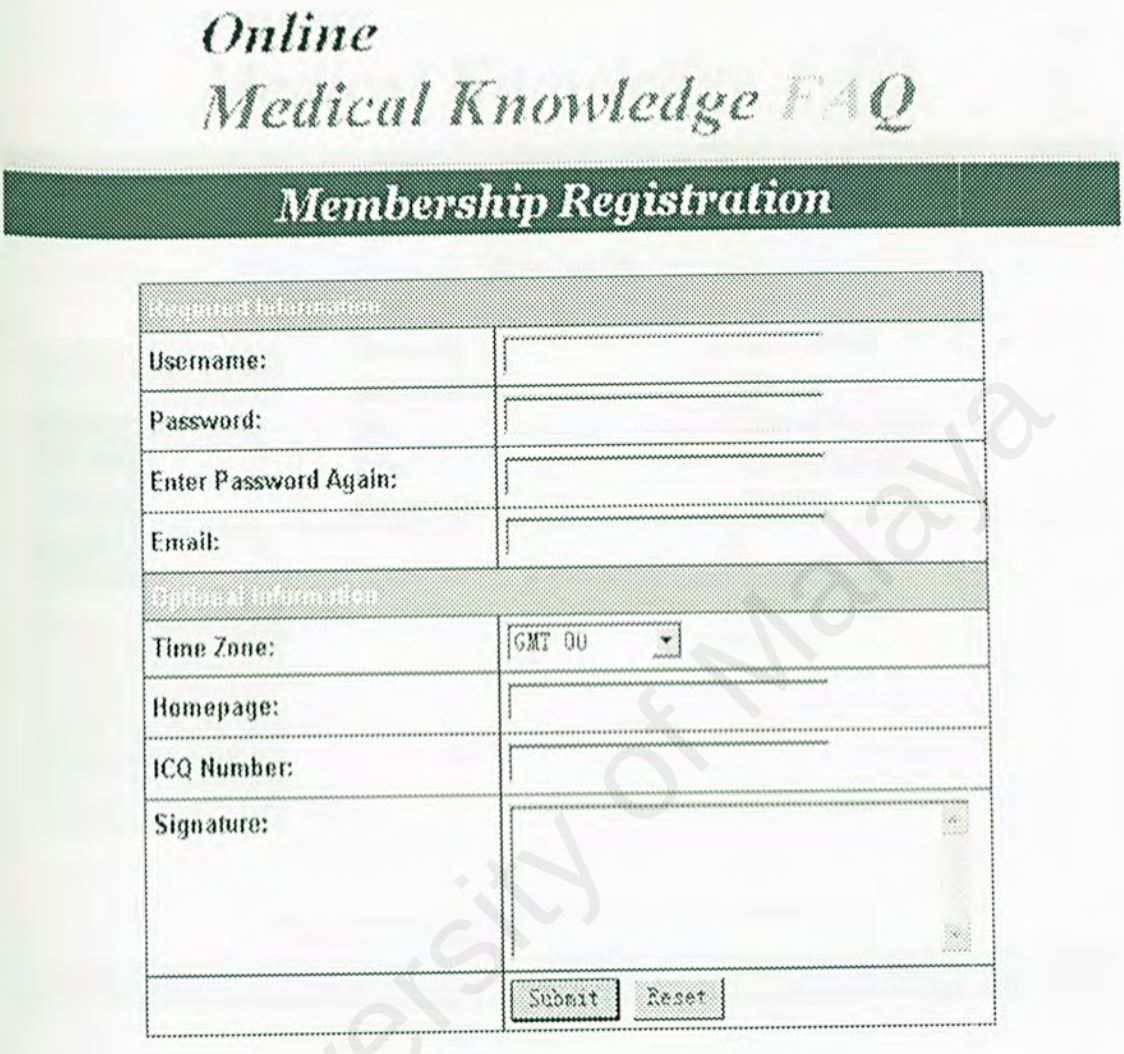


Figure 5.2: Interface of Membership Registration Page

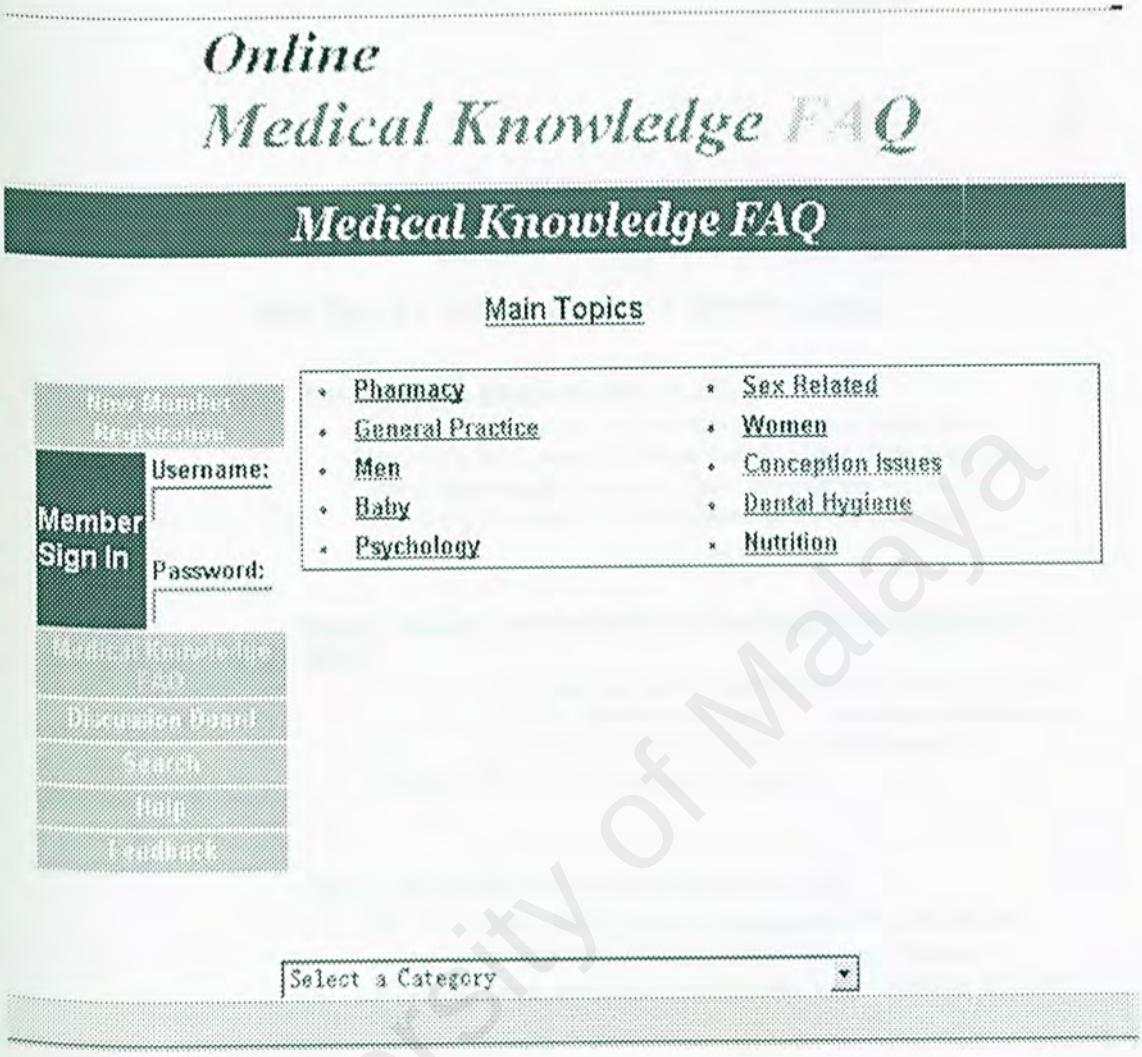


Figure 5.3: Interface of Medical Knowledge FAQ Main Topics Page

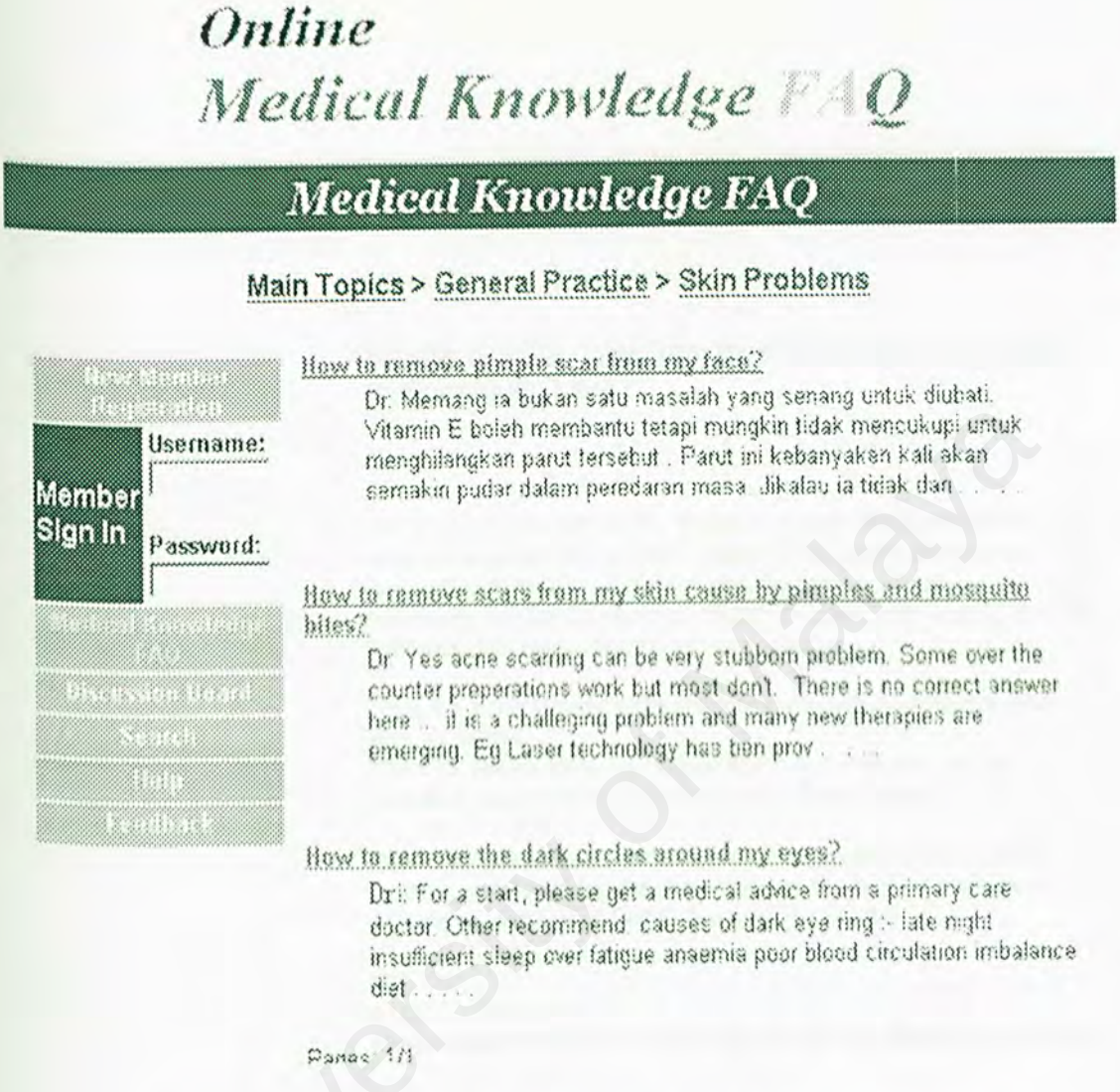


Figure 5.4: Interface of Medical Knowledge FAQ Questions Page

Online
Medical Knowledge FAQ

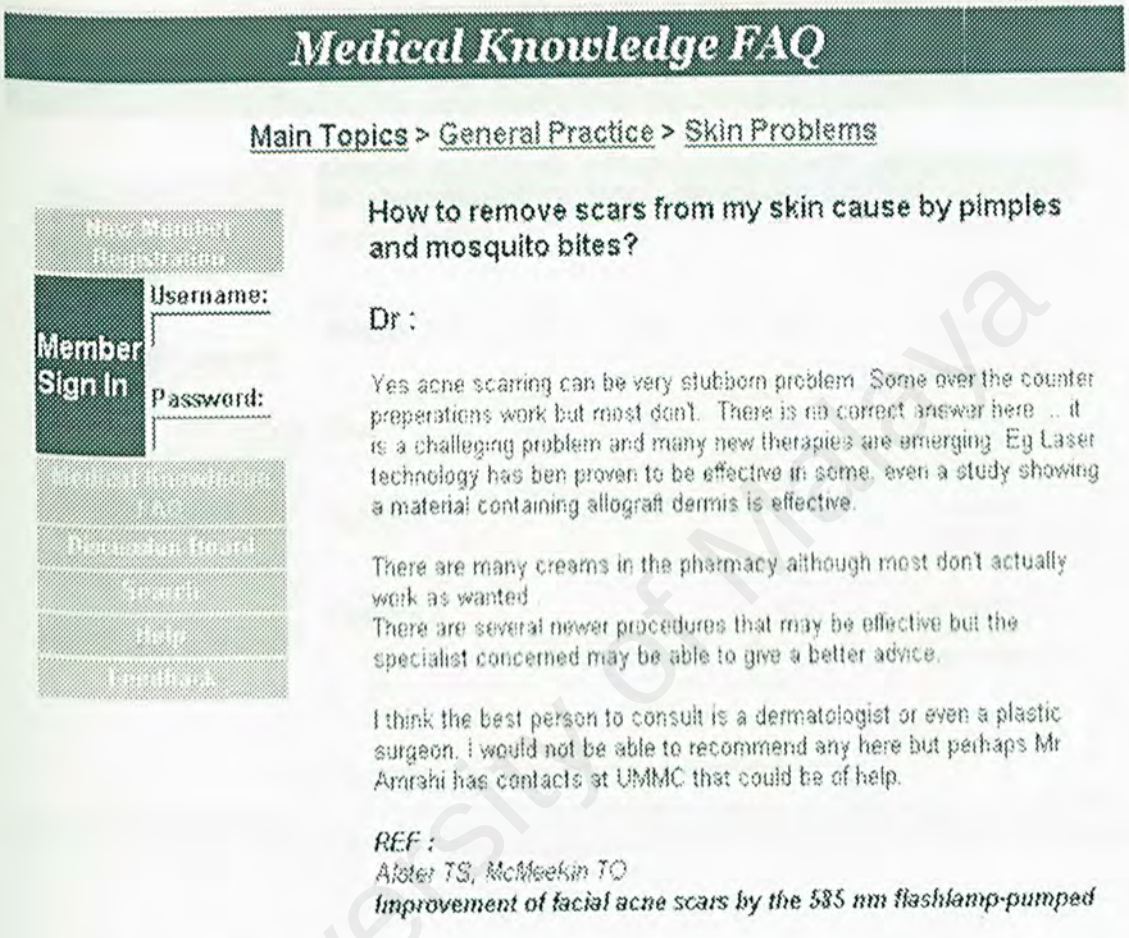


Figure 5.5: Interface of Medical Knowledge FAQ Answer Page

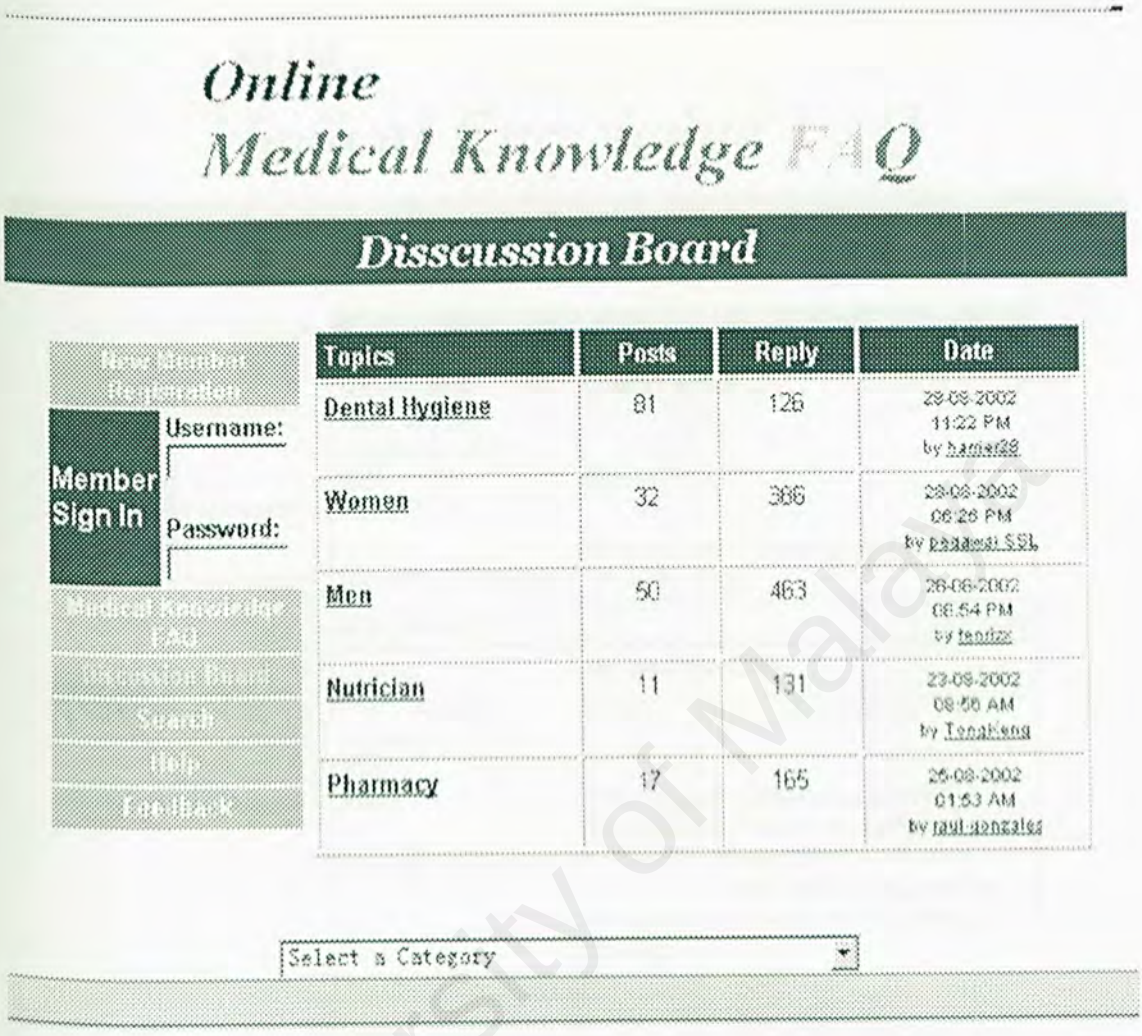


Figure 5.6: Interface of Discussion Board Topics Page

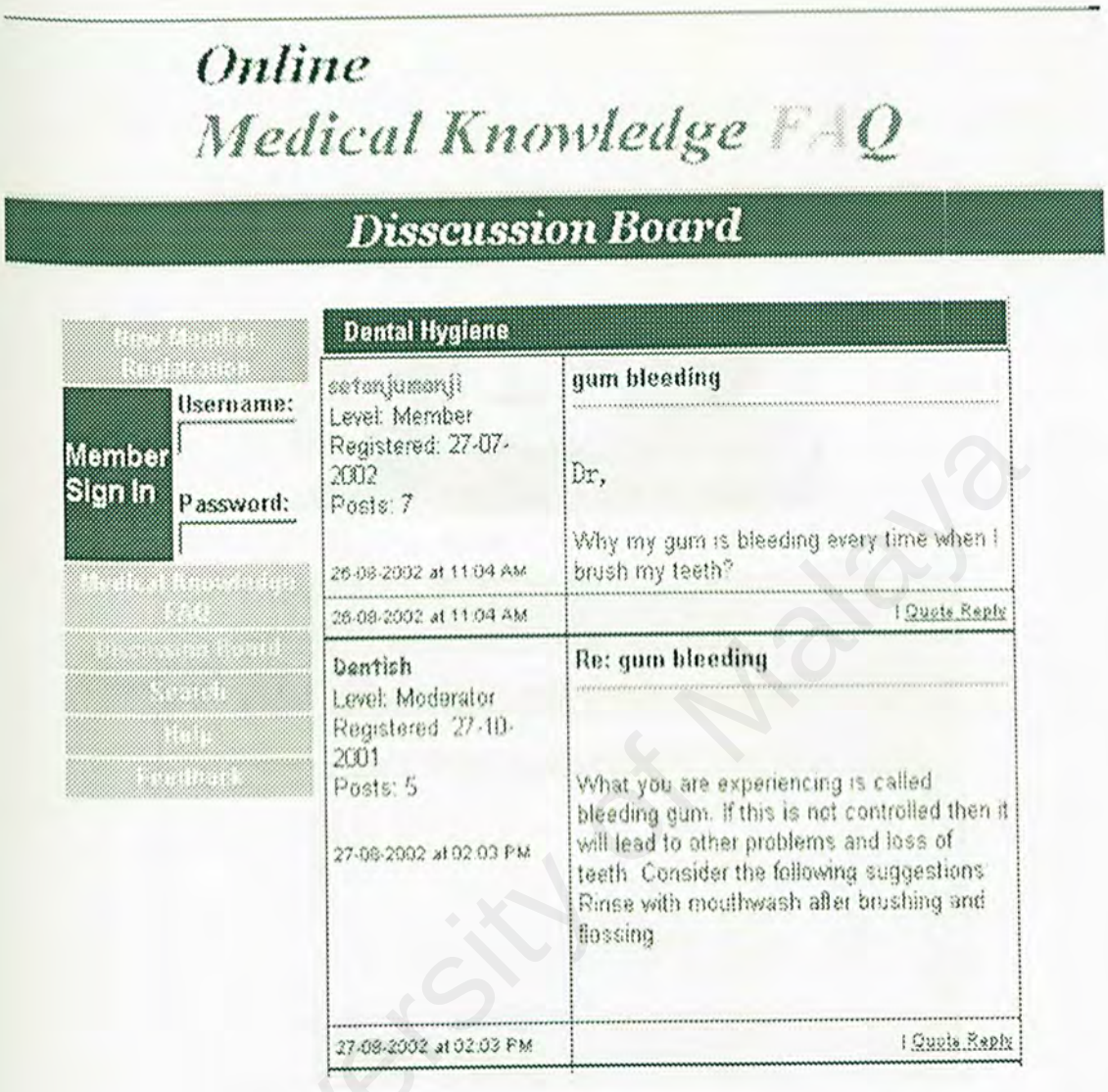


Figure 5.7: Interface of Discussion Board Page

Online
Medical Knowledge FAQ

Members' Feedback

Feedback Form

Name : *	
Email : *	
Comments *	
	Submit Reset

Figure 5.8: Interface of Feedback Form Page

5.3 Database Design

Database design can affect greatly on the performance of data retrieval, updating and query (Post, 1999). The database design transforms the information domain model created during analysis into the data structure that will be required to implement the software.

Online Medical Knowledge FAQ Database is a web-based system where entries made in the data dictionary representing the information and important details. The database is used to create the necessary tables to be connected to the front-end program. The database is linked to the web page to allow storing and editing of data and to provide data retrieval.

5.3.1 Enhanced-Entity Relationship Diagram

Enhanced-Entity Relationship Diagram (EERD) is special designed to include the semantic data modeling concepts. It is extension to the ER model that improves its representational capabilities. EER (Enhanced-Entity Relationship) model incorporates the concepts of *class/subclass relationships, type inheritance, specialization* and *generalization* into the ER model. Enhanced-Entity Relationship Diagram in figure 5.9 shows the data modeling of the system.

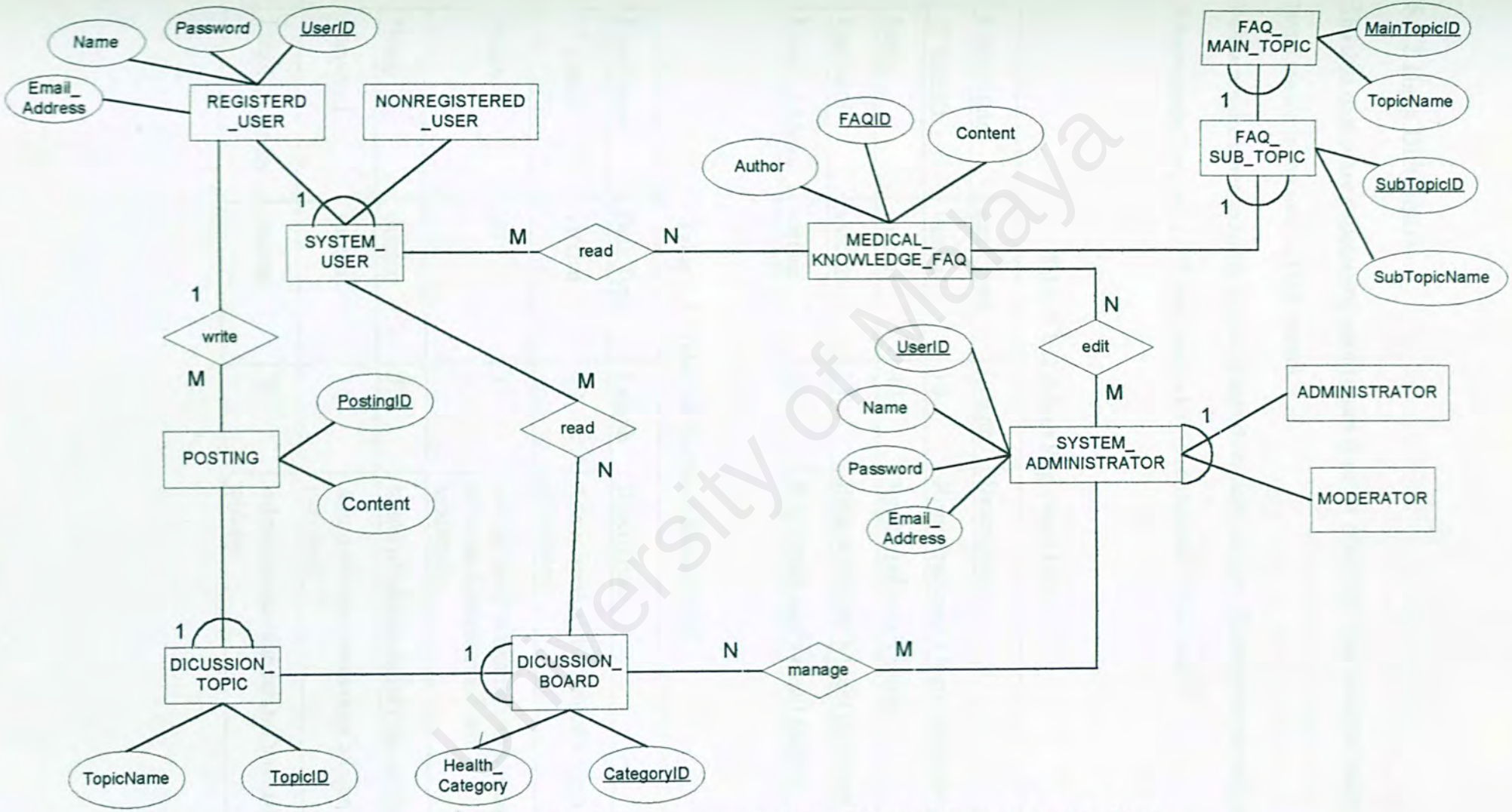


Figure 5.9: EER Diagram for Online Medical Knowledge Database

5.3.2 Data Dictionary

The data dictionary collects and coordinates specific data terms and confirms what each terms means to the users of the system.

Below are the some example tables of data dictionary design. Primary key in each table is represented by symbol ** and foreign key is represented by symbol *.

Table 5.1: Table of Registered User

Field Name	Data Type	Length	Description
** UserID	varchar	10	Registered user's login username.
Name	varchar	30	Registered user's name.
Password	varchar	15	Registered user's login password.
Email_Address	varchar	30	Registered user's email address.

Table 5.2 : Table of System Administrator

Field Name	Data Type	Length	Description
** UserID	varchar	10	Administrator/ moderator's login username.
Status	int	1	Integer used to distinguish identity between administrator and moderator.
Name	varchar	30	Name of administrator / moderator.
Password	varchar	15	Administrator/ moderator's login password.
Email_Address	varchar	30	Administrator/ moderator's email address

Table 5.3: Table of Medical Knowledge FAQ Main Topics

Field Name	Data Type	Length	Description
**MainTopicID	varchar	15	The identification number of the main category that a particular FAQ belongs to.
TopicName	varchar	30	The topic of main category.

Table 5.4: Table of Medical Knowledge FAQ Sub Topics

Field Name	Data Type	Length	Description
** SubtopicID	varchar	15	The identification number of the sub category that a particular FAQ belongs to.
* MainTopicID	varchar	15	The identification number of the main category that a particular FAQ belongs to.
SubTopicName	varchar	30	The topic of sub category.

Table 5.5: Table of Medical Knowledge Frequently Asked Question (FAQ)

Field Name	Data Type	Length	Description
** FAQID	varchar	15	The identification number of FAQ
* SubTopicID	varchar	15	The identification number of the sub category that a particular FAQ belongs to.
Author	varchar	30	The name of moderator (medical officer) who creates the FAQ.
Content	text	500	The detail explanation of medical officer to the particular Frequently Asked Question.

Table 5.6: Table of Discussion Board Category

Field Name	Data Type	Length	Description
** CategoryID	varchar	15	The identification number of the health category.
Health_Category	varchar	30	The health category of discussion board.

Table 5.7: Table of Discussion Topic

Field Name	Data Type	Length	Description
** TopicID	varchar	15	The identification number of the discussion topic.
* CategoryID	varchar	15	The identification number of the health category which a discussion topic belongs to.
TopicName	varchar	30	The topic of discussion.

Table 5.8: Table of Posting

Field Name	Data Type	Length	Description
** PostingID	varchar	15	The identification number of a particular posting.
* TopicID	varchar	15	The identification number of the discussion topic which a posting belongs to.
* UserID	varchar	10	The identification number of the user who write the posting.
Content	text	500	The content of the posting written by user.

Chapter 6

System Implementation

System implementation in software development is a process to convert system requirements into program codes. This process takes place after the system design phase. This phase describes how the initial and revised process design put into the real work. Therefore, system development, coding methodology and development tools are included in this phase.

6.1 Development Environment

The development environment of Online Medical Knowledge FAQ Database consists of software and hardware configuration. Using the suitable hardware and software will help in speed up the system development. The hardware and software tools that used to develop and document the system will be discussed as below.

6.1.1 Hardware Requirement

The hardware configurations used for developing the system are:

- Server with not less than 166 Mhz processor
- At least 64 MB memory
- 4 GB of free hard disk space
- Other standard computer peripherals

6.1.2 Software configuration

The software tools that have been used to develop Online Medical Knowledge FAQ Database are:

Software	Usage	Description
Microsoft Windows Professional 2000	System requirement	Operating System
Apache Web server	System requirement	Web server service. Map local directory to virtual directory and create local web site.
MySQL	System requirement	Database management system to generate, view and edit database tables.
Microsoft Internet Explorer 5.0	System requirement	Browser to surf the site
Microsoft Frontpage 2000	System development	Interface graphical design and HTML editor.
Macromedia Dreamweaver 4.0	System development	Interface graphical design and HTML editor.
Adobe Phototshop 6.0	System development	Graphics editing tool.

Table 6.1 Software Tools

6.2 System Development

6.2.1 Starting Off

Servers and development tools installation are the first step before development work begins after gathering the entire required information. It is essential to know the sequence of product installation to ensure smooth execution without system errors.

The sequence of the installation process is shown below:

1. Firstly, install Microsoft Windows 2000 Professional
2. Configure Microsoft Windows 2000 Professional
3. Install PHP server-side scripting environment
4. Install Apache Web Server
5. Install MySQL
6. Install other graphical softwares that are needed.

6.2.2 Setting Up The Server-Side Scripting Environment

Before can start to develop a Web-based system, the server-side scripting environment must be set up on the operating system platform. PHP scripting environment was chosen by the project developer to create the dynamic Web page applications. The installation and configuration of PHP scripting environment are described in Appendix A.

6.2.3 Web Server

Apache is chosen as the web server for the Online Medical Knowledge FAQ Database. The Apache Web server is currently the most popular server used in industry because of its stability, efficiency and portability (Deitel *et al*, 2002). PHP,

MySQL and Apache had been chosen by the developer to develop the proposed system because the integration between PHP, MySQL and Apache provides a more complete set of Web-based system features compared to the others.

6.2.4 Accessing Database

The database using by Online Medical Knowledge FAQ Database for both development and production stage is MySQL. By using this DBMS, database structure, validation rules, defaults, relationships and referential integrity could be done easily. The data structure of each table is declared, the primary key is set, and the relationship among each table is defined.

The connection to accessing database is opened as follows:

```
<?php
$user = "root";          // Put the database username at here
$pass = "";              // Put the database password at here
$db = "medicfaq";        // Put the database name at here

$link = mysql_connect( "localhost", $user, $pass );
if ( ! $link )
  die( "Could not connect to MySQL" );

mysql_select_db( $db, $link )
  or die ( "Could not open $db: ".mysql_error() );
  ?>
```

6.2.5 Programming Language Used

6.2.5.1 HTML (Hypertext Markup Language)

In Online Medical Knowledge FAQ Database, the Web-based interfaces are created using HTML. HTML is the fundamental building stuff of the web. It is the *lingua franca* for publishing hypertext on the World Wide Web. HTML is the set of "markup" symbols or codes inserted in a file intended for display on a World Wide Web browser. It uses tags like <A> and </A> to structure text into tables, hypertext links interactive forms, headings, paragraphs, lists, and more. HTML is useful to create form based data entry for this application. Below are some HTML codes examples in creating a form.

Example of HTML Coding

1) < form name="form" method="post" action="add_newmember.php" > ... < /form >

2) < input type="text" name="userid" size="30" maxlength="50" >

3) <input type="radio" name="approach" value="1">

4) < select name="month ">
   <option value="1" selected>1</option>
   <option value="2">2</option>
   <option value="3">3</option>
   < /select >

5) < input type="submit" name="Submit" value=" Submit " >

Command 1 - Creates a form and post it to add_newmember.php page which will create a new user record in the database.

Command 2 - Creates a text field for the user to enter user ID.

Command 3 - Code for radio button that allow user to click on the button to choose it.

Command 4 - Creates a drop down menu for the user to choose the month of his birthday.

Command 5 - Creates a submit button to submit the form or data to the server.

6.2.5.2 JavaScript

JavaScript is a compact, object-based scripting language. The main roles JavaScript play in the web pages are form validation, responding to input, integrating with basic graphics and dynamic HTML. JavaScript statements can be embedded directly in an HTML page. If invalid data is detected or user does not enter any data, a dialog box is displayed.

Figure 6.1: JavaScript Dialog Box for Data Validation

Example of JavaScript coding:

```
<script language="javascript">
<!-- Begin
function checkFields() {
missinginfo = "";
if (document.form.username.value == "") {
missinginfo += "\n     -  Username";
}

if (document.form.password.value == "") {
missinginfo += "\n     -  Password";
}
if (missinginfo != "") {
missinginfo ="You didn't fill in the following field(s):\n" +
missinginfo + "\n_____" +
"\nPlease fill in the mentioned field(s) and log in again.";
alert(missinginfo);
return false;
}
else return true;
}
//  End -->
</script>
```

6.2.5.3 Create Hypertext Preprocessor (PHP) Scripts

PHP is a server-side scripting environment that can use to create and run dynamic, interactive Web server applications. PHP offers a simple and universal solution for easy-to-program dynamic Web pages. The intuitive interface allows programmers to embed PHP commands right in the HTML page. PHP's syntax is similar to that of C and Perl.

There are some unique ways to indicate that blocks of PHP script are to be executed on the server (that is the server-side code). It locates between the script delimiter **<?php** and **?>** in the HTML codes. In this case, any text between these script delimiters is treated as PHP server-side scripting commands.

Example of PHP Coding:

```
<?                                  // Open script: PHP coding
   $name = "Guest";                 // Variable Declaration
?>                                   // Close script
<html>
<head>
      <title>Untitled</title>
</head>
<body>
      <!--  print variable name's value -->
      Welcome to PHP, <?php  print ( " $name" ); ?> !

</body>
</html>
```

6.2.5.4 Structured Query Language (SQL) Statement

Structured Query Language (SQL) statements are used to insert, delete and retrieve information from database once connection with database has established. The following coding is four examples of the SQL statements in Online Medical Knowledge FAQ Database's final report form coding.

Example 1: SELECT statement

Select member's data from tbluser table and assign each data value to a new variable.

```
<?
$result = mysql_query( "SELECT * FROM tbluser WHERE struserName =
'$userid' LIMIT 0,1" );
$num_rows = mysql_num_rows( $result );
//Dispay records
while ( $a_row = mysql_fetch_object( $result ) )
{
        $username = $a_row-> strUserName;
        $firstname = $a_row->strFirstName;
        $lastname = $a_row->strLastName;
        $password = $a_row->strPassword;
        $email = $a_row->strEmail;
        $birthday = $a_row->intBirthDay;
        $birthmonth = $a_row->intBirthMonth;
}
?>
```

Example 2: INSERT statement

Insert data into tbluser table in database to create a record for a new member.

```
<php?
include ("connectdb.php");
$query = " INSERT INTO tbluser
        ( strUserName, strEmail, , strPassword )
        values ('$username',   '$email',     '$password') " ;

mysql_query( $query, $link )
      or die ( " Could not add data to \"tbluser\" table. Please contact a Forum
admin and show them this error : "
      .mysql_error( ) );
?>
```

Example 3: UPDATE statement

Update the password of a particular member who intends to change his password.

```
<php?
include ("connectdb.php");
$query = "UPDATE tbluser SET strPassword = '$password1' WHERE strName
= '$userid'";

mysql_query( $query, $link )
or die ( "Could not update in \"tbluser\" table: "
.mysql_error() );

mysql_close( $link);

?>
```

Example 4: DELETE statement

Delete a member's record from tbluser table in the database.

```
<php?
include ("connectdb.php");
$query = "DELETE FROM tbluser WHERE strName = '$userid'";
mysql_query( $query, $link )
or die ( "Could not delete from \"tbluser\" table: "
.mysql_error() );
mysql_close( $link);
?>
```

6.2.6 Modules Implementation

During the development of modules in Online Medical Knowledge FAQ Database, firstly, the Online Medical Knowledge FAQ Database is developed according to the database design.

Then the interface of the entire modules is designed. The interface is developed to have Graphical User Interfaces (GUIs). GUIs support high-resolution colour screens and interaction using a mouse as well as a keyboard.

Thirdly, appropriate program coding is added to the user interfaces as functionality of the system. The coding is started based on Registration Module, User Group Module (Medical Knowledge FAQ Module), Administrator and Moderator's Module, Search Module, and Feedback Module.

The functions of these major sections are:

i. **Section 1 - Administrator and Moderator's Module**

The Administrator and Moderator's Module is consisting of 5 main function units. Those units are

- **Medical Knowledge FAQ Administration Board** - Add, delete or edit the Frequently Asked Question of medical knowledge.
- **Forum Administration Board** – Add, delete or edit the information in the forum.
- **Membership Management** – Delete Membership, assign access level to a particular user (such as assign a user as the moderator or administrator of the system or cancel someone's right as the system moderator).
- **Feedback Message Center**- Read the feedback messages sent by users through the User Feedback Module.
- **Sending Email Module** – Sending email to all registered members of the system for announcement purpose.

ii. Section 2 – Registration Module

This module provides new user with a method to register as the system's member.

It includes:

- **Membership Registration Form**
- **Error Handling Functions**

The error handling functions will validate and verify the input key in by users to prevent the errors caused by invalid input. If there is any error or invalid input occurred, an error message will be generated and displayed to inform the user about the error.

iii. Section 3 - Discussion Board Module (Forum)

This module allows registered member to perform several functions:

- **Create a new topic for discussion.**
- **Post reply to a topic.**
- **Post reply to any posting.**
- **Delete or edit user's own posting (the posting created by user himself).**

iv. Section 4 – Medical Knowledge Frequently Asked Questions Module

This module consists of frequently asked questions about medical knowledge which being categorized into various topics and subtopics.

Public users without membership are allowed to read the information in this module without any restriction.

v. Section 5 – Search Module

Search module consists of two sub modules, which are:

- **Search module for Discussion Board**
- **Search module for Medical Knowledge Frequently Asked Questions**

Public users without membership are allowed to search for required information in this module without any restriction.

vi. Section 6 – Feedback Module

Public users without membership will be able to send their feedback about the services of the system through this module.

Besides the major function modules mentioned above, login and logout functions are created to ensure only the authorized users can perform the functions determined by the system.

6.2.7System Documentation

The process of development is documented since it is important to help developer to determine the progress of the project. The system documentations that provided in Online Medical Knowledge FAQ Database are:

- **Setup tools**

The information about how to set up the tools that are using in Online Medical Knowledge FAQ Database development process will be included. They are:

- Installing PHP scripting running environment
- Installing Apache Web server
- Installing MySQL Database

Please refer to Appendix A for more details.

- **Sample Coding**

The samples of coding that had been developed and deployed in this system will be shown. Those coding are as references for the user to know how PHP coding look like and how it work in Online Medical Knowledge FAQ Database system.

Please refer to Appendix B for more details.

- **User Manual**

User manual is a reference or guide for system users. It will explain and describe how the system can be used. A well-documented user manual can reduce the learning curves of the system users and save their time.

Please refer to Appendix C for more details

Chapter 7

System Testing

System testing is a significant and critical phase that ensures the system fulfills the users' requirements and assures the quality of the delivered system. In this phase, the process of testing and debugging are done to detect defects and bugs of a system. This phase is also often referred to as Verification and Validation (V & V). Verification refers to the set of activities that ensure the software correctly implements a specific function. Validation refers to a different set of activities that ensure the software has been built is traceable to user requirements (Jarvis & Crandall, 1997). A successful testing will result in quality software with less errors and work according to the specification.

Several testing stages that involve during the development of the system are:

- Unit testing
- Integration testing
- System testing

7.1 Unit Testing

In this stage, testing will be concentrated on the smallest component of the system. Each individual component is tested independently without involving other system components, to determine whether each component is operating correctly. For example, this component might perform task like checking valid input value.

In Online Medical Knowledge FAQ Database, those units that were tested independently are:

- Open and close connection to the database
- Insert new record into database
- Retrieved data from database
- Edit the existing data in the database
- Search in database for particular record
- Form posting
- Validate of user input data before submission
- Execution of SQL statements

For Online Medical Knowledge FAQ Database unit level testing, there are three category types of testing were applied.

7.1.1 Ad Hoc Testing

Ad Hoc testing means simply play with the functioning unit, trying whatever comes to their mind, in attempt to make it fail (Jarvis & Crandall, 1997). This type of testing was a fast and efficient way of debugging code errors during the early development stage. The disadvantage of Ad Hoc testing is it usually finds many errors and never be sure what was or was not to be tested.

7.1.2 White Box Testing

White Box Testing basically involved analyse the structure of the code and use knowledge about the structure of a component to derive test data. The advantage of white box testing is that an analysis of the code can be used to find out how many

test cases are needed to guarantee a given level of test coverage. Those code coverage that were tested under this phase including basic path testing, data flow testing, path testing and loop testing. It is focused on the idea of coverage. The main objective is to check for missing function.

7.1.3 Black Box Testing

Black Box Testing is concentrate on the functionality of code. The main objective is to uncover those wrong functions programmed correctly by feeding the input to the black box and take notes on what output is produced. The test object's behaviour can only be determined by studying its inputs and the related outputs.

The advantage of this kind of testing is that a black box is free of the constraints imposed by the internal structure and logic of the test object. However the disadvantage is that it is not always possible to run a complete test in this manner. Those tests that tested during this phase including boundary value analysis, error guessing and domain testing.

7.2 Integration Testing

After the unit testing has been completed, the project developer has to conduct integration testing in order to ensure that the interfaces among the components are well defined and integrated properly. The integration testing verifies whether all of the components are working together as described in the system design specifications.

During the integration testing, groups of units are combined into test modules and tested together (Igor, 1997). Two or more units in which either unit that use output data from or provides input data for another unit were tested in collection.

The order in which components are tested affects our choice of test cases and tools. The system is viewed as a hierarchy of components, where each component belongs to a layer of the design. In this system, the Top-down Integration approach is used where testing begins from the top and works the way down. The process is continued until all of the modules are tested.

7.3 System Testing

System Testing is the last testing procedure. It is performed to uncover its limitations, measure it capabilities and make certain that the entire system works according to users' specifications. Developers will join the users to perform this stage of testing where the system is checked against the users' requirements description.

System modification will be implemented if there is a need to change or do not met the users' requirements specifications. If the users are satisfied with the system's characteristics, the system is ready to be deployed for use. The testing result will show whether or not the entire system specifications and objectives are achieved.

7.3.1 System Test Considerations

In system testing, the behaviour of the individual functions and functional tests also involved:

- **The Event List**

All the possible triggers are exercised and the expected results compared with the actual results. Every function is tested by one or more events in the event lists.

- **Error Message Testing**

The error message, which can be generated by the system during invalid data entry are checked for spelling, appropriateness and consistence. Acknowledgement messages also will also implement the same test. It is the message that informs the user about the state of a user request process. For instance, result of SQL query and submission of data.

The overall of the result was satisfactory although some modification had to make.

- **Security testing**

In security testing, the system is tested for improper penetration and unauthorized access, to ensure that the implementation of the user login and the valid user checking procedures included in every authorized page are functioning accordingly and correctly.

The test had show that the security function is working properly.

7.4 Fundamental Tests (Product Verification Testing)

There are other tests fundamental to all software. Certain of these are difficult to measure accurately. Five of these fundamental tests are:

- **Usability**

The usability should be based in building user interfaces that have patterns already familiar to the typical user. The user then learns to use the software through pattern matching and paradigm shifts, exactly as they do in mastering any product.

- **Installability**

How easy is it for a novice to install the software correctly and easily without recourse to an expert?

- **Performance**

Performance tests are conducted to ensure that the system response time meet user expectations and does not exceed the specified performance criteria under heavy stress or volume. During these tests, response time and the transaction rate are measured, the purpose of performance tests is to test-run the performance of various functions of the software within a specified hardware configuration. The performance tests can couple this test with stress testing.

- **Reliability**

Reliability tests are conducted, according to mathematical models of software reliability, to ensure that the system can be probability of some function of the system failing within a specified time. Reliability testing is monitoring the mean time between failures. Reliability and consistency testing go hand in hand where the system behavior (inputs, outputs, response time) is measured for consistency.

In conclusion, the testing steps are shown as below.

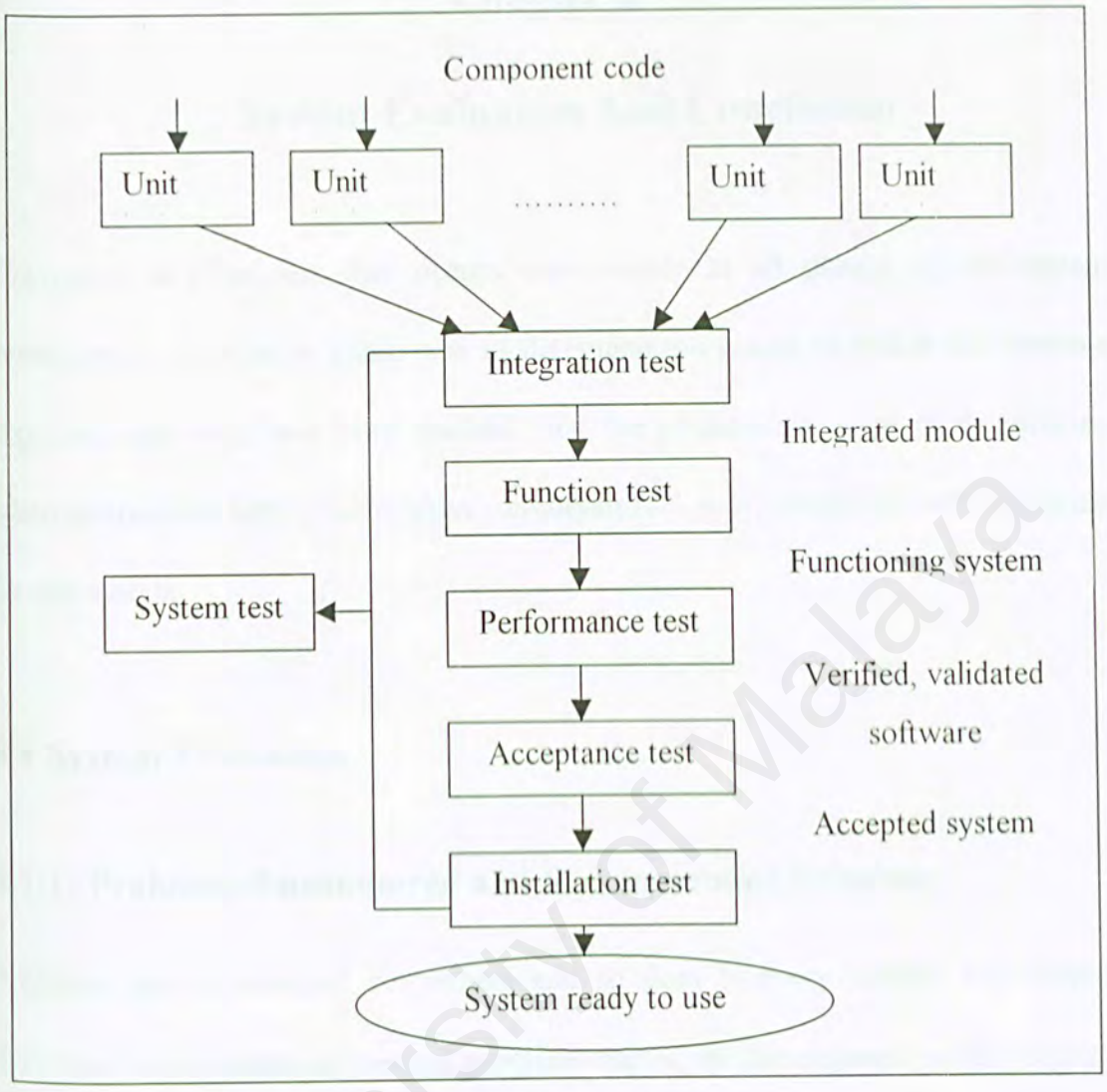


Figure 7.1 Testing Steps

7.5 SYSTEM MAINTENANCE

Usually in system development, maintenance will be conducted once the system is finished or deliverved. The maintenance services will make sure the system function properly, modify some application or add new functions to the system.

Chapter 8

System Evaluation And Conclusion

Evaluation is a process that occurs continuously at all phases of the system development. Evaluation phase was to determine the extent to which the system's expected outcomes have been realized, and the prescriptive value of the process where extraneous factors were taken consideration. Lastly, conclusion will be making for this system.

8.1 System Evaluation

8.1.1 Problems Encountered and Recommended Solutions

Problems are encountered everywhere and so does in every system. The project developer has encountered several problems during the development of this system. Those problems include:

8.1.1.1 During Analysis Phase

- **Determining Scope of the System**

Since the developer was lacking experience in developing medical knowledge related Web-based system, it was difficult for him to determine to which extent the scope of the system should be defined. However, the developer has tried to overcome this problem by having thorough analysis and studies on current similar existing systems, and various software development techniques and tools. With the efforts to dig deeper

for the required information, the developer can get a clearer picture about the problem domain of the system and its solution.

- **Difficulty in Choosing Development Technology and Tools**

There are many software tools available to develop a Web-based system. Choosing suitable technology and tools was a critical process as all tools have their own strengths and weaknesses. In addition, the availability of the required tools for development was also a major consideration. PHP, MySQL and Apache had been chosen by the developer to develop the proposed system because the integration between PHP, MySQL and Apache provides a more complete set of Web-based system features compared to the others.

8.1.1.2 During Design Phase

- **Time Constraint**

There was not enough time for the project developer to study, learn and produce the best solution for the system design during the 1st semester. Mainly, this was because the developer was lacking experience and knowledge in designing a system. Furthermore, time is needed to study and explore PHP scripting language, HTML and MySQL before having a proper plan about how to apply these technologies and languages in the system development process. Thus the best way to overcome this problem is to study the relevant approaches described in the previous year students' project documentations.

8.1.1.3 During Implementation Phase

- **No prior experience in the chosen programming language**

Since the developer has no prior knowledge of programming in PHP, there was a learning curve for him in understanding how the PHP scripting works. This new programming language and its concepts were never taught before and to implement such as application requires a fair grasp of the language. The best way of learning PHP scripting during the project development was refer to some of the PHP scripting examples which available in the PHP reference books and Internet.

- **Problems on Installation**

During implementation phase, there were a lot of problems on installing and configuring Windows 2000 Professional, PHP running environment, Apache, and MySQL before starting coding. Some of the needed software and tools were successfully installed only after a few times of formatting and reinstallation. From this experience, the developer realized that it is essential to know the sequence of products installations in order to ensure smooth execution without system errors.

8.1.1.4 During Testing Phases

- **Not fully supported by different browser**

The appearance of web pages is different on Internet Explorer 5.5 and Netscape Navigator and Communicator during the testing phase, such as different positioning of graphics, text, and tables on these web browsers. The main cause of these problems couldn't be detected.

8.1.2 System Strength

This system although does not have powerful features to some extent, but still has some strengths of its own when compared to some existing medical related Web sites.

- **Online insert and edit function**

Online Medical Knowledge FAQ Database provides online insert, update and delete functions for the authorized users. The authorized users can login to add, edit and delete information in the Discussion Board Module meanwhile the system administrator can add, edit and delete information in the Medical Knowledge FAQ module.

- **To speed up the data retrieved process.**

Each web page is designed to be lightweight. These pages loaded in a reasonable amount of time to ensure users need not wait too long to view the pages. Besides, the user can directly go to browser and search for the needed information within seconds or a minute only. Instead of, surfing page by page to find out the required information.

- **Custom password system**

A custom authentication system is created to prevent unauthorized users from viewing pages that they are not allowing to access. Users can only view and update their personal information after login their username and password. It is to avoid the unauthorized users from harming the data stored in database.

- **User-friendly interfaces**

Online Medical Knowledge FAQ Database could be evaluated as a simple and easy use application. It provides instructive graphical based interface for the user to have the control of the system flow and deal with it by using buttons, select list and hyperlinks. Therefore the user-friendly interfaces could shorten the learning curves, reduce training costs and save the times of the users.

- **System Transparency**

Online Medical Knowledge FAQ Database system hides the underlying complexity of Database Management System from the end users. Users do not need to know where the database resides, how the system is structured, how to retrieve from or insert records into the database. They are just need to know how to communicate with the user interface..

- **Search function**

Usually, people with no experience in medical field will expect a search engine on the main page when they are looking for something which they are not sure about. Online Medical Knowledge FAQ Database system provides a search method for the users to look for the required information. Users can search the related medical materials according to the topics of common heath issues.

- **Reliable system with effective errors handling**

Input of the users will be validated and verified to prevent the errors caused by invalid input. If there is any error or invalid input occurred, an error message is generated and

displayed to inform the user about the error. For example re-enter username and password will be prompt out when users input the invalid username or password.

8.1.3 System Limitations

Despite some of the system strengths mentioned previously, the system has some limitations, which cannot be researched and developed due to time constraint and the lack of resources.

Those limitations are:

- **Not fully supported by different browser**

Online Medical Knowledge FAQ Database system is being developed using the Internet Explorer 5.5. Therefore, this has make some of the features or function may not being support, look differently or not performed well by using lower version of Internet Explorer or using other browser.

- **Not secure enough**

All the information in Online Medical Knowledge FAQ Database system is not secure enough although login is required before users can enter the system. This because it is not being encrypted. The entire data or information are only stored in plain text format. Therefore, the secrecy or integrity threats still exist.

- **Not support multiple languages**

The current developing system is only limited to the mixture of two languages (Malay and English). This is due to the time limitation. But it still can be enhanced

to support more languages in order to fulfill the requirements of users from multiethnic society.

8.1.4 Future Enhancement

Further development and many new ideas have come about while the system was being implemented. Owing to time constraint and other factors, not all of the ideas could be incorporated into the system. It is hoped that the following aspects could be considered in future:

- **Encryption and decryption of password.**

Password should be encrypted before store in database and decrypted during password retrieval process.

- **Support other browsers.**

Currently, this system requires Microsoft Internet Explorer 4.0 and above for execution. In future, it can be tuned to fulfill other browser requirements such as Netscape for execution.

- **Add in "Latest News" feature.**

The "Latest News" feature can be added in to provide the latest information regarding the medical issues. It can save time for the users who are seeking for the newest information.

- **Support multiple languages**

This system can be enhanced to provide more language versions such as English, Malay and Mandarin to fulfill the requirements of users from multiethnic society.

8.2 Project Conclusion

Online Medical Knowledge FAQ Database has achieved most of the objectives and requirements which being defined during the analysis phase. However, the completion time of the system was delayed due to the inexperience of the project developer.

Throughout this project, the project developer has exposed to a lot of invaluable knowledge and experience. During the period of system development, the developer has learned much knowledge regarding PHP programming, JavaScript and HTML, the way to establish database connection and also the way to set up Apache Web server. Besides that, skills in using software such as Macromedia Dreamweaver, Microsoft FrontPage 2000 and Adobe Photoshop also have been acquired.

During the project development, the developer managed to integrate practice with theory that learnt from various subjects in Computer Science course. This project has provided good chances for the developer to experience using the method, techniques, paradigms, and approaches that learned from System Analysis & Design and Software Engineering subjects in the second year and third year study respectively.

As a conclusion, the invaluable experience and knowledge gained by the project developer from the final year project will be very beneficial for him in preparing himself for the future working environment.

REFERENCES

1. Bahrami, A. (1999). *Object Oriented System Development-using the unified modeling language*. Irwin McGraw-Hill.

2. Damon H., Aaron T. (2001). *Core JSP* New Jersey: Prentice Hall.

3. Deitel, H. M., Deitel, P. J. & Nieto, T. R. (2002). *Internet & World Wide Web: How To Program*, 2nd ed. Prentice Hall.

4. Devguru. (2001). *DevGuru HTML Quick Reference.* Available at: http://www.devguru.com/Technologies/html/quickref/html_intro.html (Access date: 11-8-2002)

5. Hall, M. (2000) *Core servlets and java server pages.* New Jersey: Prentice Hall.

5. Jarvis, A. & Crandall, V. (1997). *Inroads to Software Quality: "How to" Guide and Toolkit*. New Jersey: Prentice Hall.

6. Igor, H. (1997). *Introduction to System Analysis and Design*, 4th ed. Australia: Prentice Hall.

7. Karl, A., Danny A., Timothy, B. & Carl, B. (2000) *Professional JSP*. 1st ed. UK: Wrox Press Ltd.

8. Kendall, K.E., Kendall, J.E. (1999). *System analysis and design*. 4th ed. United States of America: Prentice Hall.

9. Loudon, K.C, Loudon J.P (2001). *Management Information Systems*. 4th ed. Prentice Hall.

10. Mitchell, S., Atkinson, J (2000). *Teaching yourself Active Server Pages 3.0 in 21 Days*. Sams Publishing.

11. Post, G.V. (1999) *Database management systems: designing and building business applications*. Singapore: McGraw-Hill.

12. Pfleeger, S. L. (2001). *Software Engineering - Theory and Pratice*, 2nded. Prentice Hall International Inc.

13. Scott, K. (2001). *UML Explained.* Addison-Wesley.

14. Sellappan, P. (1999) *Access 2000* 1st ed. Selangor: Federal Publication.

15. Sellappan, P. (2000). *Software Engineering Management and Methods*. Petaling Jaya: Sejana Publishing.

16. Zend.com. (2002). *What is PHP?* Available at: http://www.zend.com/zend/aboutphp.php (Access date: 12-8-2002)

BIBLIOGRAPHY

1. Elmasri, R., Navathe, S. B. (2000). *Fundamentals of Database Systems*. 3rd ed. Addison-Wesley.

2. Jarvis, A. & Crandall, V. (1997). *Inroads to Software Quality: "How to" Guide and Toolkit*. New Jersey: Prentice Hall.