Wellness Portal:

E-mailing and Charting Module

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ABSTRACT

Wellness Portal is a web based wellness center developed for use of all walks of life from birth to senior citizen. **Wellness Portal** is designed to create an information rich environment of wellness resources, that is accessible and available. The users of the portal are categorized into 3 main groups: Normal Members, Advanced Members and Wellness Administrators.

The **Wellness Portal** includes 5 modules that are Medical Screening, Exercise, Stress Management, Nutrition and Safety. They were divided into 5 age groups, Peadiatric, Adolescent, Young Adult, Prime Of Life and Golden Age. The Medical Screening is currently available for women in the age group of 40-60 years old. The members and wellness administrators need to logon to the system before using the portal

Wellness Portal is developed using Microsoft Active Server Pages. NET (ASP.NET). The others development tools include Microsoft SQL Server 2000 with ADO.NET data access technology. We are using their-tier architecture in developing the portal. The browsers that support VBscript and JavaScript such as Internet Explorer 6.0 can support the **Wellness Portal**.

Wellness Portal is expected to have security checking for authorized user, develop databases to keep all the records and creation of interactive homepages to deploy information to users. Wellness administrators will be maintaining the portal by tracking all activities in the portal.

ACKNOWLEDGEMENT

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

First of all, I would like to take this opportunity to express my gratitude to my respected supervisor Mr. Ang Tan Fong, moderator Dr.Selvanathan Narainasamy, for their guidance, invaluable advice and supervision throughout the project. Without their patience in guiding me, I certainly would not able to complete my project.

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Special thanks to Mr. Leong Khai Chow, Ms. Tan Sin Chee, Mr. Ong Kiah Wah and fellow course mates for sharing their knowledge and their support through the completion of this project.

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CHAPTER 1: INTRODUCTION

1.1 What is a Public Portal?

Public portals, such as Web search engines and corporate portals that facilitate access to enterprise information within a company through the Web have been available for the last few years. Such portals are made up of "channels" of information and the purpose of a portal is to provide an interface that presents an organized view of the data to which the user has access.

1.2 What is Wellness?

Wellness involves 8 facet of life, the social dimensions, physical dimensions, spiritual, emotional, nutritional, intellectual, occupational and environmental. A wellness lifestyle helps us lead a balanced life and gives a sense of purpose, inner peace, satisfaction, and the chance to see ourselves for the wonderful individual that we are. Wellness is further defined as a framework that can be used in many ways to help in organizing, understanding, and balancing human growth and development.

1.3 Project Introduction

Although wellness is seen as the way of life and greatly promoted by the Ministry of Health as the best measure in containing costs of health care, there is a lack of provision of wellness program that are affordable and accessible.

Thus this project—Wellness Portal aims to provide promotive and preventive service to its members for improvement in quality life and reduction in healthcare cost. This project will benefit all Malaysian, from birth to senior citizen. Wellness packages will be developed with a view of commercialization of a successful formula that will reduce overall health care cost. The package will be design according to gender and age group.

Wellness Portal is a self financed (with appropriate government support) and workable program that provides the public with extremely useful and most updated information on wellness with relation to age related medical screening, food supplementation, exercise program, stress management program, nutrition and safety advice.

A wellness center will be set up, public are encourage to participate in the wellness package. Registration can be done in wellness center. Members of the program will enjoy privilege such as database for personal medical screening result, exercise modules, stress management modules and such. This will be further discussed in the later chapter.

1.4 Project Structure

Wellness Portal is one part of the University Malaya Medical Center (UMMC) wellness project. The Wellness Portal is developed by Mr. Mah Choon Haw, Ms. Yeoh Sun Loo and I Jaime Chia Wai Ling as a final year thesis, under Mr. Ang Tan Fong supervision and moderated by Dr. Selvaranan from Faculty of Computer Science and Information Technology of University Malaya. Dr. George from UMMC acts as a co-coordinator for this project.

Three of us were in charged in different modules, where Mr. Mah Choon How is in charge in creating generic templates for uploading articles and news to the portal and generic form to input medical test according to different age group and gender.

Ms. Yeoh Sun Loo is in charge in creating the system's login and logout module which the user can personalize the portal according to their preferences. She also in charge in creating the system's alerting modules which list out the due date of members' medical screening due date that will be follow up by the wellness administrator.

I am in charge in creating the system's E-mailing module that enable the member to send queries to wellness center through e-mail. The module is able to keep a copy of each e-mail receive and sent. I also responsible in creating the system's charting module, which can auto generate graphs according to member's medical records.

1.5 Project Objective

The main objective of this project is to develop a Wellness Portal that:

a) To develop and test a wellness portal that are specific to the needs of 5 groups of populations which include pediatric, adolescent, young adult, prime of life, golden age

b) To provide wellness information and services to different category of members who are interested but not necessarily followed-up with regard to wellness module.

The specific objective of the project's E-mailing and Charting Module are:

a) Enable normal member and advanced member to send queries to the Wellness Center.

- Members are able to send mail to the center using their own e-mail account.
- System will able to save a copy of the incoming e-mail.

b) Enable wellness administrator to view and answer member's queries

- Wellness administrator will be logged when he read and answer member's e-mail.
- System will able to save a copy of outgoing e-mail.

c) System able to generate bar charts, line graphs and pie charts that shows the progress of member's medical records.

- Able to generate interactive chart according to member's preferences and medical records

1.6 Project Scope

i. The wellness portal is targeted to all age group of users. These users are divided into 5 age group:
   - Paedatric (0 years -13 years)
   - Adolescents (13 years – 20 years)
   - Young Adults (20 years – 40 years)
   - Prime of Life (40 years – 60 years)
   - Senior Citizen (60 years and above)

ii. The Portal will provide wellness information in 5 general modules that include medical screening, exercise, stress management, nutrition and safety.

iii. The Portal will be developed in English Language only

iv. The medical screening tests suggested in the Portal are meant for general situation and are not customized into personal medical condition.

1.7 Project Limitation

i. **Lack of medical knowledge**

This project is closely related to the field of medicine, considering the developers of this portal are all Information Technology students it is obvious that the developers do not have knowledge related to the medical fields and its practice in detail. Furthermore, there are many medical terms and jargons that are commonly used in medical field are virtually unheard of prior to this and thus have to rely on encyclopedia and Internet for help. All this will limit the developer's thorough understandings of the topics.

ii. Computer languages

For the development and coding of this Portal, the developers have agreed to use ASP.NET (Active Server Page) as the development tools. This is a relatively new programming language and has yet to be taught in the lectures in university. There are also less resources regarding to ASP.NET available as compared to other computer language. In the coding stage of this project, this lack of programming experience using the language could limit the developer's ability to code the system.

iii. Computer Hardware consideration

This project requires the use of computer that could function server and client respectively. This computer should have substantial processing speed, and also large storage capacity. However the computer that developers have at home are not able to handle such task. Therefore, the developers will need to make full use of the facility provided in the faculty for setting up, configure and coding of the system. The usage of computer is limited to the hours when lab is open. This could potentially limit the developer's flexibility in coding at any time deemed suitable.

CHAPTER 2: LITERATURE REVIEW

2.1 Definition Of Literature Review

A literature review summarizes, interprets and evaluates existing "literature" (or published material) in order to establish current knowledge of a subject. The purpose for doing so relates to ongoing research to develop that knowledge: the literature review may resolve a controversy, establish the need for additional research, and/or define a topic of inquiry.

2.2 Purpose Of Literature Review

The purpose of literature review is to establish current knowledge on an issue. Besides, the main purpose of the literature review is to guide students or researchers to use the best way to access and analysis information and synthesize and evaluate it according to the guiding concept. It helps students to develop their information seeking and critical appraisal skill.

2.3 Information Collection Techniques

It is necessary to collect information from various sources to seek further understanding for this new system. The information collected assist in the system analysis and requirement sections. Several techniques have been adopted in order to elicit all of the information required such as Internet surfing, referring to printed documents, analyzing pass year thesis, software testing and conducting discussions with friends and lecturers.

2.3.1 Internet Surfing

Internet surfing is the major source due to its high speed and up-to-date information. Therefore, Internet is the main source for information seeking. Majority online Wellness Portal system are found through this technique. Besides, relevant information on web application, client-server and programming tools are been obtained.

2.3.2 Referring to Printed Documents

Reference books especially on methodology and system design can be found from the library. These book provide sufficient information to gain a better understanding about the concept of choosing the right methodology and system design.

2.3.3 Analyzing Pass year Thesis

Several pass year thesis documentation have been studied in order to identify any potential mistakes and to gain some skills on software development.

2.3.4 Software Testing

Relevant software and web development tools have been tested out to evaluate their suitability for the development of this system.

2.3.5 Conducting Discussions With Friends and Lecturers

Useful advises have been given for each section meeting conduct with my supervisor. It is very useful as is acts as a reminder when carrying out the system development process and also useful for error correctness.

2.4 Current System

2.4.1 Fitday Online Fitness Center

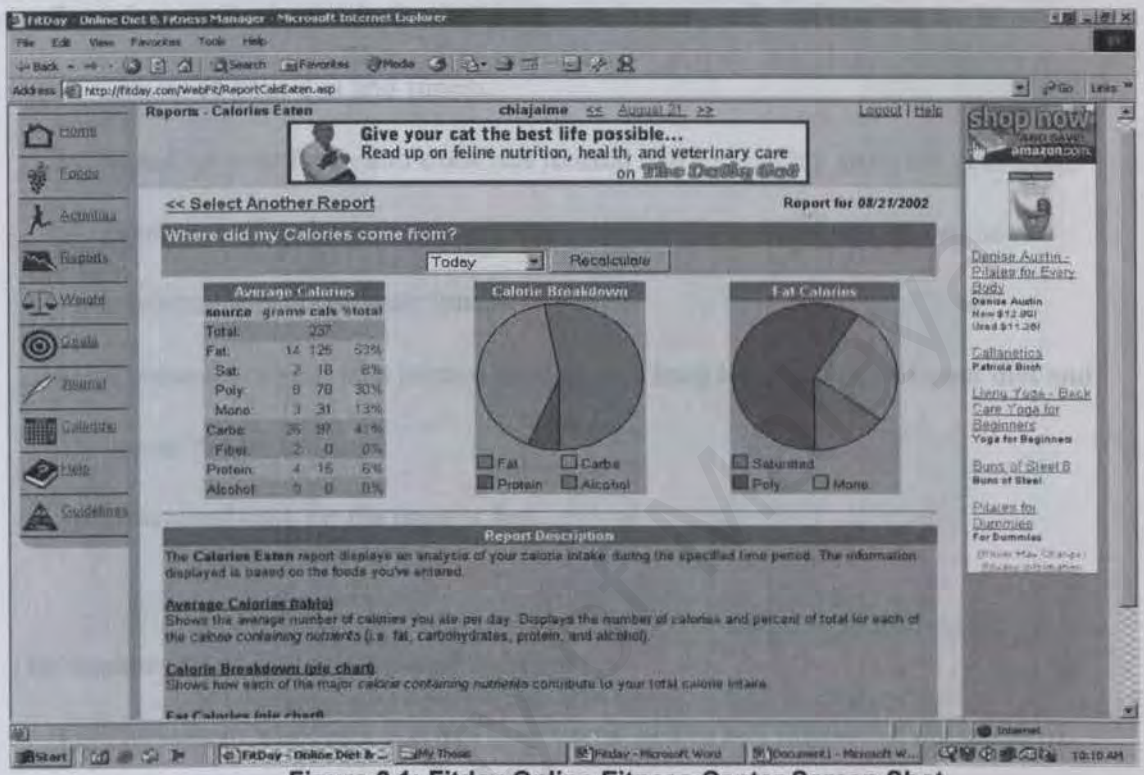


Figure 2.1: Fitday Online Fitness Center Screen Shot

Date Accessed: 15 July 2002

URL: http://www.fitday.com

This portal focuses only on the 'Fitness' of its members. Rather than providing a vast range of medical information, this portal furnishes members with a wide variety of health tools.

This system able to track their users' foods, exercises, weight loss, and goals online. FitDay provides their members with the feedback and analysis their need to stay on track towards their diet and fitness goals.

The strengths of Fitday are stated as below:

1) It is user friendly as it is simple and easy to use system.
2) It is a totally free web site designed to help you track and analyze the important aspects of your diet and fitness.
3) Based on your foods and exercises journal entries, FitDay analyzes your diet, exercise, and weight; the system can generate 7 graphical reports on the important aspects of your fitness.
4) It remembers your past journal entries, so a long term analysis of your diet and fitness can be track.
5) Download time for the page is fast.

The weaknesses of Fitday are stated as below:

1) The system work as a diary to keep users' health and fitness but not much of information about health and fitness provided.
2) The system target users are US residents because all the information provided are in US lifestyle.
3) The terms used in the system are not a layman term so a user without medical knowledge will find difficult to understand and use the system.
4) Users not able to customized and personalized the site according to their preferences.
5) System only compared the recommended allowance with user intake but not provide any alerting of over eaten and over exercises.
6) The system is not well organized; too many things were put in one page, this make the page look untidy.

2.4.2 MayHospi Online Medical Center

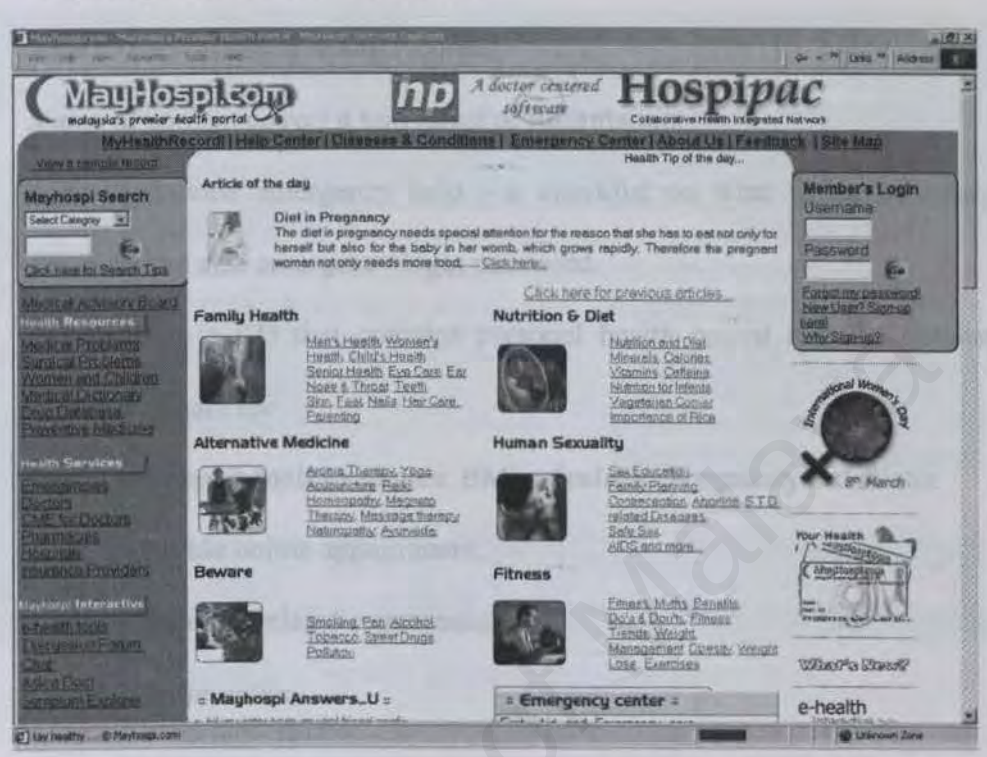


Figure 2.2: MayHospi Online Medical Center Screen Shot

Date Accessed: 15 July 2002

URL : http://www.mayhospi.com

MayHospi is a fully Malaysian portal that targets Malaysian as its main users. It provides health management services such as keeping personal medical records, e-health tools, emergency center and simple diagnostic tools. The wide range of content covers family health, exercise and fitness, nutrition, human sexuality, health issue, alternative medication and others. MayHospi also provide interactive communication such as emailing, on-line forum.

The strengths of Mayhospi are stated as below:

1. Able to keep multiple health records.
2. Scope of content covers a vast range of information.
3. Able to provide emergency help – a checklist on what to do in emergency situation and also emergency login password.
4. Totally free, a CD that contains personal health record may be obtained by paying a certain fee
5. Provides e-health tools examples: BMI calculator, Pregnancy Calculator.
6. Able to provide online appointment.
7. Links to different related organization.
8. Certified Information.

The weaknesses of MayHospi are stated as below:

1. Not able to customized according to user preference.
2. Do not provides a list of medical screening tests.
3. Terminology used in the portal is hard to understand for non-medical professionals.
4. Do not able to present user's records in graphical presentation.
5. Do not alert user on due date for screening tests.
6. Less interactive, mainly text presentation.
7. Do not cover stress management.
8. Not user friendly.

2.4.3 WebMD Online Health Care

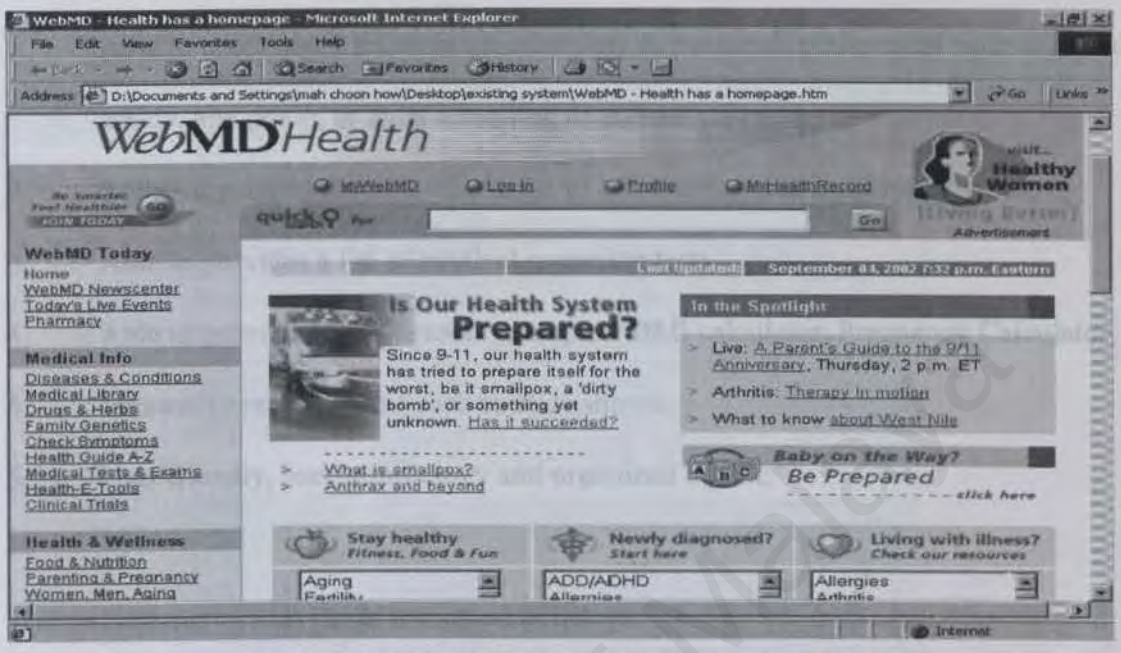


Figure 2.3: WebMD Online Health Care Screen Shot

Date accessed : 05.09.2002

URL : http://my.webmd.com

Web MD is a portal that has similar functions as in Mayhospi. However, Mayhospi targets on local users whereas Web MD targets users are more universal.

Similar to the Mayhospi portal, Web MD provides personal health record management in the portal; information on dietary, nutrition, fitness, stress and exercise; calculators and various latest issue of the healthcare industry.

Another significant difference is that Web MD provides database on medical subjects, drugs and also symptoms.

The strength of WedMD are stated as below:

1. Able to customized information according to personals preferences such as news, article, age group, or even according to disease.
2. Scope of content covers a vast range of information that includes genetics.
3. Able to provides a list of medical screening tests.
4. Able to provides e-health tools examples: BMI calculator, Pregnancy Calculator.
5. Interactive presentations such as slide shows.
6. User friendly, less terminology and organized layout.

The weaknesses of MayHospi are stated as below:

1. Not able to keep multiple health records so the user cannot compare their current records and history records.
2. Do not able to present user's records in graphical presentation.
3. Do not alert user on due date for screening tests.

2.4.4 Planet Wellness Portal

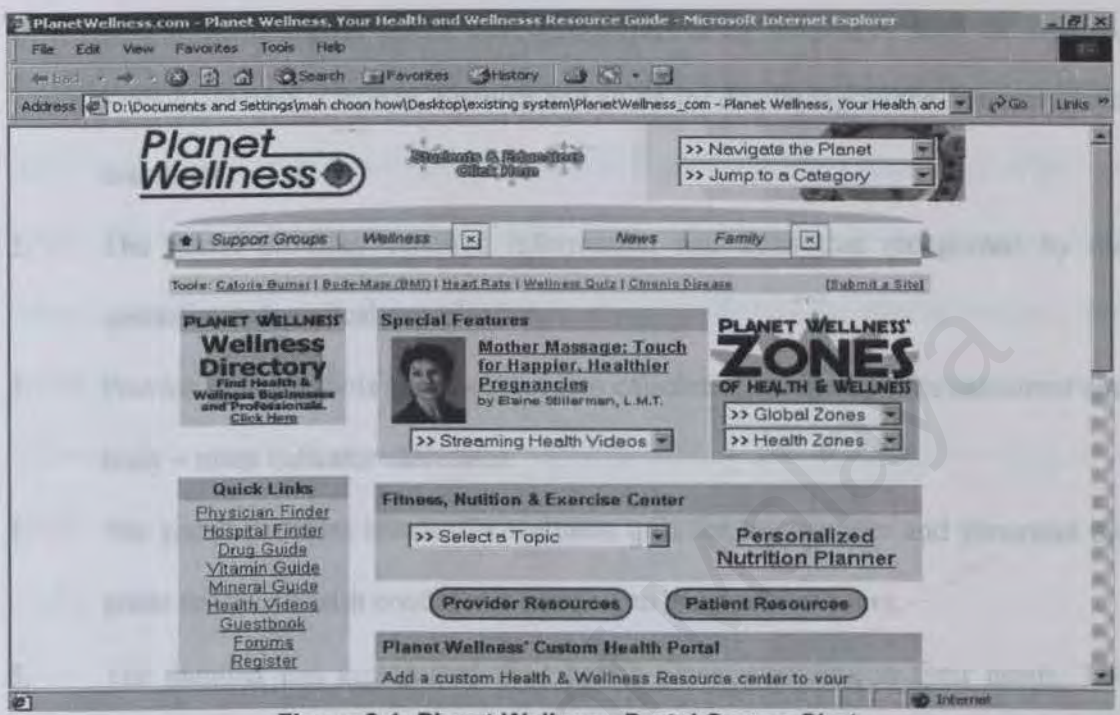


Figure 2.4: Planet Wellness Portal Screen Shot

Date accessed : 05.09.2002

URL : http://www.planetwellness.com

Planet wellness is one of the wellness portals that keep track of member's health by monitoring their diets, nutrition intake and provide special recipe for special needs, such as recipes for diabetic patient. Other than that, other services such as exercise routine plan, online coaching and support are also provided. Members can choose to be follow up by paying USD $49.90 per 3 months.

The Strengths of Planet Wellness are stated as below:

1. It is a Multi-lingual portal that support up to 25 languages such as English, French, Russian, Chinese, Spanish and so on for displaying all the information in the portal.
2. The portal provides certified information and links that recognized by the specialist and medical organization.
3. Provide e-health tools such as heart rate calculator, calorie burners calculator and body – mass indicator calculator.
4. The portal provides interactive wellness quiz for the member and generates the grade for their health condition according to their quiz answers.
5. The member can customized their health plans according to their needs. The health plans includes nutrition analysis, personalized recipes, meal plan, fast food options, shopping list and exercise routine, online coaching and so on.

The weaknesses of Planet Wellness are stated as below:

1. It is expensive because the member needs to pay USD$49.90 (≈RM 200.00) to enjoy the custom Health Portal Plans. It considered very expensive to Malaysian to join this service.
2. Not able to present member's record in graphical presentation.
3. Not able to alert member's on due date of screening/medical tests.
4. Do not cover stress module.
5. Not able to customized according to user's preference.

2.5 Consideration of Client/Server Architecture

2.5.1 Client/Server Architecture Introduction

The term client/server was first used in the 1980s in reference to personal computers (PCs) on a network. The actual client/server model started gaining acceptance in the late 1980s. The client/server software architecture is a versatile, message-based and modular infrastructure that is intended to improve usability, flexibility, interoperability, and scalability as compared to centralized, mainframe, time-sharing computing. A client is defined as a requester of services and a server is defined as the provider of services. A single machine can be both a client and a server depending on the software configuration.

As result of the limitations of file sharing architecture, the client/server architecture emerged. This approach introduced a database server to replace the file server. Using a relation database management system (DBMS), user queries could be answered directly. The client/server architecture reduced network traffic by providing a query response rather than total file transfer. It improves multi-user updating through a graphic user interface (GUI) front end to a shared database. In client/server architecture, Remote Procedure Calls (RPCs) or standard query language (SQL) statements are typically used to communicate between the client and server. Examples of client/server architectures are two-tier and three-tier architectures.

2.5.2 Two-tier Architecture

With two-tier client/server architectures, the user system interface is located in the user's desktop environment and the database management services are in a server that services many clients. Processing Management is split between the user system interface environment and the database management server environment (as depicted in Figure 2.5). The database management server provides stored procedures and triggers.

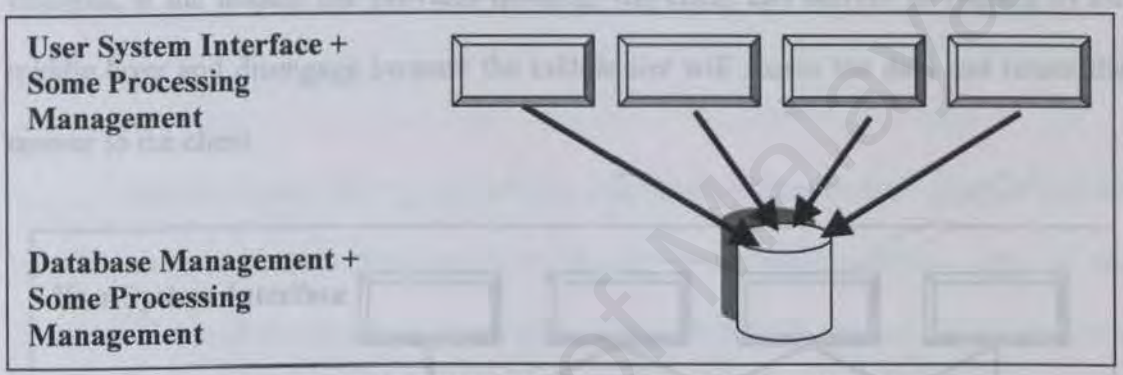


Figure 2.5: Two-tier Client/Server Architecture Design

The two-tier client/server architecture is a good solution for distributed computing when work group are defined as a dozen to 100 people interacting on a LAN simultaneously. It does have a number of limitations. When the number of users exceeds 100, performance begins to deteriorate. This limitation is a result of the server maintaining a connection via "keep alive" messages with each client, even when no work is being done. A second limitation of the two-tier architectures is that implementation of processing management services using vendor proprietary database procedures restricts flexibility and choice of DBMS for application. Finally, current implementations of the two-tier architectures provide limited flexibility in moving (repartitioning) program functionality from one server to another without manually regenerating procedural code.

2.5.3 Three-tier Architecture

In the three-tier client/server architectures, a middle tier was added between the user system interface client environment and the database management server environment (as shown in Figure 2.6) There are a variety of ways of implementing this middle tier, such as transaction processing monitors, message server, or application servers. The middle tier can perform queuing, application executing, and database staging. For example, if the middle tier provides queuing, the client can deliver its request to the middle layer and disengage because the middle tier will access the data and return the answer to the client

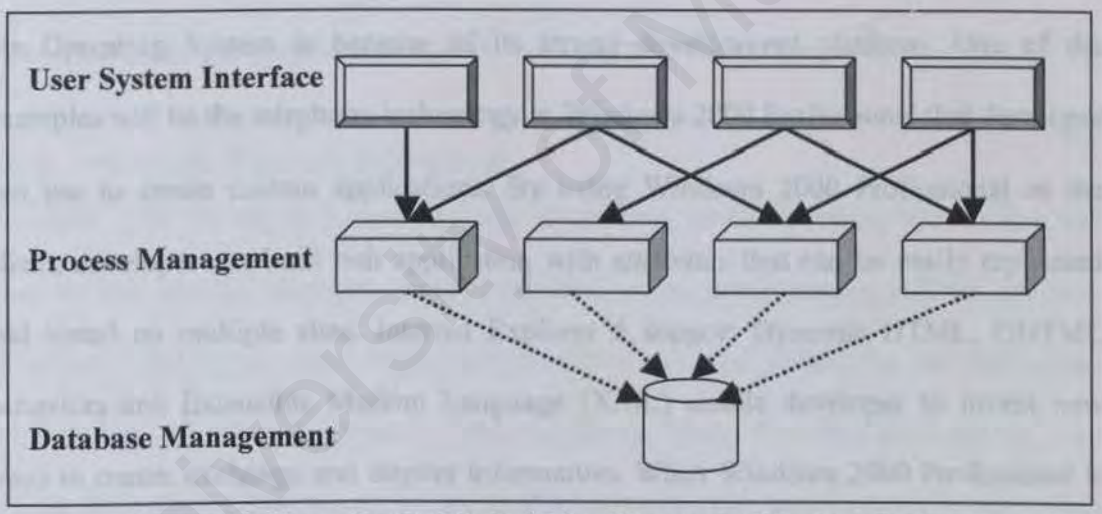


Figure 2.6: Three-tier Distributed Client/Server Architecture Design

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

2.6 Consideration of Operating System

2.6.1 Window 2000 Professional

Microsoft Window 2000 Professional was built on Windows NT technology with the user-friendly user interface. It can be used for running software applications, connect to Internet and intranet sites, and access files, printers, and network resources. Furthermore, it is the windows operating system for both business laptop and desktop system. Microsoft Window 2000 Professional is known for its flexibility, manageability, reliability and its web capabilities.

The main reason of why considering Microsoft Windows 2000 Professional as the Operating System is because of its strong development platform. One of the examples will be the telephony technology in Windows 2000 Professional that developer can use to create custom applications. By using Windows 2000 Professional as the client, developer can built rich application with attributes that can be easily replicated and tested on multiple sites. Internet Explorer 5 support Dynamic HTML, DHTML behaviors and Extensible Markup Language (XML) enable developer to invent new ways to create, exchange and display information. When Windows 2000 Professional is combined with the integrated Web and communication services built into Windows 2000 Server, developers can create highly scalable, end-to-end e-commerce and line-of-business solutions.

Others features provided by Microsoft Windows 2000 Professional includes new peripheral support that extends notebook capabilities, modifications to the operating system core to prevent crashes and the ability for the operating system to repair itself, comprehensive security features to protect sensitive business data, both locally on

desktop computer and as it is transmitted over local area network, phone lines, or the Internet. With its support for Internet-standard security features such as IP Security, Layer 2 Tunneling Protocol, and Virtual Private Networking it is so secure that many banks and organization choose to use it. Windows 2000 Professional is easier to deploy, manage, and support. Centralized management utilities, troubleshooting tools, and support for self-healing applications.

When Windows 2000 Professional is used in conjunction with Windows 2000 Server, developer can take advantage of IntelliMirror technologies. By storing important information and desktop setting on a central computer, IntelliMirror lets developer work on any computer attached to the network as if they are at their own desk.

2.6.2 Microsoft Windows 2000 Server

Windows 2000 Server is a multipurpose, entry-level server operating system that can used to provide the network users with files, print, application, or Web services. Windows 2000 Server provides a well-integrated package containing the application development environment, security, and scalability. With Windows 2000 Server, user get all the usability features of Windows 2000 professional, plus support for up to two multiprocessors for new installations and up to four multiprocessors when they upgrade for windows NT 4.0

As the server operating system built for the Business Internet Windows 2000 server lets user:

a) Use the Web to securely connect employees, customers and suppliers, anywhere in the world.

b) Share select information without compromising confidential data.

c) Expand the network environment as the application need evolve.

d) Internet-enable business with essential technologies woven throughout the operating system.

e) Cut costs with improved management systems for networks, servers and Windows desktops.

f) Taking advantage of new hardware with broad support for existing and emerging hardware and communication products.

Windows 2000 Server provides comprehensive, standard-based security services, including flexible authentication, data encryption, flexible and secure network access, protection of virtual private networks (VPNs) using core Internet Standards such IP security (IPSec), secure transaction processing and security extensions for the development platform such as the Crypto API.

Windows 2000 Server also introduces new technologies that let user build richer Web applications and solutions, such as the next generation of the Microsoft Component Object Model, COM+. Developers using COM+ find it much easer to create and use software components and benefit from a runtime environment and services that are easily used for any programming language or tool.

Windows 2000 Server also includes integrated support for streaming media, which allows organizations to develop and distribute real-time presentations and rich multimedia content to both internal and external audiences. Imagine being able to send full screen video to your users' desktops on demand, while providing CD-quality audio, and great integration with other application software.

2.6.3 Microsoft Window XP Professional

Windows XP Professional delivers new standard in reliability and performance of the Windows operating system. It provides efficient and dependable computing experience. Windows XP Professional is built on Windows 2000 and Windows NT workstation core software code, known as the NT Kernel. It is more powerful, secure and stable than the previous version of windows operating system.

Some of the significant advantages of Windows XP Professionals over the other operating systems include:

- **Superior Operating System Technology**

Including preemptive multitasking, fault tolerance, and system memory protections, which all work to prevent as well as resolve problems, and to keep system running smoothly.

- **Ability To Recover Work**

The ability to recover work in many cases, if program crashes before work can be saved.

- **System Memory Protection**

Help to prevent poorly written software from making computer unstable.

Additionally, the performance of XP professionals has certainly increase drastically as compare to the earlier version of Windows. It even meets the performance of Windows 2000 on the commercial benchmarks. It can easily resume from hibernate/stand by mode within seconds, perform several tasks at a time and many others aspect of performance. It is most well known for its stability.

The security of Windows XP Professional is also a value-added feature to all its users. It enhanced virus protection and latest security standards has help user to prevent most of the common type of Internet attack. Plus, it enables user to protect sensitive data on their computer as well as when transmitting over networks.

Windows XP Professional impressed user with a totally fresh new look of windows operating system. It is user friendly and meets the requirements of user interface under Human - Computer Interaction. With this feature, user will be able to manage their computer more efficiently and effectively.

2.7 Consideration of Programming Languages

2.7.1 Java Server Pages (JSP)

Java Server Pages (JSP) technology allows web developers and designers to rapidly develop and easily maintain, information rich, dynamic web pages that leverage existing business systems. As part of the Java family, JSP technology enables rapid development of web-based application that are platform independent. JSP technology separates the user interface from content generation enabling designers to change the overall page layout without altering the underlying dynamic content.

JSP technology uses XML-like tags and scriptlets written in the Java programming language to encapsulate the logic that generates the content for the page. Additionally, the application logic can reside in server-based resources (such as JavaBeans component architecture) that the page accesses with these tags and scriptlets. Any and all formatting (HTML or XML) tags are passed directly back to the response page. By separating the page logic from its design and display and supporting a reusable component-based design, JSP technology makes it faster and easier to build web-based application.

JSP technology is an extension of the Java Servlet technology. Servlet are platform-independent, 100% pure Java server-side modules that fit seamlessly into a web server framework and can be used to extend the capabilities of a web server with minimal overhead, maintenance, and support. Unlike other scripting languages, servlet involve no platform-specific consideration or modifications.

The JSP specification is the product of industry-wide collaboration with industry leaders in the enterprise software and tools markets, led by Sun Microsystems. Sun has made the JSP specification freely available to the development community, with the goal that every web server and application server will support the JSP interface. JSP pages share the "Write Once, Run Anywhere" characteristics of Java technology.

2.7.2 Active Server Pages (ASP)

Active Server Pages are Microsoft's solution to creating dynamic Web pages. ASP pages are scripts or short snippets of code interpreted by the Web server to perform a particular task. ASP pages contain two parts: programmatic code and embedded HTML. The programmatic code can be written in a number of scripting languages such as VBScript and Jscript.

ASP provides the ability to deliver more than just HTML. It also enables delivering of client-server scripting, web controls and server-side processing and connectivity features. ASP scripts are capable of delivering client-side script, such as JavaScript, to be executed on the client's browser. In addition, ASP also delivers a wide range of web functionality by acting as a transfer vehicle for ActiveX controls, Java applets and other Web components. Furthermore, ASP does not only produce dynamic HTML depending on the clients' requests, but also provides the capability to tap into existing systems such as databases, document retrieval services, mail services, mail service, GroupWare servers and other COM-based information servers.

ASP is implemented as an Internet Server Application Programming Interface (ISAPI) filter running under Internet Information Server (IIS). Whenever a Web client

makes a HTTP request of a Web Server, the Active Server ISAPI filter gets a chance to intercept the request. If the request is for a .asp file, the ASP server takes over from IIS, parses the entire file from top to bottom, processes the server script(s) and returns an HTML output file to IIS. IIS will then return this data stream to the requesting Web client.

2.7.3 ASP.NET

ASP.NET is a programming framework built on the common language runtime that can be used on a server to build powerful Web applications. ASP.NET offers several important advantages over previous Web development models:

- **Enhanced Performance**

  ASP.NET is compiled common language runtime code running on the server. Unlike its interpreted predecessors, ASP.NET can take advantage of early binding, just-in-time compilation, native optimization, and caching services right out of the box. This amounts to dramatically better performance before you ever write a line of code.

- **World – class Tool Support**

  The ASP.NET framework is complemented by a rich toolbox and designer in the Visual Studio integrated development environment. WYSIWYG editing, drag-and-drop server controls, and automatic deployment are just a few of the features this powerful tool provides.

- **Power and Flexibility**

  Because ASP.NET is based on the common language runtime, the power and flexibility of that entire platform is available to Web application developers. The

.NET Framework class library, Messaging, and Data Access solutions are all seamlessly accessible from the Web. ASP.NET is also language-independent, so you can choose the language that best applies to your application or partition your application across many languages. Further, common language runtime interoperability guarantees that your existing investment in COM-based development is preserved when migrating to ASP.NET.

- **Simplicity**

  ASP.NET makes it easy to perform common tasks, from simple form submission and client authentication to deployment and site configuration. Additionally, the common language runtime simplifies development, with managed code services such as automatic reference counting and garbage collection.

- **Manageability**

  ASP.NET employs a text-based, hierarchical configuration system, which simplifies applying settings to your server environment and Web applications. Because configuration information is stored as plain text, new settings may be applied without the aid of local administration tools. This "zero local administration" philosophy extends to deploying ASP.NET Framework applications as well. An ASP.NET Framework application is deployed to a server simply by copying the necessary files to the server. No server restart is required, even to deploy or replace running compiled code.

❖ **Scalability and Availability**

ASP.NET has been designed with scalability in mind, with features specifically tailored to improve performance in clustered and multiprocessor environments. Further, processes are closely monitored and managed by the ASP.NET runtime, so that if one misbehaves (leaks, deadlocks), a new process can be created in its place, which helps keep the application constantly available to handle requests.

❖ **Customizability and Extensibility**

ASP.NET delivers a well-factored architecture that allows developers to "plug-in" their code at the appropriate level. In fact, it is possible to extend or replace any subcomponent of the ASP.NET runtime with your own custom-written component. Implementing custom authentication or state services has never been easier.

❖ **Security**

With built in Windows authentication and per-application configuration, you can be assured that your applications are secure.

2.7.4 Comparisons of JSP, ASP and ASP.NET

Table below shown the comparisons of JSP, ASP and ASP. NET:

Table 2.1: Comparison of JSP, ASP and ASP.NET

	JSP	ASP	ASP.NET
Language in Page	Java	VBScript, JScript	Multiple Languages
OS Platform	Unix, Microsoft Windows, MacOS, Linux	Windows 9X, NT, other platforms requires third-party ASP porting products	Windows 9X, NT, other platforms requires third-party ASP porting products
Supported Web server	Any Web server, including Apache, Netscape and IIS	IIS, Personal Web Server(PWS), other servers with third-party products	IIS, Personal Web Server (PWS), other servers with third-party products
Supported database	Any ODBC and JDBC compliant database	Any ODBC compliant database	Any ODBC and JDBC compliant database
Portability	Good	Fair	Good
Scalability	Good	Good	Good
Component support	JavaBeans, Enterprise JavaBeans	COM components	Custom-written component
Learning curve	High (Java)	Medium (VBScript, Jscript)	Medium
Price	Free	License software	License software

2.8 Consideration of Web Authoring Tools

2.8.1 Macromedia Dreamweaver MX

Macromedia Dreamweaver MX combines its renowned visual layout tools with the rapid web application development features of Dreamweaver UltraDev and the extensive code-editing support of Macromedia HomeSite. The features of Macromedia Dreamweaver MX includes:

Jumpstart design and production using professional-quality, pre-built layouts and code, including site structures, forms, accessible templates, and JavaScript functions for client-side interactivity. Create new sites with a Site Setup Wizard that helps you quickly enter the information for configuring dynamic, staged, or ISP-hosted sites.

Write code faster than ever before using high-powered coding features like code hints, tag editors, extensible color-coding, tag choosers, snippets, and code validation.

Use one integrated development environment to develop HTML, XHTML, XML, ASP, ASP.NET, JSP, PHP, and Macromedia ColdFusion websites. Customize and extend the development environment with more than 700 free extensions available through the Macromedia Exchange for Dreamweaver.

Work in the technologies of your choice in a cross-platform, technology-agnostic development environment that supports J2EE and .NET, runs on Windows and Mac, and offers open integration with industry-leading tools such as Macromedia Flash MX and Fireworks MX.

Accelerate next-generation development with support for XML, including creating, editing, and validating XML code, and importing XML schemas. Easily introspect XML web services. Ensure standards compliance with default creation of XHTML output, easy conversion from standard HTML to XHTML, and increased support for CSS2

2.8.2 Microsoft Visual Interdev

Microsoft Visual Interdev is an integrated development tool for building dynamic Web applications accessible by any Web browser on any platform. It includes an integrated development environment, database connectivity tools, programmable components, site management and publishing capabilities, a personal Web server, content creation tools and many more.

Microsoft Visual Interdev includes a variety of development features for integrating client-server and Web technology. These features are enabled through Visual Interdev's support for ActiveX controls, seamless database connectivity to any ODBC data source, support for building and testing large system and comprehensive support for the development of Web application.

Furthermore, Visual Interdev provides a rapid, visual development environment for building ASP. It can easily integrate ActiveX server components written in Visual J++, Visual Basic, Visual FoxPro and Visual C++. Using Visual Interdev with ActiveX server components, a developer can easily create multi-tier Web application. ActiveX Server components provide a convenient and effective way to tightly integrate a Web application with existing Internet system.

Visual Interdev delivers a comprehensive set of tightly integrated database tools for Web developers. The database connectivity features are based on the industry. Standard ODBC, including Oracle, Microsoft SQL Server, Microsoft Access, Microsoft Visual FoxPro, Informix, Sybase, IBM BB/2 and others. In addition, using Visual Interdev, a developer can create scalable database solutions because it leverages ASP. The core database components of Microsoft Interdev include Active Data Object (ADO), Integrated Data View, Design-Time ActiveX Controls, Database Wizards, Query Designer and so on.

A Visual Interdev project consists of a live Website when developers open a "project" they are actually opening a live view of a sites, as it exists on the Web server. The IDE is thus a complete Web site management tool that allows the developer to easily modify the structure of a Web site and to edit, add, rename, and delete files and folders on the Web sites. It can also open multiple Web sites at the time.

2.8.3 Notepad

Notepad is the world's most versatile HTML editing tool absolutely free when purchase this software: Windows version 2.0 and above.

Notepad has one of the simplest user interfaces of any Internet Web authoring tools. The menus are logically laid out, conforming to all standards in design, so users can understand them before use Notepad.

Notepad has the same interface for all versions of Windows, so moving over to the latest version of Windows should not hamper HTML code creation. The Notepad web-authoring tool is compatible with every single standard of Internet presentation

medium yet devised. Notepad was designed to have a very small application footprint, taking up as little space as possible in computer's memory, and a minimum of disk space.

Notepad gives clear, easy to read and full HTML. There is no code hidden, and users have control over all parts of the HTML code. JavaScript is also fully supported by Notepad. All parts of the JavaScript are fully available through Notepad, without the need of complex tools.

2.8.3 Visual Studio .NET Enterprise Architect

Visual Studio .NET provides developers with the most productive tool for building next-generation applications for Microsoft Windows® and the Web. Visual Studio .NET Enterprise Architect (VSEA) builds on the power of Visual Studio .NET Enterprise Developer by including additional capabilities for designing, specifying, and communicating application architecture and functionality.

Developers using Visual Studio .NET Enterprise Architect will benefit from the ability to:

Visually Design XML Web Services and Applications

Use a complete set of Microsoft Visio®–based modeling capabilities to create and communicate application architecture, business requirements, database design, and business processes. Architects can use UML models to specify application architecture and functionality. From those models, they can reduce development time by directly generating classes, functions, and methods in Microsoft Visual C++® .NET, Microsoft

Visual Basic® .NET, and Microsoft Visual C#™ .NET. Developers can also document existing application code by reverse engineering Visual Basic .NET, Visual C++ .NET, and Visual C# .NET projects to create architectural designs and models and to share the models with the rest of their team.

Visual Studio .NET Enterprise Architect provides full end-to-end support for database modeling, including conceptual, logical, and physical views. Business analysts can easily enter business rules using the Fact Editor, which in turn generates an underlying database model that can be refined by a database analyst into logical and physical views. Full roundtrip engineering guarantees that changes made at any of the views will be reflected throughout, improving communication across the development team.

Create and Deliver Architectural Guidance

Developers have been faced with ever-increasing complexity as technologies and opportunities have proliferated. Enterprise templates and the Template Description Language will help to reduce this complexity and will increase collaboration across the development team. Architects can use enterprise template projects to create application-starting points by specifying an initial application structure, including any reusable or standard components and technologies, design documents, and models. This can be further enhanced by using Template Description Language to specify the constraints for component usage throughout the application, including the ability to set property values and ranges, so that developers are more likely to make the right implementation choices. Architects can also create custom Help topics in HTML and integrate them into the

Visual Studio .NET dynamic help system, so that developers have access to all the resources they need while building applications.

Build XML Web Services and Applications

Visual Studio .NET is the industry benchmark for developer productivity. The ultimate developer cockpit, it includes visual designers for Windows, the Web, data, and servers components to accomplish tasks more efficiently than ever before. Built on the Microsoft .NET Framework, Visual Studio .NET enables seamless creation and usage of XML Web services for building the next-generation Internet.

Use an Open Tools Platform

Visual Studio .NET provides an open and extensible architecture that enables third-party tools and component and language vendors to seamlessly integrate into the environment, providing developers with a broad range of choices for meeting development requirements.

2.9 Consideration of Database Server

2.9.1 MySQL

MySQL is an Open Source SQL database management system provided by MySQL AB. Open Source means that it is possible for anyone to use and modify. Anybody can download MySQL from the Internet and use it without paying anything. Anybody so inclined can study the source code and change it to fit their needs. MySQL uses the GPL (GNU General Public License), to define what a person may and may not do with the software in different situations.

MySQL is 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. Through under constant development, MySQL today offers a rich and very useful set of functions. The connectivity, speed, and security make MySQL highly suited for accessing databases on the Internet. MySQL is a client/server system that consist of a multi-threaded SQL server that supports different back ends, several different client programs and libraries, administrative tools, and several programming interfaces.

2.9.2 Microsoft SQL Server 2000

Microsoft SQL Server 2000 Window® CE Edition (SQL Server CE) is the compact database for rapidly developing applications that extend enterprise data management capabilities to devices. SQL Server CE has the familiar feel of SQL Server, with tools, application programming interfaces (APIs), and Transact-SQL syntax that minimize development time.

Now, through integration with Microsoft Platform Builder 3.0, SQL Server CE version1.1 extends its capabilities to embedded devices. You can easily integrate SQL Server CE into custom operating systems built with no LAN, WAN, or wireless peripherals, SQL Server CE allows consumer devices running Windows CE 2.11 or higher to immediately participate in data synchronization, right out of the box.

Additionally, the SQL Server CE engine exposes an essential set of relational database features – including an optimizing query processor and support for transactions and assorted data types – while maintaining a compact footprint that preserves precious system resources. Remote data access and merge replication, which work over Hypertext Transfer Protocol (HTTP) and support encryption, ensure that data from enterprise SQL Server databases is reliably delivered and that this data can be manipulated offline and synchronized later to the server. This makes SQL Server CE ideal for mobile and wireless scenarios.

SQL Server CE extends the frontier of data management by delivering:

A familiar database platform for rapid development

The SQL Server family provides data management support and programmability across the enterprise from the largest servers to desktop workstations. Now SQL Server CE rounds out the end-to-end SQL Server offering by providing robust data management capabilities to devices. SQL Server CE exposes a programming and operational model consistent with the rest of the SQL Server family, thereby ensuring that organizations can easily integrate with existing systems and take advantage of existing development skills.

A compact yet capable relational database.

Through devices are advancing rapidly, system resources such as available memory are often scarce, so it is critical that a relational database system be as a compact as possible while still exposing essential functionality. SQL Server CE has a small memory footprint, delivering all of its functionality in approximately one megabyte (1 MB). Performance is enhanced with an optimizing query processor. A range of data types is supported to ensure flexibility, and 128-bit encryption is provided on the device for database file security.

Flexible data access

Allowing straightforward, efficient access to enterprise data is a primary goal for SQL Server CE, whether a device is always connected or intermittently connected. Remove data access exposes data in SQL Server 6.5, SQL Server 7.0, and SQL Server 2000 through remote execution of Transact-SQL statements and the ability to pull record sets to the client device for updating. When used with SQL Server 2000, SQL Server CE provides extended capabilities for synchronization through merge replication. Both of these data access technologies take advantage of Internet standards – including HTTP Secure Sockets Layer (SSL) encryption – through integration with Microsoft Internet Information Services (IIS). This approach allows data to be accessed reliably and flexibly, even through firewalls.

2.9.3 Microsoft Access 2000

Microsoft Access 2000 is a windows-based database management system. It is a member of the Microsoft Office 2000 family and it runs under Windows 95/98/NT/2000

operating systems. Due to the fact that Access is part of the Office 2000 suite, it interoperates well with the other components of the Office 2000 family.

Access is easily the world's most popular relational database management software (RDBMS) (Sellapan, 1999). It is powerful and yet easy to use. With Access, the database administrator can design and use databases very quickly, as it has a very user-friendly interface. Furthermore, tables, forms, queries, and reports can be generated just at a snap of a finger, just by using the set of wizards that come with this software. All this makes Access an excellent all-in-one database tool for creating standalone database application.

Microsoft Office provides a broad array of tools and technologies for creating multi-user database solutions. Specifically, Microsoft Access provides tools and features for creating multi-user database solutions by using four different database architectures that is file-server, client/server, replication and Web-based data access pages.

In Access 2000,

I. Developer can create 3 types of Web pages: data access pages, server –generated HTML files, (ASP and IDC/HTX) and static HTML files.
II. Developer can use a grouped data access page to filter and view only the information they want to see.
III. Developer can use conditional formatting to make a control on a form or report look different from record to record, depending on the control's value.
IV. Developer can send data objects through e-mail as attachments. They can also send data access pages as the body of an e-mail message. Pages have important database and security considerations.

V. Developer can use keyboard to create and delete the relationships and to define default join types.

VI. Developer can sort records in a project before or after they are retrieved from the database. The method of sorting used can affect the performance. The location of the database can also affect the results of the sort.

VII. Developer can use an expression to combine two or more text strings into a single test string. They can also use string manipulation functions in an expression to separate a single text string into two or more text strings.

VIII. Developer can organize different types of database objects into a group. Adding a database object to a group doesn't actually change the object's location in the database, it creates a shortcut to the object in the group.

2.10 Considerations of Web Servers

Web servers allow a person to serve content over the Internet using the Hyper Text Markup Language (HTML). The Web server accepts request from browsers like Netscape and Internet Explorer and then returns the appropriate HTML documents.

2.10.1 Apache

Apache remains the king of Web servers despite intense efforts by Microsoft and Netscape to gain dominance in the market. Apache users have come to rely on the server's rock-solid reliability, outstanding performance, and rich set of features. The keys to Apache's attractiveness and popularity lie instead in the qualities listed above and its extensibility, its freely distributed source code, and active user support for the server.

Based originally on NCSA's freely available HTTPd server, Apache's features and strengths are too numerous to list. Among the most notable features are its cross-platform support, protocol support (HTTP/1.1), modularity (API), security, logging, and overall performance and robustness. Apache runs Windows (95/98/NT), OS/2, and all the major variants of Unix. The server is fully compliant with HTTP/1.1 and supports API and ISAPI (NT). Apache distributes a core set of modules that handle everything from user authentication and cookies to typo correction in URLs.

Apache's overall security, performance, and robustness are unquestionable—many of the most accessed sites in the world run Apache or Apache derivatives. Public distribution of the source code results in patches for the software are promptly caught and reported. As a result, Apache's large user base has allowed its developers to create a

package that is extremely stable and secure and one that is also able to compete more effectively with commercial packages in terms of both raw speed and integrated features.

Despite all of its strengths, Apache certainly is not for everybody. Setup and maintenance of the server are accomplished via command-line scripting tools. Unlike most popular commercial servers, Apache offers neither browser-based maintenance capabilities nor any GUI configuration/administration tools. This is an advantage for some developers, but for others it can translate into higher deployment and maintenance costs, especially if the site's administrators are unfamiliar with the fundamentals of the server. Furthermore, Apache's "user-driven" technical support via newsgroups may not get the job done for more than a few developers. There are, however, several companies that do provide full commercial support but for a price.

The atypical development and marketing style of the Apache server have not precluded it from becoming the most popular World Wide Web server on the Internet today. Apache's robust design and extensibility, coupled with its freeware status and the availability of its source code to the public, make Apache a good choice for enterprise-level Web sites and for individuals and workgroups that use UNIX or a combination of UNIX and NT platform.

2.10.2 Internet Information Server (IIS) Version 5.0

This version, which comes exclusively as part of the Windows 2000 Server operating system, contains many new features along with performance and reliability enhancements. Notable improvements include better and clearly documented security

policies, support for the new WebDAV publishing standards, and faster restarts of both Web and FTP services.

IIS v5.0 is good as both a fast time Web server for those familiar and comfortable with Windows operating systems, and a high-end server for hosting providers and large corporate installations. It handles the basics well and is better integrated in Windows than previous versions. IIS v5.0 also comes with performance and feature enhancements that will be attractive for mission-critical tasks.

Microsoft has improved the clustering configuration and setup to enable multiple machines to share the load and deliver more reliable Web services. However, it is still far from simple to set up. Enterprise must carefully review the documentation and copy various settings files using command line utilities supplied with Windows 2000 to set up a cluster. Such clusters are supported only by Advanced Server versions.

Version 4 of IIS saw the beginning of Microsoft's Management Console to handle the configuration and setup of IIS. This has been extended to a variety of other non-Web services in Windows 2000 and renamed Computer Management, although for the most part, the screens will be familiar. New to IIS v5.0 are performance. Application protection, and tuning enhancements. However, the documentation is inadequate to properly set up these new features without a lot of trial and error.

Microsoft has added a few new wizards to help simplify some common tasks. Three notable wizards are the Permissions Wizard (to synchronize and alignWeb and NTFS security settings), the Web Server Certificate Wizard (to obtain and install server certificates), and the CTL Wizard (to create and modify certificate trust lists). Version 5

has various security enhancements as well. Microsoft has consolidated security tips in its documentation. Such tips include restricting guest accounts and setting appropriate file permissions. However, setting up client-side certificates is still far too complex and poorly documented

One of the more significant enhancements in IIS v5.0 is Web-based Distributed Authoring and Versioning (WebDAV). WebDAV is an emerging standard designed to simplify the construction of intranets and enable multiple users to publish documents to a common Web server. This feature allows users to share Web directories as if they were standard Windows file shares, using Office 2000 and IE v5 tools running on Windows 98, NT and Windows 2000. Web DAV-enabled folders appear as "Web Folders" when users open files in Office 2000 from a remote Web site. File locking is supported so more than one user cannot edit a file concurrently.

2.10.3 Personal Web Server (PWS)

PWS is entry-level/mid-range server for Windows 9x/NT platforms. It is a scaled-down version of the commercial Information Internet Server (IIS) included with the Server edition of Microsoft Windows NT. 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.

PWS is one of the best servers available for helping to get users up and running quickly. Wizards are included to guide users through the process of setting up home pages and sharing files, and the PWS administrator reduces the complexity of actually running the Web server itself. Users can also use the familiar Explorer interface or PWS's Personal Web Manager to share directories, start and stop the server, and view Web site statistics.

One of the best uses for PWS is as a platform for testing out Web sites on Windows 95/Windows NT Workstation computers before hosting them on the Internet. This allows users to check the validity of links, scripts, and applications as well as to ensure that the overall organization of the site is functioning correctly.

PWS presents the ability to develop transactional Web applications using the Microsoft Transaction Server. Overall, while most large enterprises will likely bypass Microsoft's Personal Web Server for the high-end Internet Information Server, PWS will remain one of best available options for individuals wanting to serve their own personal home pages and for small organizations needing to host their own Web sites.

2.11 Consideration of Data Access Techniques

2.11.1 Introduction to SQL and ODBC

SQL is a language used to create, manipulate, examine, and manage relational databases. Because SQL is an application-specific language, a single statement can be very expressive and can initiate high-level actions, such as sorting and merging data. SQL was standardized in 1992 so that a program could communicate with most database systems without having to change the SQL commands. Unfortunately, you must connect to a database before sending SQL commands, and each database vendor has a different interface, as well as different extensions of SQL. ODBC, a C-based interface to SQL-based database engines, provides a consistent interface for communicating with a database and for accessing database metadata. With ODBC and SQL, you can connect to a database and manipulate it in a standard way. It is no surprise that, although ODBC began as a PC standard, it has become nearly an industry standard

2.11.2 Java Database Connectivity (JDBC)

JDBC, short for Java Database Connectivity, a Java API that enables Java programs to execute SQL statements. This allows Java programs to interact with any SQL-compliant database. It is the similar to ODBC but in Java-version. Since nearly all relational database management systems (DBMS) support SQL, and because Java itself runs on most platforms, JDBC makes it possible to write a single database application that can run on different platforms and interact with different DBMS.

2.11.3 ActiceX® Data Objects (ADO)

The ActiveX® Data Objects (ADO) is a high-level interface for data object. It was design to replace the DAO (Data Access Objects) and RDO (Remote Data Objects).

ADO is more general and can be used to access all sorts of different types of data, including web pages, spreadsheets and such.

ADO provides consistent, high-performance access to data, whether it is a front-end database client or middle-tier business object using an application, tool, language, or even an Internet browser.

ADO is designed as an easy-to-use application level interface to Microsoft's newest and most powerful data access paradigm, OLE DB. OLE DB provides high-performance access to any data source, including relational and non-relational databases, email and file systems, text and graphics, custom business objects, and more. ADO is implemented with a small footprint, minimal network traffic in key Internet scenarios, and a minimal number of layers between the front-end and data source-all to provide a lightweight, high-performance interface. ADO is easy to use because it is called using a familiar metaphor - the OLE Automation interface, available from just about any tool and language on the market today.

Some of the attractive benefits of using ADO include transparent, client-side caching architecture. By retrieving large result sets and caching data on the client system, avoids expensive data reflecting, thus boosting performance. It supports data fetching from all ODBC data sources, provides secure systems by offering support for Secure Sockets Layer (SSL) with public key encryption and mutual authentication. Plus, it is also flexible and it could increase Server efficiency in which the recordset on the client is disconnected, allowing sever-side objects to be stateless, freeing resources on high use servers.

2.11.4 ADO.NET

ADO.NET is an evolutionary improvement from Microsoft® ActiveX® Data Objects (ADO) that provides platform interoperability and scalable data access. Using Extensible Markup Language (XML), ADO.NET can ensure the efficient transfer of data to any application on any platform. A Major changes from ADO is that is no Recordset object in the ADO.NET. Instead, A dataset is used in ADO.NET. DataSet class works as a central repository for tables of data, and also supports constraints and logical relations between tables. Furthermore, the DataSet object is a disconnected data container.

With Visual Studio .NET, developers program against objects, not tables and columns. ADO.NET features strongly typed programming, enabling developers to quickly write reliable data access code. Further, strongly typed code is easier to write. Specifically, developers can navigate across entities in the data set using IntelliSense® technology to show all available tables.

The centerpiece of any software solution using ADO.NET is the data set. A data set is an in-memory copy of database data. A data set contains any number of data tables, each of which typically corresponds to a database table or view. A data set constitutes a "disconnected" view of the database data. That is, it exists in memory without an active connection to a database containing the corresponding tables or views. This disconnected architecture enables greater scalability by only using database server resources when reading or writing from the database.

At run time, data will be passed from the database to a middle-tier business object and then down to the user interface. To accommodate the exchange of data,

ADO.NET uses an XML-based persistence and transmission format. To transmit data from one tier to another, an ADO.NET solution expresses the in-memory data (the data set) as XML and then sends the XML to the other component. The following figure (Figure 2.7) shows major components of ADO.NET solution.

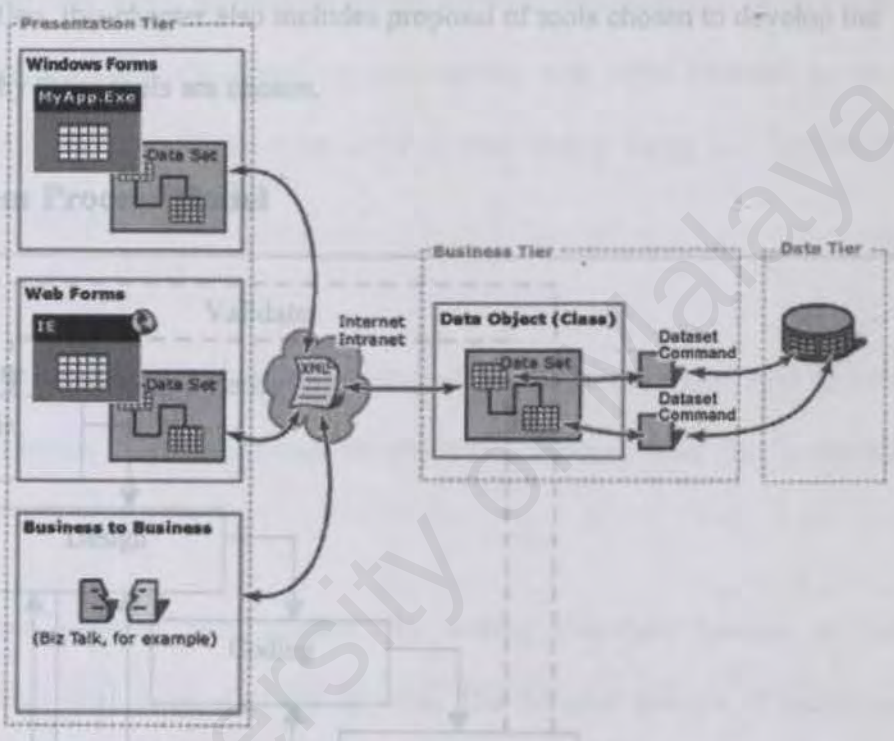


Figure 2.7: Major Components of ADO.NET Solution

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter discusses the methodology used to complete this project, reason for choosing the methodology and an overview of each phase in the system development life cycle. In addition, this chapter also includes proposal of tools chosen to develop the system and why those tools are chosen.

3.2 System Process Model

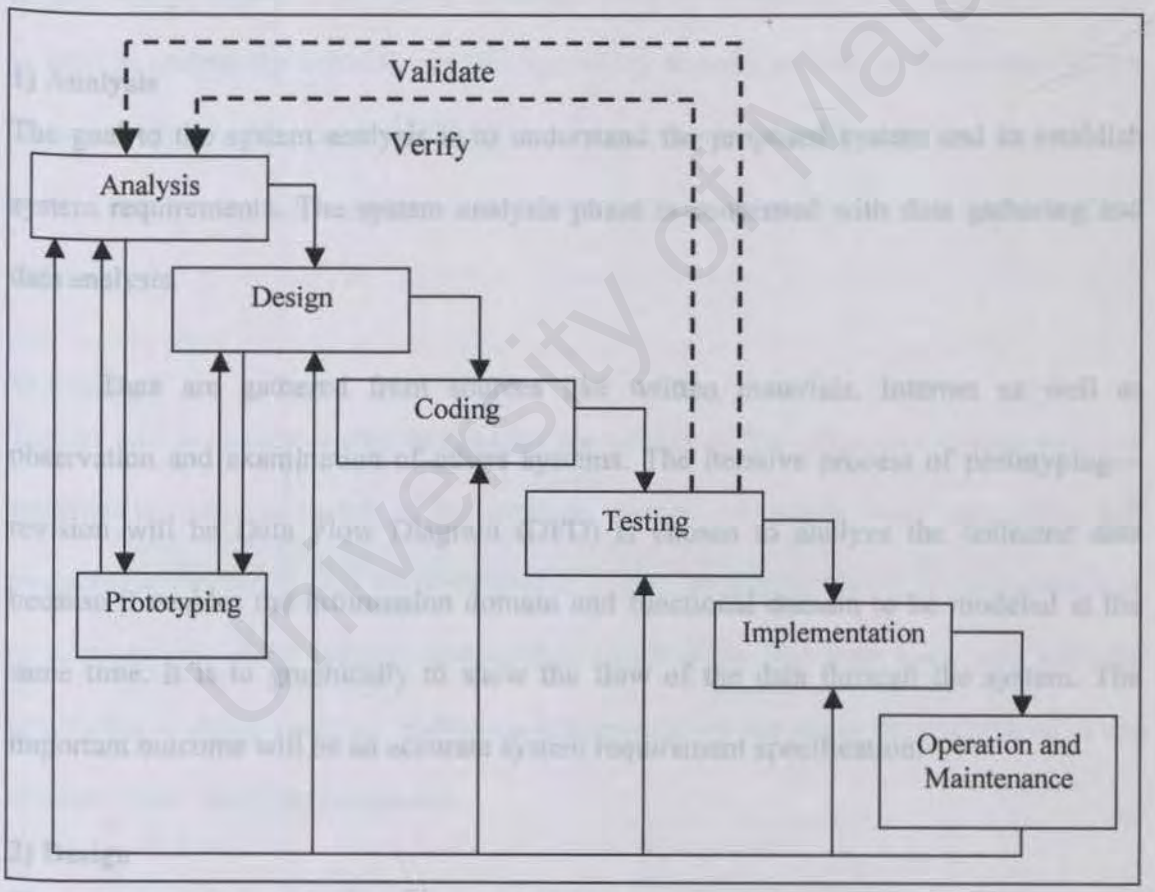


Figure 3.1: Waterfall Model With Prototyping

The project development strategy is a description of the way which this project is done in actuality. The development strategy for this project is based on the software prototyping model. Prototyping development is an idea of developing an initial implementation; expose it to the user for comment and refining it through many version until an adequate system has been developed. Rather than having separate specifications, development and validation activities, these are carried out concurrently with rapid feedback across these activities. This is based on the six steps which is presented in figure 3.1. The description of each step is discussed below:

1) Analysis

The goal to the system analysis is to understand the proposed system and to establish system requirements. The system analysis phase is concerned with data gathering and data analysis.

Data are gathered from sources like written materials, Internet as well as observation and examination of others systems. The iterative process of prototyping—revision will be Data Flow Diagram (DFD) is chosen to analyze the collected data because it enables the information domain and functional domain to be modeled at the same time. It is to graphically to show the flow of the data through the system. The important outcome will be an accurate system requirement specification.

2) Design

The system design phase is the phase in which requirements produced in the previous phase are translated into a representation of the system. This phase will be concerned with user interface design, database design and system design.

The interactive process of prototyping-revision is used to revise the design of the user interface. Interface prototypes will be built using Microsoft ASP.NET. Entity-Relational (E-R) modeling will be involved in the logical design of the Microsoft SQL database. In system design, structure chart will be involved in structuring the system's modules and flow chart might be used to depict the design of procedural details.

3) Coding

This stage translates and implements the detail design representation of the system into programming realization. Scripting languages such as JavaScript, ASP script and HTML is used in coding the information and functional domain as well as the control of the proposed system. Microsoft ASP.NET is the proposed web authoring tool that will be used to create web pages while Microsoft SQL will be used to develop the database of the system.

4) Testing

Testing will be a critical step in assuring the quality of the developed system and will represent the ultimate review of specification, design and coding. First, unit testing will be performed to verify each program module. Next, integration testing is performed. It is to integrate unit-tested program and conduct test that uncover error associated with the interfacing of those modules. Validation test succeeds when the system functions in the manner that is reasonably expected.

5) Implementation

The final stage of the development is the system implementation. The system will be implemented on its target software and hardware requirement. The whole system will be revise to uncover the necessity to add further enhancement.

6) Operation and Maintenance

Maintenance process should be an ongoing activity in real development. Monitoring necessary adjustment continue so that the system produces the expected results. However, system enhancements and maintenance will only be carried out in the proposed project if the constraint is allowed.

Activities (2) to (6) are repeated until all requirements are formalized or until the prototype has evolved into a production system. A prototype model is selected because it can be created quickly and is relatively inexpensive to build compared to the cost of a conventional system.

3.3 Development Tools

After great consideration in Chapter 2: Literature Review, the outline of software tools that need to configure into the developer computer and server is stated as below:

Table 3.1: Chosen Development Tools For System Development

Software	Description
Three-tier Client Server	System architecture
Microsoft 2000 Professional	Client side operating system
Microsoft 2000 Server	Server side operating system
Microsoft ASP.NET	Programming language
Microsoft IIS V5.0	Web server
Microsoft SQL Server 2000	Database server
Microsoft ADO.NET	Data access technology
Microsoft Visual Studio.NET	System authoring tool

3.4 Summary

In this chapter, the methodology used in developing the Wellness Portal, the waterfall model with prototyping is explained. The outline of chosen development tools is also clearly stated.

Chapter 4: System Analysis

4.1 Introduction

A good software development practice start with a good system analysis. Before developing a system, the objective of the system must be understood first, by eliciting the functional and non-functional requirements of the system. After understanding the requirements thoroughly, analysis is conducted to choose the appropriate tools, architecture, model or techniques to develop a good system. This phase involves all the activities necessary to determine the system requirements. According to Kendall& Kendall, a requirement is a feature of the system or the description of something the system is capable of doing in order to fulfill the system's purpose. Requirements are divided into two categories: **functional** and **non- functional requirements.**

4.2 Requirement Analysis

The system requirement needs to be drawn out to provide a guideline when developing a system. Therefore, the requirement analysis needs to cover the area of functional requirements and non-functional requirements of the Wellness Portal.

4.2.1 Functional Requirements

A functional requirement describes an interaction between the system and its environment. It also describes how the system should behave when given a certain stimuli. The functional requirements stated below could be categorized to three distinct sections that are General Section, Users (Members / Family Doctors) Section and Wellness Admin Section.

General Section

This section is responsible to communicate with user in getting information from user to proceed to the following module.

a) Login Sub –Module

1. Login

The Login process is vital to the system in order to protect its web pages and database from any one – authorized user. Users are required to enter their user name and password to access the personalize modules such as Stress Module, Exercise Module and so on. This will increase the security level of the system.

2. Change Password

Every user of the Wellness Portal will have a fixed login name and a changeable password. Therefore, they can change their password regularly for security purposes.

3. Emergency Case Support Login

The system should be able to generate a unique and temporarily password for the emergency login of the specific member when a special case occurred. For instance, if the members in coma, their relative or the specific doctor can obtain a unique and temporarily password which access to service will be terminated after a specific time.

b) Registration Sub - Module

Wellness Admin uses the Registration module for the registration of the new users. Two types of users are defined:

1. Advanced User

The advanced user is able to view information according to personalized and customized module. In addition, the system should enable user to input, modify all the information of his/her own.

2. Normal User

Normal users able to view all information in their personalized module such as nutrition information, stress information and etc. No personal medical records were stored in database

c) Input Medical Records Module

This module allows members to configure existing information or input the certain medical results such as cholesterol level. In addition, it should enable Wellness Admin and family doctor to input all the medical information on behalf of the members.

d) List Due Dates Module

This module should automatically calculate the due dates for all medical checkup of the members and store the calculated due date. This information is useful for alerting members on the next checkup.

e) Log Files Module

Log files are done for the Wellness Admin to keep track of all the activities in the system. Besides, it can detect who and when this programs info has been modified.

f) Logout Module

This module will logout the members from the system and directs the members back to the Home Page of the system.

Users (Advanced Members / Family Doctors) Section

a) Generate Summary and Graph Module

The system should allow member to generate summary of the current medical records and generate graph accordingly. The type of graph can be generate are bar chart, pie chart, line graph and etc.

b) Alert Module

If the due date for a checkup is reached, this module is taking the role to alert the specific members about the overdue. There are 2 method of alerting the system used:

E-mail

The system should be able to send automatically an alerting E-mail to the specific members who exceeded the due date of his / her medical checkup. The purpose of the email is to remind the user of the overdue checkup issue. The e-mail address are taken from the members profiles database.

SMS

The system should be able to send automatically an alerting SMS message to the specific members who exceeded the due date of his / her medical checkup. The purpose of the email is to remind the user of the overdue checkup issue. The telephone number are taken from the members profiles database

c) Personalization Module

This module are responsible in personalize the wellness module according to the modules subscribe by the individual members.

Wellness Admin Section

a) Approval Module

The system shall allow the Wellness Admin to process the modified medical record by members. The modified medical record be checked by the Wellness Admin and if the input medical info are relevant, the updated records will be stored in the database after being approved.

b) Template Module

This module allows Wellness Admin to upload the medical information's such as articles, URL. Wellness Admin can customize the data uploaded using this module.

c) Termination Module

This module allows Wellness Admin to remove and delete an member from the system. After the deletion, this members record is no longer attaching to Wellness Portal.

4.2.2 Non-Functional Requirements

A non-functional requirement or constraint describes a restriction on the system that limits choices for constructing a solution to the problem. These constraints usually narrow the selection of language, platform or implementation technique and tool.

1. Reliability

The application systems shall be reliable and shall not cause unnecessary and unplanned downtime of the overall environment. A system is said to have reliability if it does not produce dangerous or costly failures when it is used in a reasonable manner, that is, in a manner that a typical user is normal.

2. User Interface

Wellness Portal should apply the Graphical User Interface (GUI) approach for better visual effect to the user. The usage of suitable and meaningful captions and icons help the user to use the system with more confidence.

3. Efficiency

Efficiency in computer technology means a process or procedure that can be called or accessed in an unlimited number of times to produce similar outcomes or output at creditable pace or speed.

4. Correctness

Correctness is the extent to which a program satisfies its specification and fulfills the subscribers' and specialists' mission objectives.

5. Accuracy

Accuracy refers to the precision of computation and control. Wellness Portal provides various accuracy measures. For instance, Wellness Portal is able to auto generate graphs from an accurate database. Besides, it can provides accuracy in computation.

6. Modularity

Modularity is a key factor in good program design. The working of the system was broken into modules so that distinct functions of objects could be isolated from one another. In Wellness Portal, modularity of program module is applied from the beginning as this will lead to easy modification in future and because it is modular in design, other shell modules can be combined or joined easily.

7. Security

User must login with their correct user ID and password to prevent unauthorized access into user's personal medical details.

8. Simplicity

Forms and screens are kept properly uncluttered in a manner that focuses the user attention.

9. Understandability

Coding method used, allowed other programmer to understand the logic of the program flow.

4.3 Development Requirements

4.3.1 Development side hardware requirements

The hardware requirements for the system's development environment is as stated in table 4.1 below:

Table 4.1: Development Side Hardware Requirements

Processor	IBM compatible PC with a Pentium 4 processor or higher
Memory	192 MB RAM or higher (256 recommended)
Hard Disk	3.5 GB of hard disk space or higher
Monitor	SVGA or other compatible monitor
Input devices	Keyboard, mouse or other compatible pointing devices
Others	- 3 ½ " floppy disk drive - CD-ROM - Modem and Network Card - Sound Card

4.3.2 Development side software requirements

The software requirements for the system's development environment is as stated in table 4.2 below:

Table 4.2: Development Side Software Requirements

Authoring Tool	Microsoft Visual Studio .NET
Database Server	Microsoft SQL Server and above
Operating System	Windows 2000 Professional
Web Browser	Microsoft Internet Explorer 6
Web Server	Internet Information Server
Development Language	ASP.NET

4.4 Client-Server System Requirements

4.4.1 Client System Requirements

For a client, it is recommended that a reasonable amount of RAM is available, together with a quality dial-up connection line. The recommended software configuration will be at least 64 RAM, minimum 5 MB hard disk, a Windows 2000 operating system and Internet Explorer 6.0 as web browser.

4.4.2 Server System Requirements

A minimum of 128MB RAM is suggested but 192MB is more appropriate. Implementation of SQL Server in a production environment needs at least a Pentium III 800GHz, faster processor speed and more memory for better performance. Hard disk requirement is at least 10 GB and plus with other hardware peripherals.

The operating system required will be Windows 2000 with Internet Information Server (IIS), installed Internet Explorer 6.0 and with ASP.NET and SQl Server 2000 for development.

4.5 Summary

In this chapter the Wellness Portal functional requirements and non-functional requirements are explained in great detailed. The justification of system software and hardware requirements for development side, client side and server side are also clearly stated.

Chapter 5: System Design

5.1 Introduction

System design is a process of transforming the problem into a solution. It can be referred as the description of a solution. The description of a system may change during the system development life cycle since the nature of the solution may change as the solution is described or implemented (Pleeger, 2001). During the design phase of **Wellness Portal**, the features and components of the system are specified.

The development of the **Wellness Portal** is done using a prototype approach and it is client-server application. The prototype approach allows all or part of the system to be constructed quickly to understand or clarify some issues. Besides, it ensures that the requirements could be fulfilled. By using the prototype approach, the risk and uncertainty could be reduced in the development.

5.2 System Architecture

The **Wellness Portal** will be using a three-tier formation. This three-tier formation can represent 3 distinct services provided, the user services, the business services and the database services.

The first tier, which is the client or user tier, is where all applications needed are resided. The browsers will be the applications in this client tiers. Browsers like Internet Explorer and Netscape Navigator are used to display the user interface (web pages) to the user of the system. These web pages will have hyper links to enable requests from users.

The middle tier is the tier responsible for providing business services or functionality. This tier will take and gather information that is received from the user and will process this information. Processing of information will conform to the business rules of the requirements identified, encapsulating business logic of the system. The processing will then involve the usage of IIS (Internet Information Server), which is the application server for the system.

The third tier consists of the Microsoft SQL 2000 as the database server. The database server will be place for repository of important data. The data will be stored in the SQL server and retrieval from the middle tier can be done using the query of the database. The components involve in **Wellness Portal** are shown in Figure 5.1.

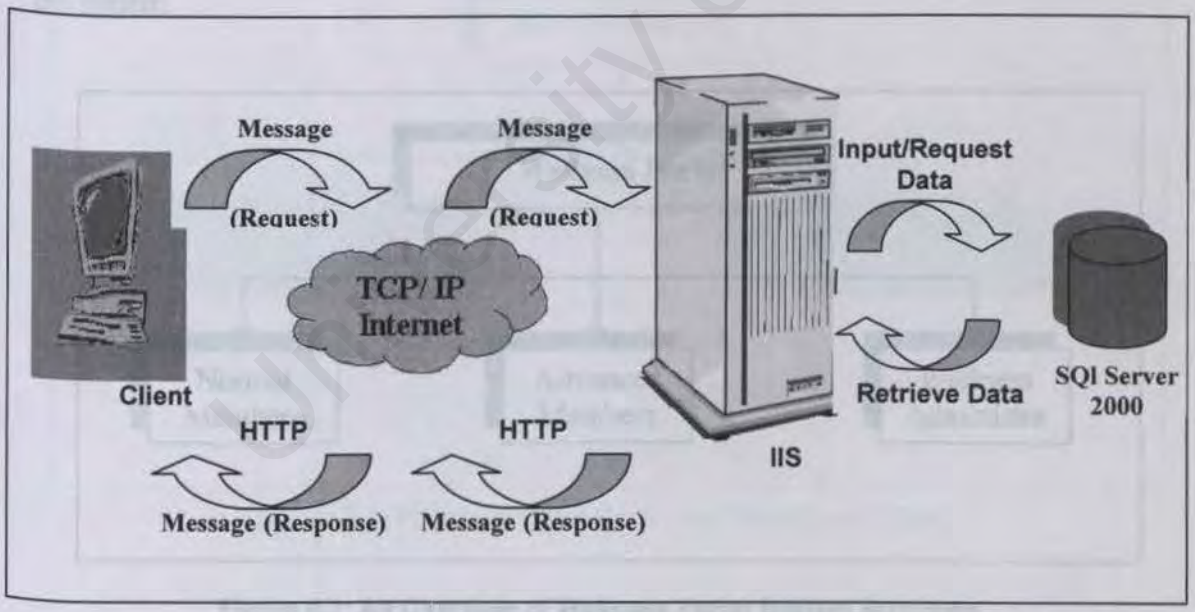


Figure 5.1: Three-Tier Client/Server System Architecture For Wellness Portal

5.3 Program Design

During program design, programmers seek to specify the structure and operation of programs that will meet the requirements articulated during the information processing system design phase of systems development. Program design transforms all the requirements into an organized picture of the system functionality and data flow diagram.

5.3.1 System Functionality Design

System functionality design is based on the system requirements stated in Chapter 4. It translates the system requirement into system functionality. This design focuses on the system structure design and data flow design. The **Wellness Portal** is divided into three components that are normal members, advanced members and wellness administrators. Each of them has different access to the system. Figure 5.2 shows the structure chart of the system.

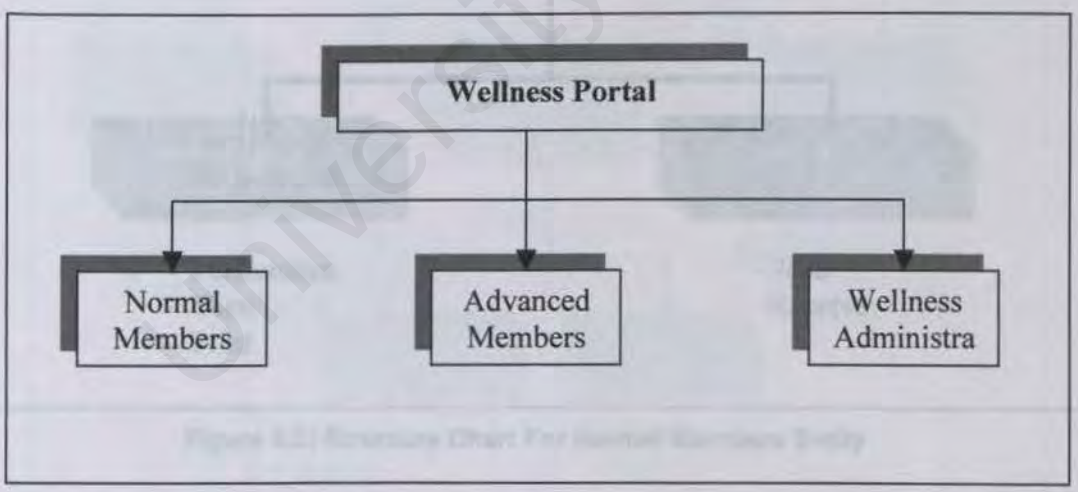


Figure 5.2: An Overview of Wellness Portal System Structure

5.3.1.1 Normal Member

Normal members here are referred to the members who registered as Wellness Member without storing their medical records in the **Wellness Portal** and not participating in the due date alerting services. Normal members will be able to perform view and personalized function on the information in the wellness package (Medical Screening, Stress Management, Exercises, Nutrition and Safety). They will also be able to send and received email through and from the wellness administrator. Figure 5.3 shows the normal member entity and the related modules.

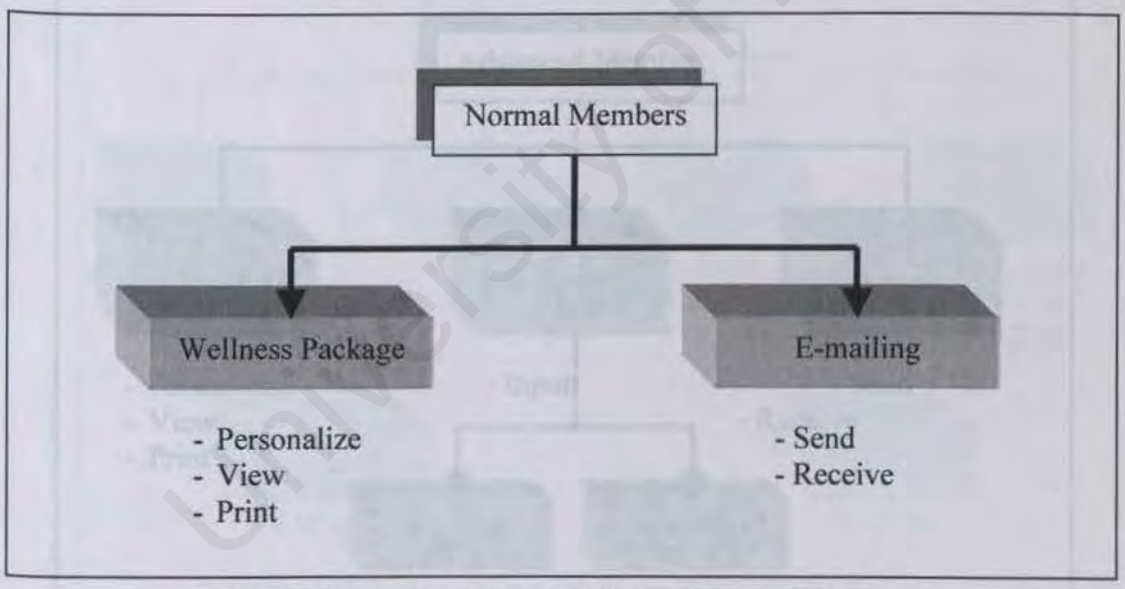


Figure 5.3: Structure Chart For Normal Members Entity

5.3.1.2 Advanced Member

The advanced members here are referred to who registered as wellness members and participating in all the services provided by **Wellness Portal**. Advanced members will able to perform all the functions that held by the normal members plus the functions of input medical record, print and view their health chart using the automatic graph generator and lastly alert by phone or email about their coming due dates.

Figure 5.4 will clearly show you the advanced members entity with their related modules.

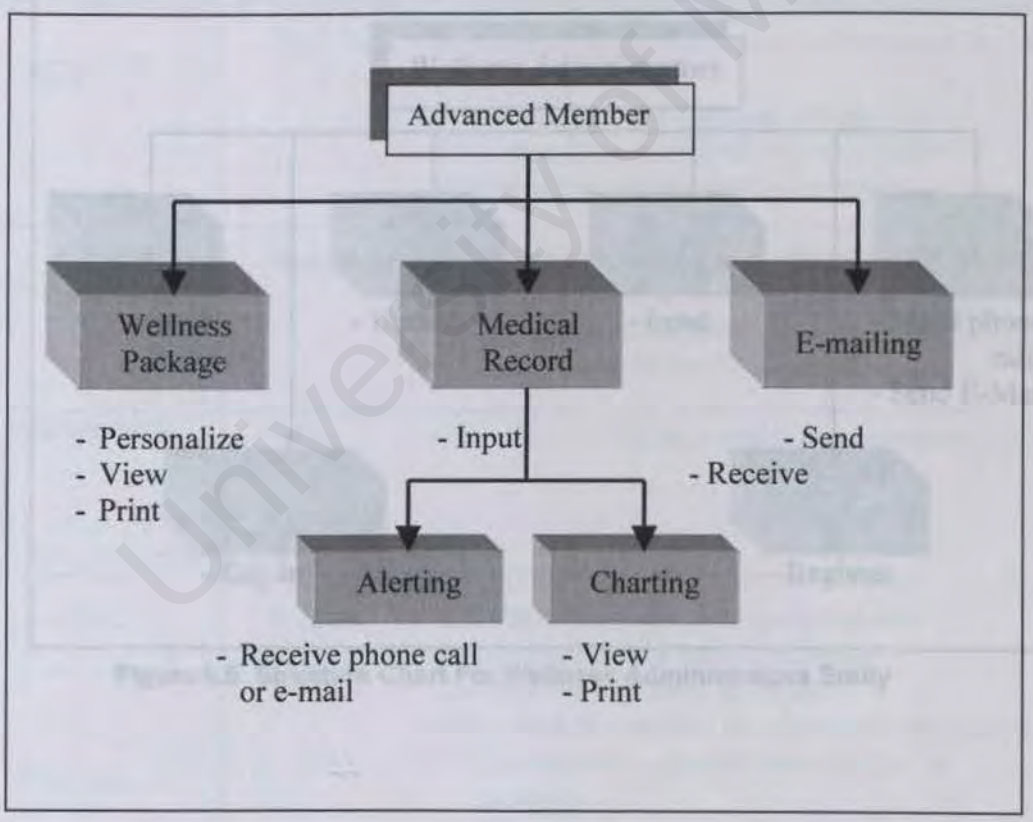


Figure 5.4: Structure Chart For Advanced Member Entity

5.3.1.3 Wellness Administrator

Wellness administrator are referred to the para-medical staff that in charge of the **Wellness Portal** operation. There are given full rights to perform the functionality on administration side in order to maintain the quality of the **Wellness Portal**. There will be able to update article about exercises, safety, nutrition and stress management in the wellness package. They're also responsible to register new members, key in members' medical records into system database and so on. The figure 5.5 shows the wellness administrator entity and the related modules.

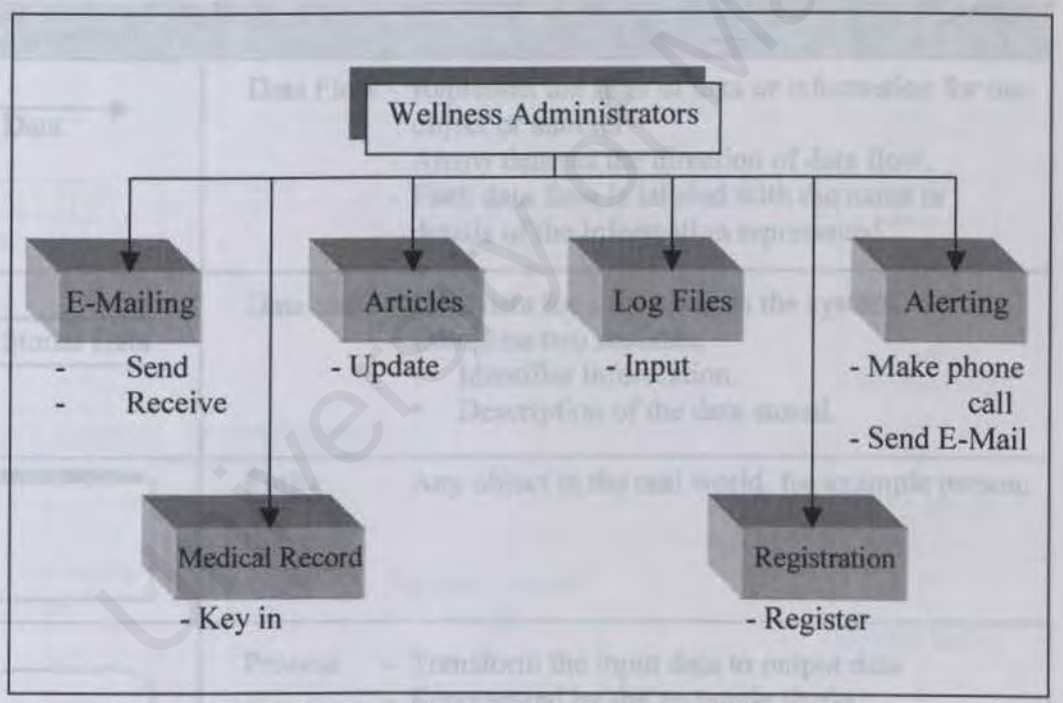


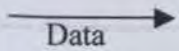
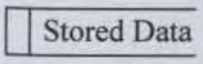
Figure 5.5: Structure Chart For Wellness Administrators Entity

5.3.2 Data Flow Diagram

Data Flow Diagram (DFD) is used to show the data processes and flows in a system. DFD graphically depicts the overview of system inputs, processes and outputs of the system (Kendall & Kendall, 1999). The figure 5.6 shows the system data flow diagram.

In this section I will emphasis on the charting module DFD only since the e-mailing module have no DFD. The DFD of others modules will be discuss in my partner's thesis report. Table 5.1 shows the descriptions of symbol used in DFD.

Table 5.1: Description of Data Flow Diagram Symbols

Component	Description
	Data Flow - Represent the flow of data or information for one object or another. - Arrow denotes the direction of data flow. - Each data flow is labeled with the name or details of the information represented.
	Data Store - Hold data for a time within the system. - Comprise two sections: ▪ Identifier information. ▪ Description of the data stored.
	Entity - Any object in the real world, for example person.
	Process - Transform the input data to output data - Represented by the rectangle shape - Comprise two or three sections: ▪ Top section contains the identifier information. ▪ Center section contains a description of process. ▪ Lower section contains the physical location or computer program information.

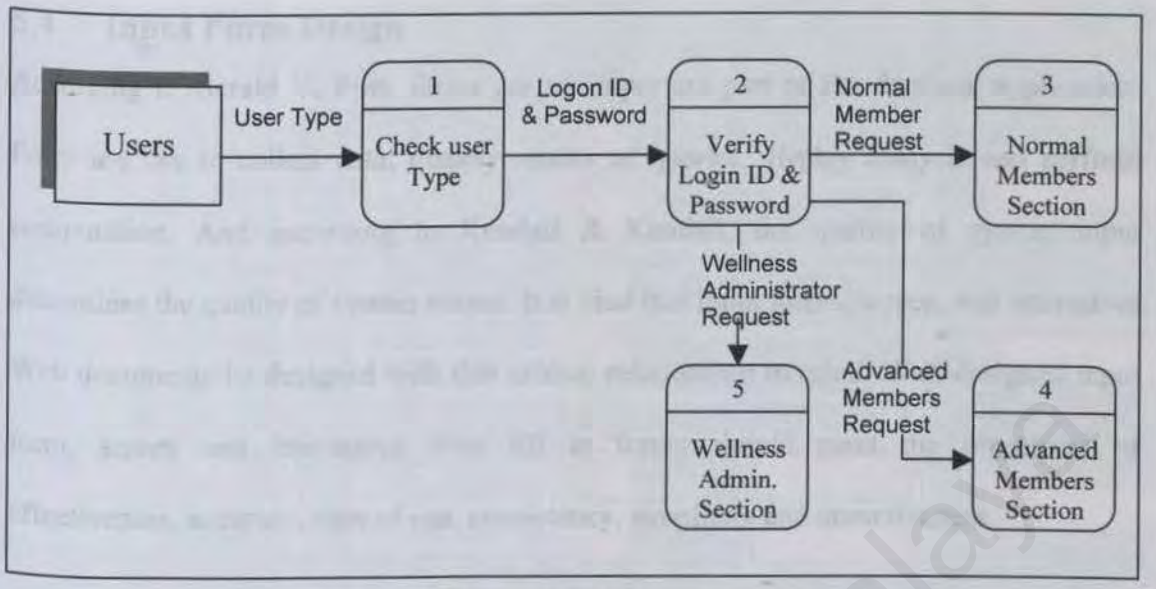


Figure 5.6: Wellness Portal Data Flow Diagram

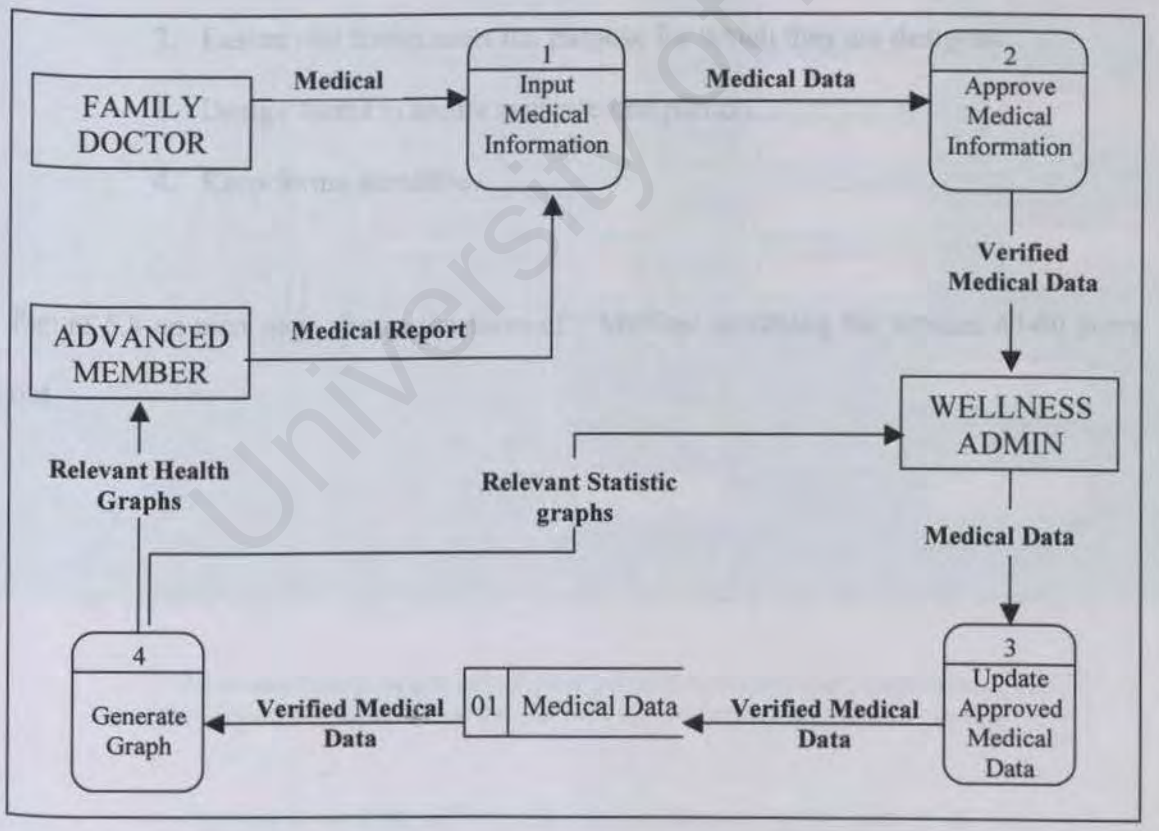


Figure 5.7: Charting Module Data Flow Diagram

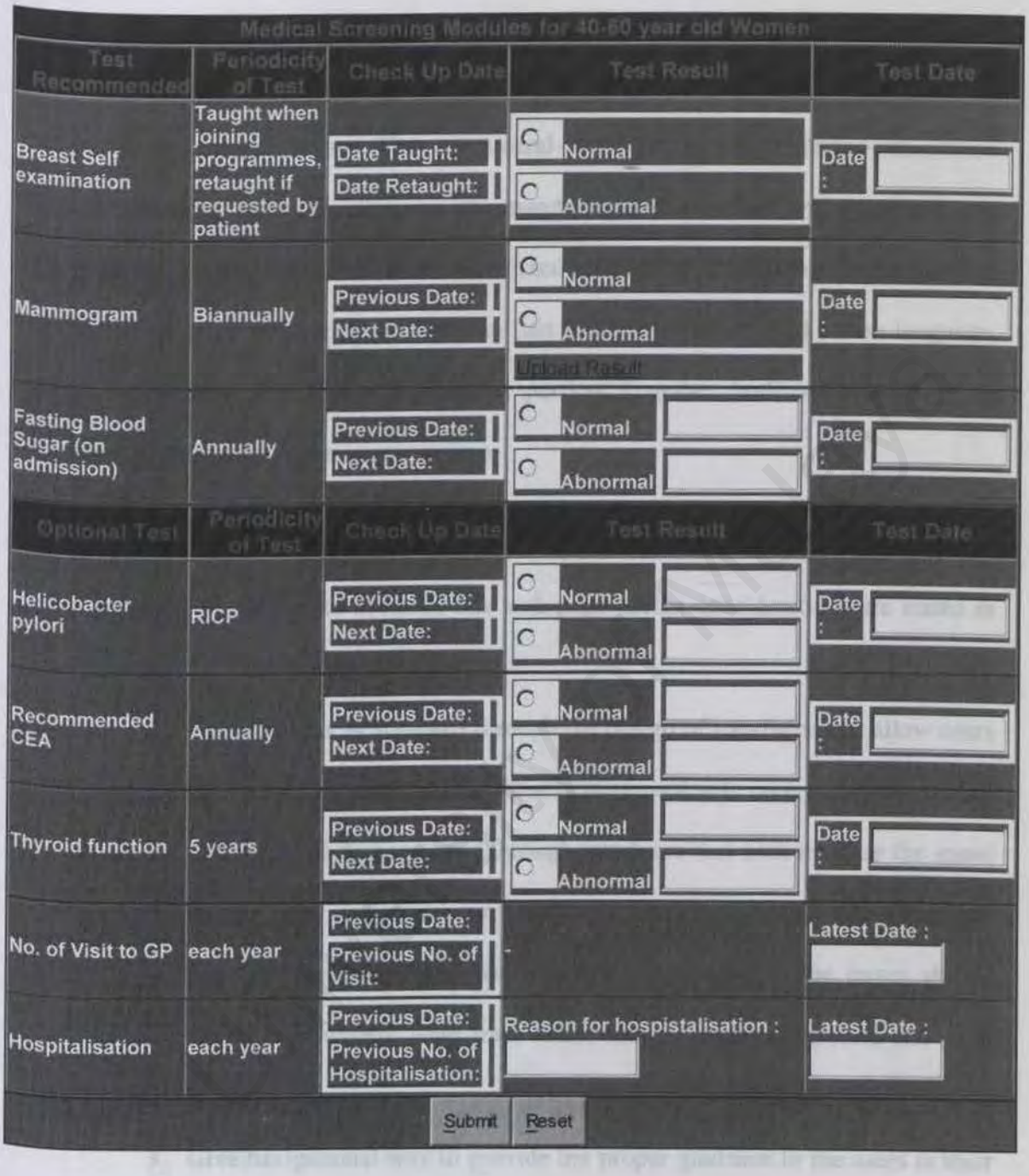
5.4 Input Form Design

According to Gerald V. Post, forms are an important part of the database application. Form are use to collect data, display results of queries, display analysis and perform computation. And according to Kendall & Kendall, the quality of system input determines the quality of system output. It is vital that input forms, screen, and interactive Web documents be designed with this critical relationship in mind. Well-designed input form, screen and interactive Web fill in forms should meet the objectives of effectiveness, accuracy, ease of use, consistency, simplicity and attractiveness.

Four guidelines for form design should be observed in order to design useful forms:

1. Make form easy to fill out.
2. Ensure that forms meet the purpose for which they are designed.
3. Design forms to assure accurate completion.
4. Keep forms attractive.

Figure 5.8 on next page shows the form of Medical screening for women 40-60 years old.



* : Recommended if certain parameters present, to be decided by specialists
RICP : Recommended for certain patients eg family history of ovarian cancer

Figure 5.8: User Input Form for Medical Screening Women 40-60

5.5 User Interface Design

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

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

1. Effectiveness as achieved through the design of interfaces that allow users to access the system in a way that is congruent with their individual needs.
2. Efficiency as demonstrated through interfaces that both increase the speed of data entry and reduce errors. Thus it is necessary to provide a common and consistent look and feel across the application. The pages should reflect a consistent page font, color, image, page background and page layout.
3. Give navigational way to provide the proper guidance to the users in their journey, make sure the users are informed where they are going during the navigation.
4. Provide the users with a path at all times. Do not create dead-end pages.

Figure 5.9 shows the design layout for the first page of normal members and advanced members after login process.

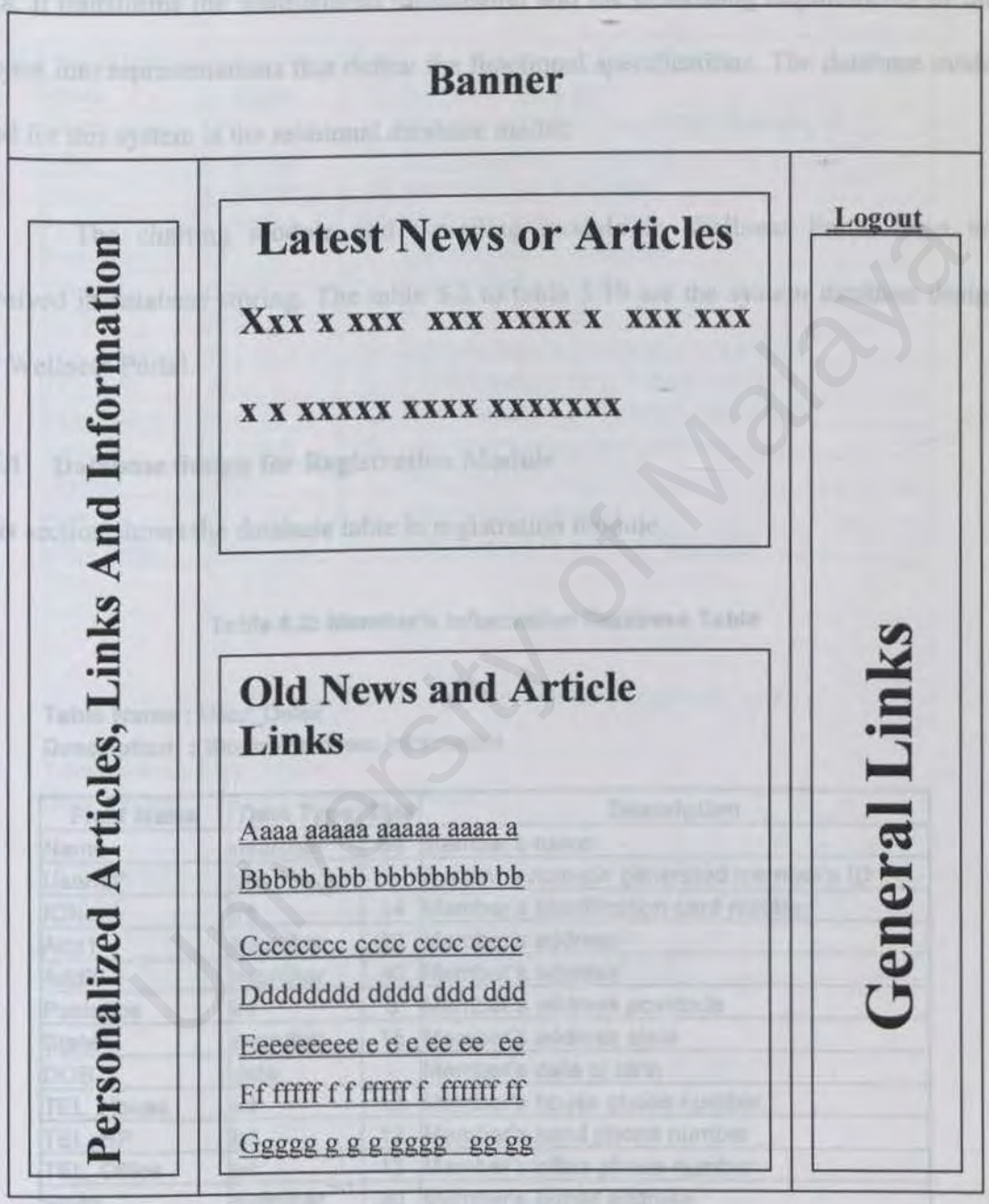


Figure 5.9: User Interface Design

5.6 Database Design

Database design involves the process of designing the structure used to store and manage data. It transforms the unstructured information and the processing requirements of this project into representations that define the functional specifications. The database model used for this system is the relational database model.

The charting module and e-mailing module in Wellness Portal have not involved in database storing. The table 5.2 to table 5.19 are the system database design for Wellness Portal.

5.6.1 Database design for Registration Module

This section shows the database table in registration module.

Table 5.2: Member's Information Database Table

Table Name : User_Detail
Description : Stores members information

Field Name	Data Type	Size	Description
Name	nvarchar	50	Member's name
UserID*	uin	-	System automatic generated member's ID
ICNo	int	14	Member's identification card number
Add1	nvarchar	40	Member's address
Add2	nvarchar	40	Member's address
Postcode	int	5	Member's address postcode
State	nvarchar	15	Member's address state
DOB	date	-	Member's date of birth
TEL_House	int	12	Member's house phone number
TEL_HP	int	12	Member's hand phone number
TEL_Office	int	12	Member's office phone number
Email	nvarchar	30	Member's e-mail address
Gender	char	1	Member's gender
Age	int	2	Member's age
Mem_Category	char	1	Member's category (normal or advanced)

Table 5.3: Wellness Administrator's Information Database Table

Table Name: Admin_Detail
Description : Stores wellness administrators information

Field Name	Data Type	Size	Description
Name	nvarchar	50	Administrator's name
WellnessID*	UIN	-	System automatic generated Wellness ID
ICNo	nvarchar	14	Administrator's Identification card number
Add1	nvarchar	40	Administrator's address
Add2	nvarchar	40	Administrator's address
Postcode	int	5	Administrator's postcode
Stste	nvarchar	15	Administrator's state
DOB	date	-	Administrator's date of birth
TEL_House	int	12	Administrator's house phone number
TEL_HP	int	12	Administrator's hand phone number
TEL_Office	int	12	Administrator's office phone number
Email	nvarchar	30	Administrator's e-mail address
Gender	char	1	Administrator's gender
Age	int	2	Administrator's age
Start_Date	date	-	Administrator's start working date

Table 5.4: Member's Login Information Database Table

Table Name : User_Login
Description : Stores user's login details

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
Login_Name	nvarchar	20	Member's login name
Login_PWD	nvarchar	20	Member's login password

5.6.2 Database Design for Personalized Module

This section will show the personalized information of members according to their preference. The personalized information includes exercise, stress management, safety, nutrition and web page skin colour.

Table 5.5: Member's Personalized Exercise Module Database Table

Table Name : Exer_Module
Description : Record member's personalized information on Exercise Module

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
Paed_F	Boolean	-	Female peadiatric exercise information
Paed_M	Boolean	-	Male peadiatric exercise information
Teen_F	Boolean	-	Female teenage exercise information
Teen_M	Boolean	-	Male teenage exercise information
Adult_F	Boolean	-	Female adult exercise information
Adult_M	Boolean	-	Male adult exercise information
Middle_F	Boolean	-	Female middle age exercise information
Middle_M	Boolean	-	Male middle age exercise information
Senior_F	Boolean	-	Female senior citizen exercise information
Senior_M	Boolean	-	Male senior citizen exercise information

Table 5.6: Member's Personalized Stress Module Database Table

Table Name : Stress_Module
Decription : Record member's personalized information on Stress Module

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
Paed_F	Boolean	-	Female peadiatric stress information
Paed_M	Boolean	-	Male peadiatric stress information
Teen_F	Boolean	-	Female teenage stress information
Teen_M	Boolean	-	Male teenage stress information
Adult_F	Boolean	-	Female adult stress information
Adult_M	Boolean	-	Male adult stress information
Middle_F	Boolean	-	Female middle age stress information
Middle_M	Boolean	-	Male middle age stress information
Senior_F	Boolean	-	Female senior citizen stress information
Senior_M	Boolean	-	Male senior citizen stress information

Table 5.7: Member's Personalized Nutrition Module Database Table

Table Name :Nutri_Module
Decription : Record member's personalized information on Nutrition Module

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
Paed_F	Boolean	-	Female peadiatric nutrition information
Paed_M	Boolean	-	Male peadiatric nutrition information
Teen_F	Boolean	-	Female teenage nutrition information
Teen_M	Boolean	-	Male teenage nutrition information
Adult_F	Boolean	-	Female adult nutrition information
Adult_M	Boolean	-	Male adult nutrition information
Middle_F	Boolean	-	Female middle age nutrition information
Middle_M	Boolean	-	Male middle age nutrition information
Senior_F	Boolean	-	Female senior citizen nutrition information
Senior_M	Boolean	-	Male senior citizen nutrition information

Table 5.8: Member's Personalized Safety Module Database Table

Table Name : Safety_Module
Decription : Record member's personalized information on Safety Module

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
Paed_F	Boolean	-	Female peadiatric safety information
Paed_M	Boolean	-	Male peadiatric safety information
Teen_F	Boolean	-	Female teenage safety information
Teen_M	Boolean	-	Male teenage safety information
Adult_F	Boolean	-	Female adult safety information
Adult_M	Boolean	-	Male adult safety information
Middle_F	Boolean	-	Female middle age safety information
Middle_M	Boolean	-	Male middle age safety information
Senior_F	Boolean	-	Female senior citizen safety information
Senior_M	Boolean	-	Male senior citizen safety information

Table 5.9: Member's Personalized Web Page Skin Colour Database Table

Table Name : Color_Skin
Description : Record user preference on web page skin colour

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
SkinID	nvarchar	20	Skin colour name

5.6.3 Database Design For Alerting Module

This section shows the database table in the alerting module. For alerting system to be run properly it needs a record of type of test and the date of test taken by the members. The medical screening suggested in the portal only list out the tests recommended for 40-60 years old female. This is due to the specialists need a substantial amount of time to discuss and concludes on recommended medical screening test on other age groups. So the tables here are specific for 40-60 years old female only.

Table 5.10: Member's Medical Screening Database Table

Table Name : MedScreen_Test
Decsription : Stores member's medical record on the specific test

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
TestDate	date	-	Date of test taken
TestField	int/nvarchar		Member's test field record
TestField	int/nvarchar		Member's test field record
..	..	..	..
..	..	..	..
..	..	..	..

Table 5.11: Due Date Information Database Table

Table Name : DueDate_List
Decsription : Stores member's medical screening due date

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
DueDate	date	-	Due Date of test taken
TestName	nvarchar	30	Member's test name

5.6.4 Database Design for Log Files Module

Logs file are created to logged members and wellness administrators activities. This is very important for system controlling.

Table 5.12: Member's Registration Log File Database Table

Table Name : Log_Reg
Description : Log the member's registration process

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
WellnessID	UIN	-	System automatic generated Wellness ID
Date	date/time	-	Member's registration date

Table 5.13: Member's Termination Log File Database Table

Table Name : Log_Termination
Description : Log the member's termination process

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
WellnessID	UIN	-	System automatic generated Wellness ID
Date	date/time	-	Member's termination date

Table 5.14: Wellness Administrator's Phone Call Log File Database Table

Table Name : Log_Phone
Description : Log the wellness adminstrator's phone alerting process

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
WellnessID	UIN	-	System automatic generated Wellness ID
Date	date/time	-	Date of making phone call
Purpose	nvarchar	100	record the purpose of making phone call

Table 5.15: Wellness Administrator's E-mail Log File Database Table

Table Name : Log_Email
Description : Log the wellness administrator's e-mailing process

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
WellnessID	UIN	-	System automatic generated Wellness ID
Date	date/time	-	Date of sending e-mail
Purpose	nvarchar	100	Record the purpose of sending e-mail

Table 5.16: Wellness Administrator's Add Information Log File Database Table

Table Name : Log_AddInfo
Description : Log the wellness administrator's add information process

Field Name	Data Type	Size	Description
WellnessID*	UIN	-	System automatic generated Wellness ID
Date	date/time	-	Date of adding information
Info_Title	nvarchar	100	Title of the added information

Table 5.17: Wellness Administrator's Delete Information Log File Database Table

Table Name : Log_DelInfo
Description : Log the wellness administrator's delete information process

Field Name	Data Type	Size	Description
WellnessID*	UIN	-	System automatic generated Wellness ID
Date	date/time	-	Date of deleting information
Info_Title	nvarchar	100	Title of the deleted information

Table 5.18: Wellness Administrator's Update Medical Record Log File Database Table

Table Name : Log_MedUpdate
Description : Log the wellness administrator's update medical record process

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
WellnessID	UIN	-	System automatic generated Wellness ID
Date	date/time	-	Date of updating the medical record
TestName	nvarchar	100	Name of the updated test name

Table 5.19: Wellness Administrator's Delete Medical Record Log File Database Table

Table Name : Log_MedDel
Description : Log the wellness administrator's delete medical record process

Field Name	Data Type	Size	Description
UserID*	UIN	-	System automatic generated member's ID
WellnessID	UIN	-	System automatic generated Wellness ID
Date	date/time	-	Date of deleting the medical record

5.7 Expected Outcome

Wellness Portal is expected to achieve the following outcome:

1. A web-based wellness center to benefit all walks of life from birth to senior citizen.
2. Act as storage for member to keep their medical record online, so there can view it wherever they want using the Internet access.
3. The advanced member will be able to view their health progress chart using the system automatic chart generator.
4. Members will be able to send queries to wellness center and wellness administrators will be able to read and send the answer of member's queries back.
5. Members will be able to personalize their web page according to their preferences.
6. System will able to generate a list of due date for the administrators to alert members about their coming due date.

5.8 Summary

Chapter 5 presents the system design for **Wellness Portal**. It gives an overview of architectural design, program design, input form design, user interface design and database design. The chapter concludes with the expected outcome from **Wellness Portal.**

Chapter 6: System Implementation

6.1 Introduction

System implementation is a process that converts the system requirements and system designs into workable program codes. Therefore, the implementation of Wellness Portal is based on the requirement specification. The process involved installing Windows NT 2000 Professional Edition, installing Microsoft SQL Server 2000, Installing Internet Information Server, web programming using ASP.NET, VBScript and HTML, debugging and testing. This means that it involved the system development environment, program coding and database development. At times it involved some modifications to the previous design due to the limitations of the programming language used. Each module in this Wellness Portal was developed separately and later integrated into a fully functional system once my thesis partners have developed their modules and tested successfully.

This chapter will explain the coding methods, techniques, important scripts involved in the development or implementation of Wellness Portal as well as the functions or effects that are produced by these methods or scripts.

6.2 Coding Approach

Top-down coding method is selected to code the chart and e-mailing module of the Wellness Portal. Top-down coding method is based on the principle of coding the high-level modules first and leaving the lower level modules called in skeleton form, to be filled in later. The lower modules are only a shell, with an entry and an exit. In other

words, as the higher module is being coded, references are made to the lower modules as if they are coded an available. But in fact, a call to that still-incomplete module will result in an empty action. This approaches is used to allow testing to begin on some of the modules while others are still being coded. By using this approach, the most serious types of errors, are identified early.

6.3 Coding Principles

Several programming principles are applied in the coding the program to ensure the system consistency, maintainability and readability.

1. Indenting, formatting and commenting the code help to increase the program code's readability.
2. Using a variable naming convention consistently increase the program's consistency and maintainability.
3. Using sub function at the code behind, include file, and user control (file.acsx) to allow certain procedures available to many ASP.NET files and HTML page. It eases the messy work of correcting all ASP.NET pages when making changes on the procedures. This ensures the system maintainability.

6.4 Development Of Wellness Portal

Most of the codes in Wellness Portal are HTML tags, ASP.NET scripts and VBScript. Briefly, HTML is just used to create the user interface and design for the system. Besides

that, VBScript is used mainly for validation of user input and handles interactive effects of some modules. In order to make the web pages more dynamic as well as to process or execute the request from the user, ASP.NET is the script that is used mostly in Wellness Portal.

The main functions produced by ASP.NET script are as follows:

- Store the temporary information of a session, for example, storing a UserID and password information in a session variable to keep track which user is working at that time and provide a dynamic page that cater for that user.
- Enables user to view their previous medical record presented by different chart type, which include bar chart, pie chart and line graph.
- Enables user to read their message, write message to wellness centre and store their message in StoreRoom.
- Enables wellness administrator to read all message that sent by user and reply the message to that user.

6.4.1 HTML

Development stage of Wellness Portal involves designing and creating the use-friendly web pages. For example, in the e-mailing module of Wellness Portal, HTML is used to show the e-mail information such as date, time and e-mail subject in a datagrid. Table are inserted and carefully align to suit the outlook of the information and documents.

<table> is used to position the display on the web page so that it looks nicer. For example, the HTML tag for table's header is shown in Figure 6.1 below.

```
<TABLE id="Table2" cellSpacing="0" cellPadding="0" width="100%">
	<!--Banner--><TR height="20%">
		<td vAlign="top" width="100%" colSpan="3" height="100%">
			<!--#include virtual="i_TopBanner.aspx" -->
		</td>
	</TR><!--End of Banner-->
	<!--Top Bar--><TR vAlign="center">
		<td class="bannerbg" align="middle" width="20%">
		</td>
		<td class="bannerbg" align="middle" width="60%">
			<user:topbar id="topbar" runat="server"></user:topbar>
		</td>
		<td class="bannerbg" align="middle" width="20%">
			 
		</td>
	</TR><!--End of Top Bar-->
	<tr vAlign="top" height="70%">
	<!--left Bar-->
		<td vAlign="top" width="20%">
			<user:leftbar id="sideleft" runat="server" width="100%">
			</user:leftbar>
		</td><!-- End of left Bar-->
	<!--Content-->
		<td vAlign="top" width="60%" height="100%"><br>
		</td><!--End of Content-->
	<!--Right Bar-->
		<td width="20%">
			<user:rightbar id="rightbar" runat="server" align="middle">
			</user:rightbar>
		</td><!--End of Right Bar-->
	<!--Footer--><tr>
			<td width="100%" colSpan="3">
			<!--#include virtual=i_BlwBanner.aspx-->
		</td>
	</tr>
	<!--End of Footer-->
</TABLE>
```

Figure 6.1: HTML Table Tag

Animated Gif, BMP or JPEG graphics are also included into the documents by using HTML's image tags. For example, the HTML tag for the image is as below.

<asp:Image id="Image1" runat="server" ImageAlign="Middle"></asp:Image>

Besides producing and displaying tables and graphics, it is necessary to use HTML to create and design the user control for users to input information to the server and select information from the server. In the E-Mailing module users are allow to select which message to be read by clicking on the link button, select which message to be store or delete by checking the checkbox, and write a new message to Wellness centre by writing their message on the textarea box. The following Figure 6.2 present the used of user controls (highlighted code) written inside HTML, in order to pass the input into ASP.NET processing page.

```
<TABLE id="tableInbox" cellSpacing="1" cellPadding="3" border="0">
        <TR>
                <TD>
                        <asp:Label id="Label6" runat="server" Width="100%" Font-
Bold="True" ForeColor="Red" Font-Size="12pt" Font-Underline="True">Wellness E-
mail>Inbox</asp:Label>
                </TD>
                <TD align="right">
                        <asp:Button id="btnDelete" Text="Delete" Runat="server" Font-
Bold="True" CssClass="sidebartitle" Font-Size="8pt"></asp:Button>
                        <asp:Button id="btnSave" Text="Save" Width="63px"
Runat="server" Font-Bold="True" CssClass="sidebartitle" BorderStyle="NotSet" Font-
Size="8pt"></asp:Button>
                </TD>
        </TR>
        <TR>
                <TD colSpan="2">
                        <asp:Label id="msgnbox" Width="100%" Runat="server" Font-
Bold="true" CssClass="sidebartitle" Font-Name="Tohama"></asp:Label>
```

```
                    <asp:DataGrid id="MyDataGrid" runat="server" Width="100%"
BorderColor="#000000" CellPadding="2" BorderWidth="2px" Font-Names="Arial"
Font-Size="13px" HorizontalAlign="Left" DataKeyField="Mail">
                    <AlternatingItemStyle CssClass="evenrow">
                    </AlternatingItemStyle>
                    <ItemStyle CssClass="oddrow"></ItemStyle>
                    <HeaderStyle CssClass="sidebartitle"></HeaderStyle>
                    <Columns>
                            <asp:TemplateColumn>
                                    <ItemTemplate>
                                            <asp:CheckBox ID="myCheckbox"
Runat="server" CssClass="border"></asp:CheckBox>
                                    </ItemTemplate>
                            </asp:TemplateColumn>
                            <asp:BoundColumn DataField="ReplyDate"
HeaderText="Date"></asp:BoundColumn>
                            <asp:BoundColumn DataField="ReplyTime"
HeaderText="Time"></asp:BoundColumn>
                            <asp:TemplateColumn HeaderText="Subject">
                                    <ItemTemplate>
                                            <asp:LinkButton id="LinkSubj"
runat="server" CommandName="Subject" Text=<%#
DataBinder.Eval(Container.DataItem, "ReplySubj")%>></asp:LinkButton>
                                    </ItemTemplate>
                            </asp:TemplateColumn>
                    </Columns>
                    </asp:DataGrid></TD>
        </TR>
        <TR>
                <TD colSpan="2">
                    <asp:Label id="lblUpdate" Visible="False"
Runat="server"></asp:Label></TD>
        </TR>
</TABLE>
```

Figure 6.2: The Used of User Controls Written in HTML

Preparation of the HTML and ASP.NET web page involves endless cycle of testing and modifying of the ASP.NET source codes, loading the file in the browser for viewing and validating and then go back to make further changes where necessary.

6.4.2 Processing of Form Using ASP.NET Code Behind

After designing and creating form for user to enter the input, the next stage is to insert the ASP.NET code behind into the processing page so that the data entered can be processed by the server and updated to the table in the database. This is very important as only ASP.NET have the capabilities to pass parameter from one page to other web pages. Code behind is the page that we write the function and command such as page load, button click, item command and so on. Code behind is very important and act as a commander to run all the function and command on the web page. Scripting delimiters <%.....%> have to insert into the HTML Page for the server-side execution. Codes located within these delimiters and codes behind are invisible to the client and are only executed in the server.

The following Figure 3 shows how the data of a datagrid can be generate by using <%.....%> delimiter and the Figure 4 shows how the code behind was write to control the delete button.

```
<asp:DataGrid id="StoreDataGrid" runat="server" AutoGenerateColumns="False"
DataKeyField="Mail">
        <Columns>
                <asp:BoundColumn DataField="ReplyDate" HeaderText="Date">
                </asp:BoundColumn>
                <asp:BoundColumn DataField="ReplyTime" HeaderText="Time">
                </asp:BoundColumn>
                <asp:TemplateColumn HeaderText="Subject"><ItemTemplate>
                <asp:LinkButton id="StoreLinkSubj" runat="server" Visible="True"
CommandName="Subject" Text=<%# DataBinder.Eval(Container.DataItem,
"ReplySubj")%>></asp:LinkButton>
                </ItemTemplate></asp:TemplateColumn>
        </Columns>
</asp:DataGrid>
```

Figure 6.3: Using Scripting Delimiter <%.....%> At The HTML Page

6.4.3 Manipulating Data In The Database Using ADO.NET

Manipulating data in the database is the most important area in both the Charting Module and E-Mailing Module. ASP.NET is powerful that it can produce dynamically web pages by allowing the system to manipulate with the database record.

Through ADO.NET, user is able to read the records, find and filter specific records, update data as well as create or delete a record in the data store. ADO.NET uses connection object to store the information about the data store connection. The connection object needed to be created first before any access to the records. Figure 6.4 below show how to open a connection for inserting new record.

```
Dim conn As SqlConnection
Dim sqlcmd As SqlCommand
conn = New SqlConnection(ConfigurationSettings.AppSettings("ConnectionString"))
Dim strInsert As String="INSERT INTO EmlUserSend (SendDate,Subject,Message)
                         values(@SendDate,@ Subject,@Message)"
sqlcmd = New SqlCommand(strInsert, conn)

  sqlcmd.Parameters.Add(New SqlParameter("@SendDate", SqlDbType.NVarChar))
  sqlcmd.Parameters("@SendDate").Value = Now().ToShortDateString

  sqlcmd.Parameters.Add(New SqlParameter("@Subject", SqlDbType.NVarChar))
  sqlcmd.Parameters("@Subject").Value = TxtEmlSubj.Text

  sqlcmd.Parameters.Add(New SqlParameter("@Message", SqlDbType.Char))
  sqlcmd.Parameters("@Message").Value = TxtEmlMesg.Value

  sqlcmd.Connection.Open()
  Try
      sqlcmd.ExecuteNonQuery()
      message.Text = "<b><p>Thank You For Your Support!</p></b><br>"
  Catch Exp As SqlException
      message.Text = Exp.Message
  End Try
  sqlcmd.Connection.Close()
```

Figure 6.4: Database Connection for Inserting New Record

6.5 Development Tools

Table 6.1 described the outline of software tools that need to configure into the developer computer and server.

Table 6.1: Development Tools

Software	Description
Microsoft Windows 2000 Server	Server Operating System
Microsoft Internet Information Server	Web Server Host
Microsoft SQL 2000	Database
Microsoft Visual Studio.NET	Coding
Adobe Fotoshop 6.0	Graphics design

6.6 Debugging

Debugging is an activity to finding and fixing the bugs in the system. If a program does not have any error, it did not mean that it is free of bugs. By doing debugging, a programmer is able to trace the error with minimum time required compare to a programmer without a debugging tool. Therefore, programme needs to carryout this debugging or trouble shooting process to eliminate these bugs. Debugging is considered as the most boring process during the development phase.

There are various types of errors that exist in the system; compile error, run-time error and logic error. Luckily, the Microsoft Visual Studio.NET tool provides the features to identify the compile errors and runtime errors. However, the programmer needs to identify and locate the logic errors by themselves.

The debugger used for the development of Wellness Portal is the Microsoft Script Debugger and with the help of the Internet Explorer browser. When an error occurs, the browser will display an error type and notifying which file and which line of the program that has error. Figure 6.5 shows the example of error message prompt by the Microsoft Visual Studio. NET.

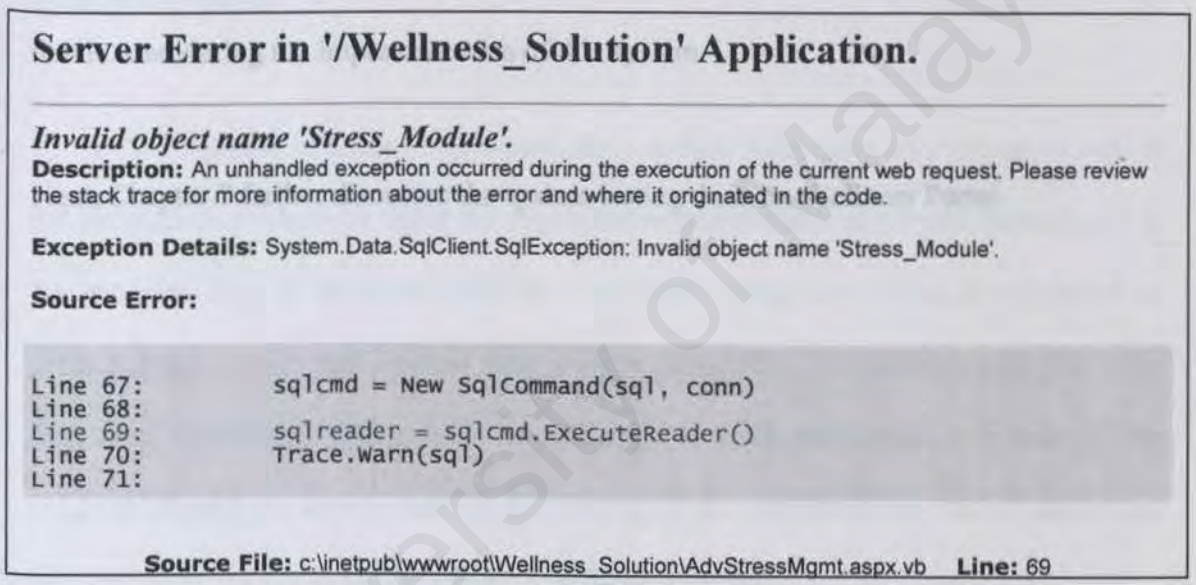


Figure 6.5: Example of Error Message

Sometimes, with this message, an experienced programmer will know the reason of this error. However, a new web programmer will need to debug the program to detect the error occurs, because the error message is not easily understandable. Then, the Microsoft Script Debugger plays it role. Programmer can put a breakpoint at where the error occurs and traces the error. However, sometimes it is impossible to make a program error free.

6.7 Summary

Chapter 6 presents the system implementation in terms of the coding approach, coding principle, developing coding for Wellness Portal and development of tools used. During the development of Wellness Portal, HTML is basically used to show the information. Code Behind is used to process all the function on HTML page and ADO.NET is used to manipulate data in the database. In order to validate inputs from user, client side scripting language is used that is VBScript. This chapter concludes with the debugging technique that is used during the implementation of this system

Next, Chapter 7 further discusses the system testing done on Wellness Portal.

CHAPTER 7: SYSTEM TESTING

7.1 Introduction

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

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

7.2 Types Of Testing

Although the testing process involved a lot of methods and testing levels, but basically, there are three stages of testing involved in this Wellness Portal System:

1. Unit testing
2. Integration testing
3. System testing

Figure 7.1 below depicts the flow of testing stages involved.

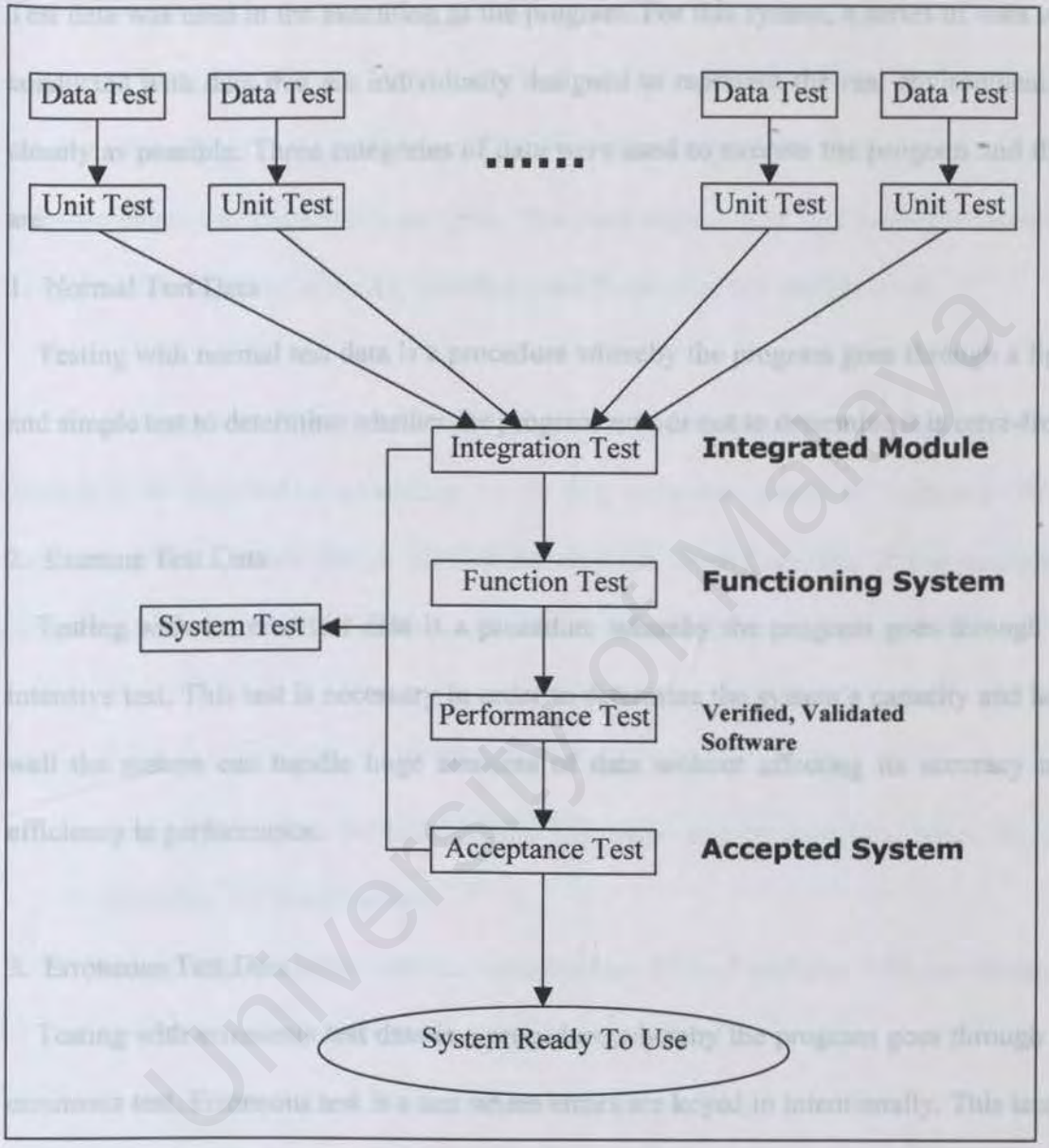


Figure 7.1: Flow Chart of Testing Stages

7.3 Data Test

Test data was used in the execution of the program. For this system, a series of tests was conducted with data that are individually designed to represent the real environment as closely as possible. Three categories of data were used to execute the program and they are:

1. Normal Test Data

Testing with normal test data is a procedure whereby the program goes through a light and simple test to determine whether the program runs or not to determine it is error-free.

2. Extreme Test Data

Testing with extreme test data is a procedure whereby the program goes through an intensive test. This test is necessary in order to determine the system's capacity and how well the system can handle huge amounts of data without affecting its accuracy and efficiency in performance.

3. Erroneous Test Data

Testing with erroneous test data is a procedure whereby the program goes through an erroneous test. Erroneous test is a test where errors are keyed in intentionally. This test is vital to determine how the program or system can handle such errors or incorrect data and from there, the reliability and the efficiency of the system can be predicted.

7.4 Unit Testing

Unit testing focuses on evaluating individual modules within a program. A module is tested independent of other modules. The sub function and input forms are verified and the flow from page to page is tested first. It is following by the testing of the relation between pages and shared-data integrity. The main objective of unit testing is to ensure program accuracy, data integrity, usability and efficiency at the module level.

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

The steps for unit testing are:

1. Manually examine the code simply just from reading though it, trying to spot algorithm and syntax errors.
2. Comparing the codes with the specification defined and also with the design is necessary to ensure all relevant cases are considered.
3. Compile the code and eliminate remaining syntax faults.
4. Develop test cases to show that the input is properly converted to the desire output.

Testing in this system is focused on both Charting Module and E-Mailing Module.

The following section discusses some of the modules testing in detail.

1. Charting Module

   - Only Advanced member who login successfully can access to this module, wellness administrator and normal member will not have the right to access this page.
   - Advanced member who successfully login need to select which test result their want to view in chart, after they click select button the chart will show.

2. E-mailing Module

   - Any user who wants to send mail must make sure the subject and the message is fill in. If any field is not fill in, a message box will be pop up to prompt the user to fill in the field.
   - When the user wants to submit the mail, a message will be pop up asking whether the user confirmed to send the mail with the entire mail written. If not, user can still click the reset button to reset the whole mail to fill in new details.

7.5 Integration Testing

The integration testing process is carried out after the unit testing process has been done. When satisfied that individual components or modules are working correctly and meet the system objective during the unit testing, these modules are then combined into a working system. Several independent modules combined into a single system causes some unpredicted and unexpected errors that related to the integration of these modules. Therefore, integration testing is a systematic approach for constructing the application

while conducting tests to uncover errors associated with interfacing of different components or modules.

One of the objectives of conducting integration testing is to determine whether the group of program's interfaces is detective or not. For Example, image buttons in the main page was tested whether it links to other modules or not and whether the image button changes it image to another image when the mouse rollover the image which is also known as rollover function.

Another objective is to ensure that the different unit-tested modules in Wellness Portal system can function smoothly together to the exaction of the system requirements. The major concerns here are the shared data, user privilege and security.

There are many approaches that can be used to do the integration testing. Such as Bottom-Up integration, Top-Down Integration, Big-Bang Integration, and sandwich Integration. For this system, the bottom-up approach has been used. When this method is used, each component or module at the lowest level of the system hierarchy is tested individual first. Then, the next components to be tested are thosethat call the previously tested ones. This approach is followed repeatedly until all components or modules are included in the testing.

After finishing the integration test, those errors and faults discovered is been corrected as soon as possible in order to proceed to the system-testing phase.

Figure 7.2 shows an example of constructed component hierarchy, whereas Figure 7.3 depicts the sequence of test and theirs dependencies of bottom-up testing.

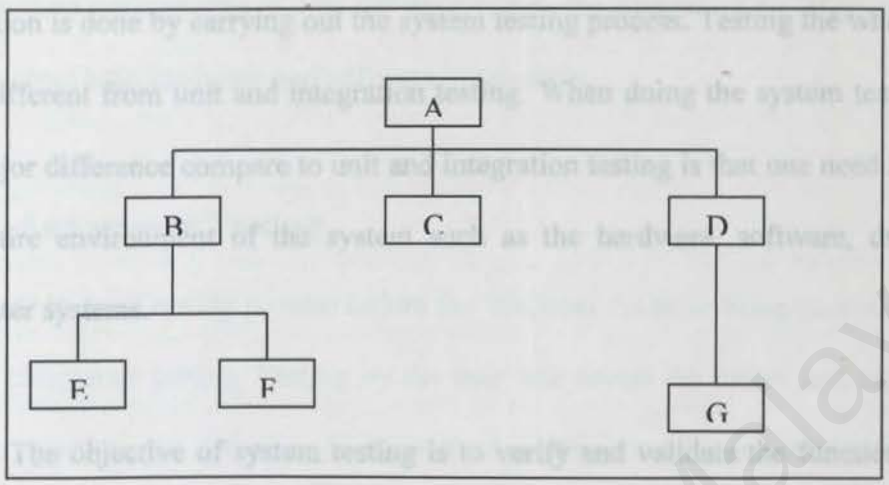


Figure 7.2: Example of Component Hierarchy

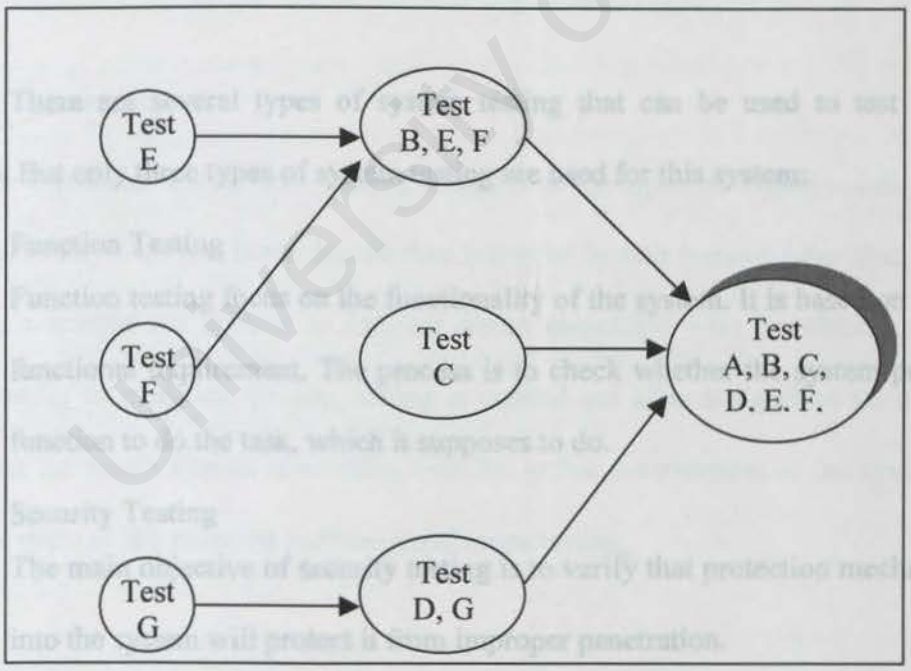


Figure 7.3: Bottom-Up Testing

7.6 System Testing

After all the modules are completed, the entire system must now be validated. This validation is done by carrying out the system testing process. Testing the whole system is very different from unit and integration testing. When doing the system testing process, the major difference compare to unit and integration testing is that one need to work with the entire environment of the system such as the hardware, software, databases and computer systems.

The objective of system testing is to verify and validate the functional and non-functional requirements of the system. The functional and non-functional requirements of Wellness Portal are as defined in Chapter 4.

There are several types of system testing that can be used to test a software system. But only three types of system testing are used for this system:

1. Function Testing
   Function testing focus on the functionality of the system. It is based on the system functional requirement. The process is to check whether the system provides the function to do the task, which it supposes to do.
2. Security Testing
   The main objective of security testing is to verify that protection mechanism built into the system will protect it from improper penetration.
3. Performance Testing

This testing is carried out after the function testing process. When the system performs the function required by the requirements, the testing process then turn to

test the way in which those functions are performed. Thus, the performance testing addresses the non-functional requirements. The purpose of this testing is to test the run time performance of this software within the context of an integrated system. It involves both hardware and software instruments.

7.7 Acceptance Testing

The final stage of testing process before the Wellness Portal is being accepted by the user is the acceptance testing. Testing by the user will reveal the errors and omission in the system requirements definition because the acceptance testing involves testing from the user. This will also reveal the requirement problems where the system facilities do not really meet the user's needs or the system performance is unaccepted.

7.8 Summary

Chapter 7 presents the System Testing in terms of the types of testing conducted for the system. Firstly, data test is conducted then followed by unit testing. After that, integration testing is carried out so that to uncover errors associated with interfacing of different components or modules. System testing is carried out after integration testing to make sure that the whole system is working with the entire environment of the system. Lastly, the end users of the program perform acceptance testing.

Next, Chapter 8 further discusses the system evaluation of Wellness Portal.

CHAPTER 8: SYSTEM EVALUATION

8.1 Introduction

This is the final phase in the life cycle of this project. During the period of coding and implementation, various problems were encountered. So, this chapter will highlight some of the problems faced throughout the project duration and also with the solution that has been taken to solve it. Besides that this chapter also will include the evaluation of the system to identify its strengths and limitations. As suggestion to further improvement of this system, the possibility to enhance the system also explored.

8.2 Problems Encountered And Solution

1. Difficulty In Determining Development Software Tools

Choosing suitable development tools is the most important and critical process in the software development cycle. There are many software tools available in the market today, for example: ASP.NET, Java. NET, C, Visual Basic, VB.NET and so on, not to mention the choices for other software such as database, report tools. Unfortunately, this wide range of tools available had raised the problems on making the decision in choosing the most suitable tools for the system needs.

To make sure that the suitable tools are chosen for this system, the first step is to define the needs of the system. Then doing some research based on the type of software needed that listed before. The research was done by surfing the Internet and seeking advice from experience people. Finally to choose the best combination among them, all the suitable software tools were listed out.

2. **Lack Of Knowledge And Experience In The Web Development**

Lack of knowledge and experience has proved to be an obstacle in the beginning. This is because the concepts of web programming and application are quite hard to understand, as it is different from the conventional programming concepts. The new exposure of the new technologies of product such as ASP.NET, ActiveX, Window NT Server, Internet Information Server and SQL Databases Server has increased the learning curve before starting the development of Wellness Portal.

Surfing the net for information and reading up on the concept of client-server and Internet programming which included the operation of web server, were some of the approaches take to overcome this problem. Most of the ambiguities are resolved by reading up on relevant materials and most importantly advice and guidance from course mates and experienced seniors.

3. **Difficulty In Understanding Script Errors**

The error messages from the Microsoft Script Debugger and Internet Information Server usually comprise of error code and error message, which are sometimes vague and unclear of the cause. Understanding the error messages was a constant struggle because I need to continue debugging, correcting, undoing and testing it until the program is correct. Some errors were solved with a clear understanding why the error occurred but some were solved without knowing why the error occurred or why the solution works. This may be due to lack of experience in ASP.NET programming. To overcome this problem, discussion with course mate using the same technology was a

great help. Besides that, many of the errors corrected were done through trial and error.

4. Searching For Related Links To Malaysian Wellness

As the name Wellness Portal implied, it was not easy to find related links. Links to Malaysian Wellness was limited. In order to solve the problem using the search engine, keywords need to be more precise. The selection of search engine is also important, as it will provide different search result. Careful selection search engines have helped to overcome this problem.

Besides that, analysis need to be done on the information provided from the websites to make sure it is relevant. This is also to make sure the information is correct and do not mislead the web users and wellness administrators to have gathered wrong information. At the same time, reference books were look up to search for related links provided by the author itself.

8.3 Evaluation By End Users

In Wellness Portal system actual testing, the researcher has invited 15 users to test on the system aspect of user acceptance test. 10 users are signed in as advanced member and 5 users are signed in as wellness administrator. After going through the whole system, the end users are given questionnaire to answer. (the questionnaire can be referred to Appendix C). The analysis of questionnaire for advanced members is shown as Table 8.1 below and the analysis of questionnaire for wellness administrator is shown in Table 8.2.

Table 8.1: Analysis Of Advanced Member Questionnaire

Event or Function	Successful	Failure	Failure reason/comment
Login to system	8	2	User forgets password and the system has no retrieve password function.
View personal chart	10	0	-
Sending e-mail	8	2	User sends a wrong message and the system has no reset or preview button.
Reading e-mail	7	3	Session time out
Storing read e-mail	10	0	-
Delete e-mail	10	0	-
Broken links	10	0	-

Table 8.2: Analysis of Wellness Administrator Questionnaire

Event or Function	Successful	Failure	Failure reason/comment
Login to system	9	1	User forgets password and the system has no retrieve password function.
Reading e-mail	10	0	-
Replying e-mail	9	1	Session time out
Broken links	10	0	-

8.4 System Strengths

The following points illustrate the strengths in the Wellness Portal system.

1. **Simple and User Friendly Interfaces**

   The interface of the system is simple and easy to use. The system makes full use of Windows, Icons, Menu, and Pointer (WIMP) techniques, allowing the user of visual object to navigate through the system. Clear, precise instructions guidance is also given to guide the user. Hence, user will find Wellness Portal easy to use and master.

2. **Fast Response Time**

   Each web page is designed as simple as possible to allow fast loading. Large size graphical images are avoided. This consideration has also been taken into the scripting part where overhead of calling script are kept to a minimum. The data validations are also carried out at the client site to enhance fast response time.

3. **Different User Privileges**

   This system can be access by three different types of users. They are normal member, advanced member and wellness administrator. Users must register with the system online to get the permission to access the system. Users only can access the pages that they have been authorized to.

4. Security Feature

This system includes the security control that only allows the authorized user to access the system. It has a login module where a user who wants to access the system needs to supply a login id and password. And since Wellness Portal is password-protected site, each user has a unique login id and password. Hence, unauthorized users are prohibited from accessing its records stored in the database.

5. System Transparency

System transparency refers to the condition where the users do not need to know where the database resides, how is the system structure, its database management system and anything related to the system built. For example, the information retrieval and downloading of records are similar to a system accessing the local database. This is to ensure not to confuse users in retrieving information. Besides that, Wellness Administrator can add, delete and update the data in the database by just click of the mouse.

8.5 System Constraints

1. Limitation in Generate 3D Charts

Currently the system only provides 2D charts online. The limitation in generating 3D charts may make user feel bored.

2. **No Charting in Wellness Administrator site**

Charting Module are currently available in advanced member's site to show member's history medical screening records, but have no single charts in the administrator site to show the web activities like the number of user sending mail or numbers of mail reply. This is because due to time constraints.

3. **No forum**

Forum is not provided in the system. Therefore, user cannot chat, share their knowledge and experience and exchange knowledge with other user.

8.6 Future Enhancement

1. **Enhance Charts Module**

In the future and as part of enhancing the charts Module, system should able to generate 3Dcharts.The variety of charts should be increase also because currently the system only can generate 3 type of charts such as pie chart, bar charts, and line graph. With more variety of graph and enhancing it to be 3D graph will increase member's satisfaction.

2. **Adding Charts Module in Wellness Administrator's Site**

Charts Module in Wellness Administrator's site is indispensable tools for managing the system activities. In the future where the number of members grows in Wellness Portal, it is difficult and troublesome for administrator to trace the

daily or weekly or even monthly activities of the system. The Charts Module will assists the administrator to trace the web activities easily without wasting time.

3. Adding Forum

To further enhance the system, forum should be included to make the system more interesting. Hence, members will able to chat, share their knowledge and experience, and exchange knowledge through the web.

8.7 Knowledge And Experience Gained

From this Wellness Portal thesis project, I have gained additional knowledge on web development and Visual Basic.NET programming. Before I involved in this project, I have no programming knowledge on web development, this includes ASP.NET technology and VBScript programming. Besides increasing the knowledge on web programming, I have also learned to use Ms SQL Server to build the database. Moreover, theories and knowledge gained throughout the course of computer studies like system analysis and design, software engineering were literally put into practice.

Besides that, I also learnt to solve the problems by made the reference to the useful source especially MSDN Documentation. The valuable experiences are especially helpful in the future involvement of software development.

8.8 Summary

Chapter 8 presents the system evaluation in terms of problems encountered and its solutions, evaluation by end users, system strengths and system constraints. Future enhancement is also included in this chapter so that Wellness Portal can be further enhanced to provide a better quality system. This chapter concludes with the knowledge and experience gained during the software development.

8.9 Conclusion

Overall, Wellness Portal has achieved the system objectives defined during the analysis stage and fulfilled all the functional and non-functional requirements. Throughout this project, useful knowledge and experience are gained. From the development of Wellness Portal, time is used to master language like HTML, ASP.NET, and VB.NET that are useful in web programming. Besides, I also gained a lot of experience in Visual Studio .NET programming. Here, theories and knowledge gained throughout the course of Bachelor Of Information Technology studies like system analysis and design, software engineering were literally put into practice.

Wellness Portal has fully tested and is a reliable system. The software engineering concepts, principles and techniques applied in Wellness Portal are carefully selected and analyzed to determine its suitability. The development of this project using these techniques will ease the tasks of future enhancements and expansions for Wellness Portal. These experiences are especially helpful in future involvement of software development.

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APPENDIX A: USER MANUAL

This user manual consist of 4 parts that are:

1. Introduction
2. Hardware and Software Requirement
3. Charting Module Manual
4. E-Mailing Module Manual

PART 1: Introduction

The evaluation throughout the years brought about the Internet and it changes the way wellness to be delivered to the people all over the world. And thus, Wellness Portal is an online Wellness Center created to people to access the portal at their own convenient via Internet. It is designed to create an information-rich environment of wellness resources, which can be obtained at any time and from anyplace to save people time.

PART 2: Hardware And Software Requirement

In order to use the system, it is recommended that the below hardware and software requirement are followed.

1. Processor -- Pentium 166 with MMX
2. Memory -- 64 MB RAM
3. Hard Disk -- 150 MB
4. Input Device -- Keyboard and mouse
5. Output Device -- Printer
6. Browser -- Internet Explorer 5.0 and above

PART 3: Charting Module Manual

3.1 Charting Module Page in Advanced Member's site

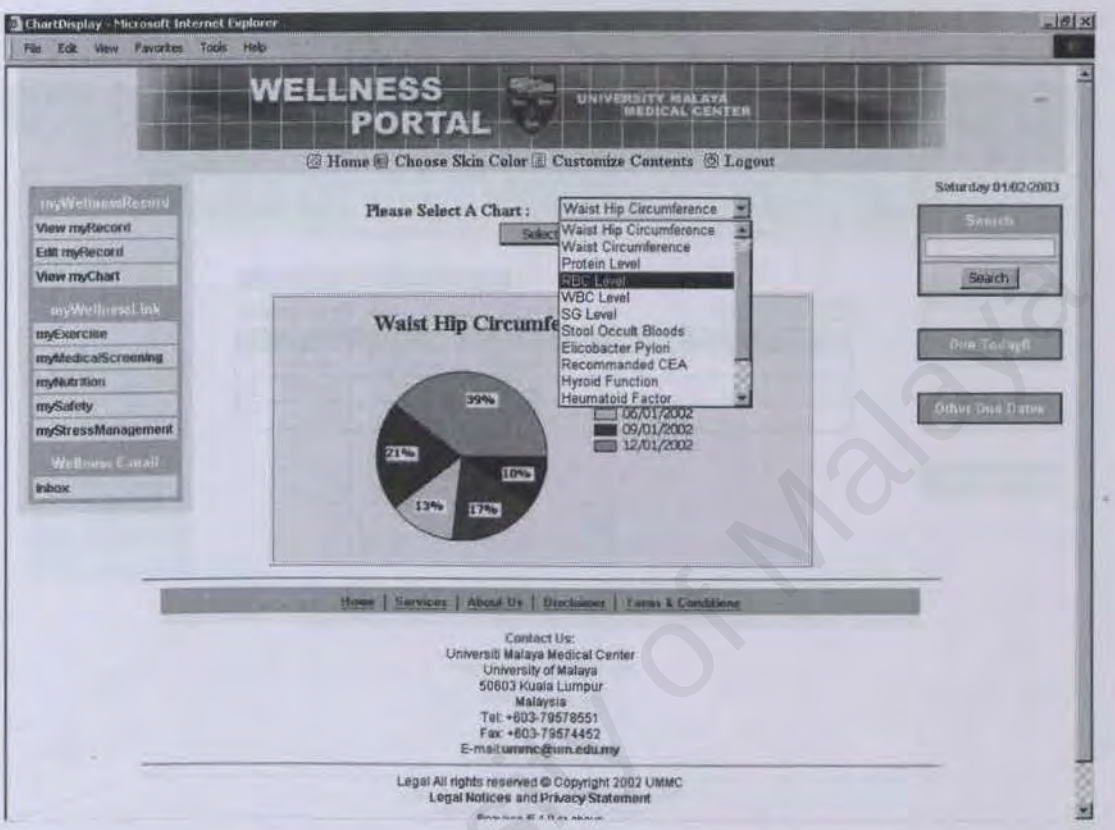

Figure 3.1: Charting Module Page In Advanced Member's Site

When you click on View myChart link at the left navigation bar, you will directed to the Charting Module page, which shown in Figure 3.1. In order to view your desired chart you need to select a chart from the list box. And click on the Select button. The chart will change every time when you select a different type of chart from the list box.

PART 4: E-Mailing Module Manual

4.1 E-mailing Module on member's Site

4.1.1 Inbox of Member's E-mailing Module

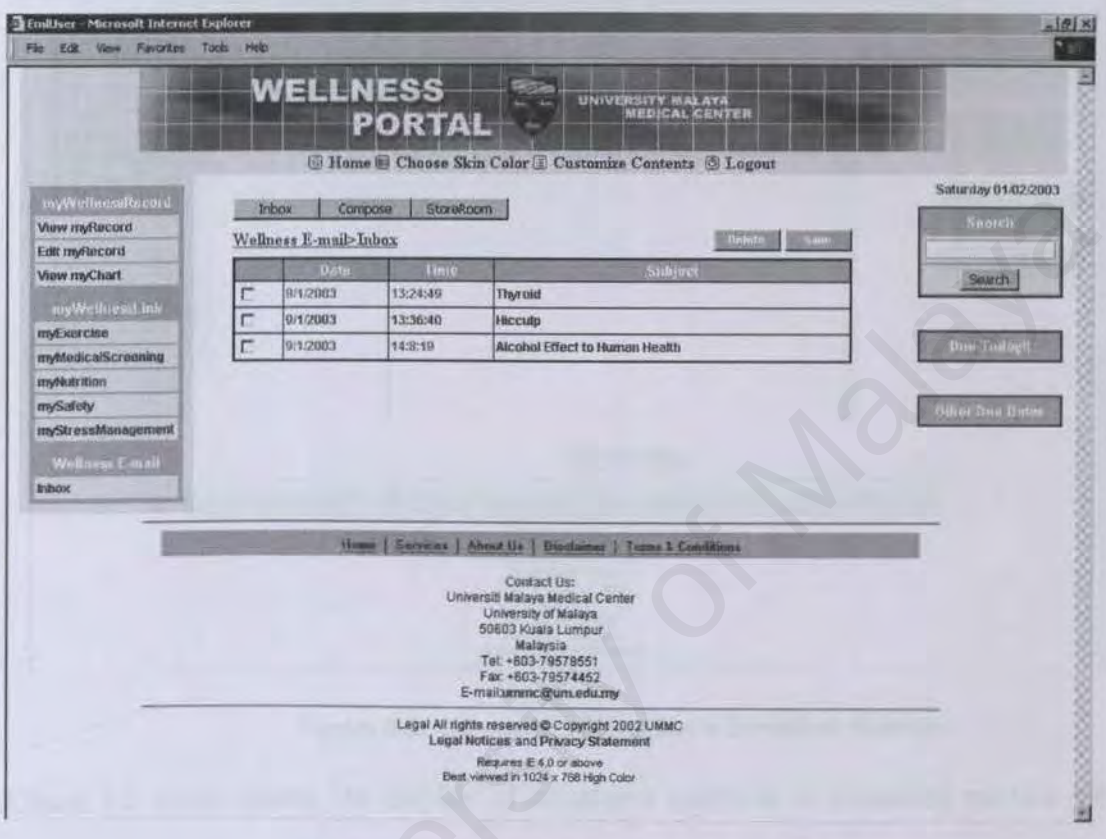

Figure 4.1: Inbox of member's E-mailing Module

Inbox of member's e-mailing module that shown in Figure 4.1 can be access by clicking on the Inbox link at the left navigation bar. The table shown the mail list in the member's Inbox. Member can easily read the mail by clicking on the subject link button. Member also can delete or store their mail by checked the check box on the first column of the table and then click on the Delete or Store button on the right-top of the table.

4.1.2 Compose of Member's E-mailing Module

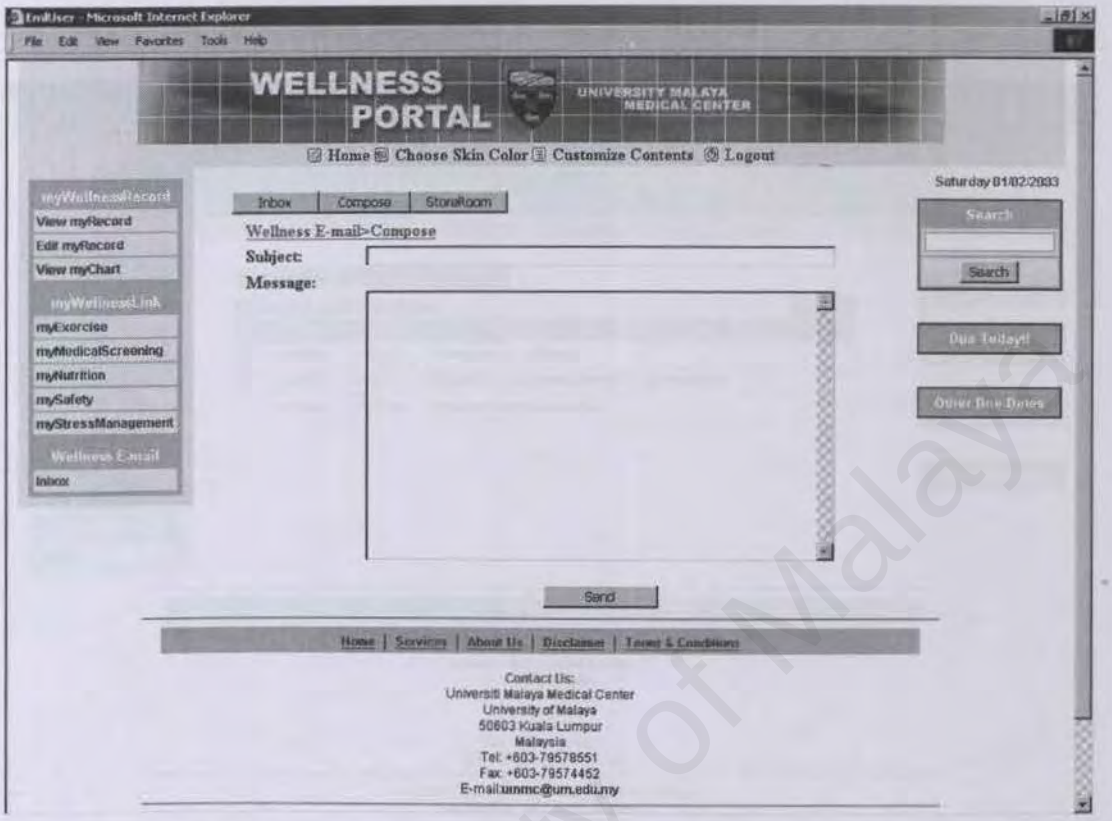

Figure 4.2: Compose of Member's E-mailing Module

Figure 4.2 above shows the display of member's compose in e-mailing module when member click on the compose button at top-left of the Inbox Page. Member need to fill in all the text boxes in order to send the mail to Wellness Center.

4.1.3 StoreRoom of Member's E-mailing Module

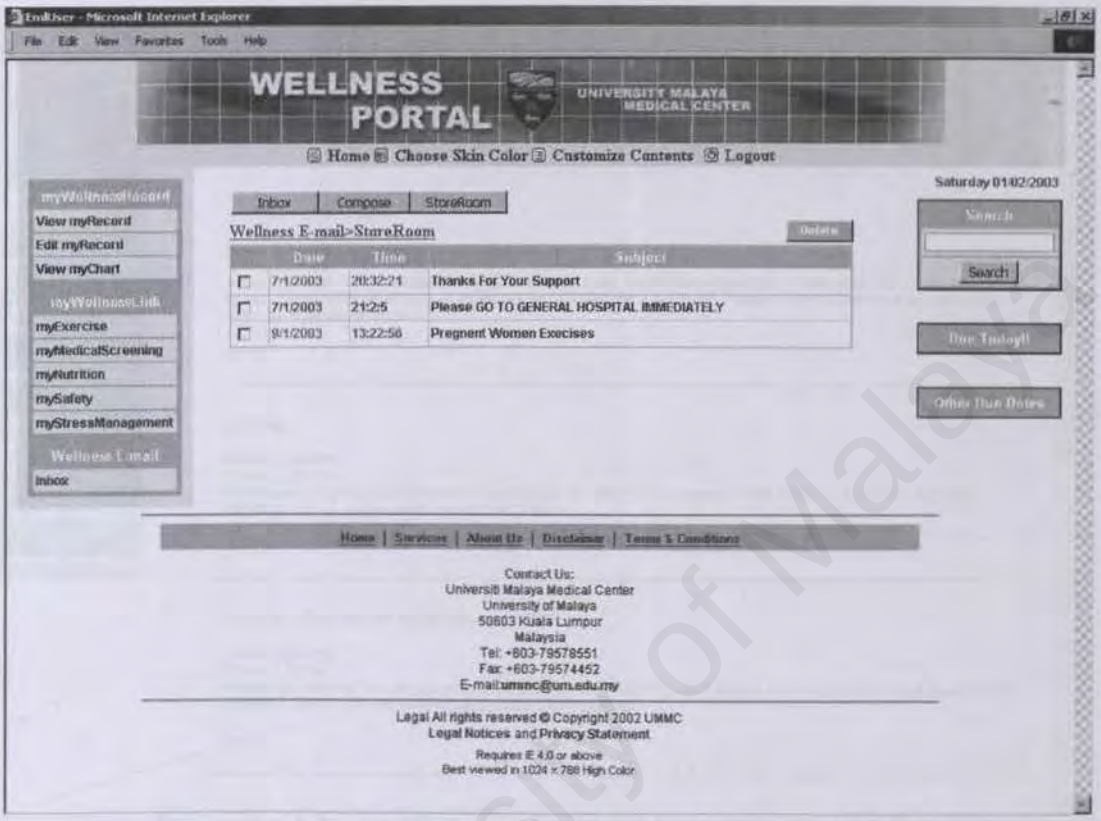

Figure 4.3: StoreRoom of Member's E-mailing Module

The StoreRoom can be easily access by clicking on the StoreRoom button on the Inbox Page. It used to list out all the mail that been stored by the member and member can read the mail by clicking on the subject link button. At the same time, member also can delete the store mail by checked the check box and click on the Delete button on the right top of the table.

4.2 E-mailing Module on Wellness Administrator's Site

4.2.1 Inbox of Wellness Administrator's E-mailing Module

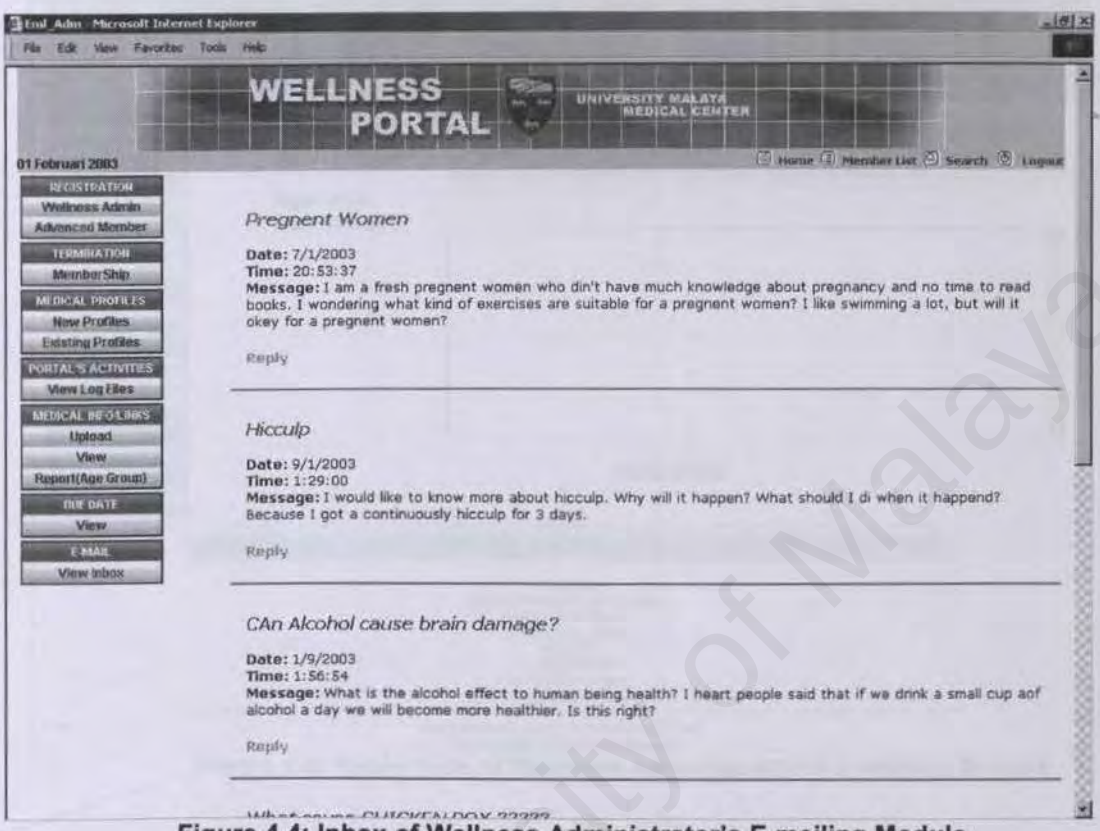

Figure 4.4: Inbox of Wellness Administrator's E-mailing Module

Wellness Administrator's Inbox can be access by clicking on the View Inbox at the left navigation bar. This page will list out all the mail that member sent to the Wellness Center. A Wellness Administrator can reply the mail by clicking on the Reply link button and the reply form will prompt out.

APPENDIX B: CODING

In this appendix, A few samples of coding which is deemed important are shown here.

The coding below is used to create a line graph by retrieving data from the database.

```
Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
        Panel1.Visible = True
        Dim bm As Bitmap
        Dim a As String
        a = lstChartsTitle.SelectedItem.ToString


        If a = "BMI" Then
            Dim sqlSelect As String = "SELECT BMI,Test_Date FROM
MedProTestRec_PhysicalInformation WHERE UserID='{92A5D6F5-B09C-49B8-
A8C5-EAAF48E1590E}'"
            bm = LineChart(sqlSelect)


            Dim sPath As String = Request.PhysicalApplicationPath
            Dim sFileName As String
            sFileName = "Images\BMI.jpg"
            File.Delete(sPath & sFileName)

            bm.Save(sPath & sFileName, ImageFormat.Jpeg)
            Image1.ImageUrl = sFileName

            bm.Dispose()
            bm.Dispose()

        End If

End Sub

Function LineChart(ByVal sqlSelect As String) As Bitmap
        Const imagew = 500
        Const imageh = 250
        Const showgridlines = True

        Dim i As Integer
        Dim objBitMap As New Bitmap(imagew, imageh)
        Dim objGraphics As Graphics
        objGraphics = Graphics.FromImage(objBitMap)
        objGraphics.SmoothingMode = SmoothingMode.HighQuality
        objGraphics.Clear(Color.WhiteSmoke)

        'Build an array of values for the bar and pie chart.
        'These values could also be pulled from a database.
        Dim con As SqlConnection = New
SqlConnection(ConfigurationSettings.AppSettings("ConnectionString"))
```

```
        Dim com As New SqlCommand(sqlSelect, con)
        con.Open()
        Dim da As New SqlDataAdapter(com)
        Dim ds As New DataSet()
        da.Fill(ds)
        Dim n As Integer = ds.Tables(0).Rows.Count - 1
        Dim dr As SqlDataReader = com.ExecuteReader()
        Dim TestResult(n) As Integer
        Dim TestDate(n) As String
        'Here is your loop that will iterate through the "Months"
column

        While (dr.Read())
            TestResult(i) = dr.GetValue(0)
            TestDate(i) = dr.GetValue(1)
            i = i + 1
        End While
        con.Close()

        'Find maximum Data element in the dataset
        Dim max As Integer = 0
        For i = 0 To n
            If max < ds.Tables(0).Rows(i).Item(0) Then
                max = ds.Tables(0).Rows(i).Item(0)
            End If
        Next

        Dim temp As Double
        If max > 10 And max <= 100 Then
            temp = max
        ElseIf max > 1 And max <= 10 Then
            temp = max * 10
        ElseIf max > 0.1 And max <= 1 Then
            temp = max * 100
        End If
        '************************************************
        Dim a As Double = temp Mod 5
        If a <> 0 Then
            temp = temp + 5 - a
        End If
        '************************************************
        If max > 1 And max <= 10 Then
            temp = temp * 10
        ElseIf max > 0.1 And max <= 1 Then
            temp = temp * 100
        End If


        ' Create Title
        Dim fmt As StringFormat = New StringFormat()
        fmt.Alignment = StringAlignment.Center
        fmt.LineAlignment = StringAlignment.Center
        objGraphics.DrawString(lstChartsTitle.SelectedItem.ToString & "
Report", New Font("Times new roman", 16, FontStyle.Bold),
SystemBrushes.WindowText, New RectangleF(0, 0, 500, 50), fmt)

        'Create xAxisLabel
```

```
        objGraphics.DrawString("Test Date", New Font("Times new roman",
10, FontStyle.Bold), SystemBrushes.WindowText, 430, 210)

        'Create yAxisLabel
        fmt.Alignment = StringAlignment.Near
        fmt.LineAlignment = StringAlignment.Far
        objGraphics.DrawString("Test Result", New Font("Times new
roman", 10, FontStyle.Bold), SystemBrushes.WindowText, New
RectangleF(50, 40, 375, 20), fmt)

        'draw the maker on the y axis and Draw grid
        Dim gridHeight As Integer = 150 / 5
        Dim gridPen As Pen = New Pen(Color.Gray, 1)
        gridPen.DashStyle = Drawing.Drawing2D.DashStyle.Dash
        gridPen.DashCap = Drawing.Drawing2D.DashCap.Triangle

        objGraphics.DrawRectangle(Pens.Black, 70, 220, 5, 1)
        objGraphics.DrawString("0", New Font("Times new roman", 10,
FontStyle.Bold), SystemBrushes.WindowText, New PointF(50, 215))

        For i = 1 To 5
            Dim addY As Integer = i * 30
            objGraphics.DrawLine(New Pen(Color.Black), 70, 220 - addY,
75, 220 - addY)
            objGraphics.DrawString(temp / 5 * (i), New Font("Times new
roman", 10, FontStyle.Regular), SystemBrushes.WindowText, New
PointF(50, 215 - addY))
            objGraphics.DrawLine(gridPen, 75, 70 + i * gridHeight, 425,
70 + i * gridHeight)

        Next

        'Loop through the values to create the Line Chart.
        Dim blackPen As New Pen(Color.FromArgb(255, 0, 0, 0), 2)
        Dim barw As Integer
        barw = 350 / n
        Dim x As Integer = 75
        Dim y As Integer = 220 - Round(150 / temp * TestResult(0))
        objGraphics.DrawString(TestResult(0), New Font("Times new
roman", 8, FontStyle.Bold), SystemBrushes.WindowText, New PointF(x - 8,
y - 17))
        objGraphics.FillEllipse(New SolidBrush(Color.Black), x - 5, y -
5, 10, 10)

        For i = 1 To n
            Dim scale1 As Integer = Round(150 / temp * TestResult(i))
            Dim x1 As Integer = 75 + barw * (i)
            Dim y1 As Integer = 220 - scale1
            objGraphics.DrawLine(blackPen, x, y, x1, y1)
            objGraphics.DrawString(TestResult(i), New Font("Times new
roman", 8, FontStyle.Bold), SystemBrushes.WindowText, New PointF(x1 -
8, y1 - 17))
            objGraphics.FillEllipse(New SolidBrush(Color.Black), x1 -
5, y1 - 5, 10, 10)
            x = x1
            y = y1
        Next
```

```
        'draw the lines
        objGraphics.DrawLine(New Pen(Color.Black), 75, 70, 75, 220)
        objGraphics.DrawLine(New Pen(Color.Black), 75, 220, 425, 220)

        'draw the markers on the x axis
        For i = 0 To n
            Dim temppointx As Integer
            Dim Cox As Integer
            temppointx = 75 + barw * i
            Cox = 50 + i * barw
            objGraphics.DrawRectangle(Pens.Black, temppointx, 220, 1,
5)
            objGraphics.DrawString(TestDate(i), New Font("Times new
roman", 8, FontStyle.Bold), SystemBrushes.WindowText, New PointF(Cox,
230))

        Next

        Return objBitMap
    End Function
```

The Code below is used in the member's E-mailing module to list out all the mail in the Inbox.

```
Sub Load_DataGrid()

        Dim myConnection As SqlConnection
        Dim SqlSelect As String
        SqlSelect = ("SELECT * FROM EmlAdmReply WHERE
UserID='{92A5D6F5-B09C-49B8-A8C5-EAAF48E1590E}'AND Status='New' ORDER
BY Mail ASC")
        myConnection = New
SqlConnection(ConfigurationSettings.AppSettings("ConnectionString"))
        Dim myCommand As SqlDataAdapter
        myCommand = New SqlDataAdapter(SqlSelect, myConnection)
        Dim ds As DataSet = New DataSet()
        myCommand.Fill(ds)

        If ds.Tables(0).Rows.Count = 0 Then
            msgnbox.Text = "You Got No Message!"
            MyDataGrid.Visible = False
            msgnbox.Visible = True
        Else
            msgnbox.Visible = False
            MyDataGrid.DataSource = ds
            MyDataGrid.DataBind()
            MyDataGrid.Visible = True

        End If
```

The code below used to send mail to Wellness Centre in Compose member's e-mailing module.

```
Private Sub BtnSubmit_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles BtnSubmit.Click
        Chck_Panel.Visible = True
        Msgn_panel.Visible = True
        Panel_Inbox.Visible = False
        ReadMsgn_Panel.Visible = False

        Dim conn As SqlConnection
        Dim sqlcmd As SqlCommand

        conn = New
SqlConnection(ConfigurationSettings.AppSettings("ConnectionString"))
        Dim strInsert As String
        strInsert = "INSERT INTO EmlUserSend
(UserID,SendDate,SendTime,Subject,Message,Status)
values(@UserID,@SendDate,@SendTime,@Subject,@Message,@Status)"
        sqlcmd = New SqlCommand(strInsert, conn)

        sqlcmd.Parameters.Add(New SqlParameter("@UserID",
SqlDbType.NVarChar))
        sqlcmd.Parameters("@UserID").Value = "{92A5D6F5-B09C-49B8-A8C5-
EAAF48E1590E}"

        sqlcmd.Parameters.Add(New SqlParameter("@SendDate",
SqlDbType.NVarChar))
        sqlcmd.Parameters("@SendDate").Value = Now().ToShortDateString

        sqlcmd.Parameters.Add(New SqlParameter("@SendTime",
SqlDbType.NVarChar))
        sqlcmd.Parameters("@SendTime").Value = Now().ToLongTimeString

        sqlcmd.Parameters.Add(New SqlParameter("@Subject",
SqlDbType.NVarChar))
        sqlcmd.Parameters("@Subject").Value = TxtEmlSubj.Text

        sqlcmd.Parameters.Add(New SqlParameter("@Message",
SqlDbType.Char))
        sqlcmd.Parameters("@Message").Value = TxtEmlMesg.Value

        sqlcmd.Parameters.Add(New SqlParameter("@Status",
SqlDbType.NVarChar))
        sqlcmd.Parameters("@Status").Value = "New"

        sqlcmd.Connection.Open()

        Try
            sqlcmd.ExecuteNonQuery()
            Msgn_panel.Visible = False
            ReadMsgn_Panel.Visible = False
            Panel_Inbox.Visible = False
            Store_Panel.Visible = False
```

```
            StoreRead_Panel.Visible = False
            BtnInbox.Visible = False
            BtnCompose.Visible = False
            BtnStoreRoom.Visible = False

            Chck_Panel.Visible = True

            message.Text = "<b><p>Your Message Has Been Send To
Wellness Center</p><p>Thank You For Your Support!</p></b><br>"

        Catch Exp As SqlException

            message.Text = Exp.Message
            message.Style("color") = "red"

        End Try

        sqlcmd.Connection.Close()

    End Sub
```

The code below shown how to list out all the mail sent by the members at Wellness Administrator's View Inbox page.

```
Sub Bind_MyDataList()

        Dim myConnection As SqlConnection
        Dim myCommand As SqlDataAdapter
        myConnection = New
SqlConnection(ConfigurationSettings.AppSettings("ConnectionString"))
        myCommand = New SqlDataAdapter("SELECT
SendDate,SendTime,Subject,Message FROM EmlUserSend WHERE Status='New'
ORDER BY SendID ASC", myConnection)
        Dim ds As DataSet = New DataSet()
        myCommand.Fill(ds)
        MyDataList.DataSource = ds
        MyDataList.DataBind()

    End Sub
```

The code below used to prompt out the Reply form when administrator click on the Reply link button on the Wellness Administrator's View Inbox Page

```
Private Sub MyDataList_ItemCommand(ByVal source As Object, ByVal e As
System.Web.UI.WebControls.DataListCommandEventArgs) Handles
MyDataList.ItemCommand
        If (e.CommandName = "select") Then
            Dim myConnection As SqlConnection
            myConnection = New
SqlConnection(ConfigurationSettings.AppSettings("ConnectionString"))
            Dim sqlSelect As String
            sqlSelect = ("SELECT UserID,Message FROM EmlUserSend WHERE
Status='New'ORDER BY SendID ASC")
            Dim com As New SqlCommand(sqlSelect, myConnection)
            myConnection.Open()
            Dim da As New SqlDataAdapter(com)
            Dim ds As New DataSet()
            da.Fill(ds)
            Dim dr As SqlDataReader = com.ExecuteReader()
            Dim OriginMsgn(ds.Tables(0).Rows.Count - 1) As String
            Dim UserID(ds.Tables(0).Rows.Count - 1) As String
            Dim i As Integer

            While (dr.Read())
                UserID(i) = dr.GetValue(0)
                OriginMsgn(i) = dr.GetValue(1)

                i = i + 1
            End While
            myConnection.Close()
            lblUserID.Text = UserID(e.Item.ItemIndex)
            lblOriginMsgn.Text = OriginMsgn(e.Item.ItemIndex)

            Dim sqlUpdate As String
            sqlUpdate = "UPDATE EmlUserSend SET Status='In Process'
WHERE Message ='" & lblOriginMsgn.Text & "'"
            Dim myCommand As SqlCommand = New SqlCommand(sqlUpdate,
myConnection)
            myCommand.Connection.Open()
            Try
                myCommand.ExecuteNonQuery()
                UpdateMsgn.Text = "<b><p>Message Sent</p></b><br>"

            Catch Exp As SqlException

                UpdateMsgn.Text = Exp.Message
                UpdateMsgn.Style("color") = "red"

            End Try
            myCommand.Connection.Close()
            Panel_Message.Visible = False
            Panel_ReadMail.Visible = False
            Panel_ReplyMail.Visible = True
        End If
    End Sub
```

APPENDIX C: QUETIONNAIRE

User Acceptance Testing Questionnaire (Member Section)

Name: _____

Age : _____ Gender: Female/Male

Instruction:

Below are the functions in the system. For each function, please tick (✓) once in the column provided. If failure, please state your reason.

Event or Function	Successful	Failure	Failure reason/comment
Login to system			
View personal chart			
Sending e-mail			
Reading e-mail			
Storing read e-mail			
Delete e-mail			
Broken links			

User Acceptance Testing Questionnaire (Wellness Administrator Section)

Name: _____

Age : _____ Gender: Female/Male

Instruction:

Below are the functions in the system. For each function, please tick (✔) once in the column provided. If failure, please state your reason.

Event or Function	Successful	Failure	Failure reason/comment
Login to system			
Reading e-mail			
Replying e-mail			
Broken links			