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ONLINE PROGRAMMING GROUP NETWORK (OPGN)

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ABSTRACT

Online Programming Group Network is a web portal with the programming as the main focus. It is a portal which develop special to manage programming problems faced by FSKTM members. By using the system, users can access useful links to other programming sites which possess a lot of notes or tutorial, post question in forum and also chat with other user to discuss the same problems that they are facing. The main objective of the system is to provide students an avenue to communicate with each other not only among students but also lecturers and tutors regarding programming problems they face. Therefore, it is hoping that this system will assist them to easily get different kinds of programming resources and help them in finding out solutions of their programming problems. In this project, Unified Process has been chosen to develop the system. Besides, special development technology and tools like ASP.NET, Internet Information Server (IIS), and Microsoft Visual Studio .Net, Microsoft SQL Server 2000 are needed in the software development. The target users of the system are FSKTM's lecturers, tutors and students.

ACKNOWLEGEMENT

First and foremost, I would like to take this opportunity to express my deepest gratitude to my project supervisor, Ms. Azwina Mohd Yusof for giving me the opportunity to take up the challenge of this topic – Online Programming Group Network. I would also like to thank her for her patience, tolerance, ongoing advice, for providing me strongly support throughout this project. The sharing of your views, knowledge and experiences had indeed enlightened me and given me plenty of ideas during carry out this project.

With this golden opportunity, I would like to give a million thanks to my project moderator, Ms. Zarinah Mohd Kasirun for her invaluable comments, opinions, advices and feedbacks regarding this project. It has provided me with much needed suggestions to further improve my project.

Also, special thanks to Dr. Phang Keat Keong, Mr Chong Theng Hui and Ms Lee Ai Yean for spending their precious time and giving chance to me to have an informal interview. Not forgetting also, all the respondents who have participate in the survey which carried out for getting system requirements for the project.

Last but not least, I would like to show appreciation to my family and friends for giving me their full support and encouragement during the entire course of this project. Without them, this project would not have been completed.

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CHAPTER 1 INTRODUCTION

1.1 Project Overview

Programming as the main subject for every FSKTM students, is always recognized as a course which is very hard to learn, understand and master. Currently, our faculty is facing a very high percentage of student failure in programming course. The reason of why this phenomenon happened always become the topic for lecturers to discuss and solved. Hence, it is important for us to provide some sort of tool to help our students in solving or at least finding the solution of their programming problems.

Online Programming Group Network is a web portal which develop special to manage programming problems faced by FSKTM members. The system aims to assist users to get different kinds of programming resources easily in order to solve their programming problems. By using the system, users can access useful links to other programming sites which possess a lot of notes or tutorial, post question in forum and also chat with other user to discuss the same problems that they are facing.

This system will be available on-line 24 hours a day for 7 days a week. As the system is always available, lecturer and tutors can help our students at anytime. It is hoping that this system will be useful for the user and indirectly help them to improve their programming skills.

1.2 Problem Domain

Below are some problems and limitations currently faced by lecturers and students in FSKTM, when teaching and studying the programming courses:

- Time Constraint

  The lecture hour is too short for students to fully understand certain chapters or programming ideas. Moreover, limited lab hour are insufficient for students to discuss lab exercise as well as other programming problems. Additionally, most of the lecturers have no enough time to handle all students during their consultation hour as too many students make appointment at the same time.

- Inefficient Communication

  A poor interaction between lecturers and students always occurs during the lecture hours. In lecture, students always shy to ask questions even they have any query about the particular topic. Besides, currently there is no very efficient way for students to communicate with lecturers or even among the students themselves.

- Lack of Learning Resources

  Currently, the course homepage provides only the note and exercises for the particular course. Most of the homepages do not provide other programming resources like collection of links to other useful websites, online tutorials and so on.

- Lack of place to share and help

  Discussion forum available in the course homepage normally joined by students who taking the particular course only and normally focuses on the particular course. Currently, a common portal or discussion board to gather all the lecturers and students to help each other or share their source code is not existed in FSKTM.

1.3 Objective of the Project

The objectives of this project are listed as below:

- Develop a web portal to provide students in FSKTM an avenue to communicate with each other regarding programming problems they face.
- Enable lecturers in FSKTM to help and guide their students to solve any programming problems by answering their questions online.
- Save a lot of precious time, where students can easily get help from lecturers through the web without finding the lecturer face-to-face.
- Enable target users to search and access many useful programming resources such as notes, tutorial, exercise which covers different criteria of programming problems and solutions.
- Easier the process of finding information by provides a search engine that can search locally or search through the World Wide Web.

1.4 Scope of the Project

The scopes of project are listed as below:

- The system only specific for searching programming problems and solutions.
- The system only concentrates on programming language such as C/C++, Java, .net and other major programming language. System does not provide programming resource for all kind of languages found in the world.
- The system will only support English as a single communication language. All the information will be communicated in English.
- The main target user of the system is undergraduate who currently study in FSKTM only.
- The system basically only manages programming problems faced by beginners and intermediary programmers.

Target Users:

- Undergraduates in FSKTM

  The main target user of the system. They are allowed to post message in forum, upload and download file, chat as well as search information.
- Lecturers in FSKTM

  The main role of lecturer in this system is to help and answer student question as well as guide them to solve their problems. They are also allowed to post message in forum, upload and download file, chat as well as search information.

Based on the system administration and target users, the proposed system has been divided into two modules namely Administrator Module and User Module which performed some of their own functions respectively.

- Administrator Module

  The main functions are managing and updating programming resources, determining which submitted file to be uploaded as well as managing the discussion forum.

- User Module

  Allow logged-in user to post message in forum, upload and download file, chat and search the programming resources from the system.

1.5 Expected Outcomes

The expected outcomes of the project are stated below:

- The system is available on-line through the Internet.
- The system is able to ensure only authorized user can access private information such as personal detail in the system database.
- The system can perform the basic function such as forum, access links to notes, tutorials and so on.
- A search engine is provided in the system.
- The system is able to expand and allow future enhancement and additional functions.

1.6 Project Schedule

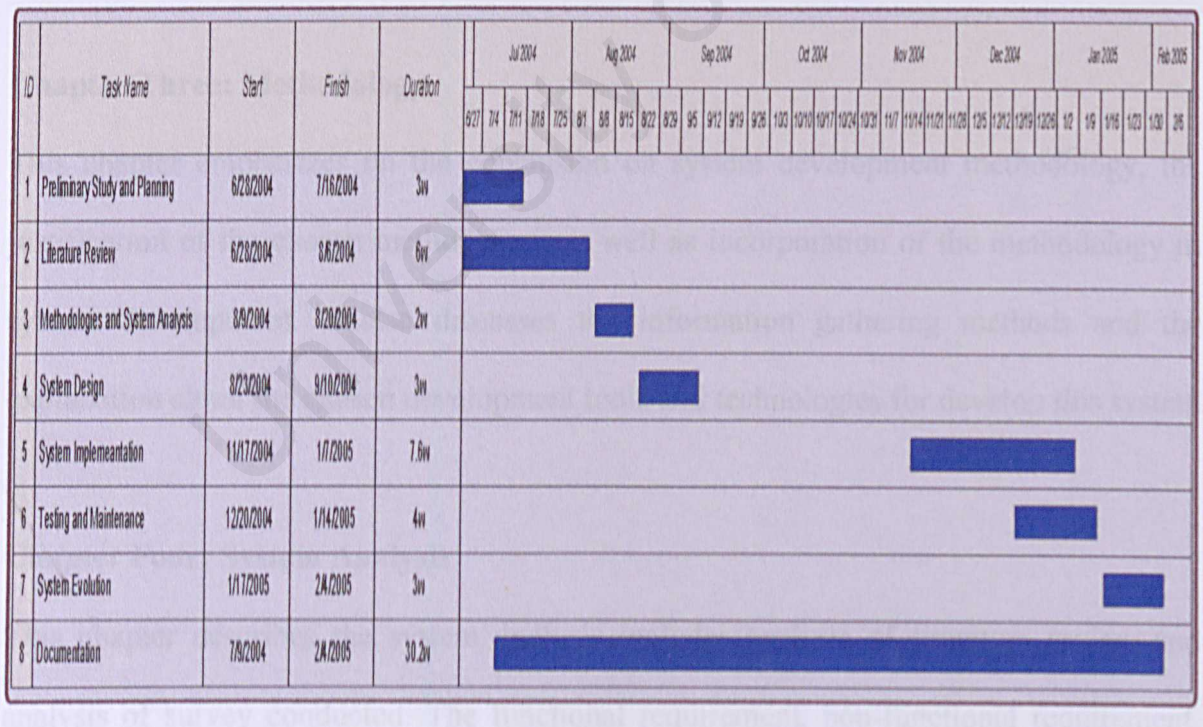


Figure 1.1: Project Schedule for Online Programming Group Network

1.7 Project Report Summary

Project Report Summary gives an overview of all the phases involved during development of the system. They are eight chapters throughout the whole project.

Chapter One: Introduction

This chapter introduces the project overview, problems domain, objectives of project, scopes of project, expected outcome and project schedule.

Chapter Two: Literature Review

This chapter describes the research has been carried out before the project can be implemented. It consists of domain studies and technology review where currently existing system and different software developing technologies are studied.

Chapter Three: Methodology

This chapter emphasizes on the conclusion on system development methodology, the justification of the chosen methodology as well as incorporation of the methodology in system development. It also discusses the information gathering methods and the explanation about the chosen development tools and technologies for develop this system.

Chapter Four: System Analysis

This chapter describes the system analysis includes analysis of literature review and analysis of survey conducted. The functional requirement, non-functional requirement, and hardware and software requirements are also stated in this chapter.

Chapter Five: System Design

This chapter explains the conceptual and technical design of the system which covers the system architecture design, database design, process design and user interface design.

Chapter Six: System Implementation

This chapter focuses mainly on the implementation phase of the entire project which consists of the coding process done to convert the proposed project into a fully functional system.

Chapter Seven: System Testing

This chapter describes the testing process and methods carried out to verify and validate the system to make sure it fulfills its requirements. It is an important phase in determining the errors, bugs and faults of the system and the subsequent action taken to overcome it.

Chapter Eight: System Evaluation

This chapter will touch on the evaluation done on the finished system. It will include the problems encountered during the system development, the system's weaknesses and strengths, etc.

CHAPTER 2 : LITERATURE REVIEW

2.1 Introduction

On-line Programming Group Network is a web portal to manage problems faced by programmers of different level in FSKTM. In order to dive into requirements specification, analysis and design of the system, it is necessary to perform a thorough investigation of all the topics related to the proposed system.

2.2 Domain Studies

Domains studies are to find out and clarify the definition of proposed system, at the same time analyze and research the current systems which have same or similar function to the project. Various good and relevant features are to be noted during the survey on current systems. This provides pertinent information and validity to determine and implement the best solution.

2.2.1 Definition

Knowledge Based System

According to Free On-line Dictionary of Computing (FOLDOC), a knowledge-based system (KBS) is a program for extending and/or querying a knowledge base. The related term expert system is normally used to refer to a highly domain-specific type of KBS used for a specialized purpose such as medical diagnosis (Internet Reference, 2/8/2004).

Hutchinson Dictionary of Computers, Multimedia, and the Internet also note that it is a Computer program that uses an encoding of human knowledge to help solve problems. It was discovered during research into artificial intelligence that adding heuristics (rules of thumb) enabled programs to tackle problems that were otherwise

difficult to solve by the usual techniques of computer science (Internet Reference, 5/8/2004).

Portal

With reference to FOLDOC, portal defined as a web site that aims to be an entry point to the World-Wide Web, typically offering a search engine and/or links to useful pages, and possibly news or other services (Internet Reference, 2/8/2004).

Another on-line dictionary Computer Telephony & Electronics Dictionary and Glossary explained portal as a web site or service that offers a broad array of resources and services, most of which, but not all, are on-line, such as e-mail, forums, search engines, and on-line shopping malls. Now most of the traditional search engines have transformed themselves into Web portals to attract and keep a larger audience. Typically, this sort of service also yields the user a central place to find what he needs (Internet Reference, 6/8/2004)

Search Engine

Search Engine is defined in FOLDOC as a remotely accessible program that lets you do keyword searches for information on the Internet. There are several types of search engine; the search may cover titles of documents, URLs, headers, or the full text (Internet Reference, 2/8/2004). For example, Yahoo, Alta Vista, Google, Lycos are some of many.

On-line Programming Group Network (A knowledge Based Portal with Search Engine)

With the reference of the definition above, therefore, the proposed system is defined as a website or service that serves as a starting point and frequent gateway to the Web (Web Portal) with the reference to a particular subject (programming as a main

focus). It offers a broad array of resources and services such as forums, hyperlink access to useful links, notes/tutorial/exercises, chatting and so on. Additionally, it has a search engine for user to search for information, existing solutions which able to cover many different criteria on programming problems.

2.2.2 Comparison of Portal and Website

Portals are large aggregative Internet technologies that are increasingly replacing homepage to provide a structured gateway to the Internet. They integrate content, community and communication services according to users' need by means of personalization and customization. A portal is different from a normal website due to some elements that are available in a portal but not in a website.

Table 2.1: Difference between Website and Portal

Website	Portal
Spreading and delivering of information only.	Based on sharing of information or a channel where the user and supplier interact.
Normally, available information is static and seldom updated.	Update process need to be done regularly.
No two-way communication between user and web developer.	Existence of two-way communication. User can receive feedback from web developer.
More specific to one topic.	Variety of topics for all users.
Majority does not have database.	Majority have large database.

2.2.3 Current System Review

2.2.3.1 Case Study 1: Free Programming and Free Webmaster Resources

Free Programming and Free Webmaster Resources is a web portal which links to free programmer resources and free webmaster resources for experienced developers as well as those who are learning programming. The resources include free programming tutorials, free online programming books, free compilers, free interpreters, free programming tools, free source code and free webmaster resources.

It also gathers other useful hyperlink like discussion forum, games, programming language FAQ and so on. This site is suitable not only for those who are studying programming in school, learning web development, but also very useful for the professional programmer and developers. (Internet Reference, 7/8/2004)

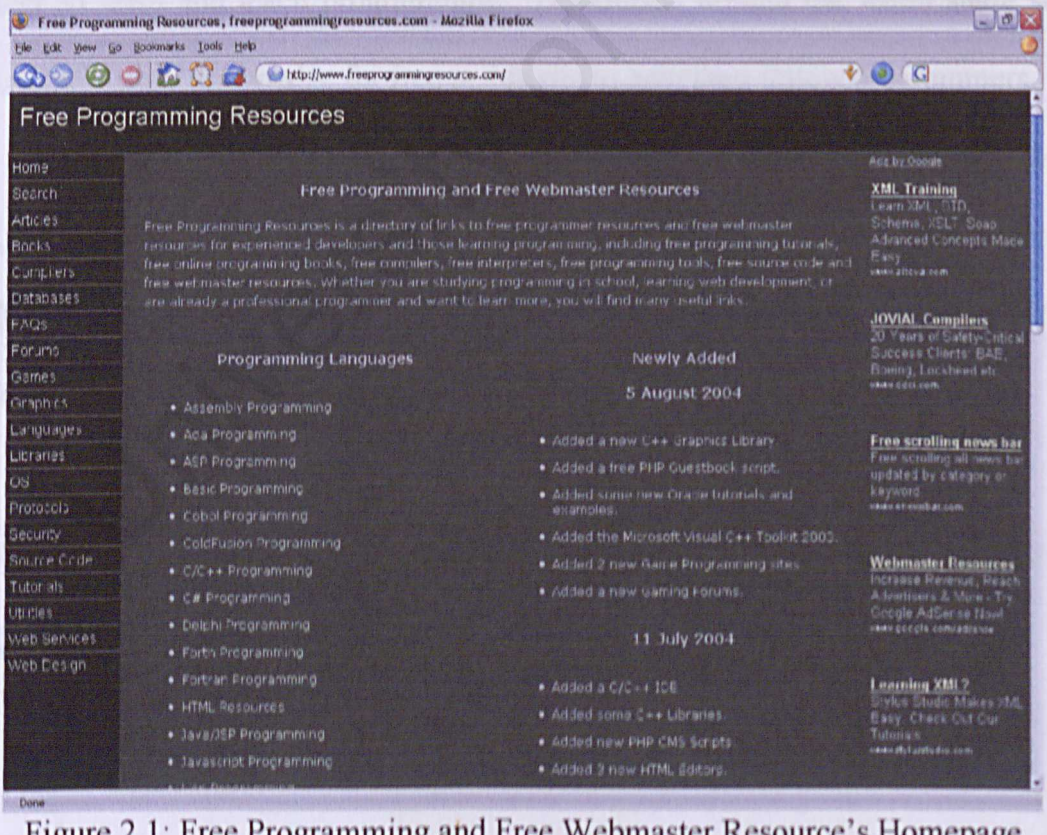


Figure 2.1: Free Programming and Free Webmaster Resource's Homepage

Pros:

- Cover various kinds of programming problems and solutions.
- All the links are well organized according to different criteria and categories.
- Data resources are updated frequently.

Cons:

- Interface design not attractive enough.
- Provide directory of links only. It does not build its own discussion board, chat room and so on.

2.2.3.2 Case Sturdy 2: The Code Project

The Code Project is a community of Visual Studio .NET developers joined together to learn and teach programming. Developers around the world share source code, tutorials and knowledge for free at this site to help their fellow programmers.

Every article on the Code Project has been contributed for free, and all source code, components and code snippets can in turn be used for free too. Now, there are over 800,000 people reading Code Project each month including those from companies such as Microsoft, HP, DevelopMentor and Wintellect.

Code Project provides several services that join developers together. This included discussion board, community survey, industry new and contact and even "the lounge" for user to kickback and socialize. (Internet Reference, 8/8/2004)

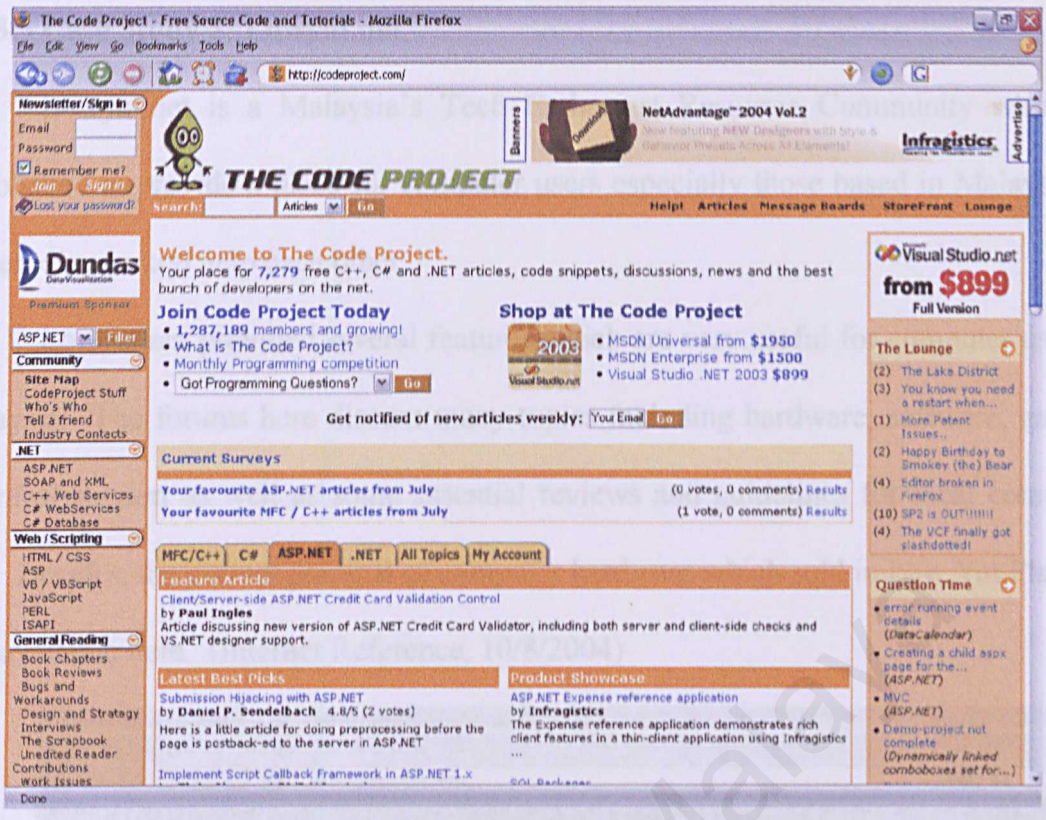


Figure 2.2: Homepage of The Code Project

Pros:

- Discussion boards are responsive and cover various kinds of programming matters.
- Provide tutorial for user from different level.
- Provide searching filter for to ease user to search on particular language.
- Provided industry contacts.
- A well known site and many experienced programmer is a member of the community.

Cons:

- The community focuses in several programming language only.
- Provide very limited links to other websites.

2.2.3.3 Case Study 3: Lowyat.net

Lowyat.net is a Malaysia's Tech Enthusiast Resource Community which is established to provide a place for computer users especially those based in Malaysia to gather, discuss and help each other.

Lowyat.net provided several features which are very useful for computer user in Malaysia. The forums here discuss many topics including hardware, software, games, technical support as well as some essential reviews and guidelines for local computer user. Besides, the current pricelist of computer hardware which sold in Law Yat Plaza is also available here. (Internet Reference, 10/8/2004)

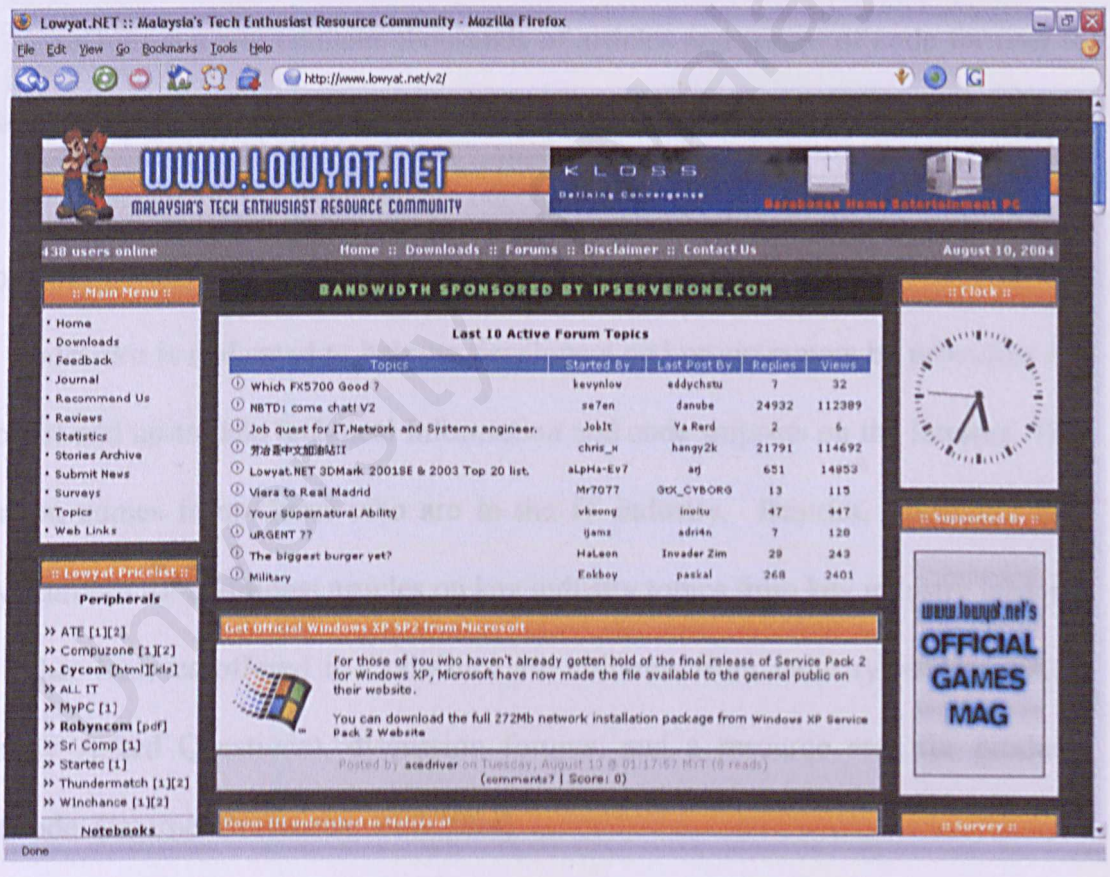


Figure 2.3: Lowyat.net 's homepage

Pros:

- The topics discussed are very suit to problems faced by local users.

- The forum is very responsive.
- It provided pricelist from different seller to make user easier to do the comparison.

Cons:

- There is very little links to other useful websites although it provides this feature.
- Very limited reviews and articles.
- Many features provided have not been fully used and discovered.

2.2.3.4 Case Study 4: CodeGuru

CodeGuru is a site contains thousands of articles and pieces of code for user to download, review, modify and use. CodeGuru is about the *sharing* of code. Most of the people who contribute code articles to CodeGuru are the same people who found and used something from here.

CodeGuru is dedicated to helping developers and programmers by providing the most robust and up-to-date technical information and code snippets on the Internet. This information comes from Gurus who are in the IT industry. Besides, CodeGuru also actively searches for additional articles on key industry topics from key industry leaders.

Other features offered in CodeGuru are columns from industry leaders, FAQs (Frequently Asked Questions), discussion forums, and a resource area for products without code. (Internet Reference, 10/8/2004)

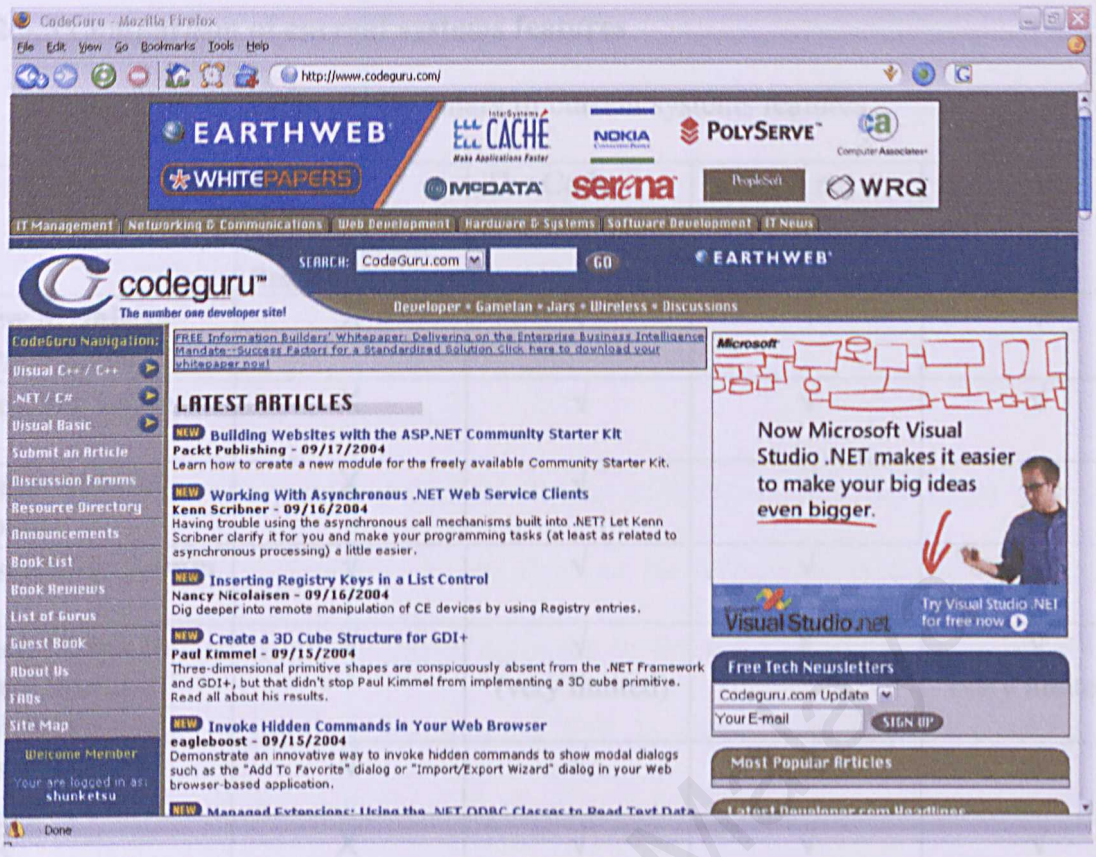


Figure 2.4: CodeGuru's Homepage

Pros:

- Attractive interface design.
- New articles are uploaded frequently.
- All the articles and resources are well organized.

Cons:

- Limited links to other useful websites.

2.2.3.5 Comparison of current systems features

Table 2.2: Summary of current systems features

	Free Programming and Free Webmaster Resources	The Code Project	Lowyat.net	CodeGuru
New Members Registration	X	√	√	√
Member Login	X	√	√	√
Personal Info Update	X	√	√	√
Discussion Forum	√	√	√	√
Access/Link to other useful websites	√	√ (very limited)	X	√ (very limited)
Search Engine	√	√	√	√
File Upload/Download	X	√	√	√
Chat Room	X	X	X	X

2.3 Technology Review

Various technologies are available in developing an online application. Following are some of the description about various technologies in the market that have been used in software development.

2.3.1 Development Model

2.3.1.1 Waterfall Life-Cycle Model

The waterfall model is a popular version of the systems development life cycle model for software engineering. It was first put forward by W.W Royce. Waterfall model is often considered the classic approach to the systems development life cycle, which describes a development method that is linear and sequential. Waterfall development has distinct goals for each phase of development. A waterfall development is similar to waterfall on the cliff of a steep mountain, once a phase of development is completed, the development proceeds to the next phase and there is no turning back.

Pros:

- Allows for departmentalization and managerial control
- Maintenance is easier

Cons:

- Inflexible. Does not allow for much reflection or revision
- Difficult to accommodate changes such as customers' requirement underway.

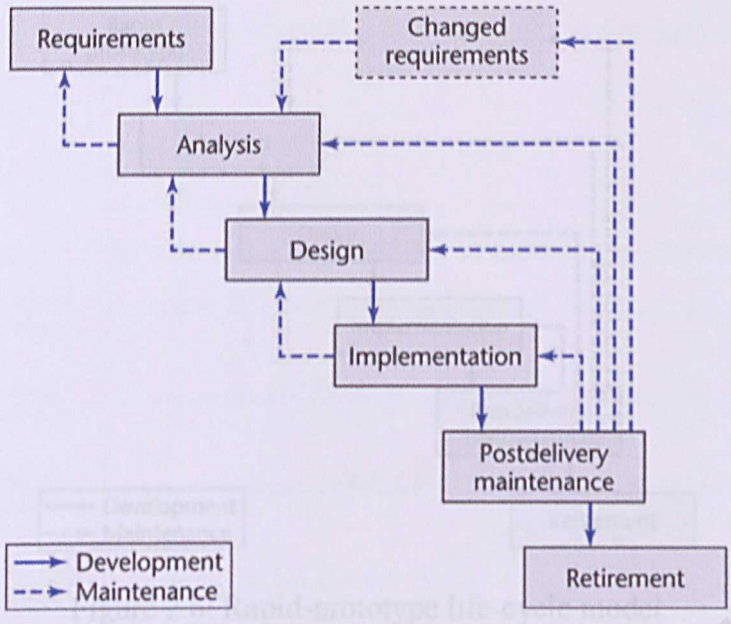


Figure 2.5: Full waterfall life-cycle model

2.3.1.2 Rapid-Prototyping Life-Cycle Model

A rapid prototype is a working model that is functionally equivalent to a subset of the product. However, the internal structure is not concerned yet. The sole use of rapid prototyping is to determine the real needs of client, and construct the rapid prototype as rapidly as possible to speed up the software development process.

In this model, the rapid prototype is build and let the client and future users to interact and experiment with. Once the client is satisfied, the developers can draw up the specification document and the software process is continued as shown in Figure 2.6.

Pros:

- Ensures that the delivered product meets the client's needs

Cons:

- Not yet proven beyond all doubt.

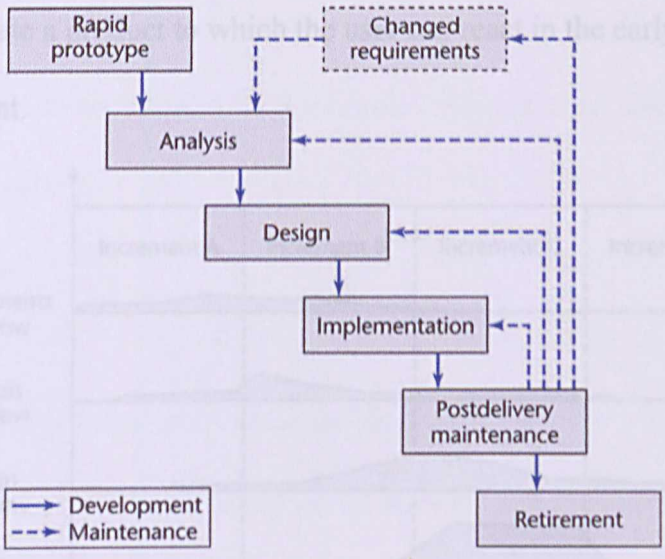


Figure 2.6: Rapid-prototype life-cycle model

2.3.1.3 Iterative-and-Incremental Life-Cycle Model

The basic concept of iterative-incremental life-cycle model is decomposed the development of software product into smaller mini projects, each of which is an iteration that results in an increment. There are five core workflow are performed over the entire life cycle. They are requirements workflow, analysis workflow, design workflow, implementation workflow and test workflow which are also part of Unified Process. However, there are times when one workflow predominates the other four. The process of iteration and incrementation is continued until a completed software product is created.

Pros:

- Closely models real-world software production.
- Allowing the developer to take advantage of what was being learned during the development of earlier, incremental, deliverable versions of the system.

- Able to create a product to which the user can react in the early stage of development.

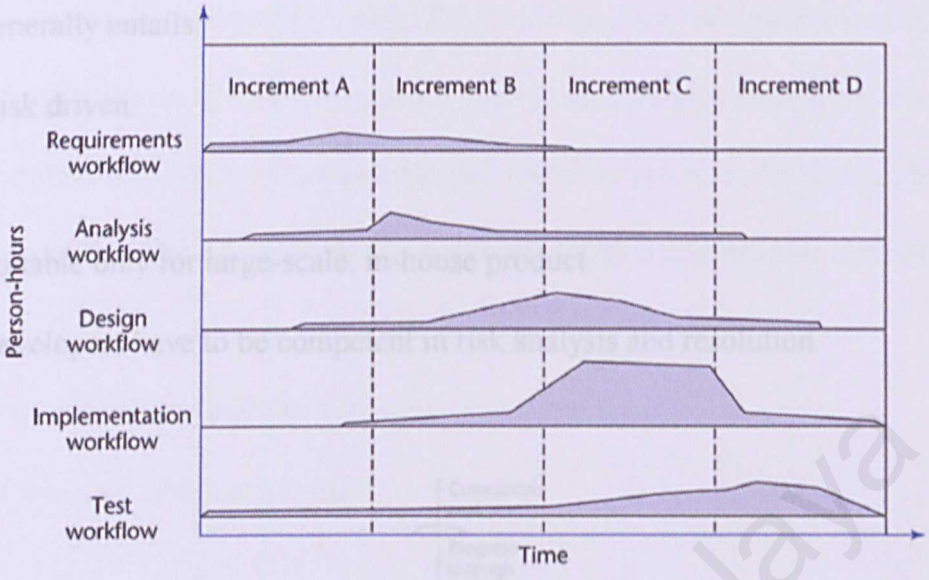


Figure 2.7: Iterative-and-Incremental Life-Cycle Model

2.3.1.4 Spiral Life-Cycle Model

Spiral life-cycle model combines the features of the prototyping model and the waterfall model. It was first defined by Barry Boehm. The concept underlying the spiral model is the idea of minimizing risk via the use of prototypes and other means. A simplified spiral model is as a waterfall model with each phase preceded by risk analysis.

In a full spiral model, the radial dimension represents cumulative cost to date, while the angular dimension represents progress through the spiral. Each cycle of the spiral corresponds to a phase. Before commencing each phase, an attempt is made to control (resolve) the risks. If it is impossible to resolve all the significant risks at a stage, then the project is immediately terminated.

Pros:

- It is more able to cope with inevitable changes that software development generally entails.
- Risk driven.

Cons:

- Suitable only for large-scale, in-house product.
- Developers have to be competent in risk analysis and resolution.

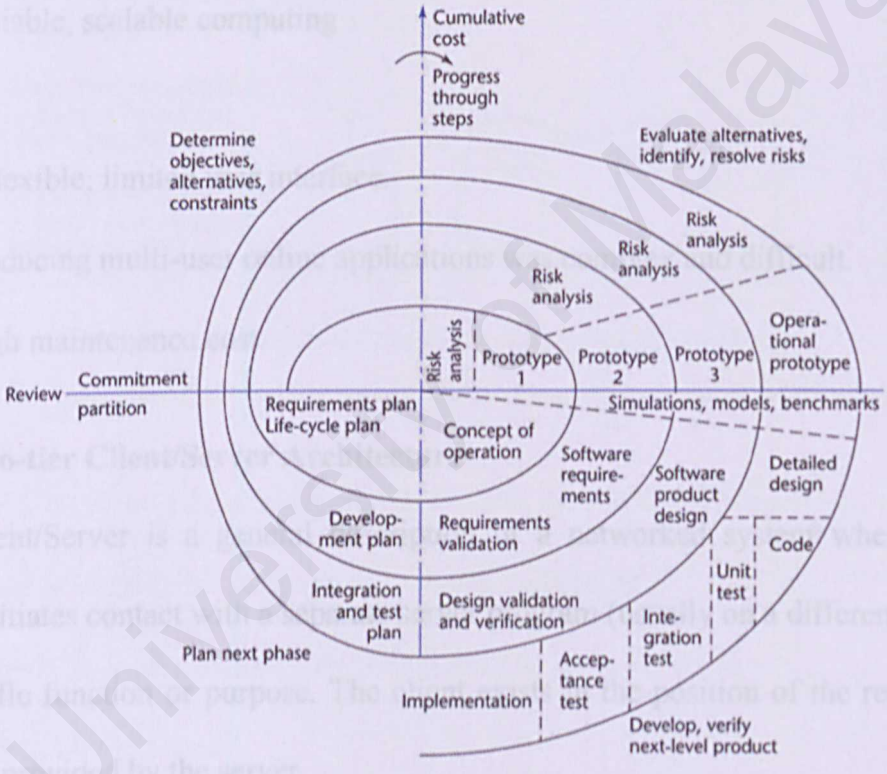


Figure 2.8: Full spiral life-cycle model

2.3.2 System Architecture

2.3.2.1 Mainframe Architecture

In mainframe software architectures, all intelligence is within the central host computer. Users interact with the host through a terminal that captures keystrokes and

sends that information to the host.

Mainframe software architectures are not tied to a hardware platform. User interaction can be done using PCs and UNIX workstations. A limitation of mainframe software architectures is that they do not easily support graphical user interfaces or access to multiple databases from geographically dispersed sites. In the last few years, mainframes have found a new use as a server in distributed client/server architectures.

Pros:

- Centralized data: high data security, ease of backups.
- reliable, scalable computing

Cons:

- Inflexible; limited user interface.
- Producing multi-user online applications was complex and difficult.
- High maintenance cost.

2.3.2.2 Two-tier Client/Server Architecture

Client/Server is a general description of a networked system where a client program initiates contact with a separate server program (usually on a different machine) for a specific function or purpose. The client exists in the position of the requester for the service provided by the server.

Two tier architectures consist of three components distributed in client layer (requester of services) and server layer (provider of services). The three components are

- User System Interface (such as session, text input, dialog, and display management services)
- Processing Management (such as process development, process enactment,

process monitoring, and process resource services)

- Database Management (such as data and file services)

In two tier client/server architectures, the user system interface is usually located in the user's desktop environment. Database management services are usually in a server that services many clients. Processing management is split between the user system interface and the database management server. Clients commonly communicate with the server through SQL statements or a call-level interface.

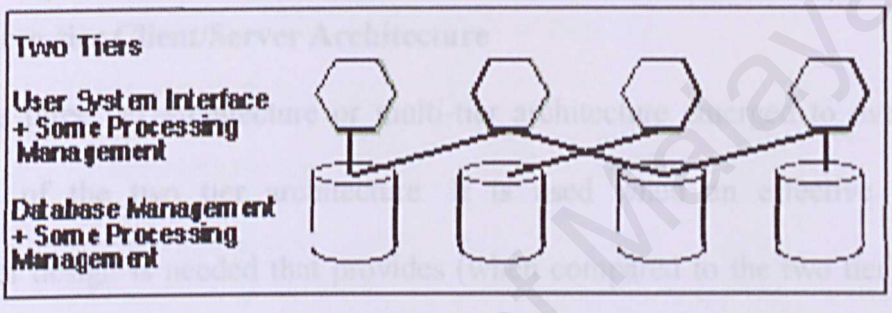


Figure 2.9: Two-tier Client/Server Architecture Design

Pros:

- Use of a relational Database increases security, reliability, flexibility.
- Better scalability by adding server nodes and clients
- Graphic user interface makes system easy to learn for users.
- Low to medium cost.
- A good solution for distributed computing when work groups are defined as a dozen to 100 people interacting on a LAN simultaneously.
- can distribute processing load

Cons:

- Maintenance: each client system must have a driver for each database it accesses

("fat client"), and drivers must be updated regularly

- Client nodes require more computing power
- Poor separation of software components
- Cost: Database vendors typically charge by maximum number of concurrent users, and clients typically hold databases open for the duration of the session
- 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.

2.3.2.3 Three-tier Client/Server Architecture

The three tier architecture or multi-tier architecture emerged to overcome the limitations of the two tier architecture. It is used when an effective distributed client/server design is needed that provides (when compared to the two tier) increased performance, flexibility, maintainability, reusability, and scalability, while hiding the complexity of distributed processing from the user.

In a three-tier or multi-tier environment, the client implements the presentation logic (thin client). The business logic is implemented on an application servers and the data resides on database servers.

A Multi-tier architecture is defined by the following three component layers:

- A front-end component, which is responsible for providing portable presentation logic.
- A middle-tier component, which allows users to share and control business logic by isolating it from the actual application.
- A back-end component, which provides access to dedicated services, such as

a database server.

In the three tier architecture, a middle tier was added between the user system interface client environment and the database management server environment. There are a variety of ways of implementing this middle tier, such as transaction processing monitors, message servers, or application servers. The middle tier can perform queuing, application execution, 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. In addition the middle layer adds scheduling and prioritization for work in progress.

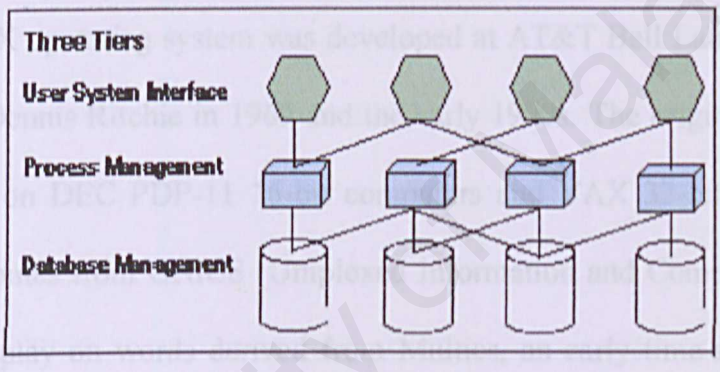


Figure 2.10: Three-tier distributed client/server architecture design

Pros:

- Thin clients are easier to configure and maintain
- If business logic is maintained on middleware server, it only needs to be updated on the server, not on all the clients using the application
- Database licensing costs may be lower due to sharing of a single database connection.
- Maximum flexibility for enterprise-wide applications

Cons:

- The development environment is reportedly more difficult to use than the visually-oriented development of two tier applications.
- Costly software distribution.
- Poor cross-platform support
- If the business is located in geographically remote locations, local data must be transmitted to and stored on the centralized database server

2.3.3 Application Platform

2.3.3.1 UNIX

The UNIX operating system was developed at AT&T Bell Laboratories by Ken Thompson and Dennis Ritchie in 1969 and the early 1970s. The original versions were designed to run on DEC PDP-11 16-bit computers and VAX 32-bit computers. The name "UNIX" comes from UNICS (Uniplexed Information and Computing System), a tongue-in-cheek play on words derived from Multics, an early time-sharing operating system.(Internet Reference, 12/8/2004)

Some of the features are listed below:

- Multitasking

  UNIX was the one of the first multitasking operating system. Single computer running the UNIX operating system can simultaneously run several independent jobs.

- Multiuser

  UNIX organizes multiple tasks from multiple users so that they can run program and access files at the same time.

- Programming environment

  UNIX provides the ultimate in computer programming environment. Powerful C, C++, FORTRAN and Java compilers along with development tools are available for free.

- Free software

  There are literally thousand of free applications available for Unix machines. This is one of the UNIX's greatest strength versus other operating system.

- Portability

  One of the major contributions of UNIX system was its portability, permitting it to move from one brand of computer to another with a minimum of code changes. New versions of UNIX were backward compatible with older version, making it easier for companies to upgrade in an orderly manner.

2.3.3.2 LINUX

Linux is a UNIX-like 32-bit operating system that runs on a variety of platforms, including Intel, SPARC, PowerPC, and DEC Alpha processors, as well as multiprocessing systems. The operating system is essentially free and you can download it from the Web. (Internet Reference, 13/8/2004)

Linux is a "user-developed" product, meaning that many of its components and drivers have been developed by users around the world who ran the operating system for their own use. The original operating system was developed by Linus Torvalds as a college project. It is now well supported and gaining ground as a respectable operating system despite its homegrown roots. The operating system is used by many Web site developers and is now available as an embedded system, either as a small software

kernel or burned into a chip.

Some of the features are listed below:

- Portability

  Linux is a portable system that will run on a variety of platform rather than being tied to only CPU chip and architecture.

- Preemptive Multitasking

  Meaning that more than one task or application program can be running at the same time, preemptive means that the operating system rather than the application has the control of tasks.

- Multiuser

  Meaning that more than one user can logged on at the same time affecting each other.

2.3.3.3 Microsoft Windows XP

Windows XP is the latest desktop version of the Windows operating system from Microsoft. It was made publicly available on October 25, 2001. Two versions of Windows XP are available: Home which is targeted at home users and doesn't allow users to join a domain, and Professional which has additional features such as dual-processor support and the ability to join a domain.(Internet Reference, 14/8/2004)

Some of the features are listed below:

- Preemptive multitasking architecture

  Windows XP is designed to allow multiple applications to run simultaneously, while ensuring great system response and stability.

- Scalable memory and processor support

Supports up to 4 gigabytes (GB) of RAM and up to two symmetric multiprocessors.

- Encrypting File System (EFS) with multi-user support

  Encrypts each file with a randomly generated key. The encryption and decryption processes are transparent to the user. In Windows XP Professional, EFS can provide multiple users access to an encrypted document.

- Windows File Protection

  Protects core system files from being overwritten by application installations. If a file is overwritten, Windows File Protection will restore the correct version.

2.3.4 Web Server

2.3.4.1 Internet Information Server (IIS)

Internet Information Server (IIS) is the largest web server available from Microsoft. It is a high-performance, secure, and extensible internet server based on Windows NT Server. IIS supports the World Wide Web, FTP, and gopher protocol. IIS transmits information through the web by using Hypertext Transfer Protocol (HTTP). The FTP service enables users to transfer files to and from the Web site. The gopher service uses a menu-drive protocol for locating documents. The gopher protocol has been largely replaced by the HTTP protocol.

Pros:

- Graphic User Interface helps new users.
- Ability to limit how much bandwidth your web pages have available.
- Crash protection. The web server and other applications continue to run, even

though one application running on the server crashes.

Cons:

- Not robust. Can be made hang easily.
- Can only be configured using GUI. Hard to encapsulate all of the settings in a single configuration file like Apache.
- Lack flexibility. Can not control how URL is parsed.
- Only available for Windows.

2.3.4.2 Apache

Apache is software that works on a web server and offers a web service which works in modern operating system including UNIX and Windows operating system. It is free open source software and was created by many volunteers. Hence, all the code and module source code can be got and modified to suit developers' needs. Apache is today most popular web server software in the world.

Pros:

- Constantly open source update.
- The software is free.
- Multi-platform support.
- Popular. It is unlikely that further development of the software will ever cease.

Cons:

- No Support from Apache's developers.
- Runs best on Linux. Given two machines with the same hardware and different operating systems (Linux and NT)

- Apache runs faster on the Linux machine. If users decided to use Windows, it makes more sense to use the Web server Microsoft includes with that operating system.

2.3.4.3 Netscape Enterprise Server

Netscape Enterprise Server is high-performance, highly scalable web server software for deploying the largest-scale web sites. This software expands on FastTrack Server, which adding content and site management tools. It also provides various options for mapping and forwarding URLs and supports URL redirection to directories on other servers. Netscape Enterprise Server is available for either UNIX or Window NT, out performs other server software on systems offering multiple processors. It comes with a 300-page guide to writing JavaScript. This commercial server is one of the most expensive servers available today.

Pros:

- Powerful and versatile compare to other server, especially when running on a multi-processor system.
- Easy and cheap upgrade path from Netscape FastTrack Server.

Cons:

- Price. Netscape Enterprise Server is expensive as it is third-party software.

2.3.5 Programming Language

2.3.5.1 Hyper Text Markup Language (HTML)

HTML is coding language which used to create Hypertext documents for use on the World Wide Web. It is more looks like old-fashioned typesetting code (Internet Reference, 18/8/2004). A HTML file contains many small markup tags where the tags tell the Web browsers on how to display the page. In every HTML file, it must have either htm or html file extension. However, with newer software it will be perfectly safe to use .html. (Internet Reference, 19/8/2004)

A HTML file can be created using a simple plain text editor like notepad and WordPad. Apart from that, instead of writing the markup tags in a plain text file, a HTML files can be edited easier by using powerful web builder like FrontPage, Macromedia Dreamweaver, Claris Home Page and Adobe PageMill.

2.3.5.2 Extensible Markup Language (XML)

XML is a programming language that enables designers to create their own tags to indicate specific information (Internet Reference, 20/8/2004). XML is much like HTML where it was designed to describe data. In XML, the tags are not predefined. Hence, developers are to define their own tags by using XML Schema or Document Type Definition (DTD).

XML and HTML were designed with different goals. Therefore, XML cannot consider as a replacement for HTML. In fact, HTML was designed to display data and focus on how data looks while XML was designed to describe data and to focus on what data is. In short, HTML is about displaying information, while XML is about describing information.

2.2.5.3 Client-side Scripting

Client-side scripting is executed within the browser, which means that the browser interprets the code, and it can be seen when viewing the source codes of the web page in browser. In consequence, client-side scripting is speeding up the HTML page by reduces the work amount to be done by server. Client-side doesn't allow accessing to local files, directories or databases. The client-side script is interpreted by browser, thus some browsers may not be able to process certain type or script.

2.2.5.3.1 JavaScript

JavaScript is an object-based scripting language which designed to extend web page functionality. It was first added to Netscape Navigator in 1995. JavaScript adds on extra functionality to HTML, without having to resort to server-side intensive CGI scripts. JavaScript has the advantages that, just like its name-sake Java, it runs locally instead of from a server. (Internet Reference, 21/8/2004)

However, JavaScript and Java are completely two different languages. JavaScript is a simplified programming language which provides only some of the features of a full-blown programming language. It was just designed to add interactivity to HTML pages. On the other hand, Java is a complex and powerful programming language which is in the same category as C and C++.

Some features of JavaScript:

- Insert dynamic text into an HTML page.
- Setup controls on page and change the page element like background and text color.

- React to events. JavaScript can be set to execute when a page has finish loading or users click on certain element in the page.
- Validate form data before it is submitted to a server and save server from extra processing.
- Enables the creation and use of cookies to keep track of user information.

2.2.5.3.2 VBScript

Visual Basic Scripting or more commonly known as VBScript is a scripting language developed by Microsoft. It is light version of the Visual Basic Programming Language. VBScript mimics the functionality of JavaScript. It is also the default language for Active Server Pages that are commonly used to provide server-side facilities on Microsoft Internet Information Server web servers. (Internet Reference, 22/8/2004)

One of the major drawback of VBScript is it is not multiplatform, that is, it isn't support non-Internet Explorer browser. Although it enables web authors to include interactive controls like buttons and scrollbars, but this is only for a pure Microsoft environment.

2.2.5.4 Server-side Scripting

2.2.5.4.1 ASP.NET

ASP.NET is a server side scripting technology that enables scripts embedded in web pages to be executed by an Internet server. It is the latest version of Microsoft's Active Server Page (ASP) Technology and a part of the new .NET Framework.

Compare with previous ASP 3.0, ASP.NET possesses better language support. Developers can author applications in any .NET compatible language, including Visual Basic .NET, C#, and JScript .NET. Also, the author can easily access the entire .NET Framework, which includes the managed common language runtime environment, type safety, inheritance, and so on. [1] Additionally, ASP.NET features server controls that can separate the code from the content and allowing WYSIWYG edit the web pages.

Similar with ASP, ASP.NET allow web authors to build their site dynamically. ASP.NET provides a large set of new programmable controls, XML based component, as well as better user authentication, with user account and roles. Also, it is able to increase the web application's performance by running a compiled code.

However, ASP.NET is not fully compatible with ASP. Hence, most of the ASP code may need some changes in order to run under ASP.NET. Anyway, it is possible to run ASP application side by side on the same server as ASP.NET files can be recognized by their .aspx extension comparing .asp for ASP files.

2.2.5.4.2 PHP

PHP or Hypertext Preprocessor is one of the most popular server-side scripting languages for creating dynamic web sites. It was created by Rasmus Lerdorf in 1994.

PHP is open-source software, so it is free to download and use. It support many database include MySQL, Informix, Oracle, Sybase, Solid, PostgreSQL, and Generic ODBC. PHP can perform any task that any CGI program can do, but its strength lies in its compatibility with many types of databases. Also, PHP can talk across networks using IMAP, SNMP, NNTP, POP3, or HTTP. (Internet Reference, 23/8/2004)

PHP is platform independent. Therefore, its implementations exist for all major operating system such as UNIX, Linux and Windows.

2.2.5.4.3 ColdFusion

ColdFusion Markup Language (CFML) is a web page markup language that allows web developers to create web page with variable information (text or graphic) that is filled in dynamically in response to variables such as user input. ColdFusion uses a tag-based, server scripting language that is ideal for programming Web applications.

Processed entirely on the server, the ColdFusion Markup Language (CFML) cleanly integrates with HTML for user interface and XML for data exchange. Both open and extendible, CFML supports more than 70 server-side tags, 200 functions, and 800 third-party components making it the most productive language available for creating advanced Web applications. In addition, ColdFusion supports Java and C++, and fully integrates with object transaction middleware through COM, CORBA, or EJB.

2.3.6 Authoring Tools

2.3.6.1 Microsoft Visual Studio.NET 2003

Microsoft Visual Studio .NET is a complete set of development tool for desktop application, mobile application, XML web services and also for building ASP Web application. Developers are able to use Visual Studio .NET to build powerful Internet application quickly and effectively.

Visual Studio .NET is the only development environment built from the ground up to enable integration through XML Web services. By allowing applications to share data over the Internet, XML Web services enable developers to assemble applications

from new and existing code, regardless of platform, programming language, or object model.

Visual Studio .NET enables developers to rapidly build a broad range of applications for Microsoft Windows, the Web, and devices. With intuitive visual designers, high-performance data access tools, server-side visual designers, native support for the Microsoft .NET Compact Framework, and inherent support for XML Web services, Visual Studio .NET delivers improved reliability, security, and performance.

Visual Studio .NET enables developers to address today's most pressing application development and deployment challenges, streamline business processes, and realize new business opportunities. The unified Visual Studio .NET integrated development environment (IDE) and a choice of programming languages—including Microsoft Visual Basic .NET, Microsoft Visual C++ .NET, Microsoft Visual C# .NET, and Microsoft Visual J# .NET enable its user to build professional applications using their existing skills.

2.3.6.2 Macromedia Dreamweaver MX

Macromedia Dreaweaver is a professional website development program. It user friend interface enables users to keep their focus on the workspace as the web page developers. Visually appealing and dynamic web sites can easily be created without sacrificing control over the source code.

Dreamweaver MX is the most dynamic HTML editor available off the shelf. With the help of this HTML Editor web designer can create powerful web sites that have animations, graphics, and complex scripting. Besides, the web site can be linked with

database. Dreamweaver also provides the power features like adding components such as flash animated buttons, Mouse rollover scripts, Navigation bar with menu's and so on.

2.3.6.3 Adobe Photoshop

Adobe Photoshop is the most popular image-editing available for Macintosh and Windows-based computers. It is used as drawing, painting and designing purposes. Users can retouch an image, apply special effects, swap details between photos, introduce text and logos, adjust color balance, and even add color to a grayscale scan. All these functions are included under a set of user-friendly editing tools in Adobe Photoshop. It contains graphical icons to represent every functions of each button. Besides that, it also provides many shortcut keys that is easier and save time for users and for those who do not like to use mouse.

2.3.7 Database Management System

Database Management System (DBMS), or more commonly known as database manager, is a program essential in enabling computer users to create and access data on a database. The DBMS ensures data integrity and security.

A DBMS is usually a part of a database product. On PCs, Microsoft Access is a popular example of a single or small group user DBMS. Microsoft's SQL Server is an example of a DBMS that serves database requests from multiple clients. Besides, MySQL is the example of open source DBMS.

2.3.7.1 Microsoft Access

Since its introduction in 1992, Microsoft Access has become one of the most versatile applications in the Office suite. This versatility is evidenced by the rich set of

tools that even the most experienced database user can take advantage of, while offering the same level of simplicity as the other Office applications for first-time database users. Access version 2002 extends this versatility by giving developers and more experienced users new functionality, enabling them to access and analyze their important data as well as build powerful new database solutions. At the same time, Access now makes it easy for beginning users to discover and use more of the existing application.

2.3.7.2 Microsoft SQL Server 2000

Microsoft SQL Server 2000 is a relational database management, and analysis system for e-commerce, line-of-business, and data warehousing solutions. SQL Server 2000, the latest version , includes support for XML and HTTP, performance and availability features to partition load and ensure uptime and advanced management and tuning functionality to automate routine tasks and lower total cost of ownership.

SQL Server Enterprise Edition builds on the established strengths and broad functionality of SQL Server, extending its already extensive scalability, interoperability, availability, and managebility. Enterprise Edition provides the means for building, and deploying large-scale distributed appliations, making it the best platform for the largest, and most mission-crucial support and can expand to use to 3GB of memory.

As the Internet, and Intranets become more complex, and more heavily trafficked, managing incoming, and outgoing information becomes even more difficult. By applying basic distributed computing, and client or server principlesto this new frontier, companies can reduce the risk, and the complexity of doing business on the Internet. Integrating Microsoft SQL Server with the Internet or an intranet allows organization to:

- Build Active web sites, capturing the user's interest by publishing real-time information, and providing user interaction, and customization.
- Conduct business on the Internet, securely, and reliably.
- Develop corporate intranets, giving users new tools to access business information, without compromising security, and data integrity.

2.3.7.3 MySQL

The MySQL database server embodies an ingenious software architecture that maximises speed and customisability. Extensive reuse of pieces of code within the software and an ambition to produce minimalistic but functionally rich features have resulted in a database management system unmatched in speed, compactness, stability and ease of deployment. The unique separation of the core server from the storage engine makes it possible to run MySQL under strict transaction control or with ultrafast transactionless disk access, whichever is most appropriate for the situation.

Today MySQL is the most popular open source database server in the world with more than 4 million installations powering websites, datawarehouses, business applications, logging systems and more. Customers such as Yahoo! Finance, MP3.com, Motorola, NASA, Silicon Graphics, and Texas Instruments use the MySQL server in mission-critical applications.

2.3.8 Data Access Technology

In order to enable communication and access to various database of a system, a data access technology is required. Here, a few of the Microsoft Data access strategy and technology is reviewed and considered.

2.3.8.1 ODBC (Open Database Connectivity)

ODBC is a standard database access method developed by Microsoft Corporation. The goal of ODBC is to make it possible to access any data from any application, regardless of which database management system (DBMS) is handling the data. ODBC manages this by inserting a middle layer, called a database *driver*, between an application and the DBMS. The purpose of this layer is to translate the application's data queries into commands that the DBMS understands. For this to work, both the application and the DBMS must be *ODBC-compliant* -- that is, the application must be capable of issuing ODBC commands and the DBMS must be capable of responding to them. Since version 2.0, the standard supports SAG SQL.

2.3.8.2 OLE DB

OLE DB Providers are the data access engines or services, as well as the business logic components that these applications can use in a highly interoperable, component-based environment.

OLE DB is a set of interfaces that are designed to provide data access to *all* data, regardless of type, format or location. It effectively "componentized" database and related data processing functionality, breaking it up into interoperable components that can run as middleware on the client or server across a wide variety of applications. The OLE DB architecture provides for components such as direct data access interfaces, query engines, cursor engines, optimizers, business rules and transaction managers.

The concept of OLE DB is to explode the database into its basic parts. OLE DB delivers components, external to the database, that provide this typical database functionality in reusable component architecture. And these components, because they

are not directly linked to the database itself, can be shared across multiple applications, systems and data stores to provide a higher level, universal interface.

2.3.8.3 ADO (Active Data Object)

Active Data Object (ADO) is the Microsoft's newest high-level interface for data objects that most applications developers will use.

ADO is designed to eventually replace *Data Access Objects (DAO)* and *Remote Data Objects (RDO).* Unlike RDO and DAO, which are designed only for accessing relational databases, ADO is more general and can be used to access all sorts of different types of data, including web pages, spreadsheets, and other types of documents.

ADO provides consistent access to data for creating a front-end database client or middle-tier business object using an application, tool, language, or even an Internet browser. ADO is the single data interface for developers creating 1 to n-tier client/server and Web-based data-driven applications.

2.3.8.4 ADO.NET

When Microsoft began designing the .NET Framework, the company took the opportunity to redesign the data-access model. Microsoft designed ADO.NET based on its experience with its successful ADO object model. ADO.NET addresses three important needs that ADO doesn't address: providing a disconnected data-access model, which is crucial to the Web environment; providing tight integration with XML; and providing seamless integration with the .NET Framework.

Figure 2.11 below shows the ADO.NET architecture. The Recordset object, which performs so many functions in ADO, is now missing. In place of the Recordset object, ADO.NET has several dedicated objects to perform specific tasks.

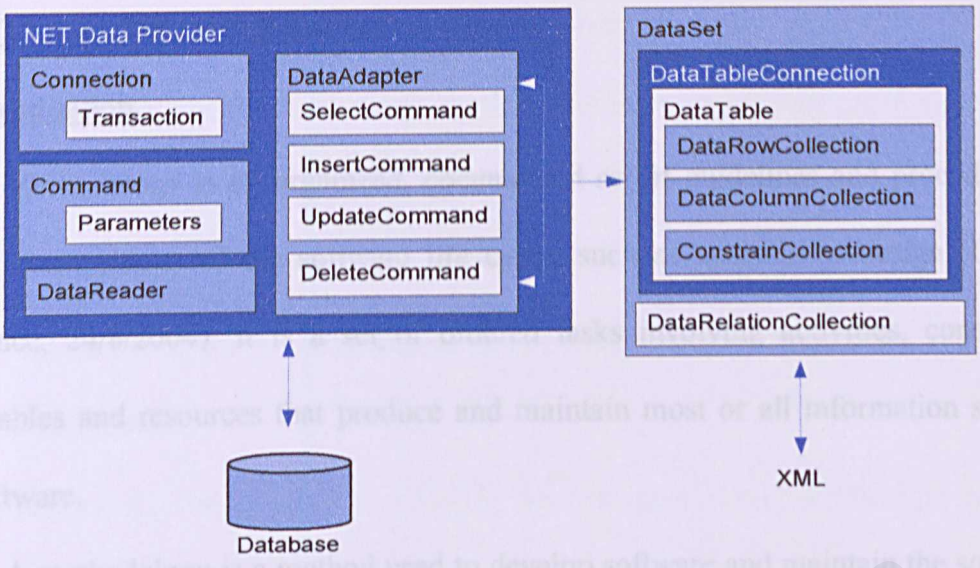


Figure 2.11: ADO.NET Architecture

2.4 Chapter Summary

This chapter is generally concentrated describe the research which has been carried before the system can be developed. In domain study, the definition of the key term in the project has been discovered. Also, four currently similar systems have been study to understand their pros and cons respectively. In technology review part, all related technology have been reviewed in order to make the best decision when choosing system development technology in Chapter 3.

CHAPTER 3 : METHODOLOGY

3.1 Introduction

Methodology is an organized, documented set of guidelines and procedure for one or more phases of the software life cycle, such as analysis or design (Internet Reference, 24/8/2004). It is a set of ordered tasks involving activities, constraints, deliverables and resources that produce and maintain most or all information systems and software.

A methodology is a method used to develop software and maintain the software. It involves study of how to navigate through each phase of the software process model and how to represent phase products including structure charts, stimulus-respond threads, and state transition (Internet Reference, 25/8/2004). It is an algorithm that finds a solution in the given environment of the multi-layered finite space consisting of the analysis, design, implementation, and testing plane, starting with the root represented by the problem statement and ending with the goal represented by the system acceptance test.

In the process of developing a full-fledged software system, it is crucial for us to have a specific methodology. This is important to ensure the software product delivered on time, meet user requirements whilst errors and faults are as minimal as possible.

3.2 Methodology Consideration

3.2.1 Importance of Good Methodology

As stated above, it is essential to choose a good methodology that suite the project in order to make all the development phases have clear beginning and end at which milestones can be established.

A good methodology is expected to offer the following benefits:

- Provides a standards framework for the developers so that they are in the right track and develop the system consistently.
- Provides better understanding of the system requirements.
- Able to identify any errors, inconsistencies and discrepancies during development.
- Increase the system quality by forcing the developer to produce flexible systems and adequate documentation
- Facilitate and enhance the planned process towards greater effectiveness, efficiency and reliability.
- Facilitates planning and controlling of the project.

3.2.2 Conclusion on Development Methodology

Methodology used in the development of On-line Programming Group Network is Unified Process model, underlay of iterative-and-incremental life-cycle model. The Unified Process (or Unified Software Development Process) was developed by the team that created Unified Model Language (UML). It adopts the object-oriented concept.

Unified Process is a methodology which based on ideas of iterative-and-incremental. In Unified Process model, it is divided into four main phases: Inception, Elaboration, Construction and Transition. Within each phase, five core workflows are carried out in an iterative manner. The five core workflows are requirements workflow, analysis workflow, design workflow, implementation workflow and test workflow.

Every step performed in the Unified Process falls into one of the five core workflows and also into one of the above-mentioned four phases or increments. However, the emphasis that given to each workflow changes from one phase to another. The emphasis lies more on the capture, modeling and requirement analysis in the earlier phases. In the later phases, the emphasis would be concentrated more on implementation and testing.

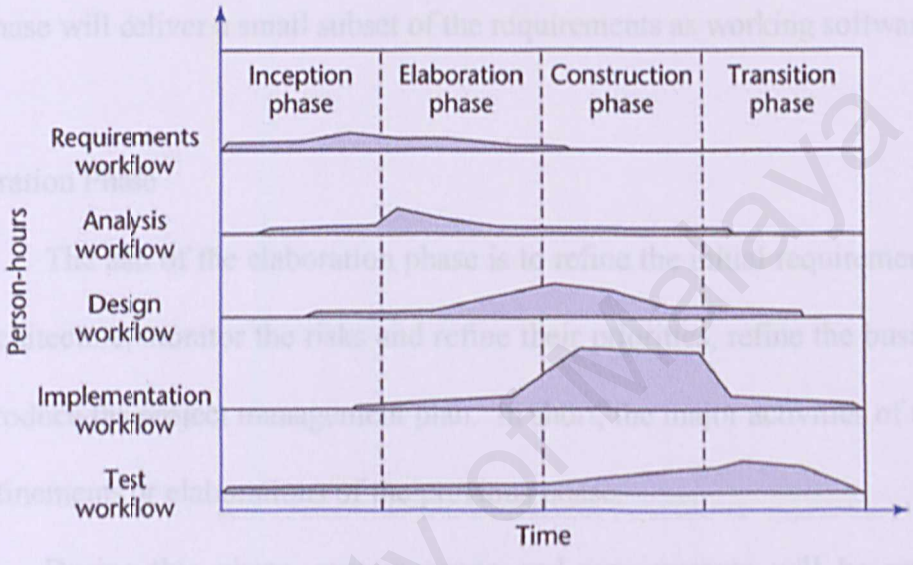


Figure 3.1: The core workflow and the phases of the Unified Process.

Below is the brief description of four main phases of Unified Process:

1. Inception Phase

   The aim of the inception phase is to determine whether the proposed software product is economically viable. The main goals of this phase include establish feasibility of the project, capture key requirement and identify the critical risks of the project.

   During this phase, the main focus will be concentrate on requirement and analysis workflow where the business case, scope and core requirements are

established. A small amount of design and implementation was done in order to carry out a proof-of-concept prototype to test the feasibility of constructing part of the software product.

The major milestone for this phase is Life-Cycle Objectives. This milestone is reached when the major stakeholders agree with the project scope and the business case justifies that the project development is worth to continue. At last, this phase will deliver a small subset of the requirements as working software.

2. Elaboration Phase

The aim of the elaboration phase is to refine the initial requirements, refine the architecture, monitor the risks and refine their priorities, refine the business case and produce the project management plan. In short, the major activities of this phase are refinements or elaborations of the previous phase.

During this phase, system scope and requirements will be refined and analysis. A stable architecture is created and the architecture baseline is built. Also, the architecture baseline is tested in this phase.

The major milestone of this phase is Life-Cycle Architecture. This milestone is reached when most of the functional requirements for the new system have been captured in the use case model and the project team has an initial project that describes how the Construction phase will proceed.

3. Construction Phase

The aim of the construction phase is to produce the first operational-quality version of the software product, which is sometimes called the beta release.

The other goals in Construction Phase include completing use-case identification, description and realization; finish analysis, design, implementation and test; maintain the integrity of the system architecture; and revise the Risk Assessment. The emphasis in this phase is on implementation, and testing of system modules, subsystem integration and overall system product.

The major milestone of this phase is Initial Operational Capability. It is reached when the product is ready for beta testing in the user environment.

4. Transition Phase

The aim of the transition phase is to ensure that the client's requirements have indeed been met. This phase is driven by feedback from the site at which the beta release has been installed.

In this phase, the main activities will be focused on implementation and testing. The project teams are going to correct faults in software product and modify the system to fix any previously unidentified risks or problems that have emerged late in the project.

The major milestone or this phase is Product Release. It is reached when all beta testing, acceptance testing and defect repair are finished, and the product is released into the user community.

(Stephen, 2005)

3.2.3 Justification of Methodology

The Unified Process model was chosen for the following reasons:

- Requirements Driven

  There are a lot of techniques have been used in Unified Process in order to capture the user requirements. These include Use Case Modeling, Class Modeling, Sequence Modeling and so on and so forth. This for sure will help the developers more understand on what the users really need from the system, and therefore produce a system which can fulfill users' requirements as many as possible.

- Iterative

  In each phase of Unified Process, all the workflows are performing iteratively. Every iteration incorporates the test workflow and this allows the process of checking all the artifacts developed up to this point. This provides the opportunity to search faults and correct them in the early stage of development. Positively the time of whole software development process can be shortened.

- Incremental

  As every phase in Unified Process come to the end, normally a small increment will be delivered. The stakeholders especially customers are able to use and experience the proposed system from small aspect at the earlier stage of development. This allow them to determine what changes needed to ensure that the future complete implementation meet their desires. At the same time, the risk of overall project failure can be mitigated since some of the services has been delivered and satisfied the customer's needs.

- Component-based Architecture

  In Unified Process, system can be divided into smaller components, which is easier to understand and implement, as each component normally has when through design, implementation and testing stage before being integrated with each other. Besides, this also encourages component reusability and brings predictable result.

3.2.4 Incorporation of Methodology in System Development

Based on the chosen methodology, the development of Online Programming Group Network system is divided into four major phases. Each phase is required to achieve certain milestone before the next phase can be proceeded.

During inception phase, system requirement elicitation will be the main focus. Several techniques such as current system review, interview, questionnaire and so on will be used to capture the functional and non-functional requirements of the system. The core scope and objective are established but subjected to be changed. A proof-of-concept prototype is delivered in order to show certain subset of system requirement.

In elaboration phase, the initial objective, scope as well as system requirements are analyzed and refined. At the same time, the baseline of system architecture and the tools to construct system are determined. Finally, all the functional requirements will be presented in a use case model.

When proceed to construction phase, an operational version is going to be constructed. Different system modules will be tested and integrated. Milestone of the phase is the release of product which ready for beta testing in the user environment.

Finally, in transition phase, the Online Programming Group Network system is installed and a fully test is performed. The system user may be invited to participate in the system testing and give the feed back. Any fault discovered here will be fix before the final product released.

3.3 Requirement Elicitation Techniques

Requirements elicitation is an important step in building a complete and fault-free system. This process has equal significance with system design and implementation as it lays out the groundwork for the system.

There are no particular for requirement elicitation technique as each system may require different methods. In this project, five methods have been used to gather information and elicit requirements. The five main methods are Internet surfing, reading materials, observation of existing system, interview and questionnaire.

- Internet surfing

  Internet has been utilized for searching information concerning all topics germane to the proposed system. By using many famous search engines like Google and Yahoo, different types of information such as online journals, teaching materials, articles can be collected as the resource for literature review especially the review of technology issues. Besides, on-line tutorial regarding programming language can be also obtained through the Internet surfing.

- Reading Materials

Reading materials like reference books, journals and some other printing materials had been read in order understand more on software methodologies as well as the technology issues related to the development of proposed system. Senior's theses which available in FSKTM thesis room are also the main resource to identify the previous work had been done and the requirements of similar system. Some ideas had been used for the proposed system.

- Observation of existing system

The current system applied in FSKTM for programming study had been analysis to clarify the problem domain. Other existing system which similar to proposed system are also been analyzed. The common system functionalities are determined via this analysis and is elaborated in Chapter 2.

- Interview

Several interviews had been performed in order to understand the real needs of system user. The interviewees are selected from two groups of system users, the professional programmer and unprofessional programmer. Informal interview had been performed to:

  - Dr. Phang Keat Keong (FSKTM lecturer)
  - Mr. Chong Theng Hui (FSKTM 3rd year student)
  - Ms. Lee Ai Yean (FSKTM 2nd year student)

- Questionnaire

Questionnaire had been performing on 100 students study in FSKTM which from different year of study. FSKTM's students are selected as target for this

questionnaire because they are the main user of this system. The main purpose of this questionnaire is to elicit the functional requirements of purposed system.

3.4 Conclusion on Tools and Technologies

After reviewing and analyzing on all the tools and technologies available, the most appropriate tools and technologies to develop the system are chosen.

3.4.1 System Architecture

The Online Programming Group Network will be designed based on three-tier architecture in order to perform better functionality of the system.

Advantages of three-tier architecture:

- Processing is centralized in at the middle tier.
- Allows for the parallel development of individual tiers by application specialists.
- Enhance security.
- Provides flexibility of resource allocation.
- Hide the complexity of deploying and supporting underlying services and network communications.

3.4.2 Application Platform

Windows XP Professional is selected as the system application platform due to several distinct advantages compared to other operating system and its ability to support all the tools and technologies that will be used in this project.

Advantages of Windows XP:

- At least 10 times more reliable than Windows 98 Second Edition

- Provides better integration of Windows 9x and Window NT that did in Windows 2000
- Achieve high performance by manages system resources efficiently, meeting the performance standard set by Windows 2000 and exceeding those set by Windows 98 Second Edition.
- Provide more stable and improve troubleshooting tools
- Protect sensitive and confidential data both on user's computer and while user are transmitting over a network or the Internet.

3.4.3 Web Server

Microsoft Internet Information Server (IIS) is chosen as the system web server as it is free and come along with Microsoft Windows XP Professional. It has been proved as powerful and easier to set up and maintain compare to many UNIX-based server.

Advantages of IIS:

- Easy installation and uninstall on the existing hardware with graphical setup.
- Support Microsoft ASP.NET technology and web based application that access database
- Windows-based Web authoring and development tools are supported.
- Well integrated server administration tools
- Virtual server support optimises hardware and allows for hosting multiple sites.

3.4.4 Programming Language

ASP.NET is chosen as the core programming language to develop this system as it is the newest version of Microsoft's Active Server Page (ASP) and a part of the new .NET Framework.

Advantages of ASP .NET:

- Fully compatible with other Microsoft's component.
- World-Class Tool Support because ASP.NET framework is complemented by a rich toolbox and designer in the Visual Studio integrated development environment.
- Simplicity. The ASP.NET page framework allows developers to build user interfaces that cleanly separate application logic from presentation code and to handle events in a simple, Visual Basic - like forms processing model.
- Customizability and Extensibility. ASP.NET delivers a well-factored architecture that allows developers to "plug-in" their code at the appropriate level
- Security. With built in Windows authentication and per-application configuration, you can be assured that your applications are secure.

3.4.5 Authoring Tool

Microsoft Visual Studio .NET 2003, which provide a rapid application integrated development environment for programming with the .NET Framework is the main authoring tool to develop this system.

Advantages of Microsoft Visual Studio .NET 2003:

- Rapid Development for the Server and Data Tiers. The Component Designer and Server Explorer work in concert to enable visual composition of middle-tier business

logic components. Built-in ADO.NET and Visual Database Tools provide support for creation of professional data-driven software.

- Reliability and Security. Built on the proven foundation of the .NET Framework, Visual Studio .NET 2003 employs a fine-grained security policy for user-based, role-based, and code access security models.
- Professional Software for Windows, the Web, and Devices. Visual Forms Designers expedite the creation of rich desktop applications for Windows, dynamic, broad-reach Web applications, and applications for a wide range of devices.
- Simplified Application Deployment and Maintenance. No Touch Deployment enables Windows-based applications to be distributed with the ease of Web applications, while side-by-side application deployment helps alleviate DLL versioning issues. Built-in support for Windows Installer technology provides advanced options for creating Windows and Web deployment packages.

3.4.6 Database Management System

Microsoft SQL Server 2000 which is the most robust database for the windows family has been chosen for develop the system database as it is able to work well with databases of any size.

Advantages of Microsoft SQL Server 2000:

- Support large-scale database
- Rich XML support
- Allow future expansion
- Work well with other Microsoft's component

- Automatic tuning and maintenance features simplify database administration

3.4.7 Data Access Technology

ADO.NET which designed specifically for the scalable and stateless web application is chosen as the data access technology. ADO.NET is an evolutionary improvement to ActiveX Data Objects (ADO)

Advantages of ADO.NET:

- Performs faster at the same tasks than its predecessor, ADO.
- Optimized SQL Provider that is highly optimized for interaction with SQL Server.
- XML support and integration.
- Disconnect Access Model
- Rich Object Model

3.5 Chapter Summary

This chapter mainly discusses the chosen methodology and the requirement elicitation techniques that been used throughout the project. First, a details explanation of chosen methodology Unified Process is given. Next, the reason choosing and how the methodology incorporates with project development are described. Finally, all the techniques which use to gather system requirements are stated.

CHAPTER 4 : SYSTEM ANALYSIS

4.1 Introduction

System analysis can be defined as a systematic investigation of a real or planned system to determine the functions of the system and how they relate to each other. In any system development, systems analysis is truly one of the most critical phases without any doubt.

The main purpose of this phase is to determine clearly of all necessary requirements before proceeding into system design and implementation. In shorts, system analysis is the process of gathering and interpreting facts, diagnosing problems and risks, and then using the analyzed information to recommend the improvement of the system.

4.2 Analysis of Literature Review

Table 4.1 below shows the summary of the current system features which explained in Chapter 2 as well as the functions which are going to be included in the proposed Online Programming Group Network.

From the table, it shows that Member Login is the major function of many major programming web portals. Therefore, this function would certainly need to be included in the proposed system because the member login function can be used to keep track the member identity so that all their activities in the portal are under administrator's control.

Also, once the member login function is included, normally user allows updating certain personal information like password and email. However, some crucial information like user ID is not allowed to change. This is very important for the administrator to recognize each user's identity precisely.

In the proposed Online Programming Group Network, the member registration is not included under its functionality. It is because the target users of this system are FSKTM members where their personal information is already available in the FSKTM database. Therefore, all FSKTM members suppose should able to login to the system without any registration. If any non FSKTM member wishes to join to the system, he is needed to contact the administrator before he can be added to the system.

The other major functions of a programming portal are useful link access, forum, file uploading/downloading and search engine. They are included in the proposed system in order to meet the system objectives and user's functional requirements. Also, the chat room function is added in the proposed system to encourage interactivity among FSKTM members.

Table 4.1: Summary of current system features

	Free Programming and Free Webmaster Resources	The Code Project	Lowyat.net	CodeGuru	**Online Programming Group Network**
New Members Registration	X	√	√	√	X
Member Login	X	√	√	√	√
Personal Info Update	X	√	√	√	√
Discussion Forum	√	√	√	√	√
Access/Link to other useful websites	√	√ (very limited)	X	√ (very limited)	√ (Focus on major language only)
Search Engine	√	√	√	√	√

File Upload/Download	X	√	√	√	√
Chat Room	X	X	X	X	√

4.3 Analysis of Survey Conducted

4.3.1 Questionnaire Results Analysis

After the questionnaire is done, the result of questionnaire were analyzed and summarized in order to understand user's expectation and needs so that a better system can be developed. The results are shown in charts form to give a better view and direct comparison.

A total of 100 questionnaires have been made to students in FSKTM who come from different study year. Results are shown as below:

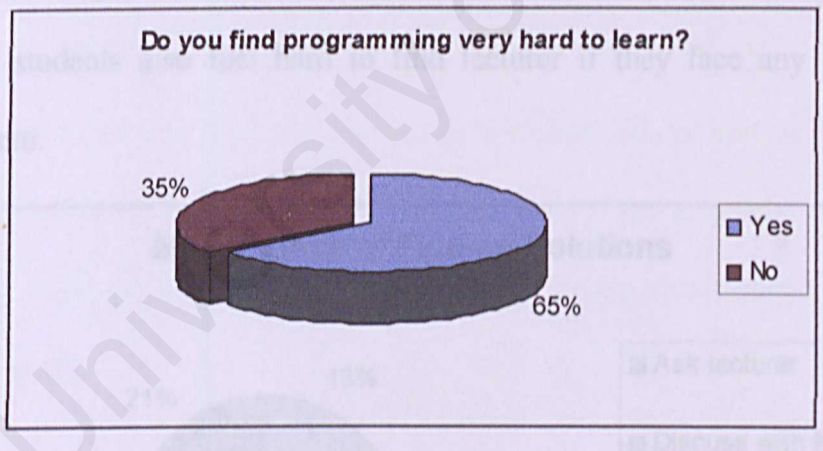


Figure 4.1: Do you find programming very hard to learn?

- Figure above shows majority of students feel programming is very hard to learn. So, it shows the needs of developing some sort of system to help students to deal with programming problems.

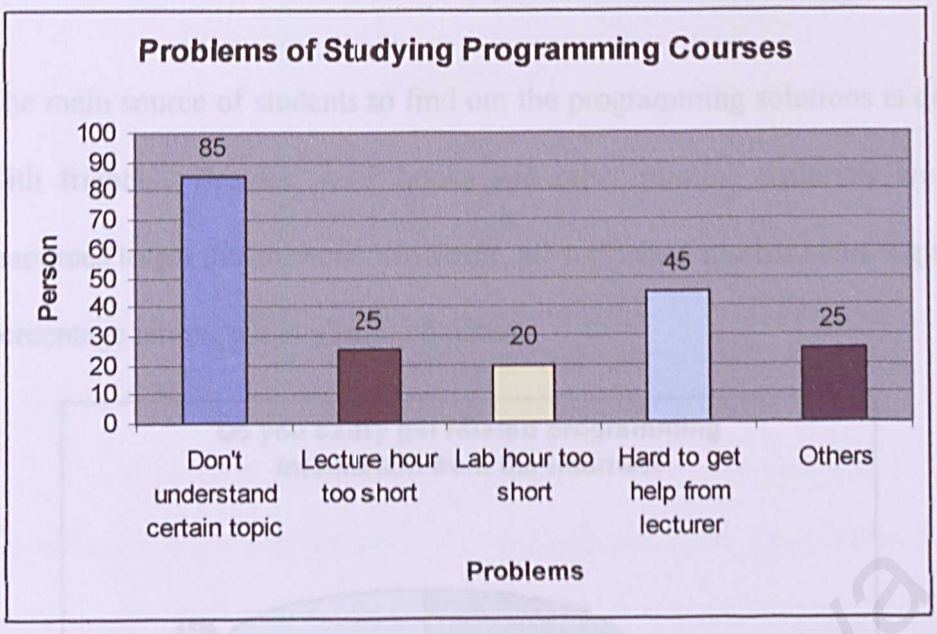


Figure 4.2: Problems of studying programming course

- The bar chart shows that the main problem of FSKTM students in studying programming courses is do not understand certain chapter or topic. Besides, some students also feel hard to find lecturer if they face any programming problem.

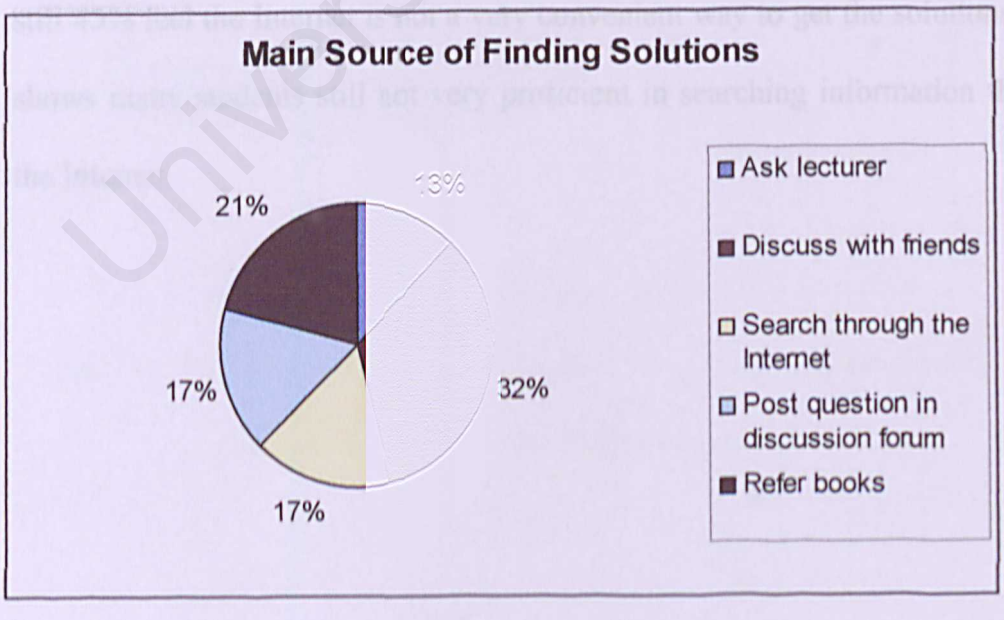


Figure 4.3: Main source of finding solutions

- The main source of students to find out the programming solutions is discussing with friends. Besides, refer books and other printing materials are another resources to get the answers. However, all suggested sources share a quite equal percentage among the students' choices.

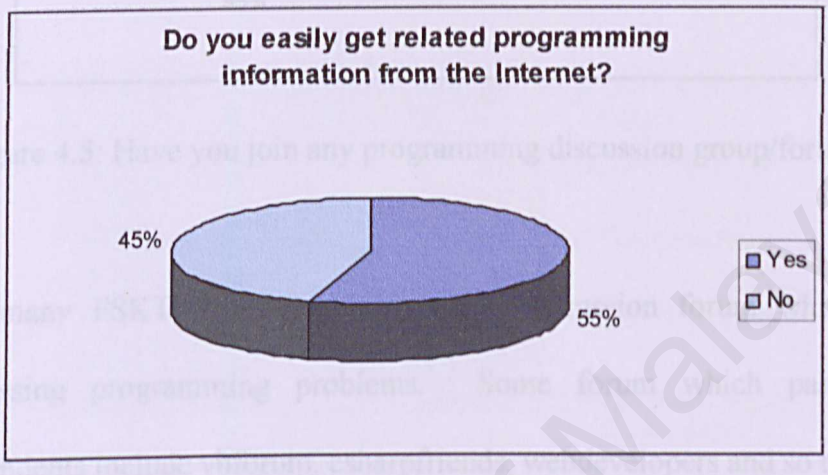


Figure 4.4: Do you easily get related programming information from the Internet?

- Although more than half of students can find their information easily but there is still 45% feel the Internet is not a very convenient way to get the solutions. This shows many students still not very proficient in searching information through the Internet.

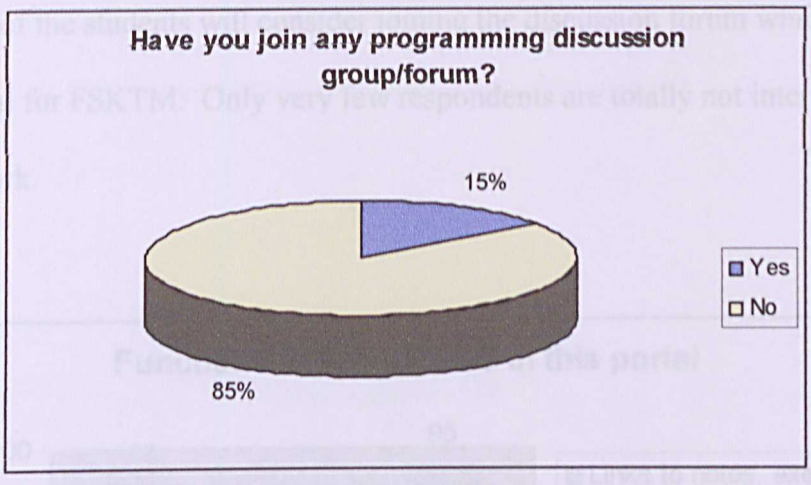


Figure 4.5: Have you join any programming discussion group/forum?

- Not many FSKTM students join online discussion forum which focus on discussing programming problems. Some forum which participated by respondents include vbforum, csharpfriends, webdevelopers and so on.

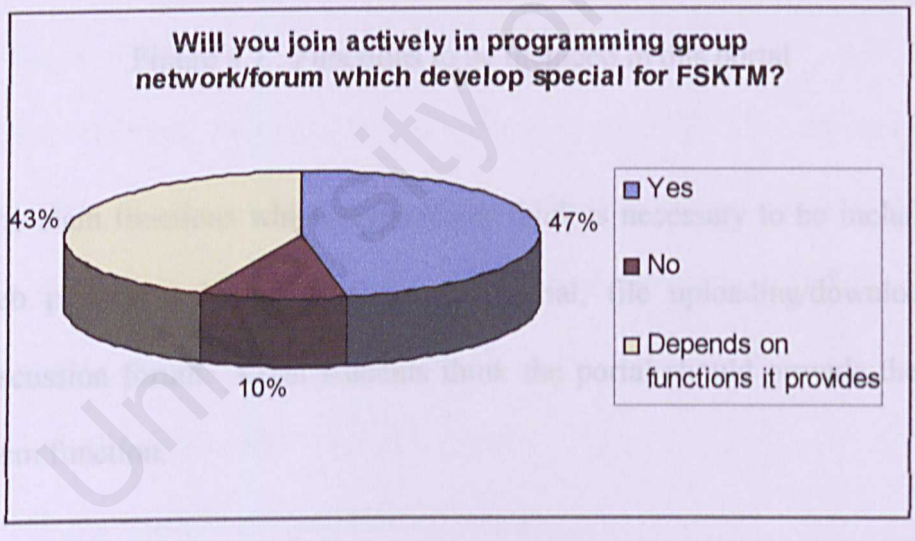


Figure 4.6: Will you join actively in programming group network/forum which develop special for FSKTM students?

- Most of the students will consider joining the discussion forum which develop special for FSKTM. Only very few respondents are totally not interested in this network.

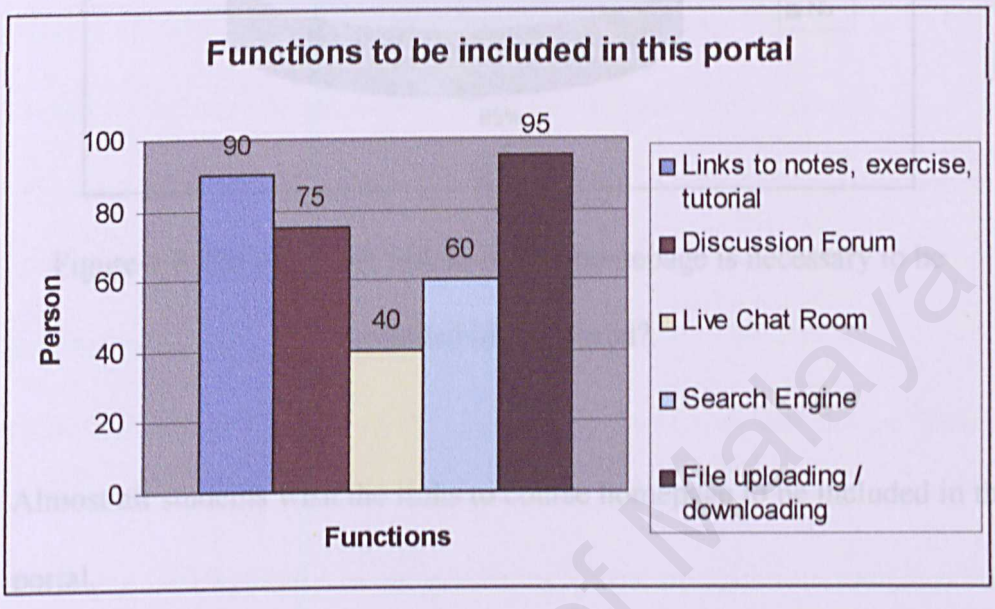


Figure 4.7 : Functions to be included in this portal

- The main functions which respondents think is necessary to be included in this web portal are links to notes and tutorial, file uploading/downloading and discussion forum. Least students think the portal should provide the live chat room function.

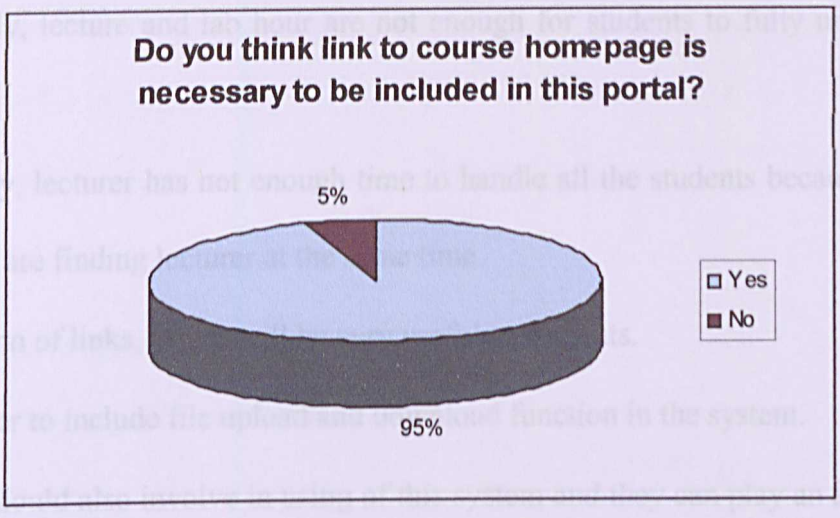


Figure 4.8: Do you think link to course homepage is necessary to be included in this portal?

- Almost all students wish the links to course homepage to be included in this web portal.

4.3.2 Summary of Interview

Several informal interviews had been made to three FSKTM members in order to understand more on the user's needs and expectation. Their ideas and opinion had become a very good reference in order to makes the system better. The three interviewees are:

- Dr. Phang Keat Keong (FSKTM lecturer)
- Mr. Chong Theng Hui (FSKTM 3rd year student)
- Ms. Lee Ai Yean (FSKTM 2nd year student)

Below is the summary of their ideas and opinions:

- Generally, lecture and lab hour are not enough for students to fully understand all topic.
- Normally, lecturer has not enough time to handle all the students because too many students are finding lecturer at the same time.
- Collection of links, forum will be very useful to students.
- It is better to include file upload and download function in the system.
- Tutors should also involve in using of this system and they can play an active role in the chat room.
- Current course homepage have limited functions.
- The course discussion board is only joined by students who take the particular course only.
- Many source codes should be able to share in the portal so that student can learn from each other.
- It is better to have a discussion forum which is special for all FSKTM members so that the topic discussed is close to students' problems.

4.3.3 Conclusion on Analysis of Survey Conducted

Based on the analysis of the questionnaire and interview above, it can be concluded that the proposed system should:

- Specific for the use of FSKTM members include lecturer, tutor and students.
- Available 24 hours for users to access at anytime.
- Provide discussion forum or chat room for students to share their programming problems and enable lecturer to help them as well.

- Provide the links to useful websites, online tutorial, exercise and so on for students to find similar programming solution.
- Able the user to upload and share their ideas and source code.
- Include links to course homepage.

4.4 Requirement Analysis

After all the information has gathered, it is important to analyze and organize them in a proper manner before the software development proceeds to design and implementation phase. In this part, all the system functional and non-functional requirements as well as software and hardware requirements are listed.

4.4.1 Functional Requirements

The functional requirements for a system are statements of services where the system is expected to provide. A functional requirement specifies what the system must be able to do, it terms that are meaningful to its users. It also states what the system should provide and how system should react to the particular situation.

4.4.1.1 List of Functional Requirements

After careful identification and analysis of the information gathered, the functional requirements of the proposed system are listed as below according to different needs of system administrator and system users.

System Administrator:

- Manage collection of useful website links and organize them according to different categories.
- Manage and update user's information in the database.
- Manage and control the message posted in discussion forum.

- Determine which submitted file or article to be uploaded to the system.

System User:

- Only allow updating their certain personal information, not include the userID.
- Create or join existing forum by posting message in the forum.
- Join chat room.
- Submit file or article to administrator.
- Download file which available in the portal.
- Access links to useful website.
- Search information through the provided search engine.

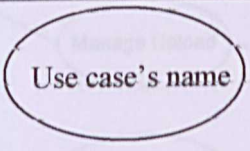
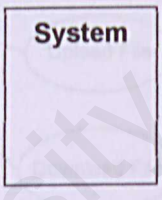
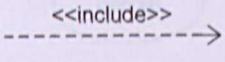
4.4.1.2 Use Case Diagram

Use case diagram is central to modelling the behaviour of a system, a subsystem, or a class by showing a set of use cases and actors and their relationships. They are applied to model the use case view of a system.

Use case diagrams are important for visualizing, specifying, and documenting the behaviour of an element. They make systems, subsystems, and classes approachable and understandable by presenting an outside view of how those elements may be used in context. Besides, they are crucial for testing executable systems through forward engineering and comprehending executable systems through reverse engineering.

Table 4.2 shows some of the use case diagram notation and Figure 4.9 is the use case diagram which shows the functional requirements of the proposed system, Online Programming Group Network.

Table 4.2: Use case diagram notation

Elements / Relationships	Notation	Description
Use case		A sequence of actions that an actor performs within a system to achieve a particular goal.
Actor		A role that a human (user), a hardware device, or even another system plays with a system
System Boundary		Indicates the scope of the system where anything within the box represents functionality that is in scope and anything outside the box is not.
Association		Lines connecting use cases and actors, with an optional arrowhead on one end of the line
Include		Indicates that one use case always includes functionality of another use case.

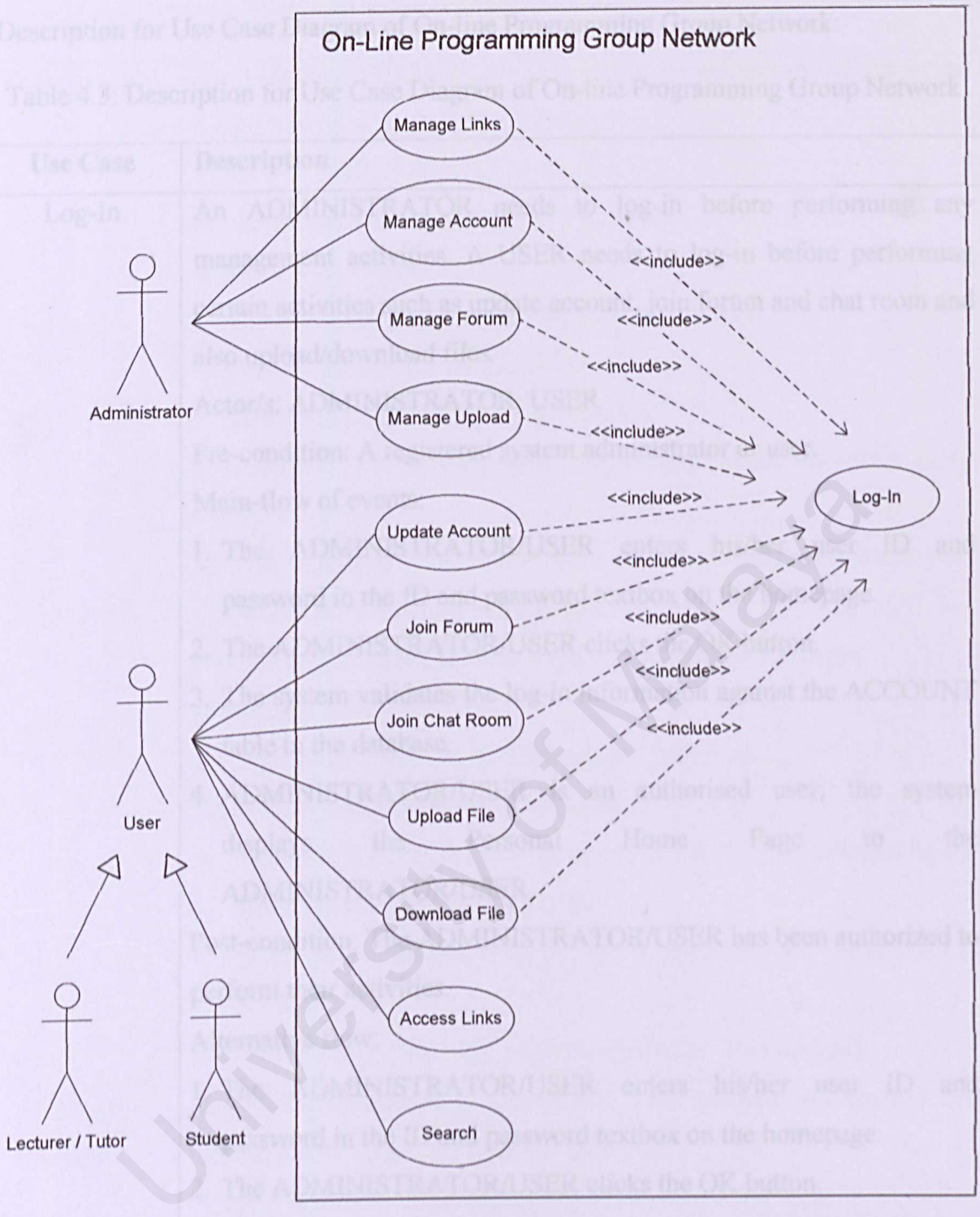


Figure 4.9: Use Case Diagram of On-line Programming Group Network

Description for Use Case Diagram of On-line Programming Group Network:

Table 4.3: Description for Use Case Diagram of On-line Programming Group Network

Use Case	Description
Log-In	An ADMINISTRATOR needs to log-in before performing any management activities. A USER needs to log-in before performing certain activities such as update account, join forum and chat room and also upload/download files. Actor/s: ADMINISTRATOR, USER Pre-condition: A registered system administrator or user. Main-flow of events: 1. The ADMINISTRATOR/USER enters his/her user ID and password in the ID and password textbox on the homepage. 2. The ADMINISTRATOR/USER clicks the OK button. 3. The system validates the log-in information against the ACCOUNT table in the database. 4. ADMINISTRATOR/USER is an authorised user; the system displays the Personal Home Page to the ADMINISTRATOR/USER. Post-condition: The ADMINISTRATOR/USER has been authorized to perform their activities. Alternative flow: 1. The ADMINISTRATOR/USER enters his/her user ID and password in the ID and password textbox on the homepage. 2. The ADMINISTRATOR/USER clicks the OK button. 3. The system validates the log-in information against the ACCOUNT table in the database. 4. ADMINISTRATOR/USER is not an authorised user; the system displays the Invalid ID/Password Page to the ADMINISTRATOR/USER. Post-condition: The ADMINISTRATOR/USER is not authorized to

	perform their activities.
Manage Links	An ADMINISTRATOR can add/remove useful websites links in the database according to different categories. Actor/s: ADMINISTRATOR Pre-condition: Administrator has logged-in. Main flow of events: 1. ADMINISTRATOR clicks Manage Links button. 2. System displays the list of all links. 3. ADMINISTRATOR clicks Add button. 4. ADMINISTRATOR enters all information about links and clicks OK. 5. System adds the link in the list and saves inside the database, then updates the LINK table in the database. Post-condition: LINK table in the database has been updated. Alternative flow: 1. ADMINISTRATOR clicks Manage Links button. 2. System displays the list of all links. 3. ADMINISTRATOR ticks the check box beside the link that he/she wishes to delete and click Delete. 4. System delete the link from the list, then updates the LINK table in the database. Post-condition: LINK table in the database has been updated.
Manage Account	An ADMINISTRATOR can update user account information and add/remove system user from the database. Actor/s: ADMINISTRATOR Pre-condition: Administrator has logged-in. Main flow of events: 1. ADMINISTRATOR clicks Manage Account button. 2. System displays the list of all users. 3. ADMINISTRATOR clicks Add button. 4. ADMINISTRATOR enters all information about user and clicks

	OK. 5. System adds the user in the list and saves inside the database, then updates the ACCOUNT table in the database. Post-condition: ACCOUNT table in the database has been updated. Alternative flow: 1. ADMINISTRATOR clicks Manage Account button. 2. System displays the list of all users. 3. ADMINISTRATOR ticks the check box beside the user that he/she wishes to delete and click Delete. 4. System delete the user from the list, then updates the ACCOUNT table in the database. Post-condition: ACCOUNT table in the database has been updated.
Manage Forum	An ADMINISTRATOR can manage forum by remove any improper message posted in the forum. Actor/s: ADMINISTRATOR Pre-condition: Administrator has logged-in. Main flow of events: 1. ADMINISTRATOR clicks Manage Forum button. 2. System displays the list of all forum title. 3. ADMINISTRATOR clicks the forum title that he/she wish to update. 4. System displays the list of messages under the selected forum title. 5. ADMINISTRATOR ticks the check box beside the message that he/she wishes to delete and click Delete. 6. System delete the message from the list, then updates the FORUM table in the database. Post-condition: FORUM table in the database has been updated.
Manage Upload	An ADMINISTRATOR can approve and upload user submitted file to the system. Actor/s: ADMINISTRATOR Pre-condition: Administrator has logged-in.

	Main flow of events: 1. ADMINISTRATOR clicks Manage Upload button. 2. System displays list of all submitted files and list of all uploaded files. 3. ADMINISTRATOR ticks the check box beside the submitted file that he/she wishes to upload and click Upload. 4. System move the file from the submitted list to uploaded list, then updates the FILE SUBMIT and FILE UPLOAD table in the database. Post-condition: FILE SUBMIT and FILE UPLOAD table in the database has been updated.
Update Account	A USER can update certain personal information in his/her account. Actor/s: USER Pre-condition: USER has logged-in. Main flow of events: 1. USER clicks the My Account button on the Homepage. 2. System displays USER's account information on the page. 3. USER enters all the information which he/she wishes to update and clicks Update. 4. The system updates the ACCOUNT table in the database. Post-condition: The ACCOUNT table in the database has been updated.
Join Forum	A USER can create or join forum and post message in the forum. Actor/s: USER Pre-condition: USER has logged-in. Main flow of events: 1. USER clicks Forum button on the Homepage. 2. System displays the Forum web page. 3. USER selects the forum title he/she wish to join. 4. System displays all posted messages of the forum. 5. USER clicks Reply button.

	6. USER enters his/her message and clicks Post. 7. System adds the message in the forum and saves inside the database, then updates the FORUM table in the database. Post-condition: FORUM table in the database has been updated. Alternative flow: 1. USER clicks Forum button on the Homepage. 2. System displays the Forum web page. 3. USER clicks New Thread button. 4. USER enters his/her message and clicks Post. 5. System adds the message in the new forum and saves inside the database, then updates the FORUM table in the database. Post-condition: FORUM table in the database has been updated.
Join Chat Room	A USER can join and chat in the chat room. Actor/s: USER Pre-condition: USER has logged-in. Main flow of events: 1. USER clicks Chat button at the Homepage. 2. System displays Chat Room page. 3. USER clicks Join button. 4. System adds the USER into the chat room. 5. USER can chat with other members in the chat room. Post-condition: USER can chat with other members in the chat room.
Upload File	A USER can submit file to the system and share among the users. Actor/s: USER Pre-condition: USER has logged-in. Main flow of events: 1. USER clicks the Article button at the Homepage. 2. System displays the article page with list of article. 3. USER clicks Submit Article button. 4. System display the submit article wizard. 5. USER follows the wizard's steps and upload his/her file to system.

	6. System save the file in the database, then update the FILE SUBMIT table in the database. Post-condition: FILE SUBMIT table in the database has been updated.
Download File	A USER can download file (source code) which shared by other users. Actor/s: USER Pre-condition: USER has logged-in. Main flow of events: 1. USER clicks the Article button at the Homepage. 2. System displays the article page and list of article. 3. USER clicks the article he/she wishes to review. 4. System displays the selected article on the page. 5. USER clicks the file's title which able to be downloaded. 6. USER enters the saved location on the Download message box and clicks OK. 7. The system sends the file and saves at targeted location. Post-condition: Download file is saved to the USER's computer.
Access Links	A USER can access to other useful websites which list down by the system. Actor/s: USER Pre-condition: USER has accessed to system Homepage. Main flow of events: 1. USER clicks one of the Programming Languages Hyperlink in the Homepage. 2. System displays the list of websites under the category of selected language. 3. USER clicks on the title of the website which he/she wish to visit. 4. System displays the homepage of selected website in a new Window. Post-condition: Homepage of selected website displayed in new Window.
Search	A USER can search the information by using system search engine.

	Actor/s: USER Pre-condition: USER has accessed to system Homepage. Main flow of events: 1. USER clicks Search button on the homepage. 2. System displays Search page. 3. USER enters the keywords that he/she wish to search on the search textbox in Homepage. 4. USER select in the radio box either performing a search in the website or search through the World Wide Web. 5. USER clicks the Search button. 6. System displays the matching search results on the page. Post-condition: Searching result displayed on the page.

4.4.2 Non-functional Requirements

Non-Functional requirements are requirements which are not directly concerned with the specific functions delivered by the system. They may relate to emergent system properties such as reliability, response time and security.

Many non-functional requirements relate to the system as a whole rather than to individual system features. While failure to meet an individual functional requirement may degrade the system, failure to meet a non-functional requirement may make the whole system unstable.

Below are the descriptions of non-functional requirement of the system:

- Reliability

  The system should reliable in performing its functions and operations without delay in response time during the concurrent usage. Besides, the system server and

database should able to run 24 hours as this is one of the crucial requirements for an online application.

- Security

  Information in the database should only be viewed, created or modified by system administrator and the rightful user. Any system user should only allow viewing and updating their own personal information. This can be achieved by using user ID and password authentication manner.

- User friendly

  User interfaces should be user friendly to make user easy to learn and master in using any of the system functions.

- Multi-user environment

  As this is a web-based application, it is possible that more than one person are using the system at the same time. Hence, the proposed system should able to handle the situation where many users request system resource simultaneously.

- Maintainability and expandability

  The system modules should be easy to manage. In the future, any new requirement or function should be easy to adapt in the existing system.

4.4.3 Hardware and Software Requirements

Hardware and software requirements for both system development and runtime environment are listed in Table 4.4.

Table 4.4: Hardware and software requirements

	Development	Run Time
Hardware Requirements	• Pentium IV 1.6 Gigabyte • Random Access Memory : 256MB • Hard disk : 20GB • Others standard computer peripherals	• 233 MHz Pentium / higher microprocessor / or equivalent • Random Access Memory : 64 MB and above (128MB recommended) • Hard disk : 2.5 GB and above • Others standard computer peripherals
Software Requirements	• Windows XP Professional • Internet Explorer 6.0 • Internet Information Server 5.0 with .NET framework • Microsoft SQL server 2000 • ADO.NET • Microsoft Visual Studio .net 2003	• Windows 2000 server (Windows XP is recommended) • Any web browser (Internet Explorer 5.5 is recommended)

4.5 Chapter Summary

This chapter discusses about the evaluation of the requirement analysis, where analysis of literature review and analysis survey conducted are performed. Next, the functional requirements which describe the functionality and the services that the system provides are presented in Use Case Diagram. Later, the nonfunctional requirements which affect the overall quality of the system are given. The summary of hardware and software requirement is presented at the last part of the chapter.

CHAPTER 5 SYSTEM DESIGN

5.1 Introduction

System design defined as those tasks that focus on the specification of a detailed computer-based solution. It is applied regardless of what kind of development model or standard is being used. Shortly, system design is a process to convert the conceptual ideas from requirement specification in system analysis into more technical specification. If system analysis emphasized on understanding the problems, systems design focuses on the technical and implementation concerns of the system.

System design is equally important compared to system analysis and need to be carried out carefully since the design phase will affect the subsequent stage – system implementation. Any mistakes in the system design may result in catastrophic results, which may only be unveiled when the product reaches the customer. Hence, it must not be taken lightly.

In this chapter, the following categories will be discussed:

- System architecture
- Data design
- Process design
- Input design
- Interface design

5.2 System Architecture

System architecture from a software view, addresses the description of the structural aspects of a software system. It is a framework that describes how system components interact and work together to achieve total system goals.

For this project, generally, there are two kinds of client server architecture to choose from: two-tier and three-tier. The choice should be made based on the scope and complexity of a project, the time available, and also the expected enhancement of the system. Table 5.1 shows the advantages and disadvantages of two-tier and three-tier architecture.

Table 5.1 Comparison of two-tier and three-tier architecture

	Advantages	Disadvantages
Two–tier architecture	• Low to medium cost. • Clean, modular design • Less network traffic • Secure algorithms	• Must design/implement protocol • Must design/implement reliable data storage • Client nodes require more computing power • Poor separation of software components •
Three-tier architecture	• Can separate UI, logic, and storage • Reliable, replicable data • Thin clients are easier to configure and maintain • Efficient data access • Maximum flexibility	• Poor cross-platform support • Need to hire DBA • More down times in a large host system • Object-relational mapping is difficult

For Online Programming Group Network, three-tier architecture is chosen. Figure 5.1 shows how the three-tier architecture works.

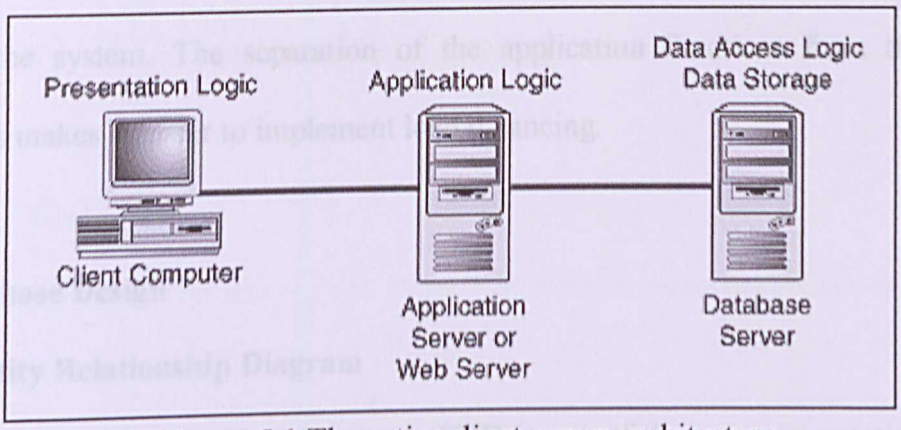


Figure 5.1 Three-tier client-server architecture

Referring to Figure 5.1, the presentation logic in the first tier means any browser that the system administrator or user will use to access the web server. The interface for the system has been identified as a web interface which will be written using ASP.NET. This makes it independent of any web browser which will be used to view the data. User can access to the system anytime and anywhere as long as he/she has the Internet connection, and uses a browser to access to the system homepage.

The web server of resides in the middle tier. The web server for the system is Internet Information Server 5.0 that provide functional module to process data. It processes user's request from the client tier and then returns the result to the browser in HTML form. The web server is linked to the database server. Any data request will be authenticated to verify its validity.

The third tier is the database server, which is responsible for data storage and management. In this system, Microsoft SQL Server 2000 is chosen as the database server that maintains the data repository of the system. Each query requested from the web server will be authenticated before the result passing back to the web server.

The proposed system implements the three-tier client/server architecture because it allows any tier of the system to be modified or changed without affected the other two

tier of the system. The separation of the application functions from the database functions makes it easier to implement load balancing.

5.3 Database Design

5.3.1 Entity Relationship Diagram

Entity Relationship Diagram or ERD is one of the common notations used for data modeling. Data modeling is a technique for organizing and documenting a system's data. Data modeling is sometimes called database modeling because a data model is usually implemented as a database. ERD depicts data in terms of entities and relationships described by the data.

A relationship actually is a natural business association that exists between one or more entities. In this system, the relationship represents event that links the entities or merely a logical affinity that exists between the entities. All relationships are implicitly bi-directional, meaning they can be interpreted in both directions.

Figure 5.2 shows the system's entity relationship diagram. There are five entities in the system:

- Account

  Contain all the personal information of system administrators and users. There are two type of user: system administrator and other system user. System administrator is allowed to manage the links and upload the file submitted by system user. Other system user is allowed to post message in the forum submit file to the system.

- Forum

Contain the forum's name and ID as well as information of all the messages which posted under the same forum title.

- File Upload

  Contain information about files which have been approved by administrator and upload to the system.

- File Submit

  Contain information about files which have submitted by users.

- Link

  Contain information of useful website's link such as link ID, website's name and introduction of the website.

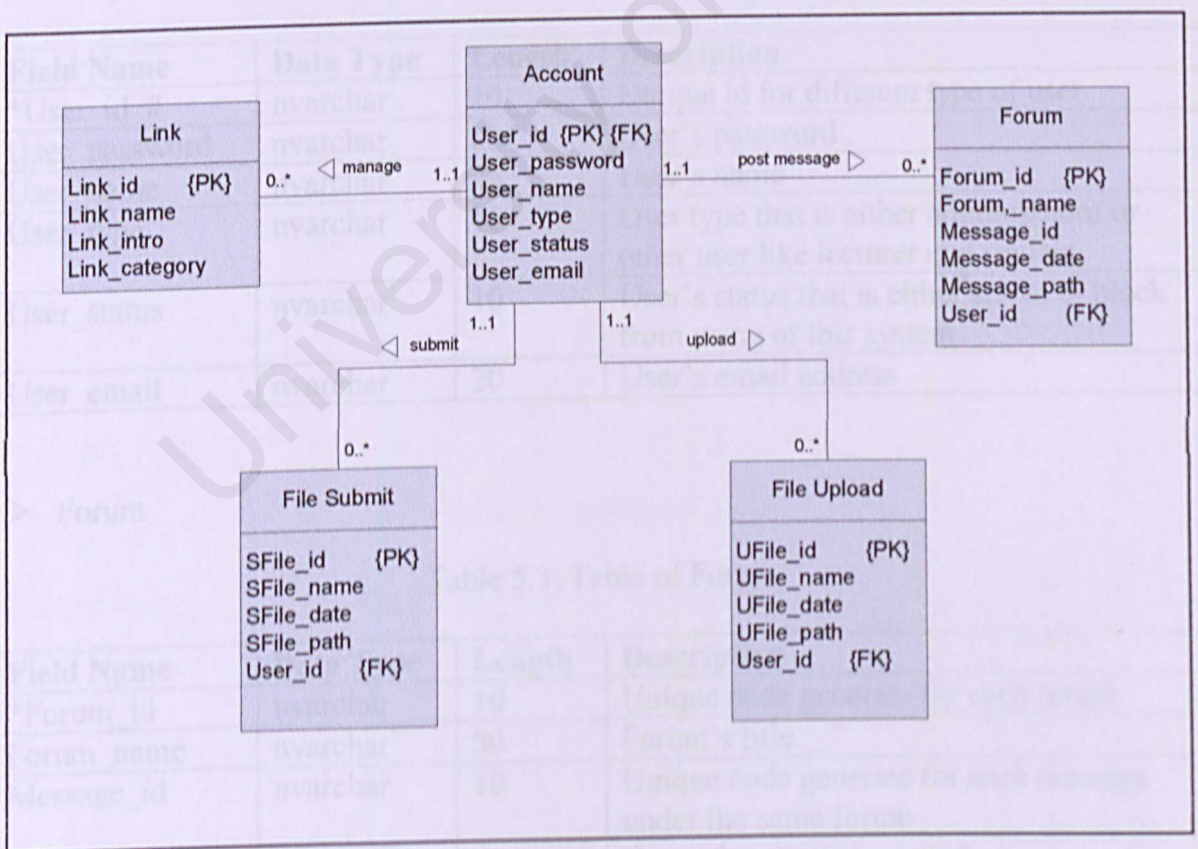


Figure 5.2 Entity Relationship Diagram

5.3.2 Data Dictionary

Data dictionary or metadata can be defined as descriptions of the database structure and contents where it defines the field, field type and description of each table. A data dictionary is a repository of elements in a system. It is developed to let system analysts and programmers keep track of data definition used in the system.

Below is the data dictionary of Online Programming Group Network:

* : primary key

\# : foreign key

- Account

Table 5.2: Table of Account

Field Name	Data Type	Length	Description
*User_id #	nvarchar	10	Unique id for different type of user
User_password	nvarchar	20	User's password
User_name	nvarchar	25	User's name
User_type	nvarchar	10	User type that is either administrator or other user like lecturer and student
User_status	nvarchar	10	User's status that is either active or block from using of this system
User_email	nvarchar	20	User's email address

- Forum

Table 5.3: Table of Forum

Field Name	Data Type	Length	Description
*Forum_id	nvarchar	10	Unique code generate for each forum
Forum_name	nvarchar	50	Forum's title
Message_id	nvarchar	10	Unique code generate for each message under the same forum
Message_date	datetime	8	Date of message is posted.
Message_path	nvarchar	50	Location of message is saved inside the

			database
User_id #	nvarchar	10	ID of user who post the message

- File Upload

Table 5.4: Table of File Upload

Field Name	Data Type	Length	Description
*UFile_id	nvarchar	10	Unique code generate for each file upload
UFile_name	nvarchar	25	Uploaded file's name
UFile_date	datetime	8	Date of file is uploaded
UFile_path	nvarchar	50	Location of uploaded file is saved inside the database
User_id #	nvarchar	10	ID of user who submit the file

- File Submit

Table 5.5 Table of File Submit

Field Name	Data Type	Length	Description
*SFile_id	nvarchar	10	Unique code generate for each file submitted
SFile_name	nvarchar	25	Submitted file's name
SFile_date	datetime	8	Date of file is submitted
SFile_path	nvarchar	50	Location of submitted file is saved inside the database
User_id #	nvarchar	10	ID of user who submit the file

- Link

Table 5.6: Table of Link

Field Name	Data Type	Length	Description
*Link_id	nvarchar	10	Unique code generate for each link
Link_name	nvarchar	25	Name of the website
Link_intro	nvarchar	300	Brief introduction of the website
Link_category	nvarchar	25	Link's category

5.4 Process Design

System process design is based on the system requirements stated in Chapter 4. It translates the system requirement into system functionality and explains how the system modules interact with one another.

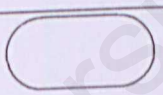
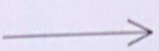
5.4.1 Activity Diagram

An activity diagram describes the dynamic aspects of a system. It is essentially a flowchart, showing flow of control from activity to activity. It involves modelling the sequential steps in a computational process and modelling the flow of an object as it moves from state to state at different points in the flow of control.

Activity diagrams allow the readers to see the system's execution, and how it changes direction based upon different conditions and stimuli. In this part, activity diagram is used to model the workflows of use cases which identify in Chapter 4.

Table below shows some of the notation of activity diagram:

Table 5.7: Activity diagram notation

Elements/Action	Symbol	Description
Activity/action State		Indicates that an object performs on an ongoing activity or action.
Initial State		Indicates start of the flow of control.
Final State		Indicates end of the flow of control.
Transition		Used to show the path from one action or activity state to the next action or activity state.
Forking and Joining		Fork is a splitting of a flow of control into two or more flows of control while join is a synchronization of two or more flows of control into one flow

Below are the activities diagrams of Online Programming Group Network:

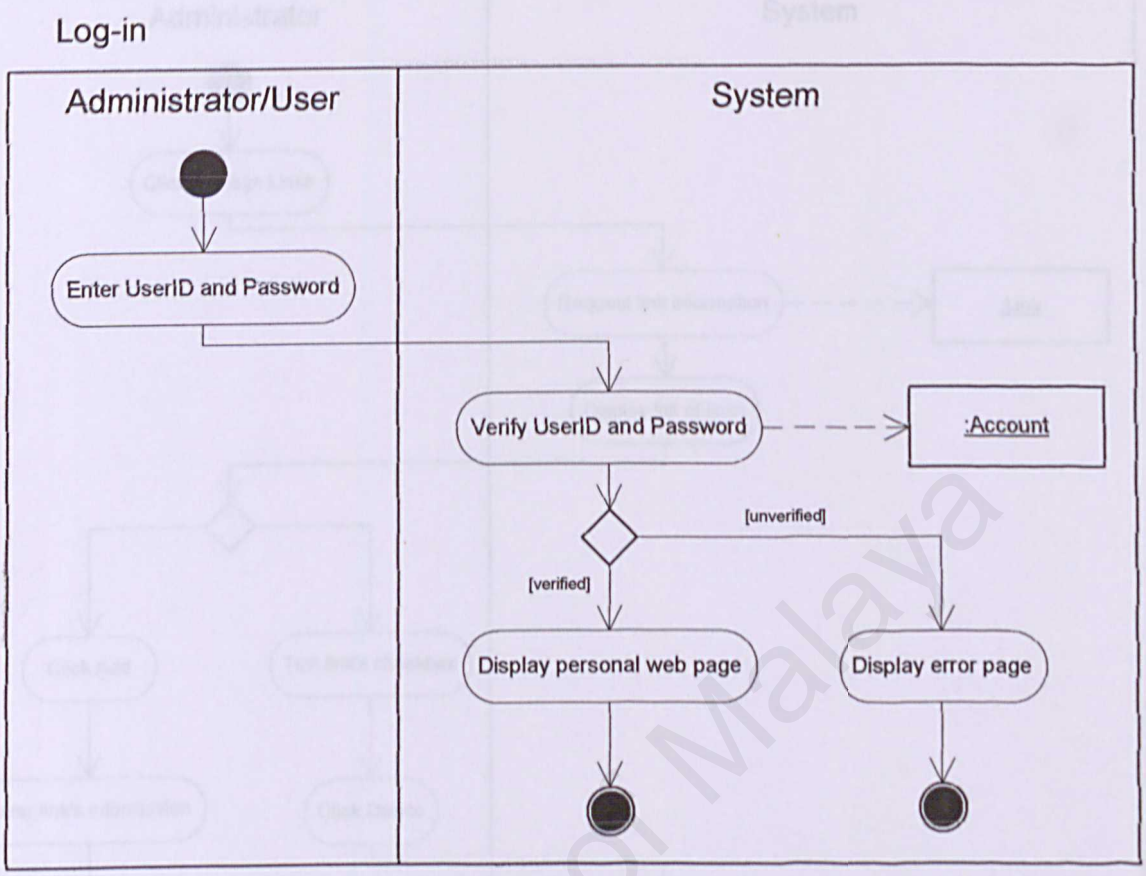


Figure 5.3: Activity Diagram of "Log-in"

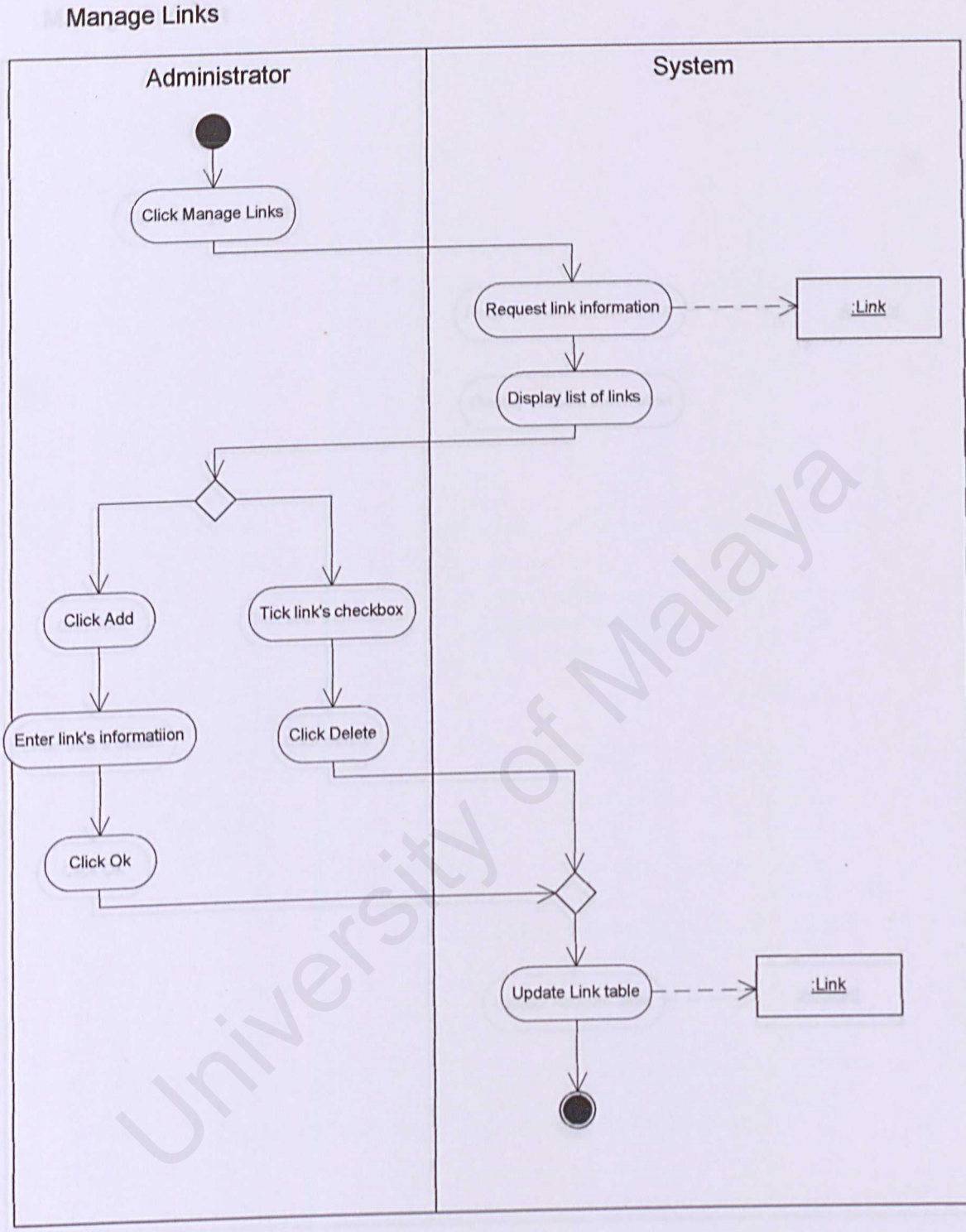


Figure 5.4: Activity Diagram of "Manage Links"

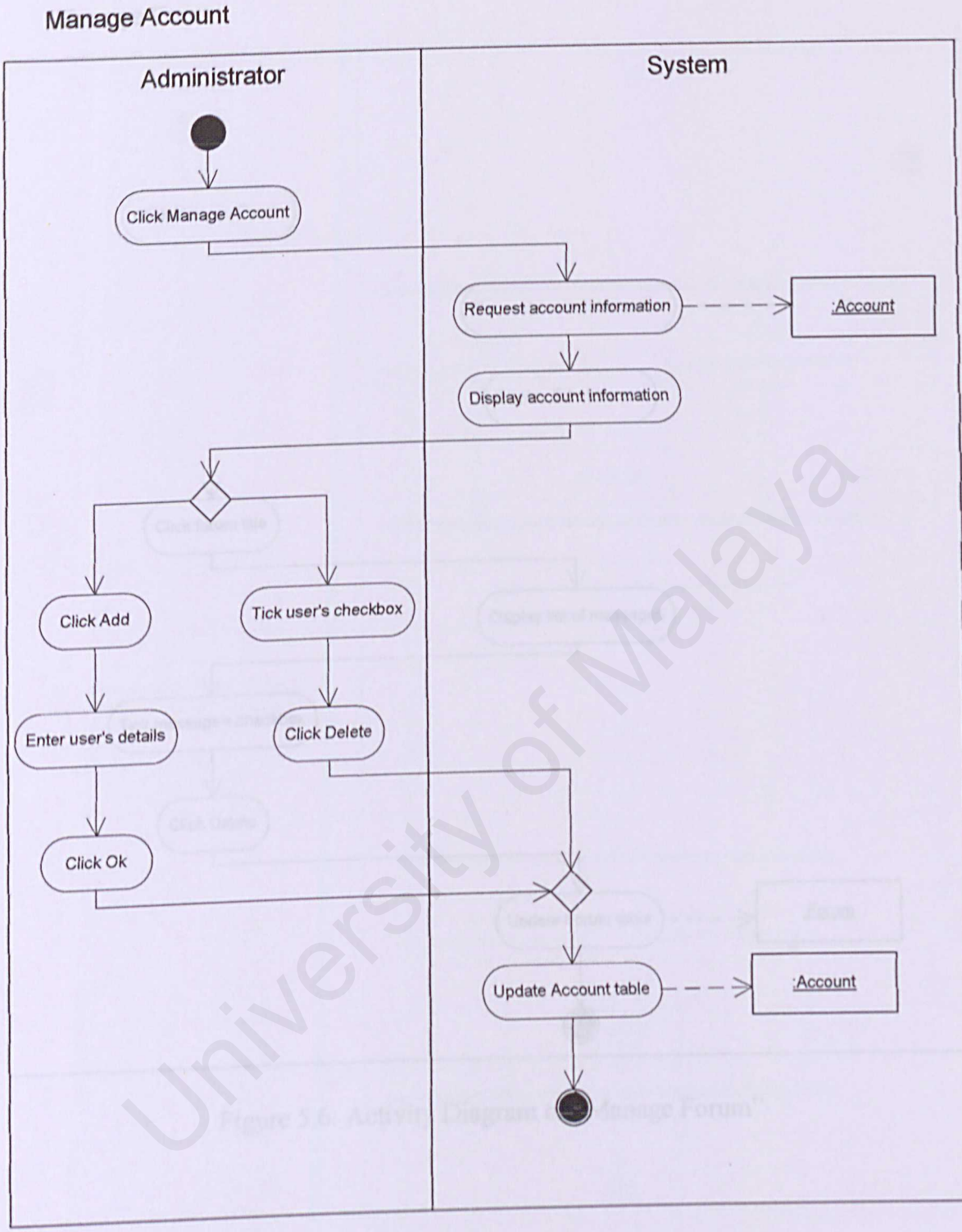


Figure 5.5: Activity Diagram of "Manage Account"

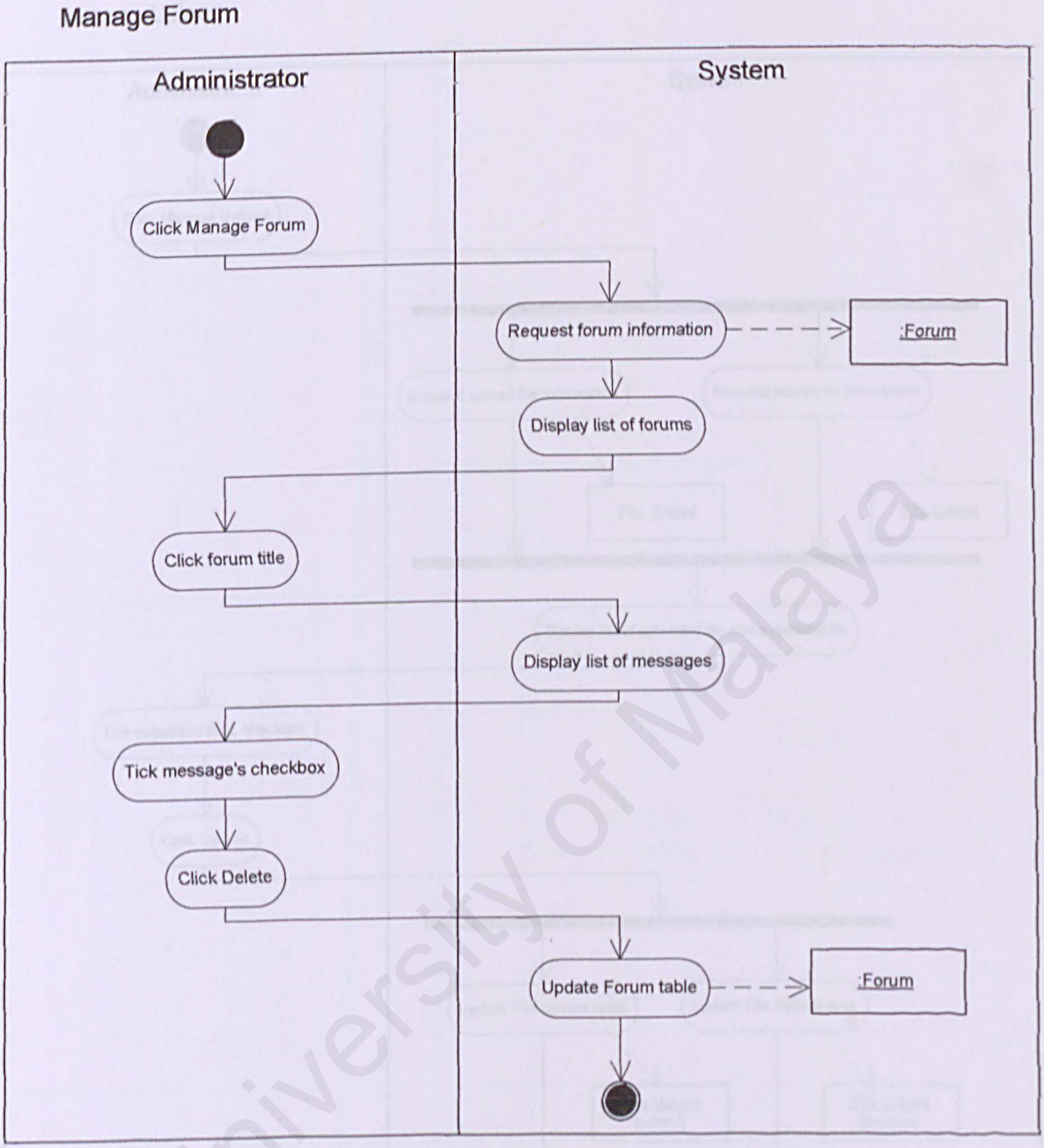


Figure 5.6: Activity Diagram of "Manage Forum"

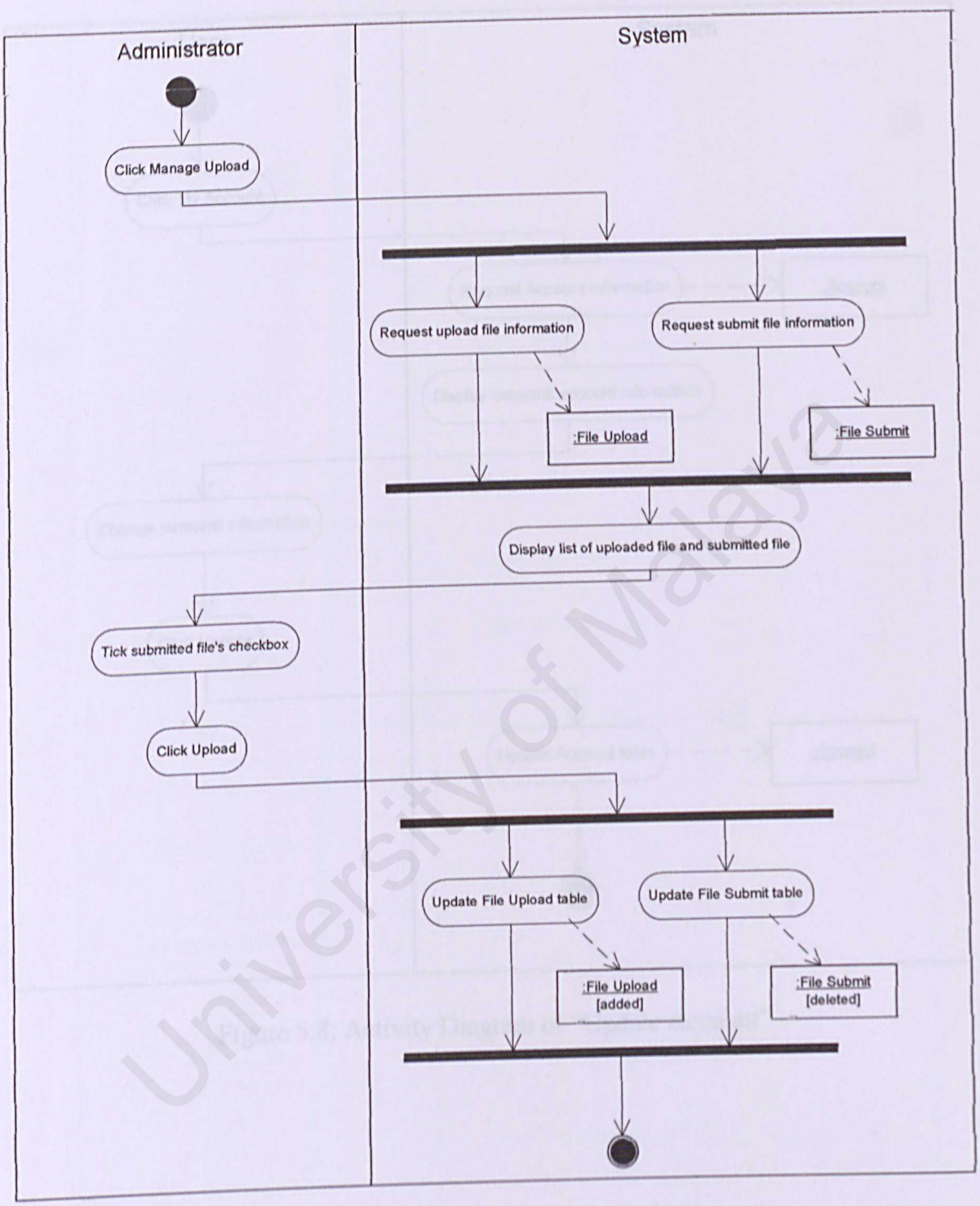


Figure 5.7: Activity Diagram of "Manage Upload"

Update Account

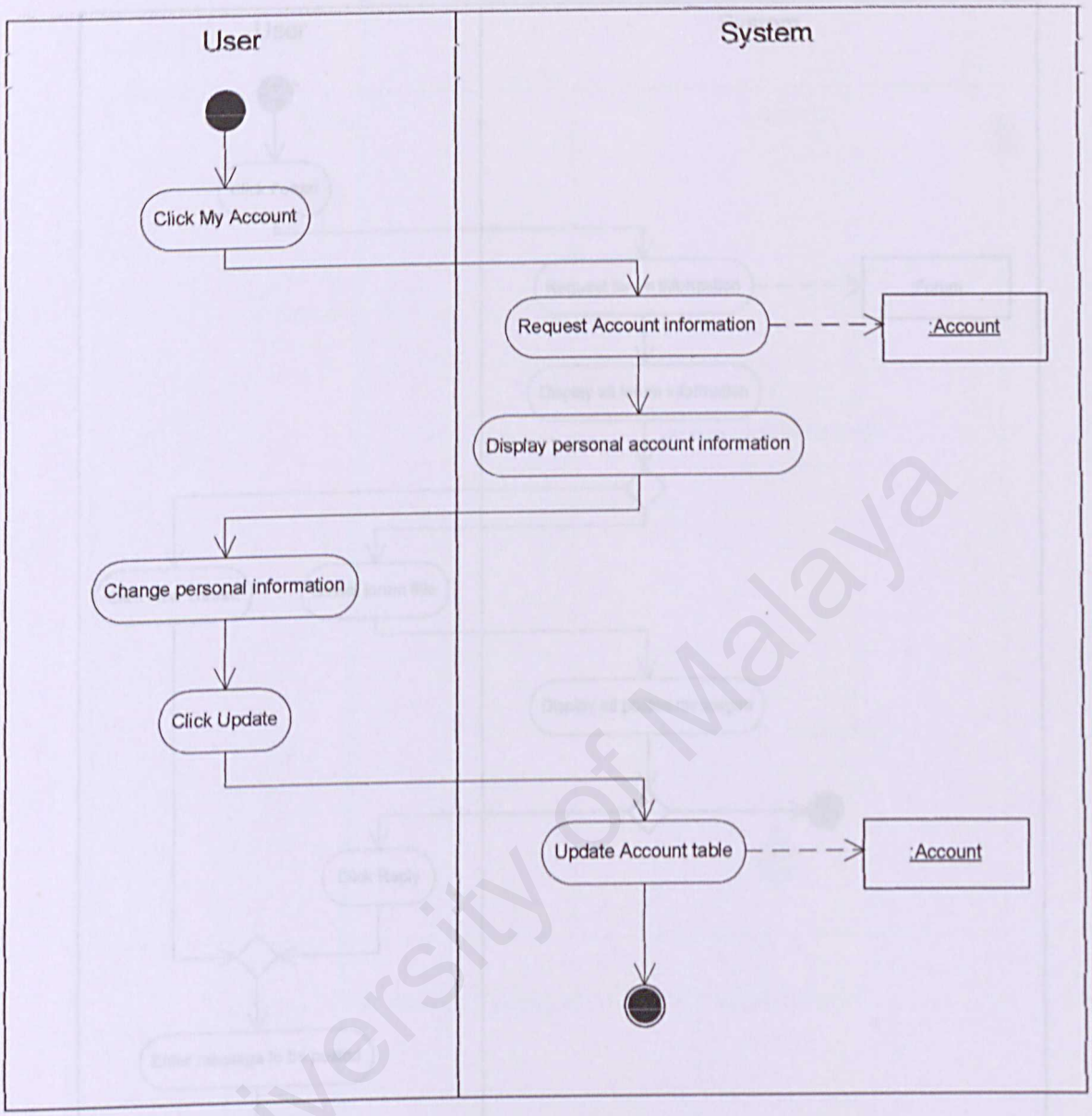


Figure 5.8: Activity Diagram of "Update Account"

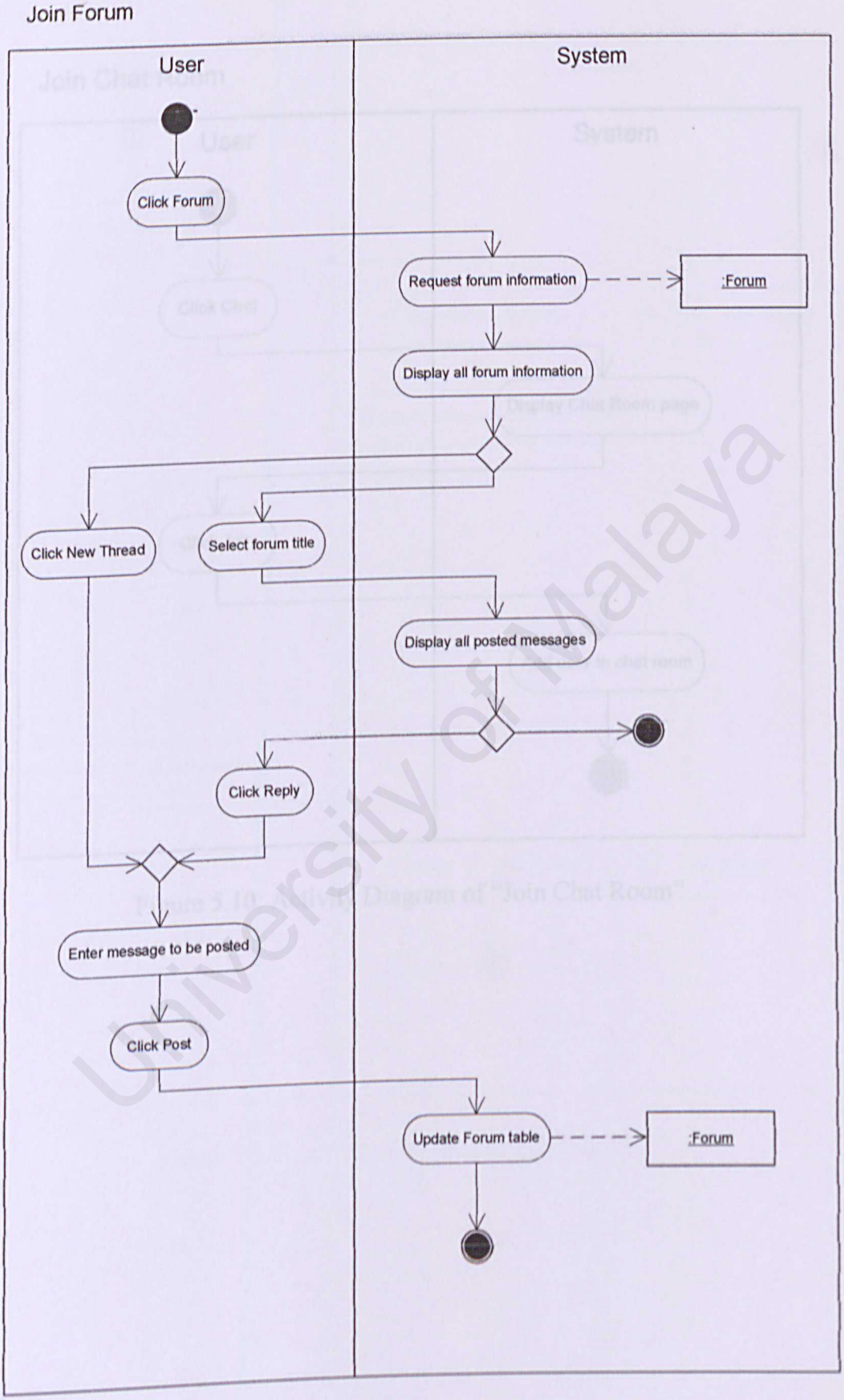


Figure 5.9: Activity Diagram of "Join Forum"

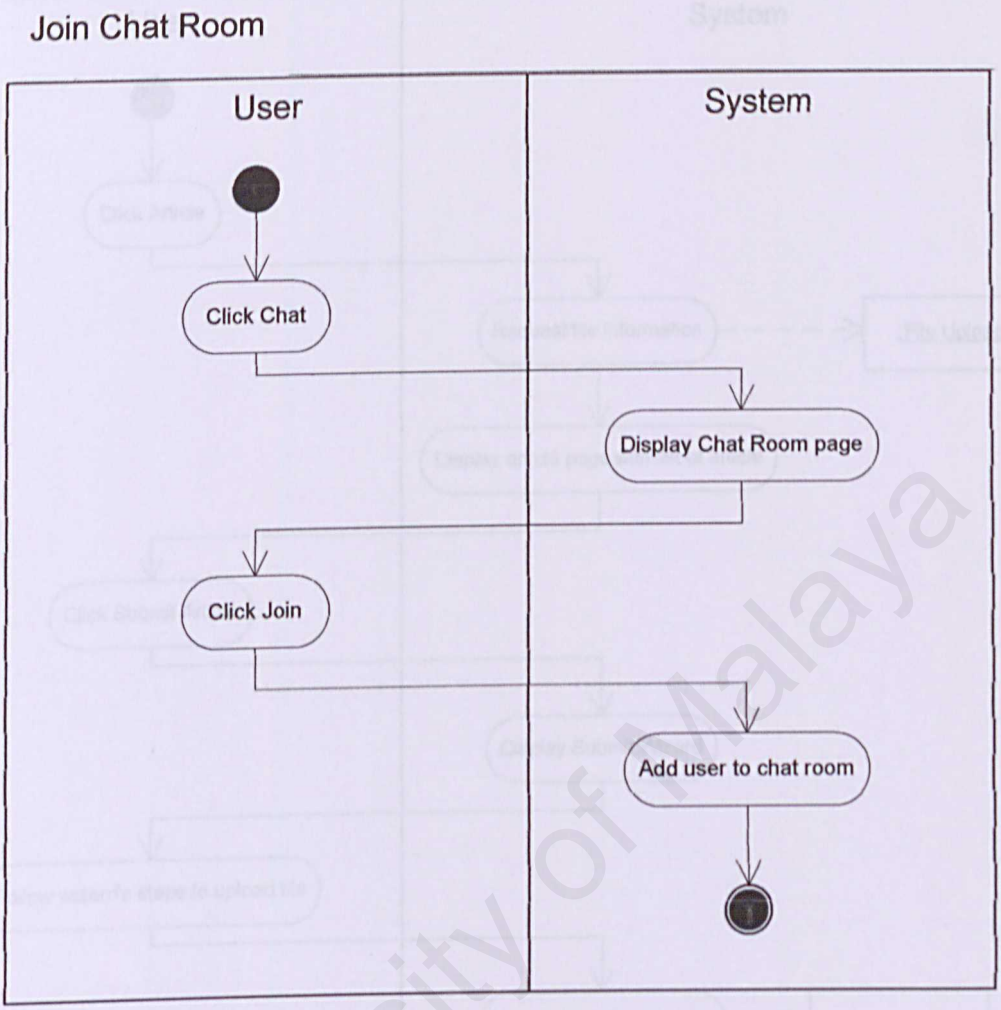


Figure 5.10: Activity Diagram of "Join Chat Room"

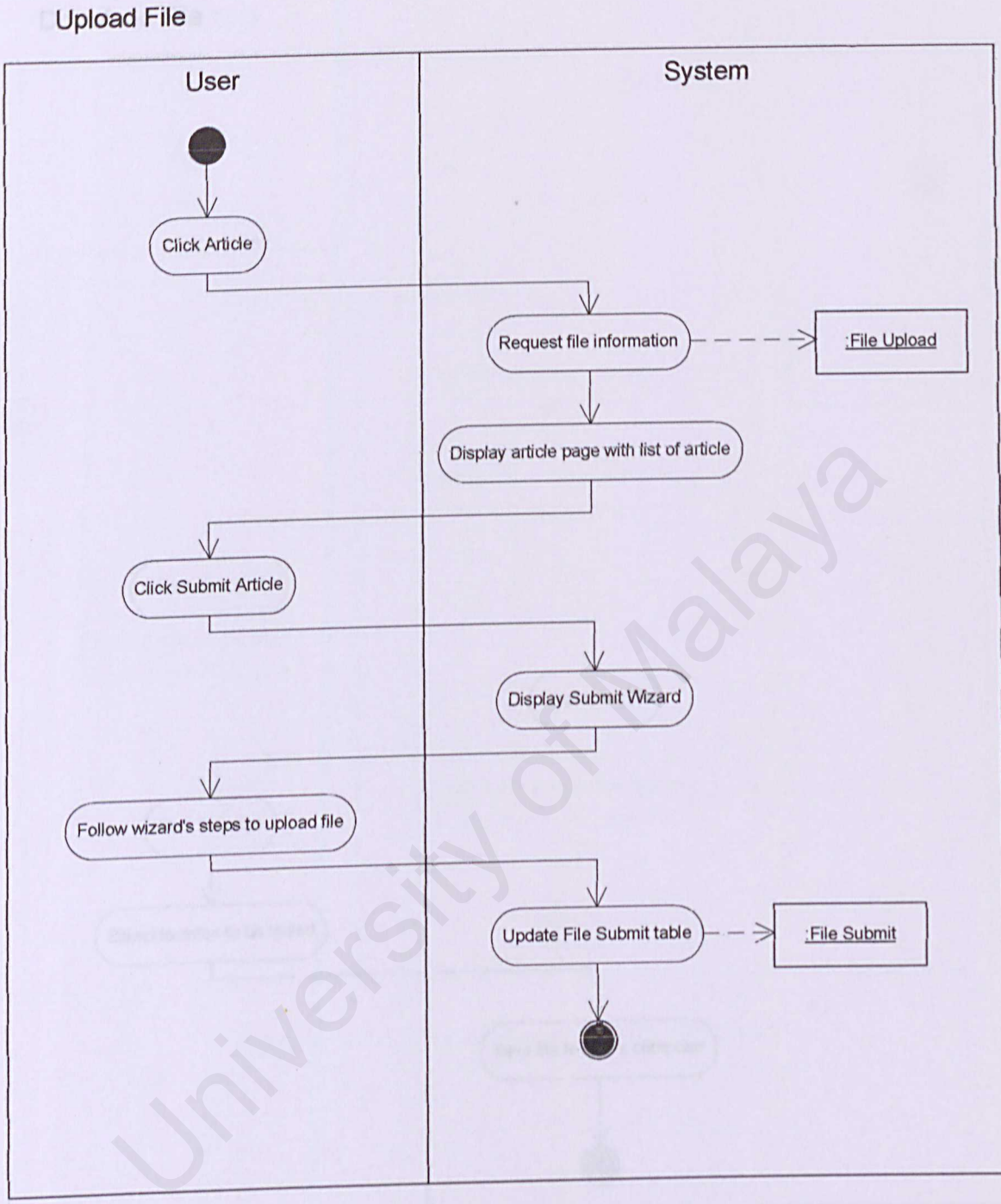


Figure 5.11: Activity Diagram of "Upload File"

Download File

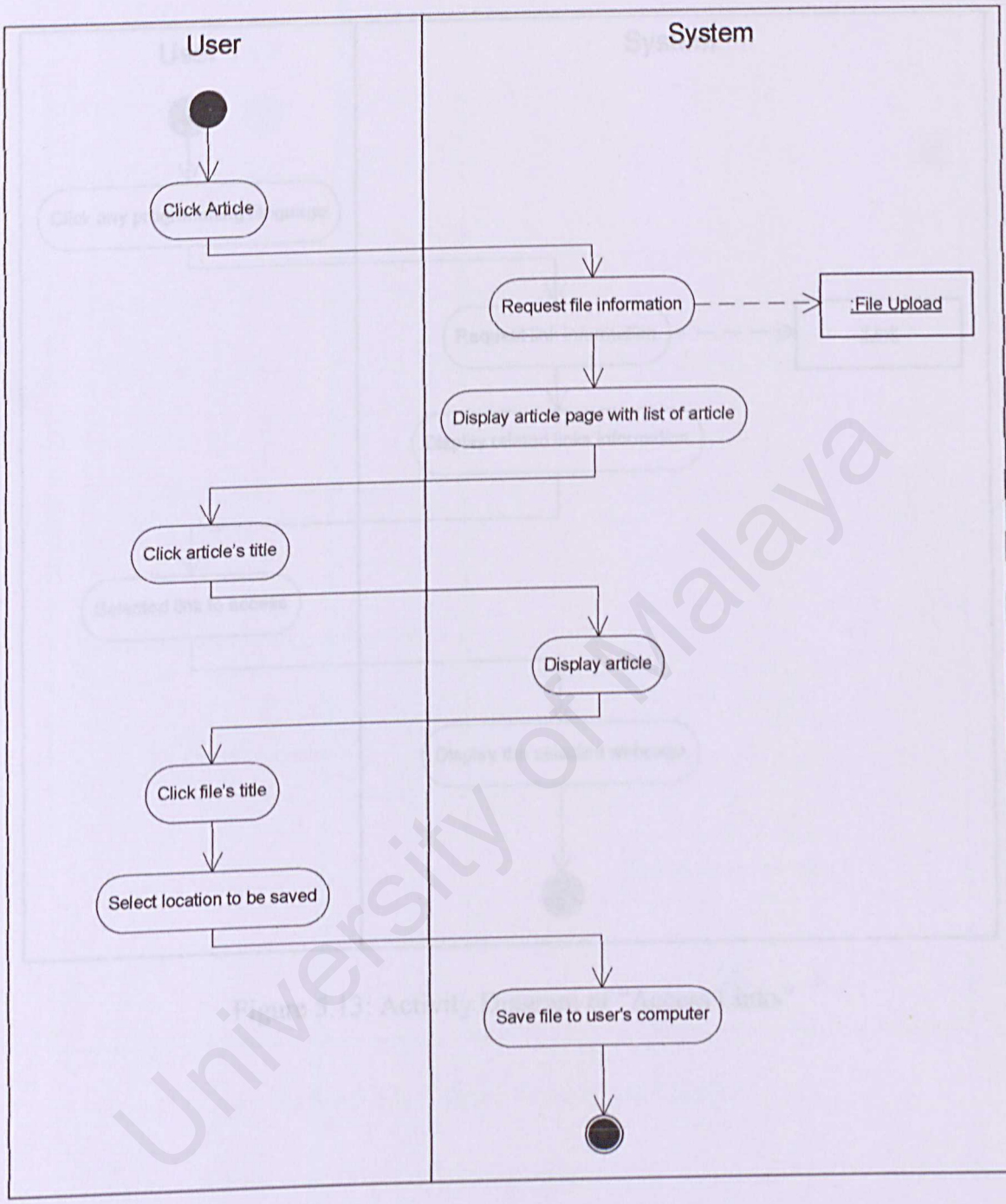


Figure 5.12: Activity Diagram of "Download File"

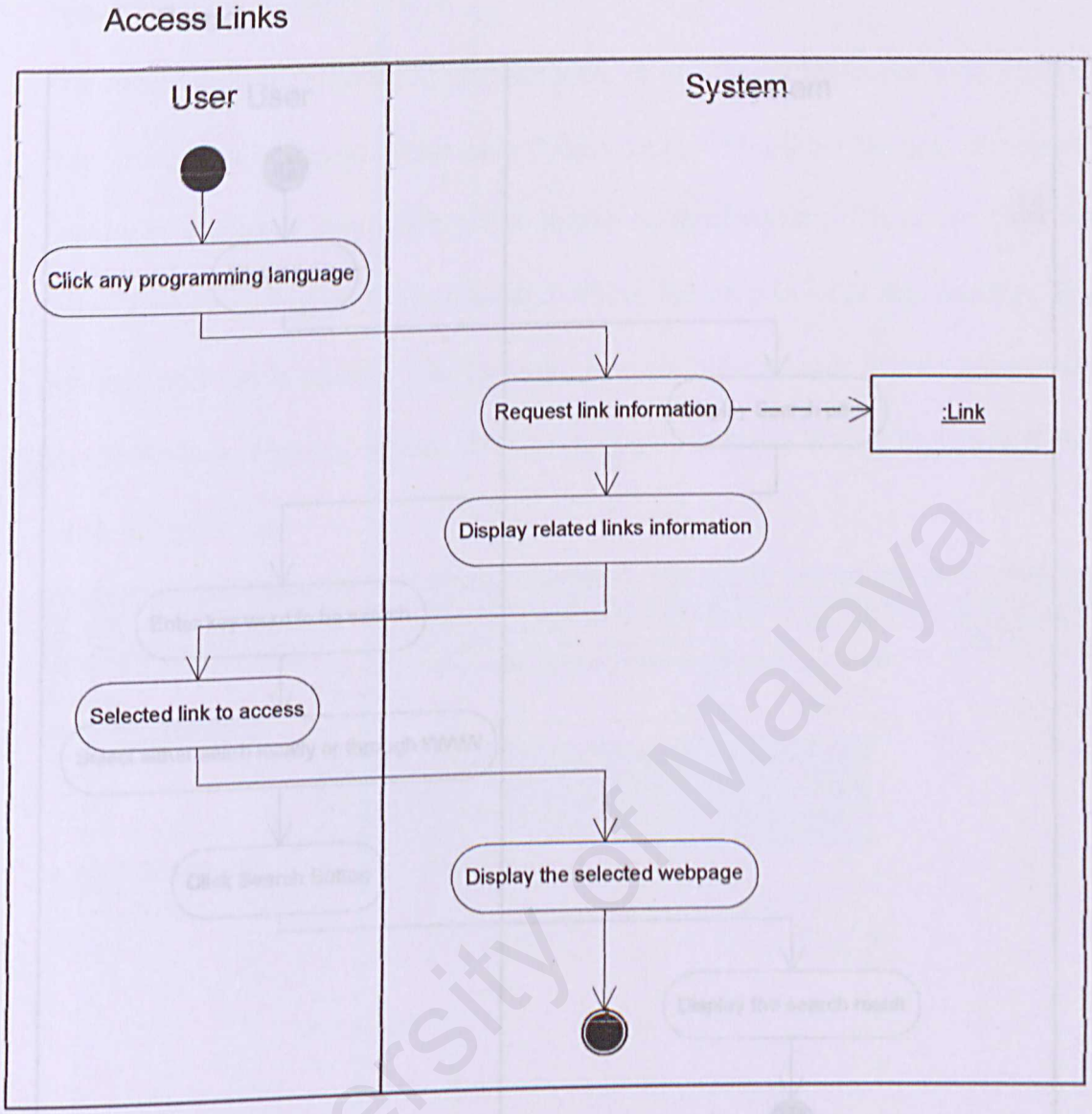


Figure 5.13: Activity Diagram of "Access Links"

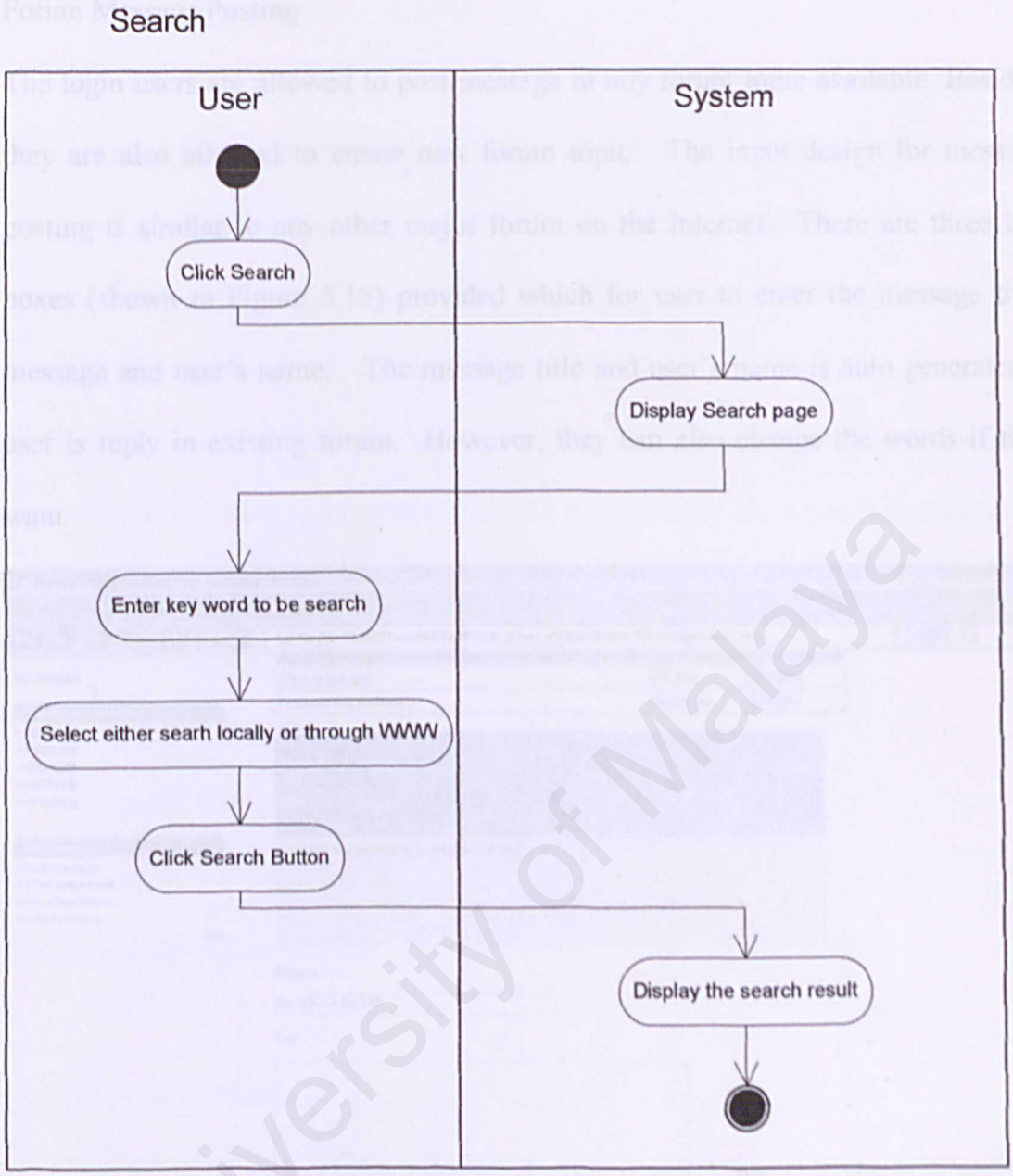


Figure 5.14: Activity Diagram of "Search"

5.5 Input Design

Input design describes the method or way for user to input certain kinds of data to the system. In Online Programming Group Network, the main user inputs are post forum message and upload article. The designs for these two inputs are described below respectively.

- Forum Message Posting

The login users are allowed to post message in any forum topic available. Besides, they are also allowed to create new forum topic. The input design for message posting is similar to any other major forum on the Internet. There are three text boxes (shown in Figure 5.15) provided which for user to enter the message title, message and user's name. The message title and user's name is auto generated if user is reply in existing forum. However, they can also change the words if they want.

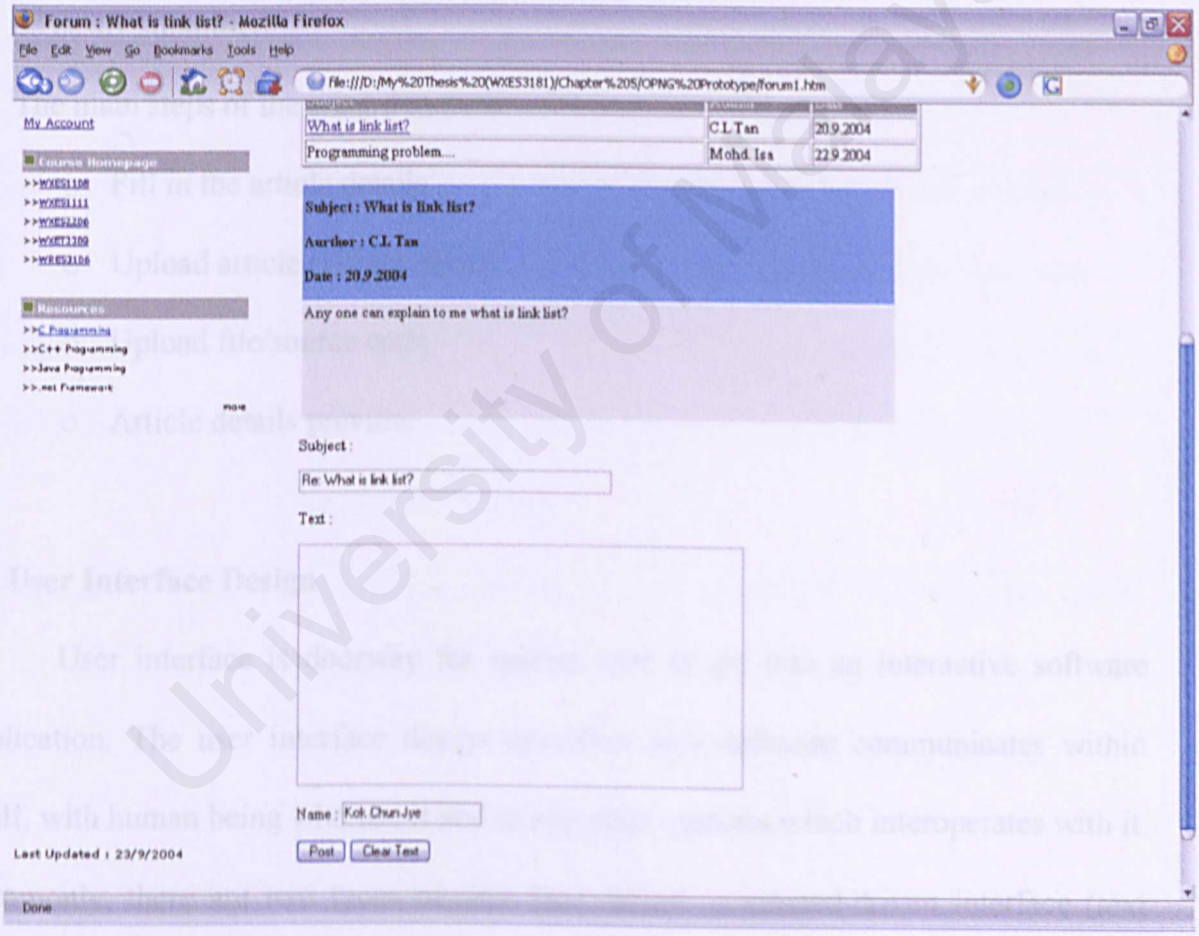


Figure 5.15: Input design for forum message posting

- Article Uploading

In order to better control the content of articles in this portal, system users are not allowed to direct upload their article to the system. To upload any of articles, system users are required to first submit their article include any source code or file to system administrator. The article will available in the portal only after system administrator approved and upload to the system.

To easy the process for system user to submit their article and file, a submit wizard is designed. Users just need to follow the steps perform by the wizard, then their can be easily submitted.

The main steps of the wizard include:

- Fill in the article details
- Upload article (HTML form)
- Upload file/source code
- Article details preview

5.6 User Interface Design

User interface is doorway for system user to get into an interactive software application. The user interface design describes how software communicates within itself, with human being who use it and to any other systems which interoperates with it. Commonly, there are two types of user face design: command-driven interface (text based) and menu-driven interface (graphical user interface). However, the graphical user interface design is now become the major interface design for most of the software because of it is much more user friendly and easy to use.

Good user interfaces design is crucial for any of software development, as it stands as the representative of the system. Table 5.8 lists down some of the principles of User Interface Design.

Table 5.8: Prinsiple of User Interface Design

Principle	**Description**
User familiarity	The interface should use terms and concepts which are drawn from the experience of the people who will make most use of the system.
Consistency	The interface should be consistent in that, wherever possible, comparable operations should be activated in the same way.
Minimal surprise	Users should never be surprised by the behavior of a system.
Recoverability	The interface should include mechanism to allow users to recover from errors.
User guidance	The interface should provide meaningful feedback when errors occur and provide context-sensitive user help facilities.
User diversity	The interface should provide appropriate interaction for different type of system user.

The User Interface of Online Programming Group Network is designed according to web page style as it is an online web application. Typically the user interface is to help the system administrator in performing their tasks at the same time

enable other system users to navigate through web pages and make functionality request on it. User interface can be seen as a transparent layer between the users, administrators and the back end itself system.

Figures 5.16 shows how of the web components deploy in the Online Programming Group Network system. The other figures below show some of the graphical user interface design of the system.

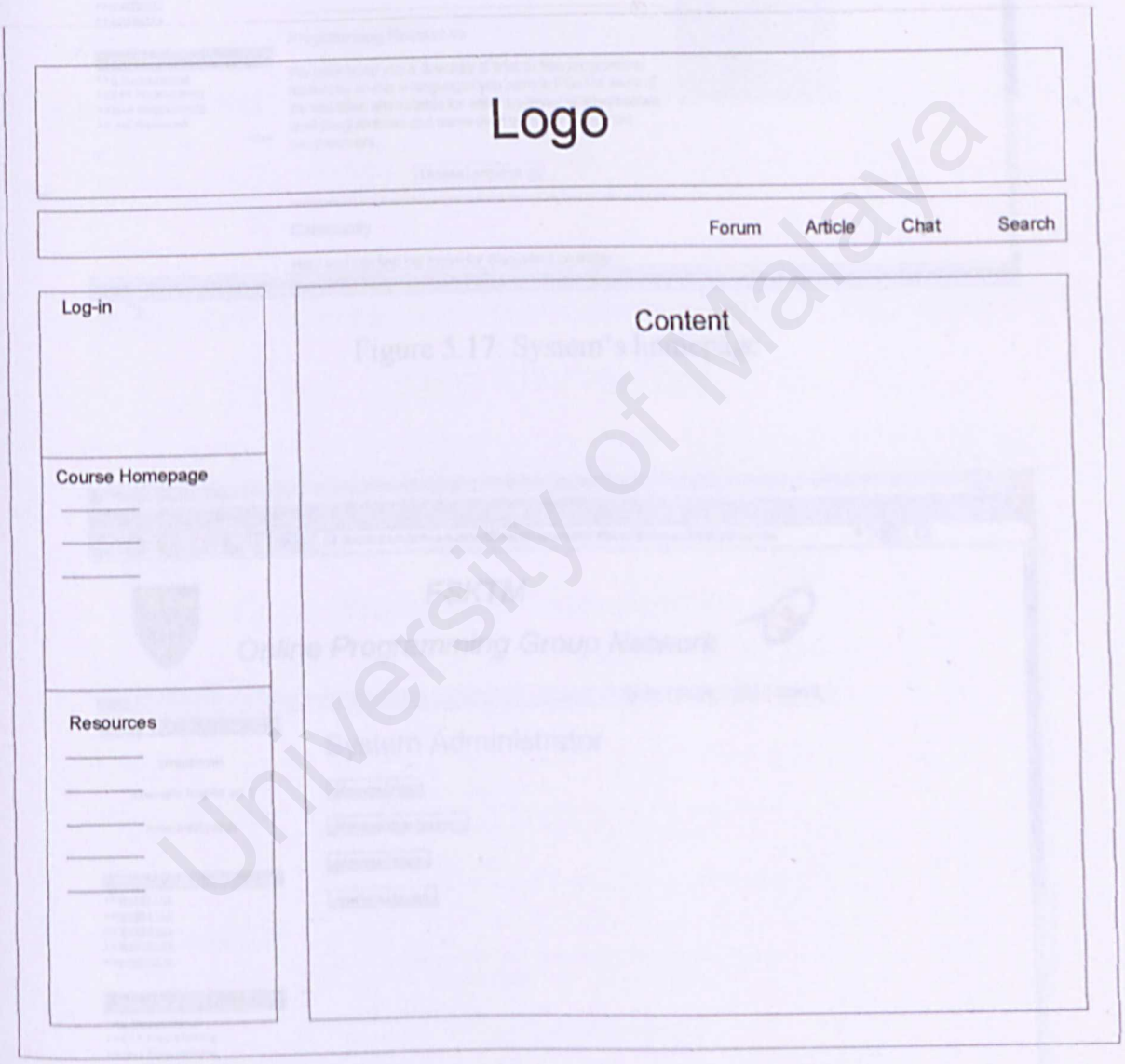


Figure 5.16: How the web components deploy

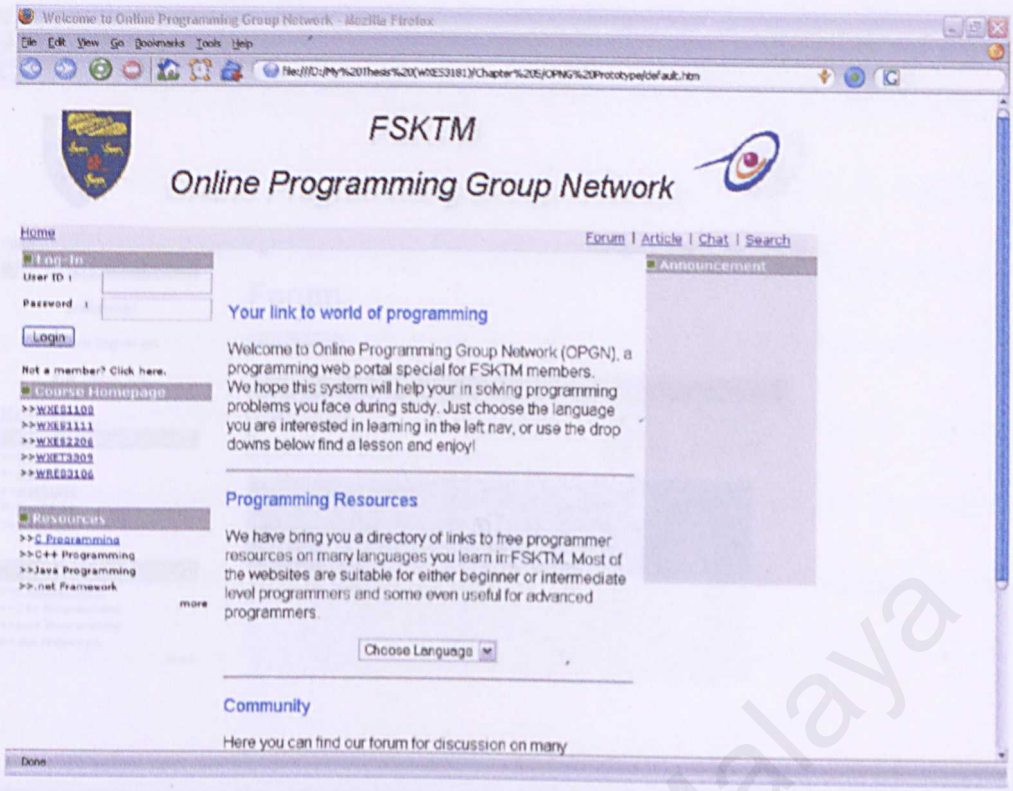


Figure 5.17: System's homepage

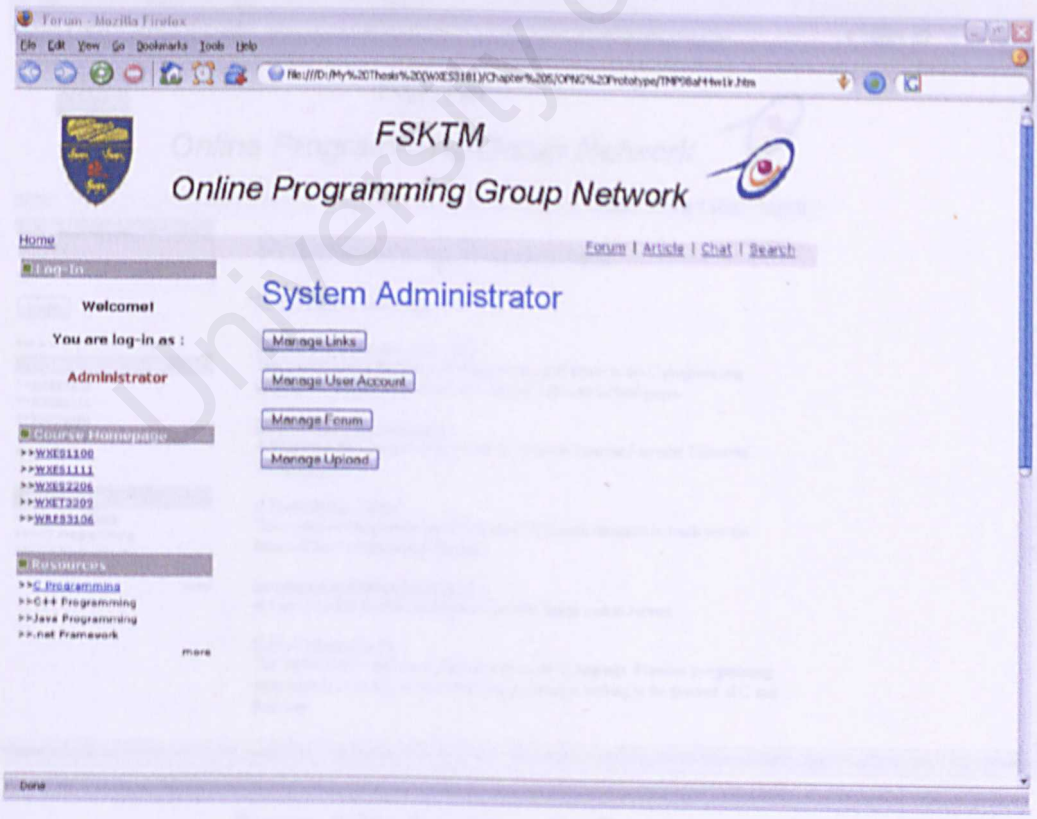


Figure 5.18: System Administrator page

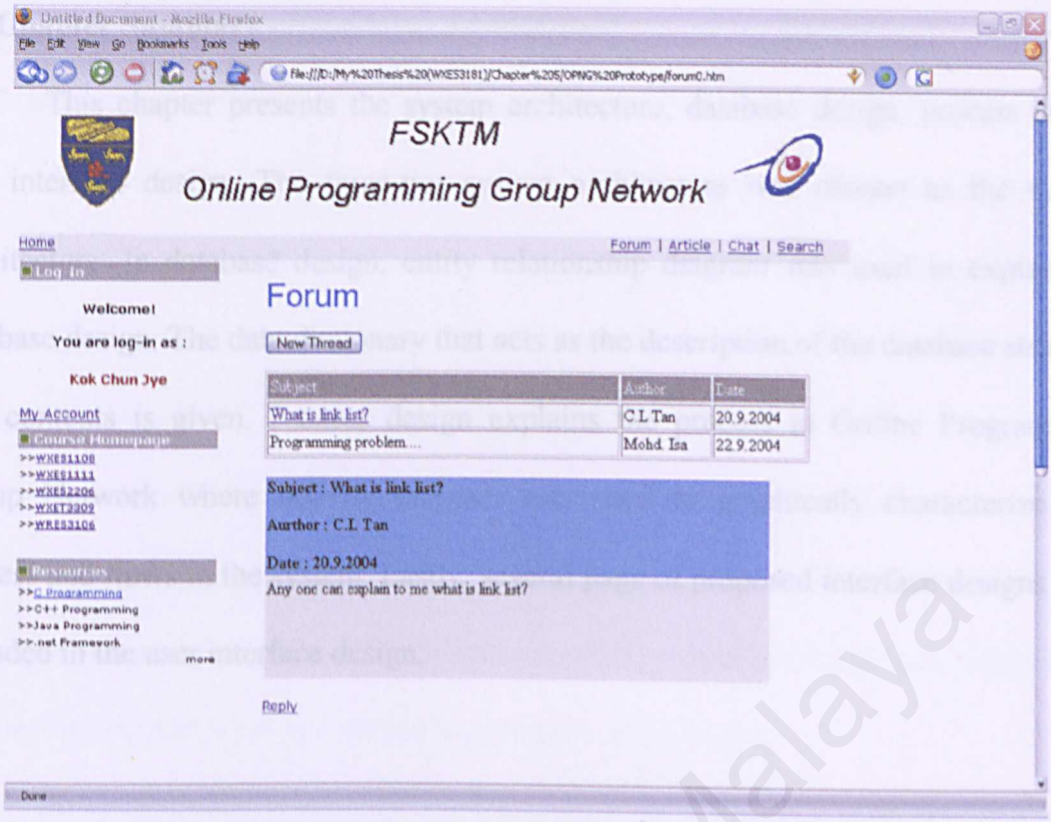


Figure 5.19: Forum page

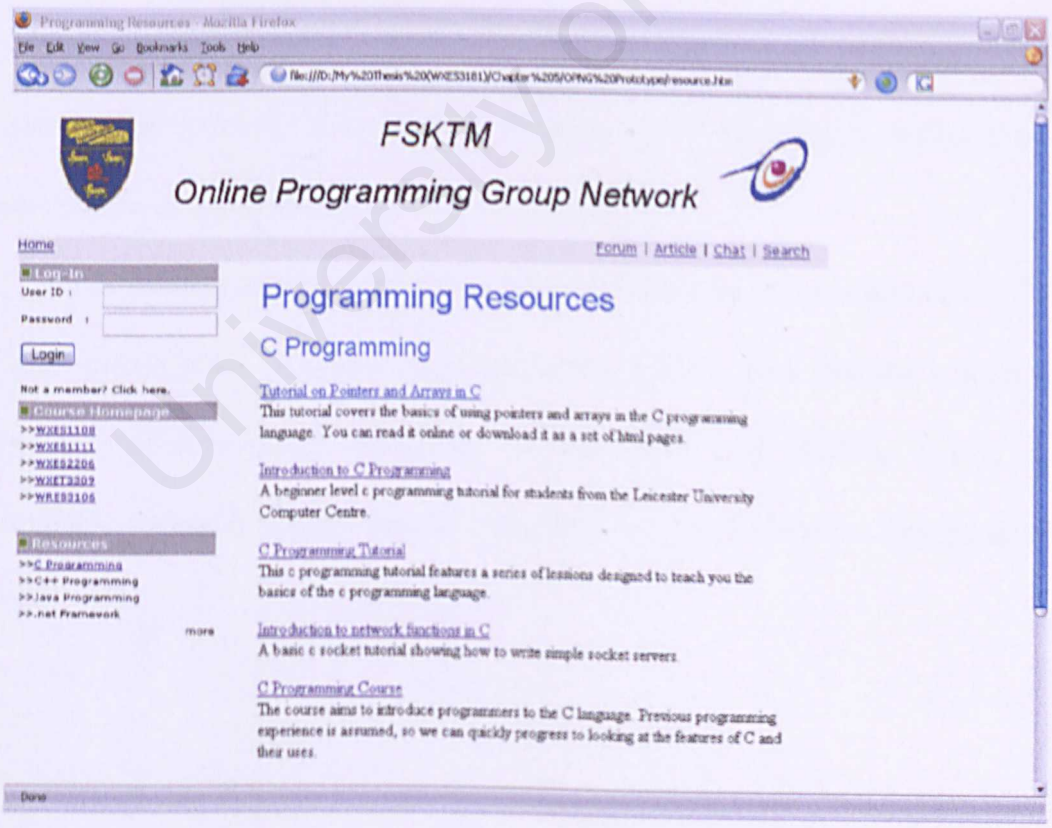


Figure 5.20: Programming Resources page

5.7 Chapter Summary

This chapter presents the system architecture, database design, process design and interface design. The three-tier system architecture was chosen as the system architecture. In database design, entity relationship diagram was used to explain the database design. The data dictionary that acts as the description of the database structure and contents is given. Process design explains the process in Online Programming Group Network where activity diagram was used to graphically characterize data process and flows in the system. Lastly, several page of proposed interface designs were included in the user interface design.

CHAPTER 6 SYSTEM IPLEMENTATION

6.1 Introduction

System implementation phase is where the design of the software transforms into a real and workable product. That is, implementation involved the translation of the system requirement and design specification into a computer understandable program codes.

Implementation should be carried out by following the system design rigorously as the design was carried out from thorough research and literature review, not forgetting the goals, objectives at the same time taking into consideration other issues such as the targeted users and system's operating environment.

However, during the actual implementation of the system, it is predictable that certain parts of the system design are found to be unsuitable. Inevitably, during the design phase, it is easy to get over-enthusiastic and overlook some important aspects of the system. Furthermore, it is hard to foresee what will happen during the actual implementation of the system.

Hence, certain attributes of the system may have to be implemented differently from the original plan. Anyhow, it is important to make sure that the system do not violate the pre-determined objectives at the same time fulfills critical system requirements. Also, it is hope that all changes made would lead the system to a better quality.

6.2 Development Environment

The initial stage of system implementation involves the setting up of development environment. The development environment depicted here are the settings, conditions and surroundings where the actual system development takes place. A stable and reliable development environment is very important to the system implementation as it is one of the key factors of the success of the project.

6.2.1 Hardware Configuration

The hardware specifications utilized for the entire implementation phase are as described below. It was found to be suitable and satisfactory for the entire period of the development stage.

Table 6.1: Hardware specifications for the system implementation

Categories	Description
Processor	Intel Pentium 4, 1.7GHz
RAM capacity	512 MB
Hard-disk capacity	80 GB
VGA card	NVIDIA RIVA TNT 2 Model 64
Display monitor	15" color monitor capable of 1024 x 768 resolution
Others	Other standard computer peripherals

6.2.2. Software Configuration

Table 6.2 describes the software and tools used to develop the system. These development tools have been pre-determined earlier on (during the system analysis phase) as the selected tools for system implementation.

Table 6.2: Software specification for system development

Categories	Description
Operating System	Microsoft Windows XP (with Microsoft .Net Framework 1.1)
Web Server	Microsoft Internet Information Services 5.0
Web Browser	Internet Explorer 6.0
Development tools	Microsoft Visual Studio .Net 2003
Database	Microsoft SQL Server 2000 – Enterprise Manager
Interface Design	Macromedia Dreamweaver MX Adobe Photoshop 7.0
Documentation	Microsoft Word

6.3 Platform Development

In order to start the development process, the services and tools need to be probably installed and setup. Platform development includes setting up the operating system and web server.

6.3.1. Operating System Setup

Microsoft Windows XP Professional (Service Pack 2) is the operating system which used for this project development. Before the operating system is installed, first of all, the computer hard disk is formatted. This is to prevent the development environment being affected by any previous settings or configurations. Besides, it can also guarantee that any possible virus and Trojan are deleted to ensure a stable and secure environment for system development.

The installation of Microsoft Windows XP's is very easy as it provides a descriptive and user friendly installation guide. User just needs to follow the step-by-step instruction which appear throughout the whole installation process.

6.3.2 Web Server Setup

As stated in previous section, Microsoft Internet Information Services (IIS) is chosen as the web server for this project. IIS is included in the package of Microsoft Windows XP, Professional Edition and its installation is easy too.

IIS provides a feature that allows web content to be organized by using virtual servers. It enables user to map local directory to virtual directory and create local web site. A virtual directory is created for Online Programming Group Network and it can be accessed through http://servername/OPGN1/ (eg: http://10.100.1.218/OPGN1)

6.4 Database Implementation

Microsoft SQL Server 2000 is used as database management system for this online programming group network system. By using Ms SQL Server, data retrieving, adding, updating, deleting and other information manipulation activities can be done by using stored procedures.

6.4.1 Database Setup

After the SQL Server has been installed and configured successfully, a database for this Online Programming Group Network can be build. A new database named "OPGN1db" is created by using the SQL Server 2000 Enterprise Manager. After the creation of database, the tables are created according to database design in precious chapter. Field types and size of length are specified based on the database design as well.

6.4.1.1 Modification in Database Design

During the system implementation of a few modifications in database design have been done in order to perform better system implementation. The modifications included:

- Increase of length for certain fields to make sure the field size big enough to store the possible coming data.
- New tables are added to store data for used of announcement, forum and chat room.
- Table File Upload has been cancelled as it seen to redundant with table File Submit. Table File Submit has been redesigned to keep the status of submitted file whether it is approved or not.
- Tables have been renamed by adding "mst_" (eg, mst_Account) in front of each table. This is used to differentiate the user defined tables from tables which predefined in Enterprise Manager. "mst" stands for master table in the database.

Below is the modified data dictionary of Online Programming Group Network:

* : primary key

\# : foreign key

➢ mst_Account

Table 6.3: Table of mst_Account

Field Name	Data Type	Length	Description
*UserId #	nvarchar	10	Unique id for different type of user
UserPassword	nvarchar	20	User's password
UserName	nvarchar	100	User's name
UserType	nvarchar	10	User type that is either administrator or other user like lecturer and student

UserStatus	nvarchar	100	User's status that is either active or block from using of this system
UserEmail	nvarchar	20	User's email address

- mst_Anouncement

Table 6.4: Table of mst_Anouncement

Field Name	Data Type	Length	Description
*AnnouncementId #	numeric	9	Unique id for announcement.
Announcement	text	16	Announcement's content.

- mst_Forum_Main

Table 6.5: Table of mst_Forum_Main

Field Name	Data Type	Length	Description
*ForumId	numeric	9	Unique code generate for each forum
ForumName	nvarchar	100	Forum's title
StartUserId #	nvarchar	10	ID of user who start the forum(thread)
TotalReply	numeric	9	Keep track of total reply.
TotalView	numeric	9	Keep track of total view
LastDate	datetime	8	Date of last message posted.
LastUserId #	nvarchar	10	ID of user who last post the message

- mst_Forum_Detail

Table 6.6: Table of mst_Forum_Detail

Field Name	Data Type	Length	Description
ForumId #	numeric	9	Unique code generate for each forum
*MessageID	numeric	9	Unique code generate for each message
MessageName	nvarchar	100	Title/name of the message
Message	text	16	Message's text
MessageDate	datetime	8	Date of the message
UserID #	nvarchar	10	ID of user who post the message

➢ mst_File_Submit

Table 6.7 Table of mst_File_Submit

Field Name	Data Type	Length	Description
*SFileId	numeric	9	Unique code generate for each file submitted
SFileName	nvarchar	50	File's name to be displayed in article.
SFileDate	datetime	8	Date of file is submitted
SFilePath	nvarchar	50	Location of submitted file is saved inside the server.
SFileTitle	nvarchar	100	Article's title.
SFileDescription	text	16	Article's description
UserID #	nvarchar	10	ID of user who submit the file
SFileStatus	nvarchar	10	File status(submitted or approved)
SFileActualName	Nvarchar	25	File's actual name.

➢ mst_Link

Table 6.7: Table of mst_Link

Field Name	Data Type	Length	Description
*LinkId	nvarchar	10	Unique code generate for each link
LinkName	nvarchar	50	Name of the website
LinkIntro	nvarchar	500	Brief introduction of the website
LinkCategory	nvarchar	25	Link's category
LinkURL	nvarchar	100	URL of the link
SearchWord	text	16	Gathering of all words from fields above(in lower case) for used of searching algorithm.

➢ mst_Chat

Table 6.8: Table of mst_Chat

Field Name	Data Type	Length	Description
*TimeEntered	datetime	8	Datetime of message sent .
EnteredBy	nvarchar	100	Name of sender.
EnteredTo	nvarchar	100	Name of receiver.
Message	text	16	Message text.
UserID #	nvarchar	10	ID of login user.

- mst_ChatName

Table 6.9: Table of mst_ChatName

Field Name	Data Type	Length	Description
*ChatName	nvarchar	100	Name of user in chatroom.

6.4.2 Database Connection

In three-tier system architecture, database server, which responsible to data storage and management, normally resides to the third tier. In this system, operations related to database are utilized the ADO.NET data access technology together with Microsoft Data Access Application Block.

In order to utilize Microsoft Data Access Application Block, first we need to add reference to the *Microsoft.ApplicationBlocks.Data.Dll* file. Inside the DLL file, the Data Access application block contains optimized code for data access. It encapsulates the *System.Data.SqlClient* namespace and can be used for accessing SQL Server data.

As shown in Figure 6.1, Data Access block contains two classes. The *SqlHelper* class has five static methods (shared in VB.NET) that are used for all common data access needs include insert, update and delete statement. Also, the *SqlHelperParameterCache* class is a utility class that caches parameters used with the commands on SQL Server databases. (Internet Reference, 20/3/2005)

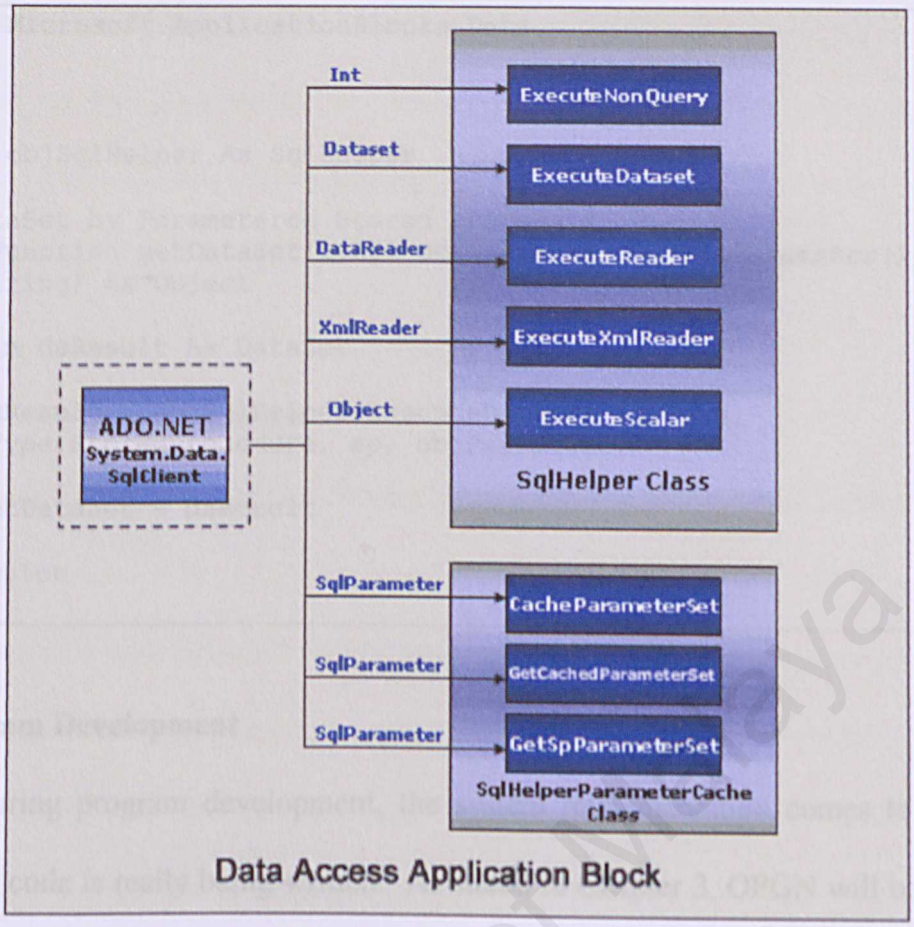


Figure 6.1: Microsoft Data Access Application Block

In OPGN, to establish database connection, first a connection string is set in Web.config file.

```
<appSettings>
            <add key="ConnectionString" value="Data
Source=cjkok;Initial Catalog=OPGN1db;User ID=sa;Password=020086"></add>
</appSettings>
```

Then, any reference to the connection string can be done by the following way:

```
Private strConn As String =

System.Configuration.ConfigurationSettings.AppSettings.Get("ConnectionS

tring")
```

Here is one of the example functions which utilized the connection string above.

```
Imports Microsoft.ApplicationBlocks.Data

Private objSqlHelper As SqlHelper
'Get DataSet by Parametered Stored Procedure
Public Function getDataSet(ByRef objParamsRef As SqlParameter(), ByVal
sp As String) As Object

      Dim dsResult As DataSet

      dsResult = objSqlHelper.ExecuteDataset(strConn,
CommandType.StoredProcedure, sp, objParamsRef)

      getDataSet = dsResult

End Function
```

6.5 Program Development

During program development, the system implementation comes to the stage where the code is really being written. As stated in Chapter 3, OPGN will be designed based on three-tier client-server architecture. The first tier normally refers to the web interface which can be access or browse using any browser. This web interface is built using ASP.NET in this system. On the other hand, the middle tier is meant to the web server. Most server side coding is developed using VB.NET. Finally, by utilizing the stored procedures and Data Access application block mentioned above, the server is connected and communicates with database and data can be initialized.

6.5.1 Coding Approach

Before diving straight into the system's implementation, a study of the different approaches on carry out the system development. Basically, there are two types of methodology which is used to develop a system: 1. top-down approach; and 2. bottom-up approach.

6.5.1.1 Top-Down Coding Approach

Top-down programming refers to a style of programming where an application is constructed starting with a high-level description of what it is supposed to do, and breaking the specification down into simpler pieces, until a level has been reached that corresponds to the primitives of the programming language to be used.

Top-down programming tends to generate modules that are based on functionality, usually in the form of functions or procedures. Typically, the high-level specification of the system states functionality. This high-level description is then refined to be a sequence or a loop of simpler functions or procedures, that are then themselves refined, etc.

6.5.1.2 Bottom-Up Coding Approach

Bottom-up programming refers to a style of programming where an application is constructed starting with existing primitives of the programming language, and constructing gradually more and more complicated features, until all of the application has been written.

In a language such as C and C++, bottom-up programming normally takes the form of constructing abstract data types from primitives of the language or from existing abstract data types.

6.5.1.3 Chosen Coding Methodology

After reviewing the two different approaches towards system implementation and comparing it against the characteristics of the system, it has been decided to use top-down approach for the implementation of the system.

The decision is made due to several reasons. First, it can avoid chaos of attempting to implement the system all at once as this will make planning and

implementing incredibly complex. Besides, it also prevents the developer from getting mire in details that might cause us to lose sight of why the system is developed in the first place. This may probably happened for those who are not yet expert in software development.

6.5.3 Coding Principle Applied

There are a few principles that are intended to be applied in the system coding:

Modularity

Software with effective modularity eases the job of development as different functions are compartmentalized and simplified. Independent modules helps in maintenance because secondary effects caused by design or code modification are limited, error propagation is reduced.

Readability

Readability is essential for future enhancement and maintenance. Coding style and convention applied strongly affect the readability. Codes need to be formatted and naming convention should be standardized to enhance understanding.

Reusability

Reusability is one of the important principles in programming. It reduces the coding time as well as the testing and documentation time. It can be considered as a method for improving product quality throughout the system development process.

6.5.4 Style Adopted

Coding style is an important attribute of source code. The coding paradigm adopted in this system is oriented at giving the system modularity, readability and reliability.

6.5.4.1 Naming Convention

Standard naming convention provides easy identification of variables for the programmer. Usages of these standards perform as a mean towards coding consistency and standardisation. Table 6.10 shows the list of naming convention for ASP.NET web form components which been used in the system development.

Table 6.10: Naming Convention of ASP.NET Web Form Components

ASP.NET Server Input Controls	**Instances**
Button	**btn**ObjectName
Data Grid	**dtg**ObjectName
Drop Down List	**lst**ObjectName
Hyper Link	**lnk**ObjectName
Label	**lbl**ObjectName
Link Button	**lnk**ObjectName
Panel	**pnl**ObjectName
Radio Button List	**rdl**ObjectName
Text Box	**txt**ObjectName
ListBox	**lbx**ObjectName

6.5.4.2 Indentation and Spacing

The main purpose of indentation and spacing is to ease reading and tracing of code. It makes the coding looks neat and tidy, indirectly help developers to understand the code.

6.5.4.3 Program Comments

Program comments are essential in explaining the logic of certain line of code, the purpose of a particular program block or function as well as other descriptive label. For instance:

```
'Get current selected index
dtgUser.SelectedIndex = e.Item.ItemIndex


'Display User information

'Retrive dataset by submitted user ID
Dim objDataSet As New DataSet
objClsDataSet.getParameterSet(ObjParams, "usp_Mst_Account_By_UserID")
ObjParams(0).Value = dtgUser.DataKeys(dtgUser.SelectedIndex)
objDataSet = objClsDataSet.getDataSet(ObjParams,

"usp_Mst_Account_By_UserID")
```

6.5.4.4 Sample Code

Here are some of the sample codes in OPGN system:

- ASP.NET Coding example

```
<asp:TextBox id="txtKeywordMain" style="Z-INDEX: 106; LEFT: 72px;
      POSITION: absolute; TOP: 64px" runat="server"
      Width="256px"></asp:TextBox>
```

- VB.NET Coding example (Save data)

```
Try
      'Retrieve parameter set from stored procedure
      objClsDataSet.getParameterSet(ObjParams, "usp_Mst_Link_Modify")
```

```
        ObjParams(0).Value = "update"

        ObjParams(1).Value = txtLinkID.Text.Trim
        ObjParams(2).Value = txtName.Text.Trim
        ObjParams(3).Value = txtIntro.Text.Trim
        ObjParams(4).Value = txtCategory.Text.Trim
        ObjParams(5).Value = txtURL.Text.Trim
        ObjParams(6).Value = searchWord.ToLower()
        'Save all the search word in lower case

        'Save the updated data
        Dim flag As String
        flag = objClsDataSet.saveData(ObjParams, "usp_Mst_Link_Modify")

        If flag = "OK" Then
            Dim scriptString As String = "<script
language=JavaScript>alert('Record is saved!');</script></pre>"
            If (Not Me.IsStartupScriptRegistered("Startup")) Then
                Me.RegisterStartupScript("Startup", scriptString)
            End If
        End If

        Catch ex As Exception
            lblErrMsg.Text = ex.Message
End Try
```

- Stored Procedure Coding example

```
--Retrieve all user's information

CREATE   proc usp_Mst_Account

as

SELECT
      isnull(UserID, '') UserID,
      isnull(UserPassword, '') UserPassword,
      isnull(UserName, '') UserName,
      isnull(UserType, '') UserType,
      isnull(UserStatus, '') UserStatus,
      isnull(UserEmail, '') UserEmail

FROM mst_Account
ORDER BY UserID



GO
```

6.6 Chapter Summary

This chapter depicts the actual development and implementation of the system itself. This includes hardware and software configuration, database implementation as well as the coding style and approach. In this phase, the design specification which discussed before has transforms into a workable system.

Chapter 7 would be discuss about various type of system testing includes system testing, integration testing and unit testing

CHAPTER 7 SYSTEM TESTING

7.1 Introduction

After the coding process in implementation phases, the successive stage in software development would be the system testing. System testing is the testing of a complete system prior to delivery. The main objective of system testing is to identify and reveal as many errors as possible in the tested system. It is hoping that system testing would bring the tested system or software to an acceptable level of quality after correction of the identified errors and retesting.

Normally, a well planned system testing can enhance the integrity of a system. It is expected to detect any deviations in design and errors in the system. A testing plan aims at detecting error-prone areas. This helps in the prevention of errors while a system is being used at the same time adding value to the product by conforming to the user requirements.

Some of the most common causes of errors in a system are:

- Communication gaps between the developer and other stakeholders
- Time provided to a developer to complete the project
- Insufficient testing and quality control
- Inadequate requirements gathering

7.2 Testing Strategies

In OPGN, the testing strategies had been used include unit testing, module testing, integration testing and system testing.

7.2.1 Unit Testing

Unit testing is the first approach in system testing and it is sometimes referred as function testing or component testing, which is extremely time-consuming. This is a testing stage where each component the system is tested idependently and isolated from other program components.

The main purpose of unit testing is to make sure every component works properly with the types of input and output expected from studying the component's design. By this, it is confirmed that all the units are correctly coded and perform functions and algorithm properly as what the developer expected.

7.2.2 Module Testing

After unit testing, module testing is carried out. A module is a collection of dependent components where all related components encapsulated together to perform a common goal or function. Module testing enables each module to be tested independently.

In module testing, two or more units were tested in collection. For example, unit which provides input data tested together with unit which provides output data. These units have related characteristics to perform a common goal or function such as the search engine function which comprised of SQL statement generating, query form submission, and finally display the query results.

The motive of module testing is to make sure that all modules can be executed as a complete module. In a system, an individual module would call other module to perform certain tasks. The this process, parameters will be passed to each other among these modules. If these modules are not fully tested, the parameters may be passed incorrectly and it is very hard to determine which module goes wrong.

7.2.3 Integration Testing

When the individual modules meet the objectives and work correctly, these modules are combined into a working system. In other words, integration testing is the process of verifying that the system components work together as described in the system and program design specifications. This integration testing is planned and coordinated so that when a failure occurs, the causes of failure can be identified.

In OPGN, top-down approach is applied for integration testing. Under top-down approach, the system is viewed as a hierarchy of components. The testing would start with high-level system and integrate from the top-down replacing individual components by stubs where appropriate, that is the sub modules will be gradually added until the bottom is reached.

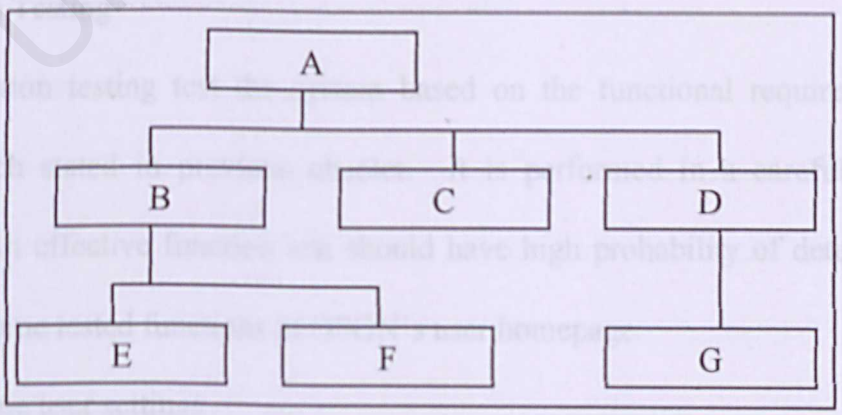


Figure 7.1: Example of component hierarchy of a system

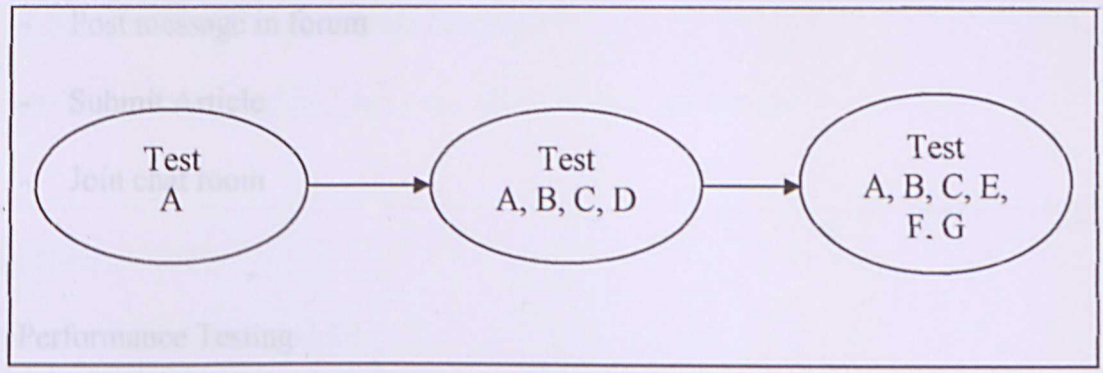


Figure 7.2: Top-down integration

7.2.4 System Testing

System testing involves a final test of all programs. It refers to a series of different tests which designed to fully exercise the system to uncover its limitation in order to measure system's capabilities. Also, it will make sure and verify all system components work correctly.

Compare with unit and integration testing, objective of system testing is to verify whether the integrated system meets specified requirements, that is whether the system does what the user want.

OPGN involves two kinds of system testing: function testing and performance testing.

- Function Testing

Function testing test the system based on the functional requirements of the system which stated in previous chapter. It is performed in a carefully controlled situation. An effective function test should have high probability of detecting a fault. Below are some tested functions in OPGN's user homepage:

- Update user settings
- Search programming resources

- Post message in forum
- Submit Article
- Join chat room

- Performance Testing

Performance testing is a series of tests done to measure all the non functional requirements after function is completed. Below are few type of performance testing:

- Stress Testing

  The goal of this testing is to determine whether the system can handle, as it should, large and varies workload at one time.

- Security Testing

  The purpose is to verify the protection and authentication mechanism such as dealing with improper penetration.

- Human Factor Testing

  User interface and message display are being evaluated in this testing by system user to get the best interaction effects. It concentrates at the appearance and the interaction of the system.

7.3 Test Case Design

Test cases are scenario where each test is listed out the detail of input, series of task as well as the expected results. They are developed to show that the input is precisely converted to the desired output. For each test case, testing is done repetitively to prove the consistency of the results.

7.3.1 Sample Test Case for Unit Testing

Below is an example of unit test case which is done for OPGN:

Test Case : 1

Module : User Module

Sub Module : User Settings

Unit : User Settings – Clear

Scenario : To clear all entered data in text boxes.

No	Test Procedure	Data	Output/Error	Analysis of Result
1.	- Click CLEAR button after entered data in all text boxes.		System clears data in all text boxes.	Data in all text boxes are cleared.

Status: Pass

Data: 15/1/2005

Figure 7.3: Unit Test Case

7.3.2 Sample Test Case for Module Testing

Below is an example of Module test case which is done for OPGN:

Test Case : 5

Module : User Module

Sub Module : Download file

Unit : Download file – view description, download source code

Scenario : User click the link to the article he/she wish to view and download the source code provided.

No	Test Procedure	Data	Output/Error	Analysis of Result
1.	Click ARTICLES link in the system site bar.		System displays article page in main frame of system's default page.	Article page displayed.
2.	Click the link to one of the uploaded article.		System displays description of the selected article.	Article's description displayed.
3.	Click the link below the description to download the source code.		System popup a message to ask user to save the file.	Save message popup.
4.	Choose a path in PC and		System saves the	The correct file

	click SAVE.		file in selected path.	saved in the right path.

Status: Pass

Data: 5/2/2005

Figure 7.4: Module Test Case

7.3.3 Sample Test Case for Integration Testing

Below is an example of Integration test case which is done for OPGN:

Test Case : 9

Module : Administrator Module

Sub Module : Login, Manage Resources

Unit : Login, Manage Resources – view, save, back

Scenario : Administrator login, select one of the resources information, edit and save it, finally back to Manage Resources main page then logout.

No	Test Procedure	Data	Output/Error	Analysis of Result
1.	Enter system URL in browser.		Browser displays system main page.	System main page displayed.
2.	Enter invalid User ID and password in login bar.	Acb, 111	System popup error message.	Error message popup.
3.	Enter valid User ID and password and click	Admin, 123	System authenticates the	Administrator is authenticated

	LOGIN.		administrator and system administrator's site bar.	and administrator site bar displayed.
4.	Click MANAGE RESOURCES link.		System displays manage resources page in main frame.	Manage resources' main page displayed.
5.	Click link to one of the resources.		System displays all information of the resource.	Resource information displayed.
6.	Edit information of the link and click SAVE.		System saves the data and popup data saved message.	Data saved message popup.
7.	Click BACK button		System back to manage resources main page.	Manage resources main page displayed.
8.	Click LOGOUT button.		Default page's main frame displays home page.	Home page displayed.

Status: Pass
Data: 15/2/2005

Figure 7.5: Integration test case

7.4 Debugging Strategies

Debugging strategies is the way to find and correct program errors. There are various types of error can be found in a system. This includes compile error, runtime, error and logic error. Below are some of the debugging strategies applied:

- By using label lblMsgErr

  Label lblErrMsg is a label built by author to catch the exception message from the program. It is initially invisible. If any error occurs during program runtime, the label would show out the error message in the web page. Below is an example of using lblErrMsg in a delete button of OPGN.

```
Private Sub btnDelete_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnDelete.Click
        Try
            'Retrieve parameter set from stored procedure
            objClsDataSet.getParameterSet(ObjParams,
"usp_Mst_Link_Modify")
            ObjParams(0).Value = "delete"

            ObjParams(1).Value = txtLinkID.Text.Trim
            ObjParams(2).Value = ""
            ObjParams(3).Value = ""
            ObjParams(4).Value = ""
            ObjParams(5).Value = ""
            ObjParams(6).Value = ""
            'Delete data record
            Dim flag As String
            flag = objClsDataSet.delData(ObjParams,
"usp_Mst_Link_Modify")

            pnlMain.Visible = True
            pnlEdit.Visible = False

            dtgLink.CurrentPageIndex = 0
            objClsDataSet.bindDataSet(dtgLink, "usp_Mst_Link")
```

```
        Catch ex As Exception
            lblErrMsg.Text = ex.Message
    End Try
End Sub
```

Figure 7.6: Example of using label lblErrMsg

- By using built in debugging function and error detection

  Microsoft Visual Studio .Net provides a very good debugging function and error detection mechanism. Every time when the solution is built, the code will be compiled and any compile error is shown with detail description. Also, the system can be check with its debugging function to check the value of different passed parameters during runtime.

- If the programming runs well but come out with unexpected result, the review on logic flow of the code is conducted. Algorithm also needs to be checked for their correctness and efficiency.

7.5 Chapter Summary

System Testing is a critical phase in analyzing logical errors in the system and to test system's liabilities. In this chapter, different testing strategies which used in the system are reviewed followed by test case of each type of testing. The system's testing strategies include unit, module, integration and system testing. At the end of the testing phase, it is hope that system should be able to perform the tasks required and free of most errors.

Chapter 8 would presentation a detail evaluation on the system built and give a overall conclusion for the whole project.

CHAPTER 8 SYSTEM EVALUATION

8.1 Introduction

System evaluation is the final and ultimate stage of a system development. It is an important phase before the final release of product can be delivered to end user.

Every system should go through the system evaluation phase, for the benefit of the system and also the system developer. It is implemented by more than simply comparing the information obtained with the information which is expected. But, it is related to user environment, attitudes, information priorities and several other concerns that are to be considered carefully before effectiveness can be concluded.

System evaluation can help to us identify the best practices which have been applied and remember to use it again in the future. We must also take note of the less than perfect events that happened and remember not to repeat the same mistake again. Therefore, a thorough evaluation should always be carried out at the very end of every system's life cycle.

Throughout this chapter, the system will be evaluated to reveal its strengths, constraints and possible future enhancements to the existing system. Not forgetting also, the brief explanation of problems encountered, knowledge gained during the system development and finally an overall conclusion will be given.

8.2 Problems Encountered and Solution

Throughout the whole system development, many problems have been encountered. It is important to overcome these problems as fast as possible and with the best available solutions. The project schedule should be followed stringently amid problems to ensure the system will be delivered on time.

Below are the major problems faced during the software development:

8.2.1 Problem of selecting tools and languages

Problem:

There are various tools and programming languages available in market and all claim that they are better to each other. It is a very hard to determine the best tools and language for system development. Also, once the tool and language is selected, there is no way to turning off due the project schedule and time limitation.

Solution:

Carefully conducted research and literature review on all available tools and languages in the market. Try using the development tools for possible selected languages and evaluate personal understanding on the tools and languages as well. Compare pros and cons between each tool and language. Get advice from supervisor.

8.2.2 Lack of skills and knowledge in ASP.NET and other relevant languages

Problem:

Once the tool and development language is selected, it is time to develop the system using the chosen language and its respective development tool. In this project, ASP.NET is chosen and the most powerful tool for it is Visual Studio.Net. However,

lacking of knowledge in ASP.Net programming increases the difficulties of program coding as ASP.NET is totally a new language for the author.

Solution:

Refers to various ASP.NET programming references which borrow from friends and library. Search through the Internet to find out sample code and solution on similar problem faced during programming coding. Discuss with friends regarding programming problems.

8.2.3 Lack of End User's evaluation

Problem:

At the end of the system development, it is hard to find the end user to test the system thoughtfully due to limitation of time and tight project schedule.

Solution:

Ask friends around who are also the target users as many as possible to become the system tester and ask their opinion and evaluation on the system. Show the system to supervisor and ask for improvement advice.

8.3 System Strengths

System strengths of OPGN are described as below:

8.3.1 Simplicity

OPGN is an easy-to-use system where user can master its operation in a short period of time even without any user manual. The simplicity of the system enables both users and administrator to perform their tasks easily and efficiently.

8.3.2 User Friendliness

Careful design concept had been applied into the designing of the system interface to promote user friendliness. Color palettes used were also carefully picked to ensure the web pages are intelligible and pleasant to eyes. Consistent user interface are promoted in the system. All buttons are well defined to ensure the easiness of system using.

8.3.3 Availability and Convenience

Similar to all other web applications, OPGN is available to users 24 hours a day, 7 days a week unless the server goes down. The availability of system provides the necessary convenience to users all around the world. It is accessible as long as the intended users have Internet access. This fulfills one of the main objectives of the system that is student can seek help from lecturers at any time without finding lecturer face to face.

8.3.4 System Transparency

OPGN promote system transparency the users do not need to know about the structure, where the database resides, its database management system and anything related to the system implementation. For instance, both administrator and user are login through the same login bar without knowing how the system differentiates different types of users.

8.3.5 Data Security and Privacy

OPGN is a password-protected site. By giving authorized user ID and password, unauthorized users are prohibited from accessing others' personal records. Certain functions can only be done by administrator. These prevent intruders from intentionally or unintentionally causing the system damage.

8.4 System Constraints

System constraints of OPGN are described as below:

8.4.1 No automatic email generation

For user who forgets his/her password, there is no automatic generated email to remind the forgotten password. Users have to contact administrator by their own to retrieve their password.

8.4.2 Limited Announcement making function

Currently, administrator can only entered all the announcement information in a simple textbox in order to display in the homepage. This is because the announcement making function is not the major function under the specification of system requirement in previous chapter.

8.4.3 Limited Types of Programming Resources

OPGN only supports few types of programming languages at this moment where all this programming languages are languages which learn by FSKTM student in their studies.

8.4.4 Limited Functions in Forum discussion

The discussion forum in the system currently only provides the basic functions such as post message and start a new thread. More function can be added to make the discussion forum more attractive.

8.5 Future Enhancement

Based to the constraints of this system stated above, there are a few suggestions for to future enhancement of OPGN. These suggestions are:

8.5.1 Auto-generated email for password remind

Extends the functionality of the system by add in an auto-generated email for user who forget the password. The password would be sent to users according to their email address which store in OPGN.

8.5.2 Enhance Announcement Making Function

Improve the announcement making function by allow administrator to enter the announcement according certain format. Different announcements are saved separately according to their date so that outdated announcement can be deleted accordingly.

8.5.3 Increase Types of Programming Languages

More types of programming languages can be added into system to enrich system's programming resource to make this system more useful for different kinds of user.

8.5.4 Extend Functions in Discussion Forum

More function can be added in to discussion forum like insert hyperlink, emotion sign, insert quote and so on and so forth. This will make the forum more attractive and enhance interaction between the users.

8.6 Knowledge and Experience Gained

After working with this project, there are plenty of valuable knowledge and experience gained. These experiences are not limited to the programming and technical skills but involve all other aspects which related to whole software development process. Below are some of these experiences:

- Improve information searching skill through the Internet.
- Dealing with real system users by carried out a survey.
- Learn how to plan and manage a software development project.
- Learn the concept of integrate and utilize various technologies into a system.
- Setup Internet and database server.
- Master server-side and client-side scripting language as well as the relevant software until certain level.
- Learned the way to connect and manipulate database.
- Improve coding and debugging skills.
- Cultivated skills in writing documentations and reports.
- Boost self-confidence, good communication skill and working independently
- Learned from all mistakes had been made.

8.7 Overall Conclusion

Overall, Online Programming Group Network has achieved and fulfilled the objectives and basic functional requirements as an online web-based system as determined during system design and analysis. Moreover, the final released product met the criteria such as user friendliness, reliability, manageability and expandability.

This project gives me a golden chance to build a full application from scratching, planning, designing, coding, testing and last evaluating. Here, knowlege and theories learned throughout the three year course of Computer Science were literally put into practice.

Undoubtedly, a lot of knowledge and experience gained throughout the development of OPGN. This includes knowledge in information searching, conducting a survey, systetem desgin and analysis, programming and coding, and how work disciplinaryly and indepentently. Programming with ASP.Net, VB.Net, HTML and and using of Visual Studio.net has proved to be a valuable and priceless experience.

However, there are many more space for improvement in this system, especially in order to achieve to be a powefully online web portal. To be franckly, the system developed is still far away from perfect. But, with the first step taken, enhancements could still be made with more features and functions added in future version.

Last but not least, carried out this project has been a very useful and practical experience which exposes the idea of research work to the developer. These experiences will definitely become a precious fortune for the developer in future career.

8.8 Chapter Summary

In the final chapter of the report, the through evaluation of the system has been depicted. The problems encountered and solutions are first stated, following by system strengths and weaknesses. In order to, make the system better in future, several suggestions are made. This can be viewed as the start of future maintenance and part of effort to guarantee system's future expandability. Not forgetting also, the knowledge and experience gained are shared. Lastly, an overall conclusion is given as the end of the whole system development project.

APPENDIX: (Sample of survey form)

This survey is conducted to discover the problems faced by FSKTM students when learning programming courses. The information collected from this survey will be used for develop a online programming network portal which help student in software programming learning.

Study Year : _____
Department : _____
Gender : _____

1. Do you find programming very hard to learn?
   ( ) Yes
   ( ) No

2. What is the main problems do you face when study programming course in FSKTM? (Can choose more than 1)

   ( ) Some chapter or idea is very hard to understand during lecture.
   ( ) Lecture hour too short.
   ( ) Lab hour is too short.
   ( ) Hard to get help from lecturer.
   ( ) Others. Please specify_____

3. If you find difficulties in solving lab questions or any other programming problems, what is the main source for you to find out the solutions? (Choose **ONE** only)

   ( ) Ask lecturer.
   ( ) Discuss with friends
   ( ) Search through the Internet.
   ( ) Post question in discussion forum.
   ( ) Others. Please specify_____

4. Do you easily get the information which related to your programming problems from the Internet?
   ( ) Yes
   ( ) No

5. Have you joined any online discussion forum/group or portal which focuses on discussing programming problems?
   ( ) Yes. Please specify_____
   ( ) No

6. If there is a online programming group network forum which is develop special for FSKTM, will you join it actively?
   ( ) Yes
   ( ) No
   ( ) Depends on the functions it provides.

7. Which functions below do you think is necessary to be included in a web portal which aims to help students in learning software programming?
   (Can choose more than 1)

   ( ) Links to notes, exercise, tutorial
   ( ) Discussion Forum
   ( ) Live chat room
   ( ) Search Engine.
   ( ) File or source code uploading/downloading.

8. Do you think the link to programming course homepage necessary to be included in this web portal?
   ( ) Yes
   ( ) No

Thanks for your co-operation.

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User Manual
(Online Programming Group Network)

ONLINE PROGRAMMING GROUP NETOWORK (USER MANUAL)

Chapter 1: Introduction

1.1 About this manual

Welcome to Online Programming Group Network (OPGN). User can use this system access different programming resources with related to the programming courses study in FSKTM. By reading this user manual, both system administrator and user would get to know the operations of all functions provided this system.

Enjoy learning in world of programming!!

Chapter 2: Hardware and Software Requirements

2.1 Server Side Requirements

Hardware requirements:

Category	Description
Processor	Intel Pentium 4, 1.5 and above
RAM	256 MB (recommended 512 MB)
Hard disk spaces	10 GB

Software requirements:

Category	Description
Operation System	Microsoft Windows XP Professional
Web Server	Microsoft Internet Information Services 5.0
Frame work	Microsoft .Net Framework 1.1
Database	Microsoft SQL Server 2000

Chapter 3: Using of Online Programming Group Network

3.1 System Main Page

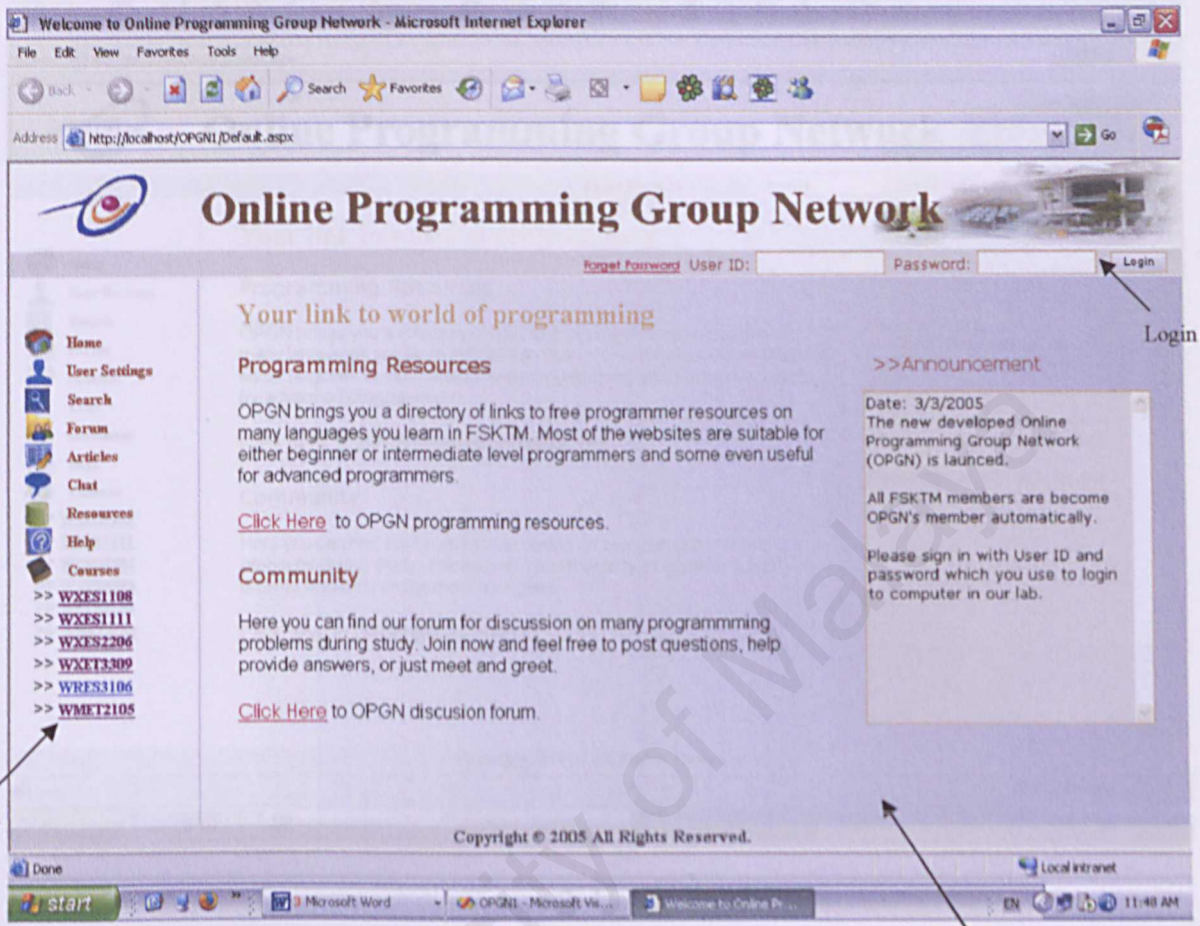

Figure 1: System Main page

- Figure 1 shows the main page of OPGN.
- The system consist of 3 parts:
    - Login Bar – For user login. User needs to login to perform User settings, Forum, Articles and Chat function.
    - Site Bar – All available functions are accessed through the buttons available in this site bar. Click on hyperlink below the button to access course's home page.
    - Home Page – Display system introduction and updated announcement.

3.2 User Login

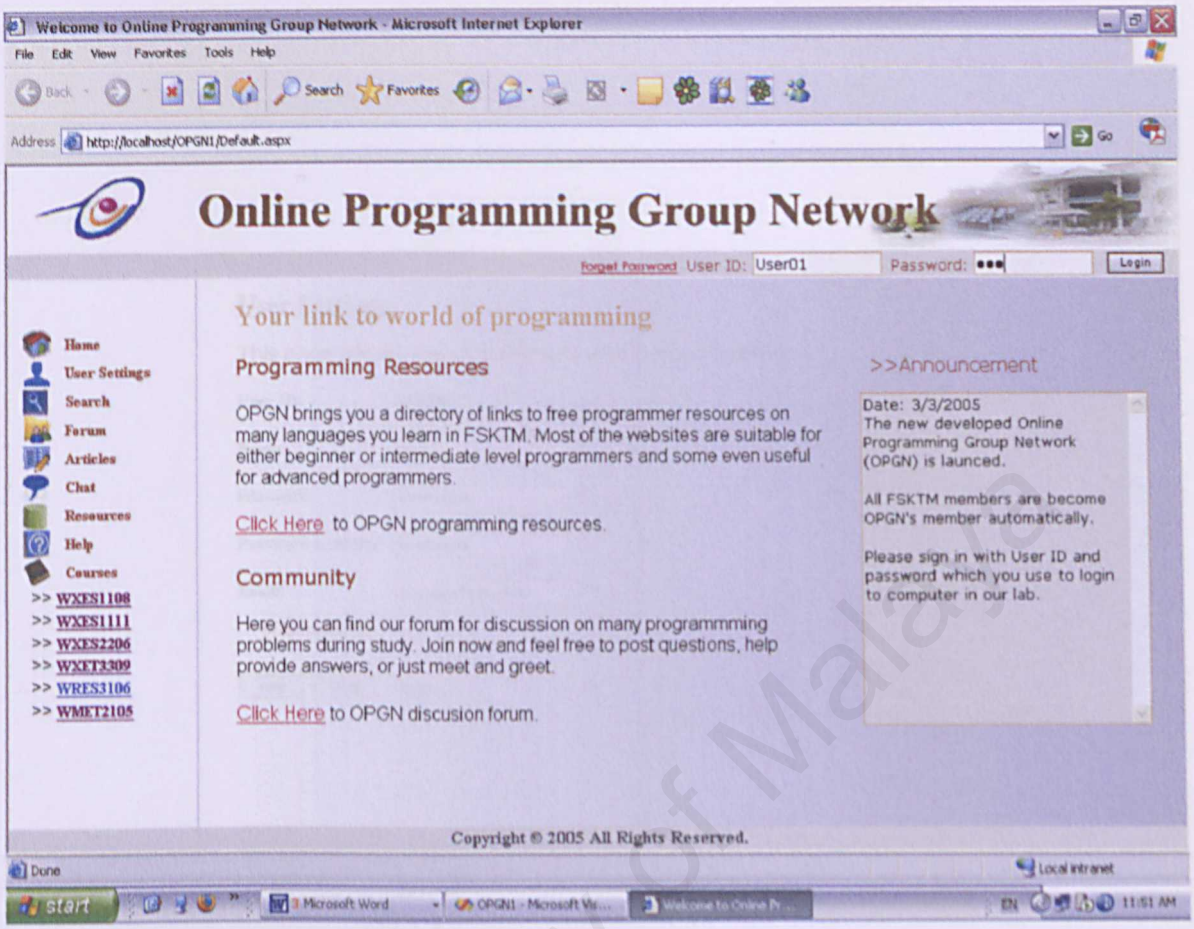

Figure 2: User Login

- All types of users are login using login bar in the main page.
- Enter the user ID and password. (Figure 2)
- Click "Login" button.
- The Login bar will display "Welcome, userID" to indicate that login success.
- Error message would popup for invalid userID or password.

3.3 User Settings

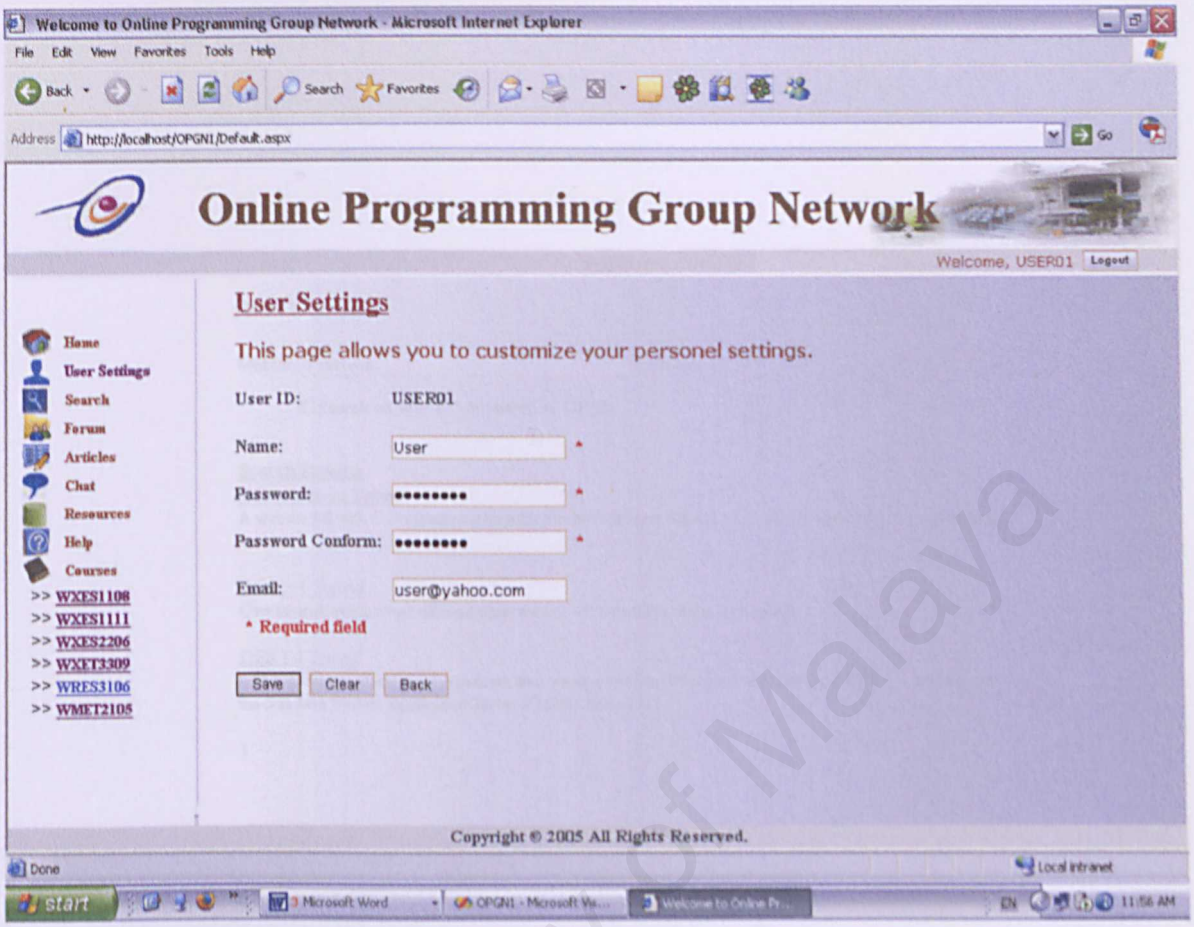

Figure 3: User Settings Page

- User Settings page allows all users to modify their personal information. (Figure 3)
- Click "Save" button to save the modified information. (Caution: Information is not saved if "Save" is not clicked)
- Click "Clear" to clear data in all text boxes.
- Click "Back" button to back to homepage.

3.4 Search

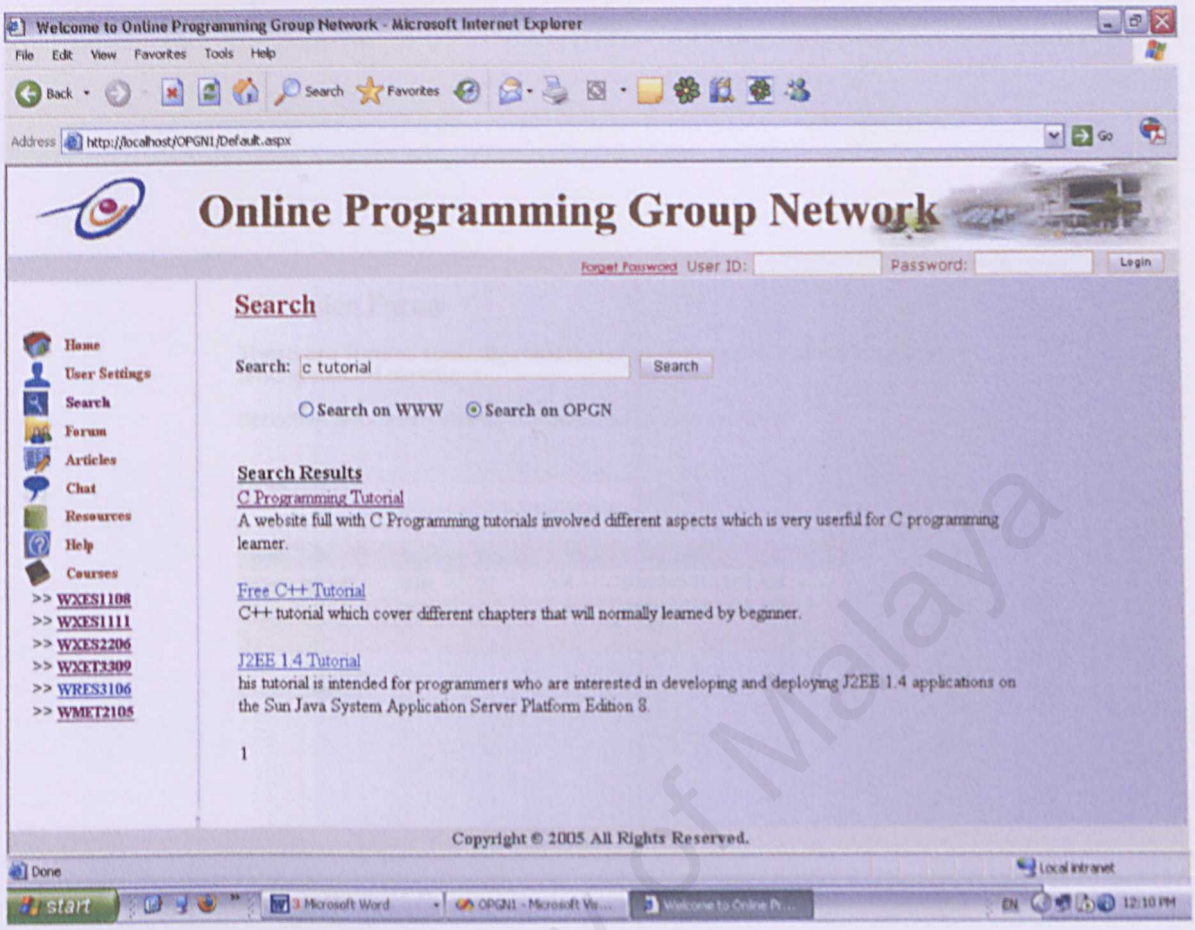

Figure 4: Search Page

- Search page allows user to search different programming links through OPGN's collection or through the World Wide Web. (Figure 4)
- Enter the searching keyword.
- Select either search on WWW or search on OPGN in the radio button list below.
- Click "Search" button and Search Result is displayed.

3.5 Forum

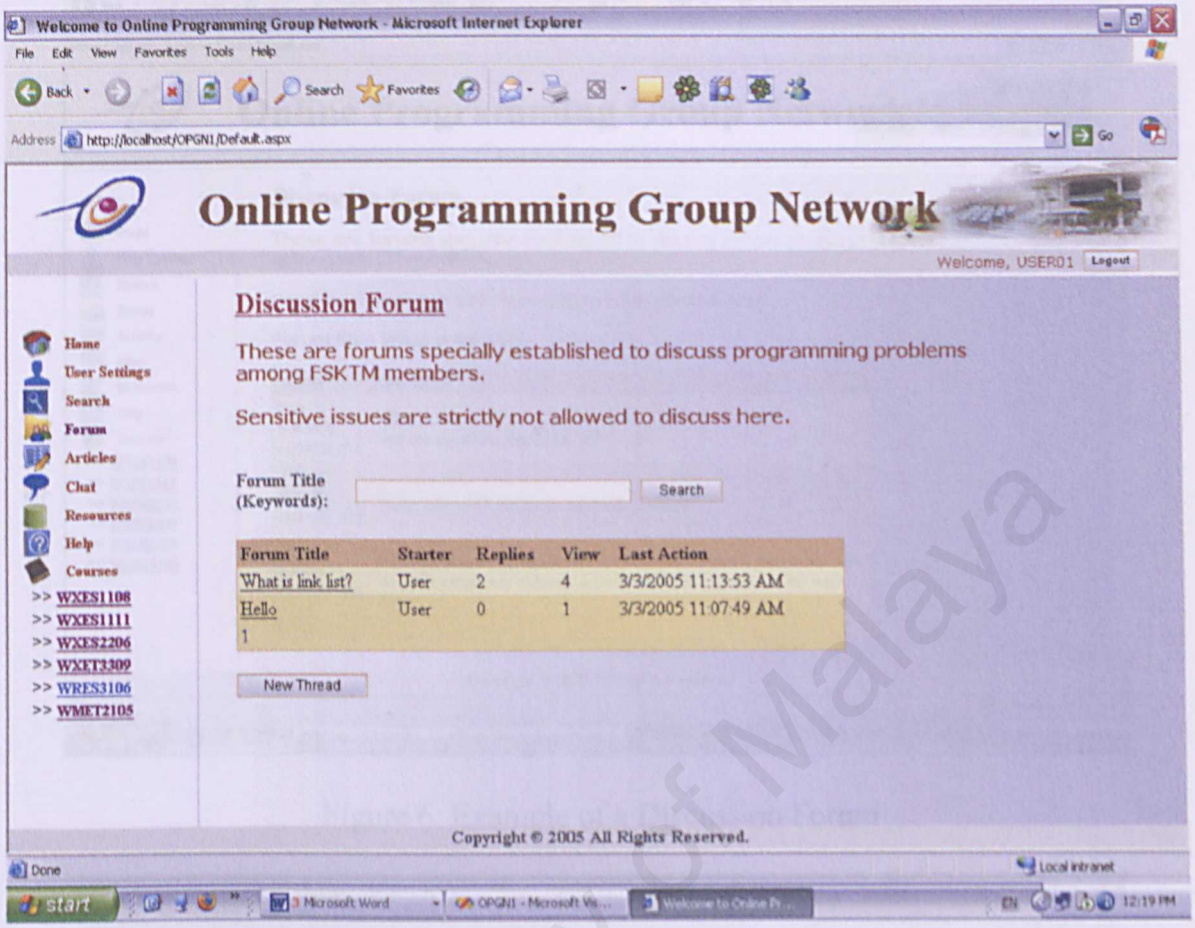

Figure 5: Forum main page

- User needs to login to access Discussion Forum.
- Click on the forum title in particular row to enter particular forum. (Figure 5)
- Click "New Thread" button to start a new discussion.
- Enter the forum title's keyword in search bar above to search for particular forum.

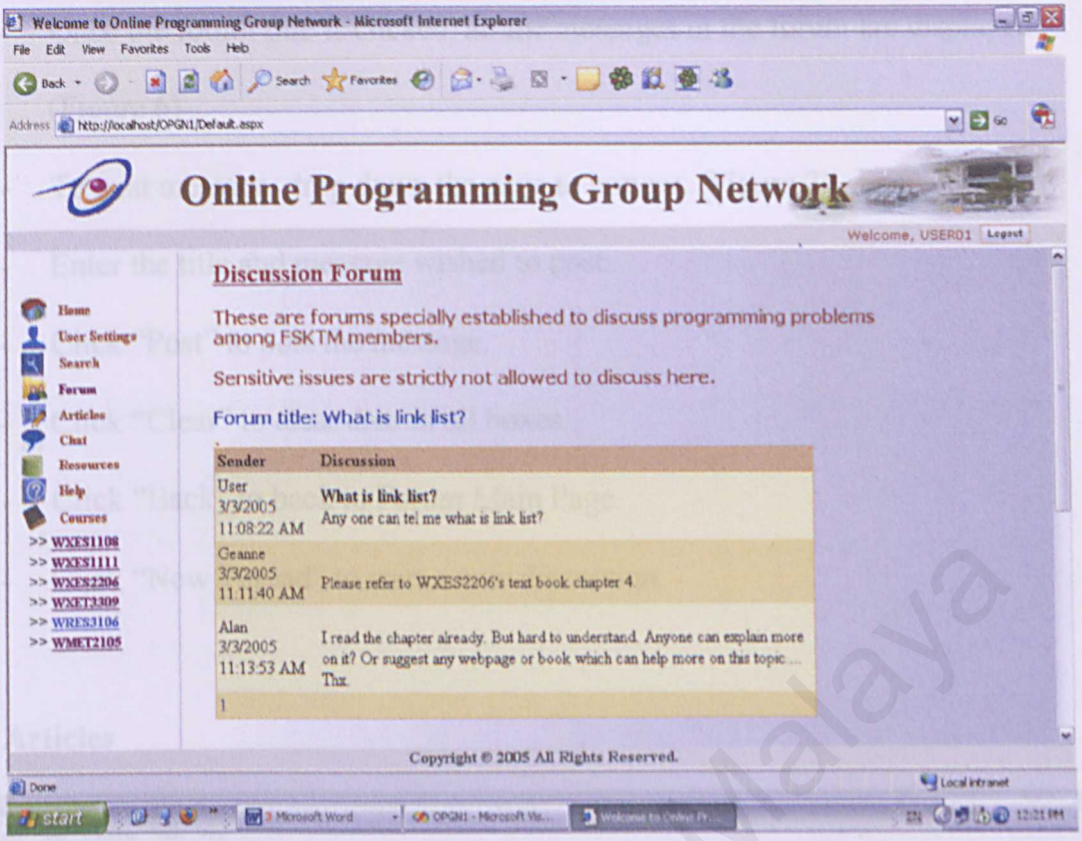

Figure 6: Example of a Discussion Forum

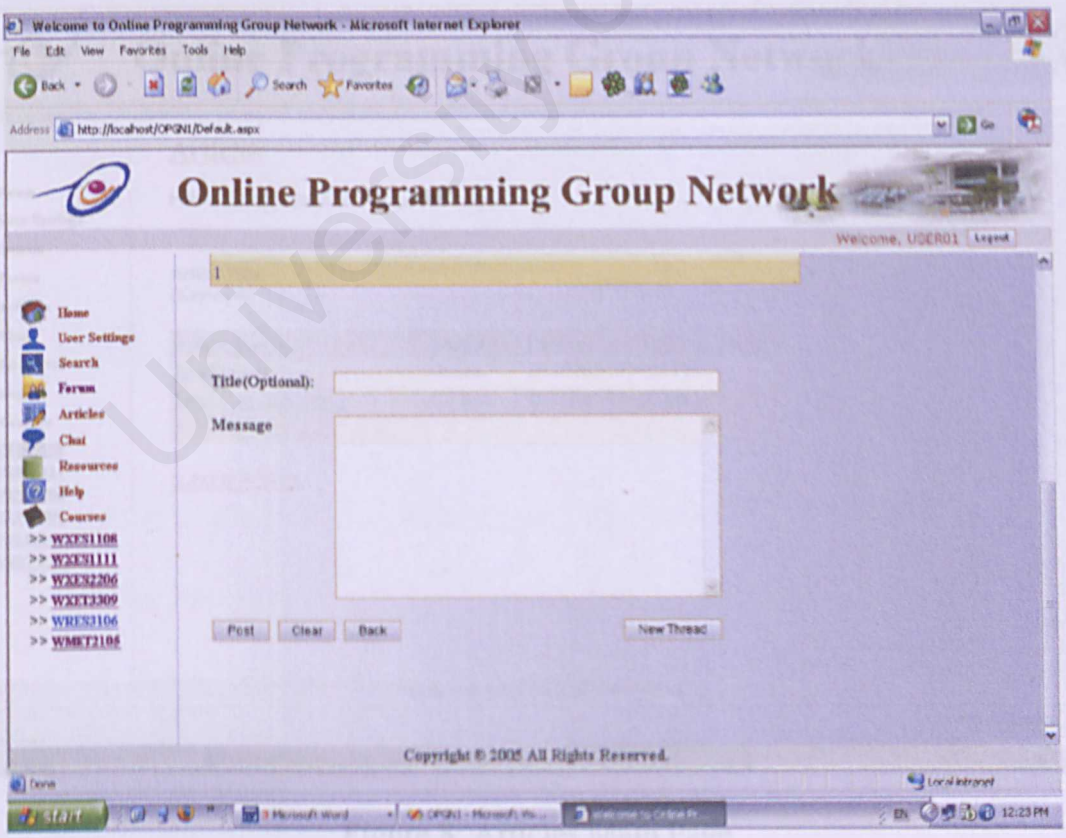

Figure 7: Post Message

- Once the forum title is clicked, all the messages in the forum are displayed. (Figure 6)
- To post message, drop down the page to bottom. (Figure 7)
- Enter the title and message wished to post.
- Click "Post" to post the message.
- Click "Clear" to clear data in all boxes.
- Click "Back" to back to Forum Main Page.
- Click "New Thread" to start a new discussion.

3.6 Articles

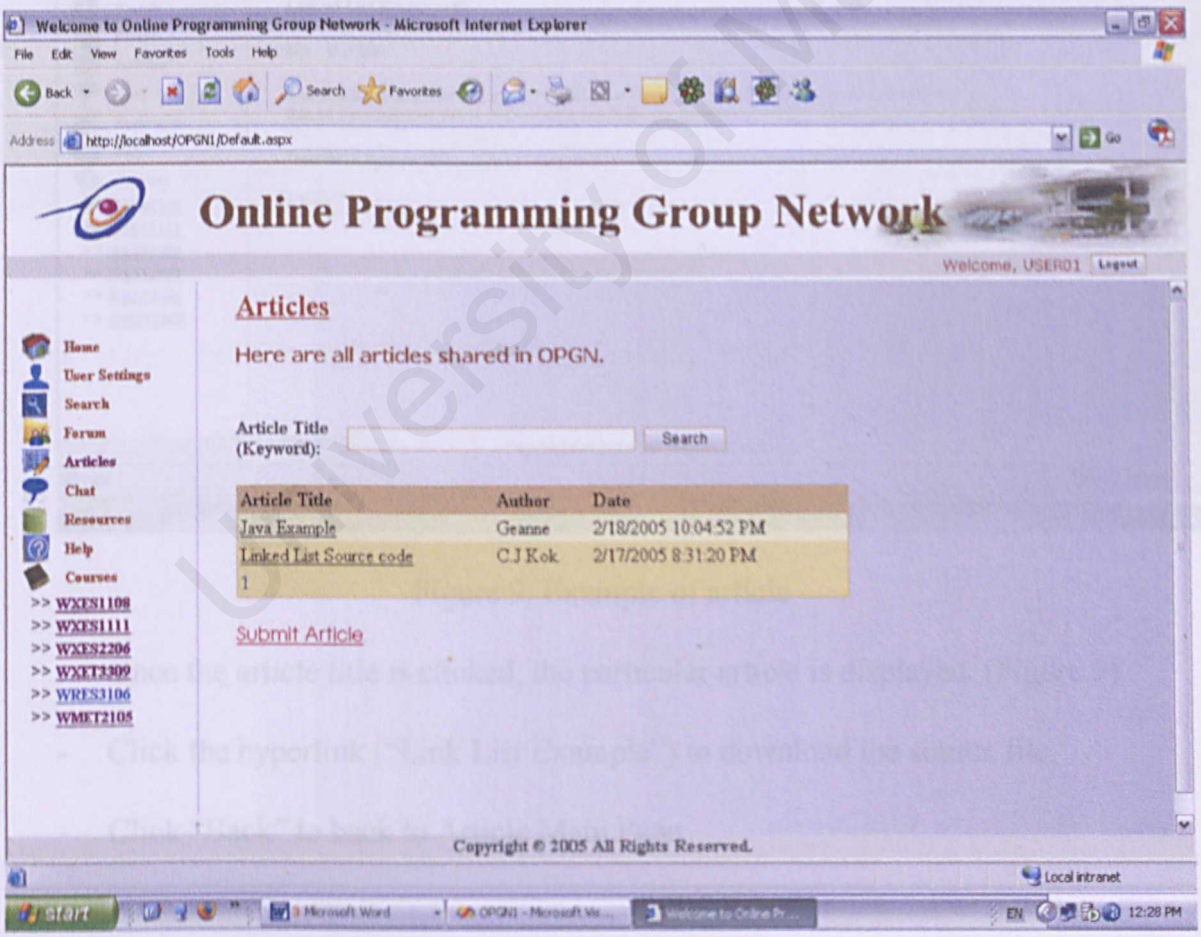

Figure 8: Articles Main Page

- User needs to login to access Articles. (Figure 8)
- Click on the article title in particular row to view particular article.
- Click "Submit Article" button to submit article. (Refer section 3.7)
- Enter the article title's keyword in search bar above to search for particular article.

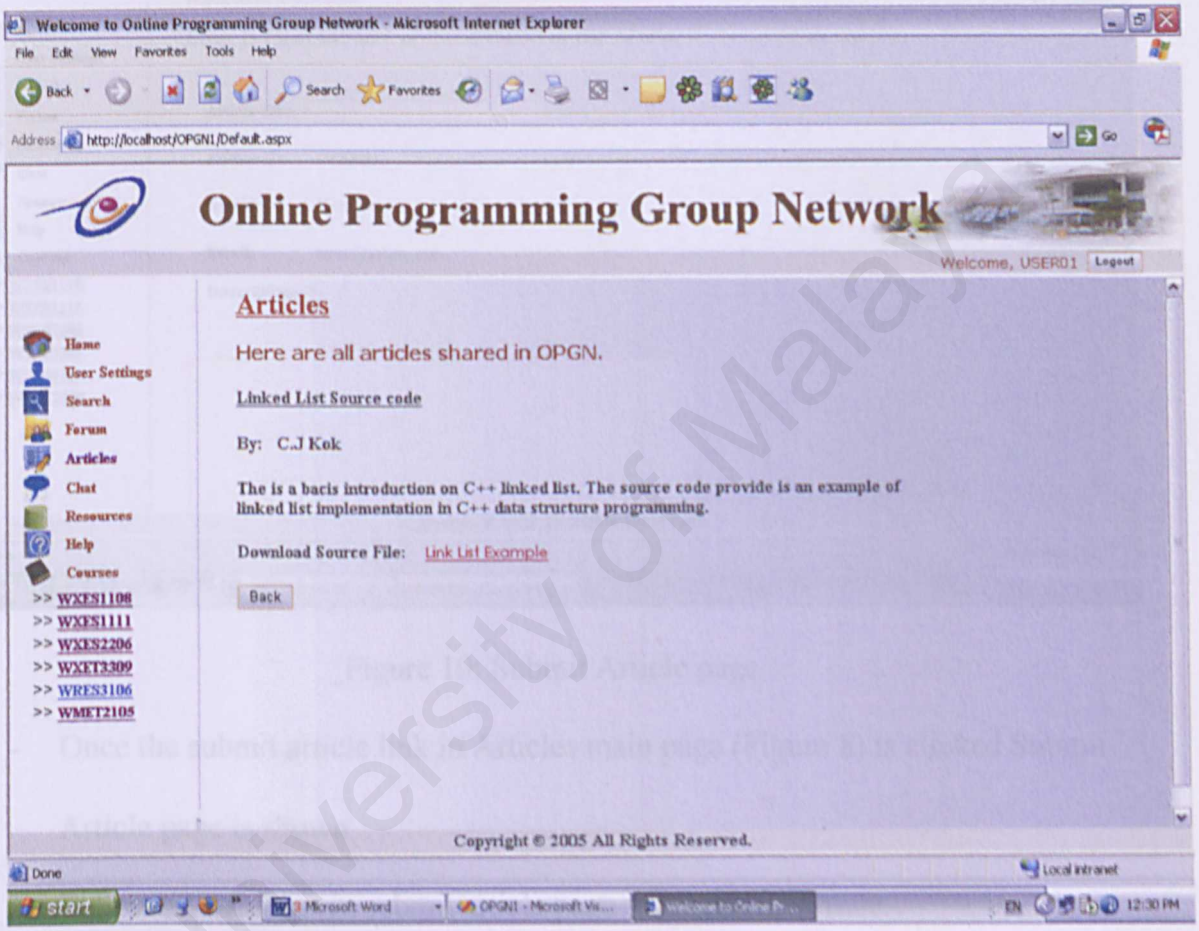

Figure 9: Example of article

- Once the article title is clicked, the particular article is displayed. (Figure 9)
- Click the hyperlink ("Link List Example") to download the source file.
- Click "Back" to back to Article Main Page.

3.7 Submit Article

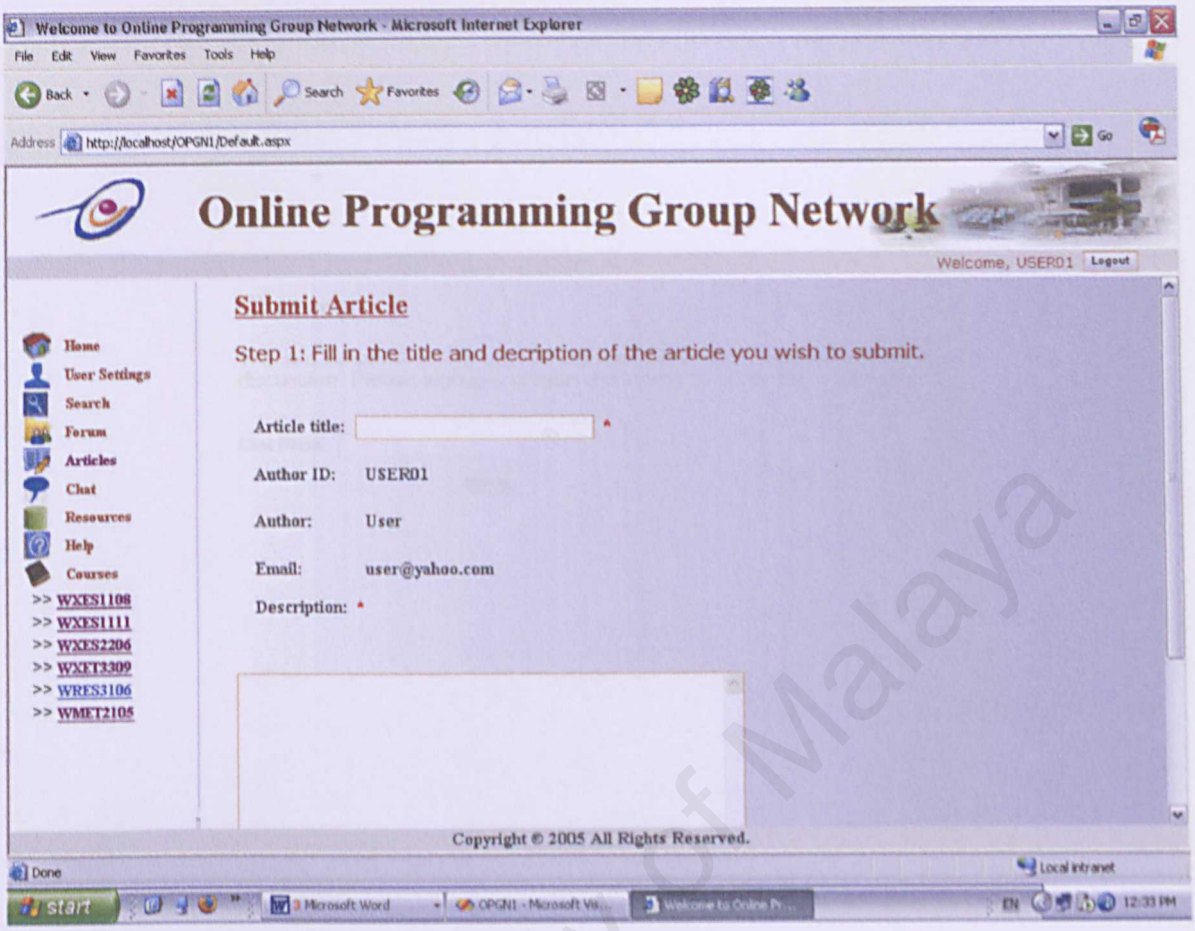

Figure 10: Submit Article page

- Once the submit article link in Articles main page (Figure 8) is clicked Submit Article page is shown.
- Follow all the steps in submit article page to submit an article.

3.8 Chat

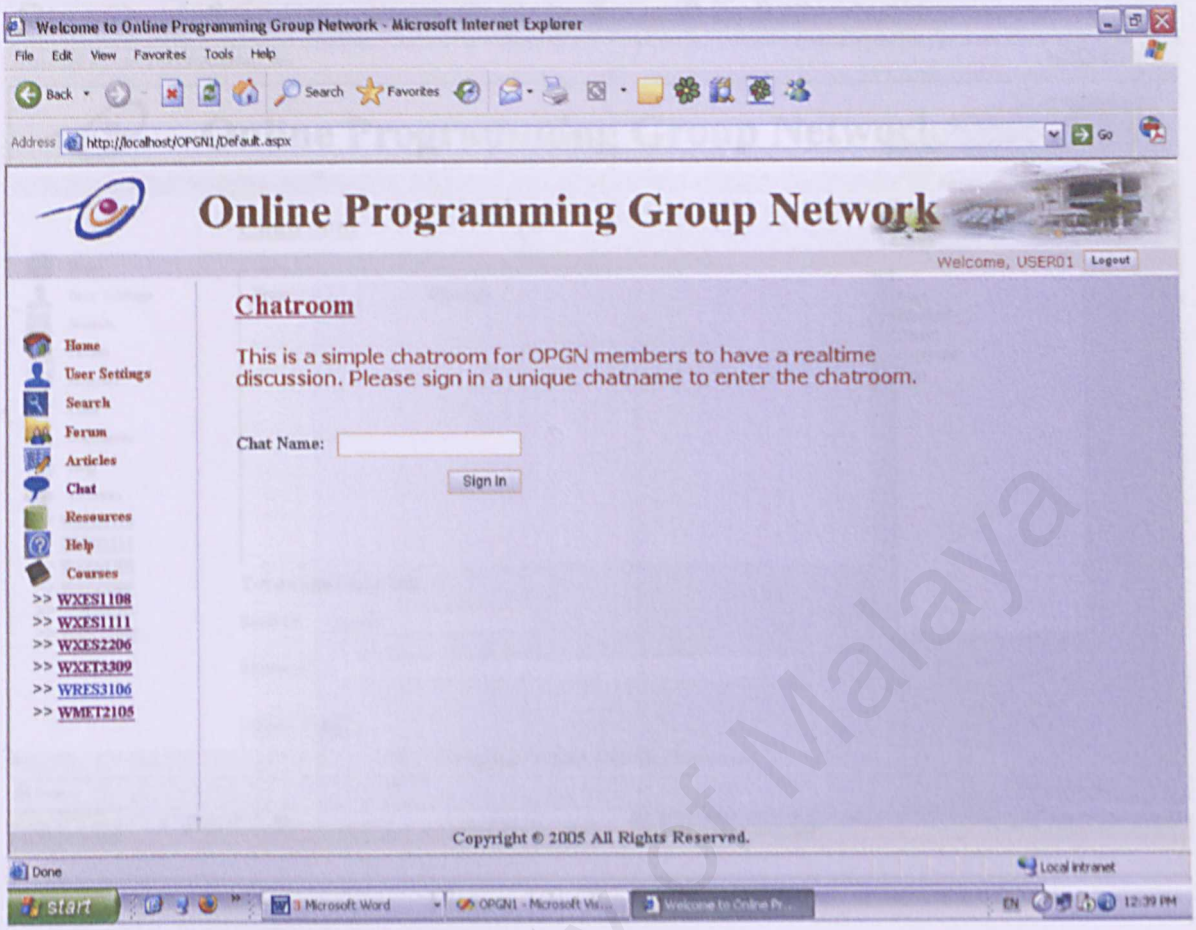

Figure 11: Chatroom Sign In page

- User needs to login to access Chatroom. (Figure 11)
- Enter a unique chat name to join chatroom.
- Click "Sign in" button to enter the chatroom.

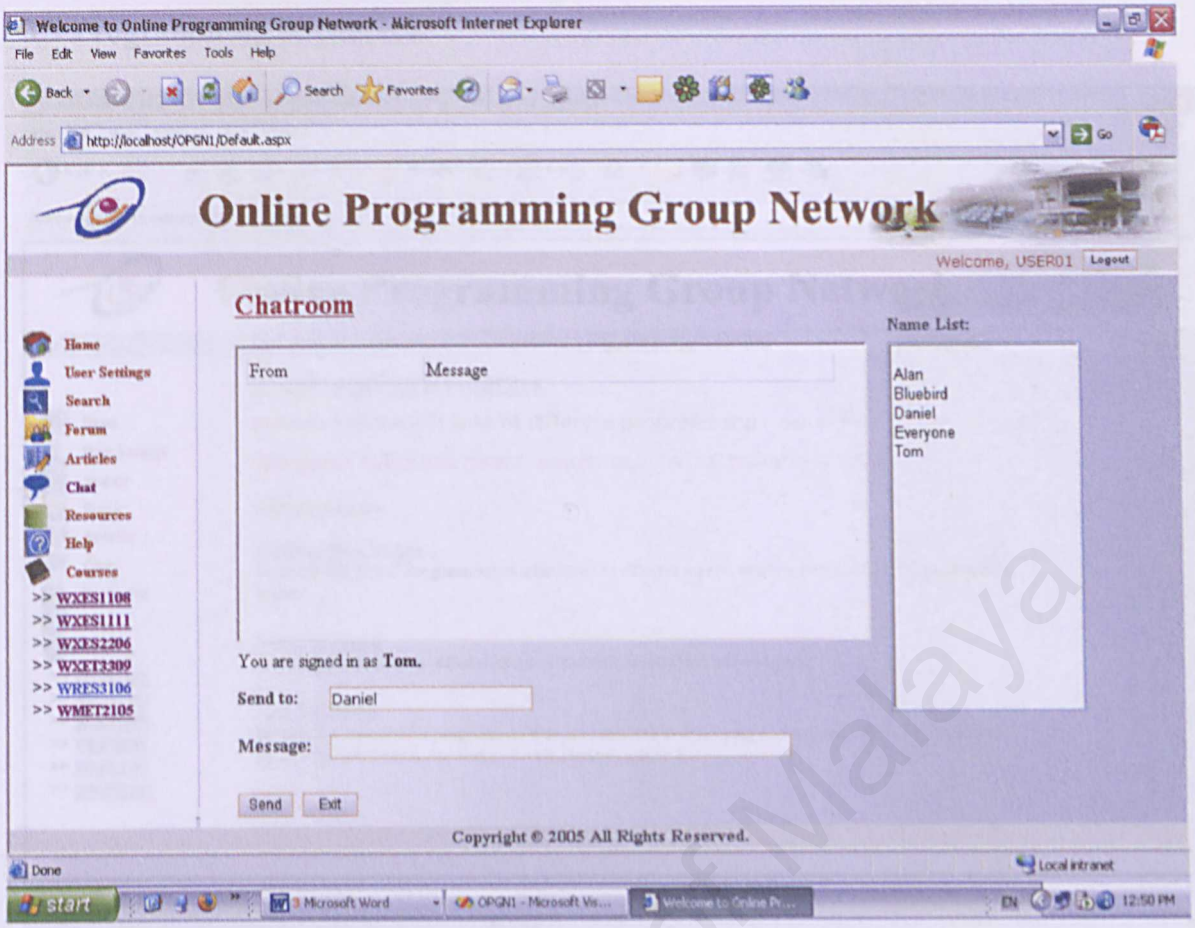

Figure 12: Chatroom page

- Once the "Sign In" is clicked, user enters the chatroom with his/her chat name. (Figure 12)
- To send message, click on the name of the received person in the name list.
- Click "Send" button to send the message.
- Click "Exit" button to exit chatroom.

3.9 Programming Resources

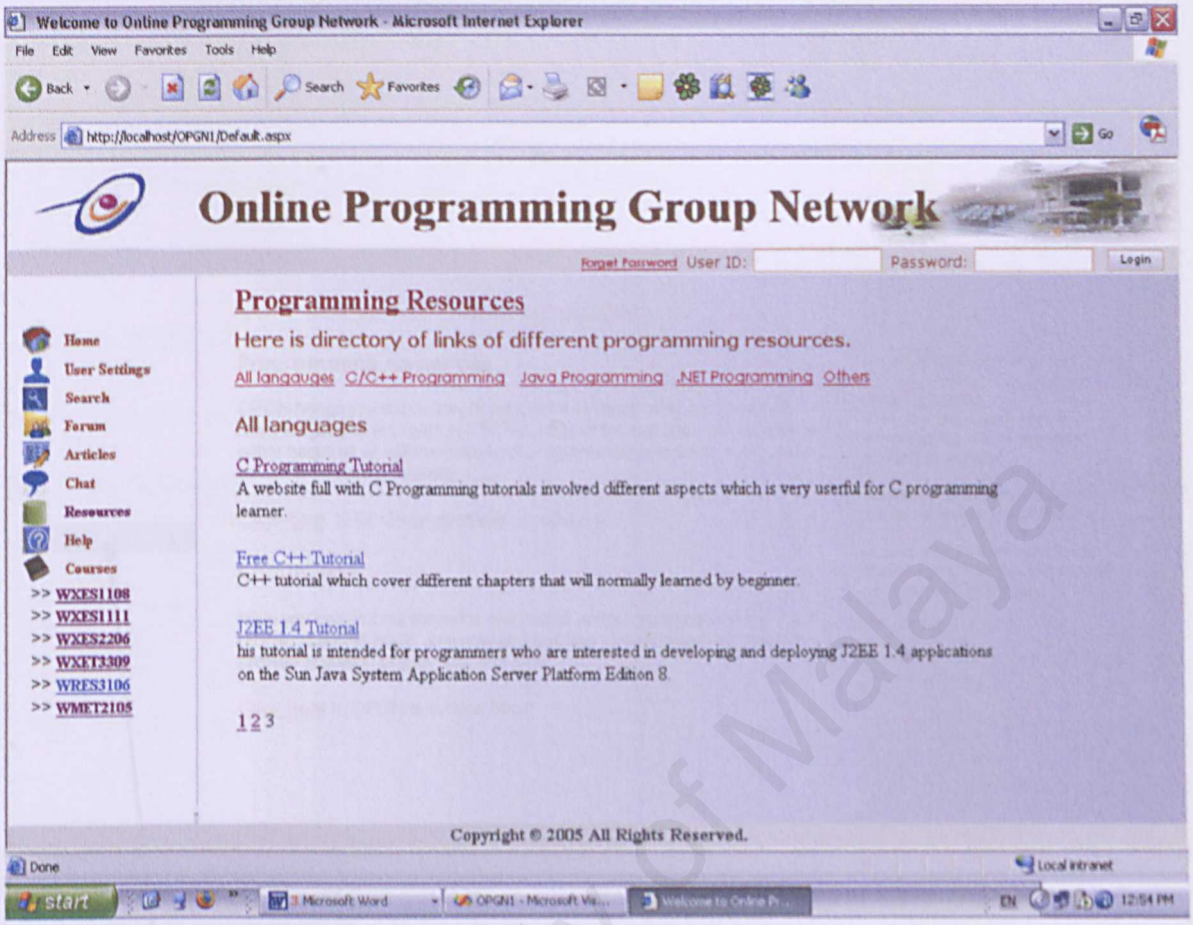

Figure 12: Programming Resources page

- Programming Resources page allows user to access different programming links under OPGN's collection. (Figure 12)
- Click on the title of the resource to link the resource in new browser window.

3.10 Help

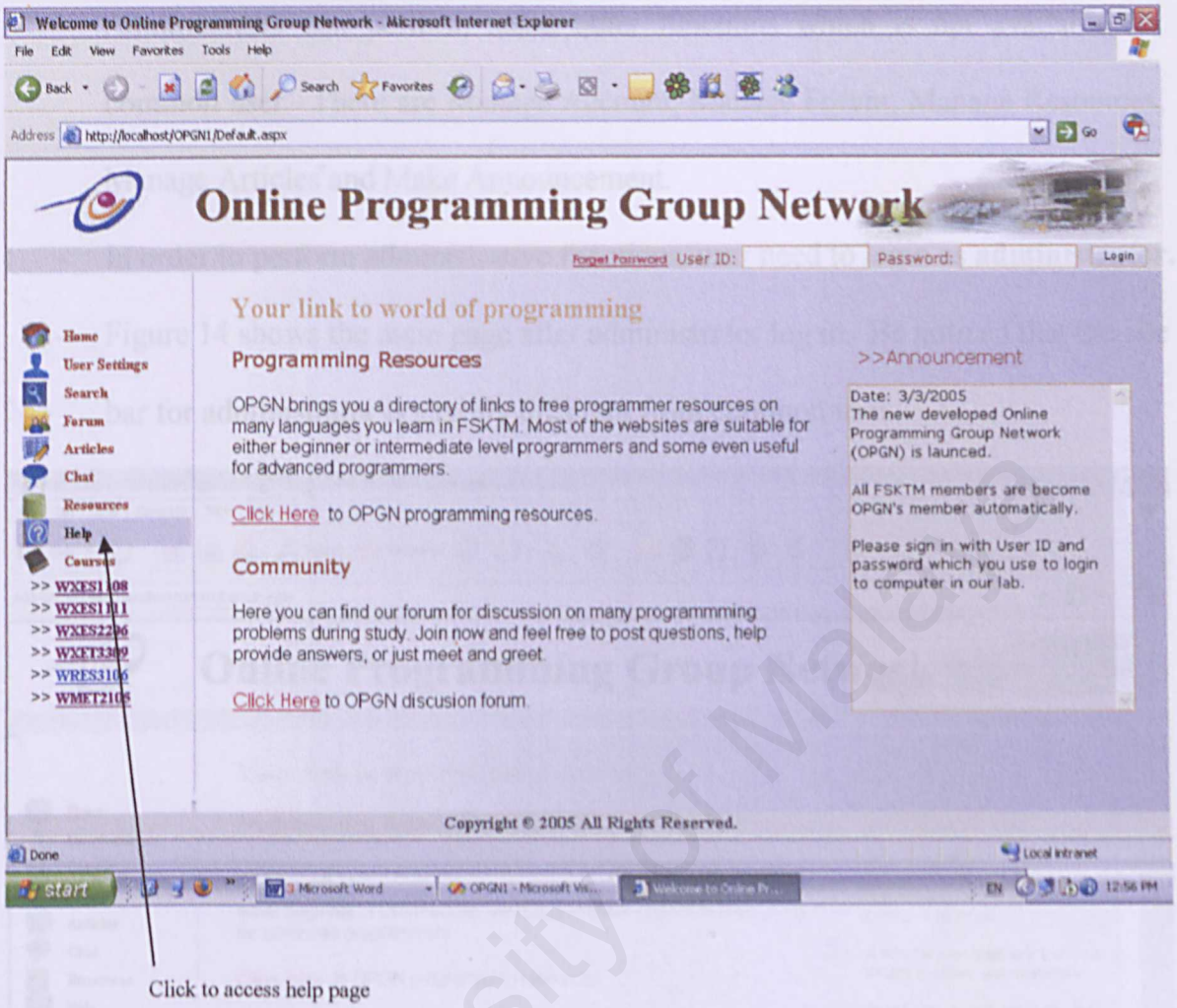

Figure 13: Online help button

- To get the help online, click the help button in site bar and the help page is displayed in new browser window.

3.11 Administrative Functions (Manage)

- Administrator can perform some other functions which is not available for common user. There are Manage Account, Manage Forum, Manage Resources, Manage Articles and Make Announcement.
- In order to perform administrative functions, user need to login as **administrator.**
- Figure 14 shows the main page after administrator log in. Be noticed that the site bar for administrator is slightly different from common user.

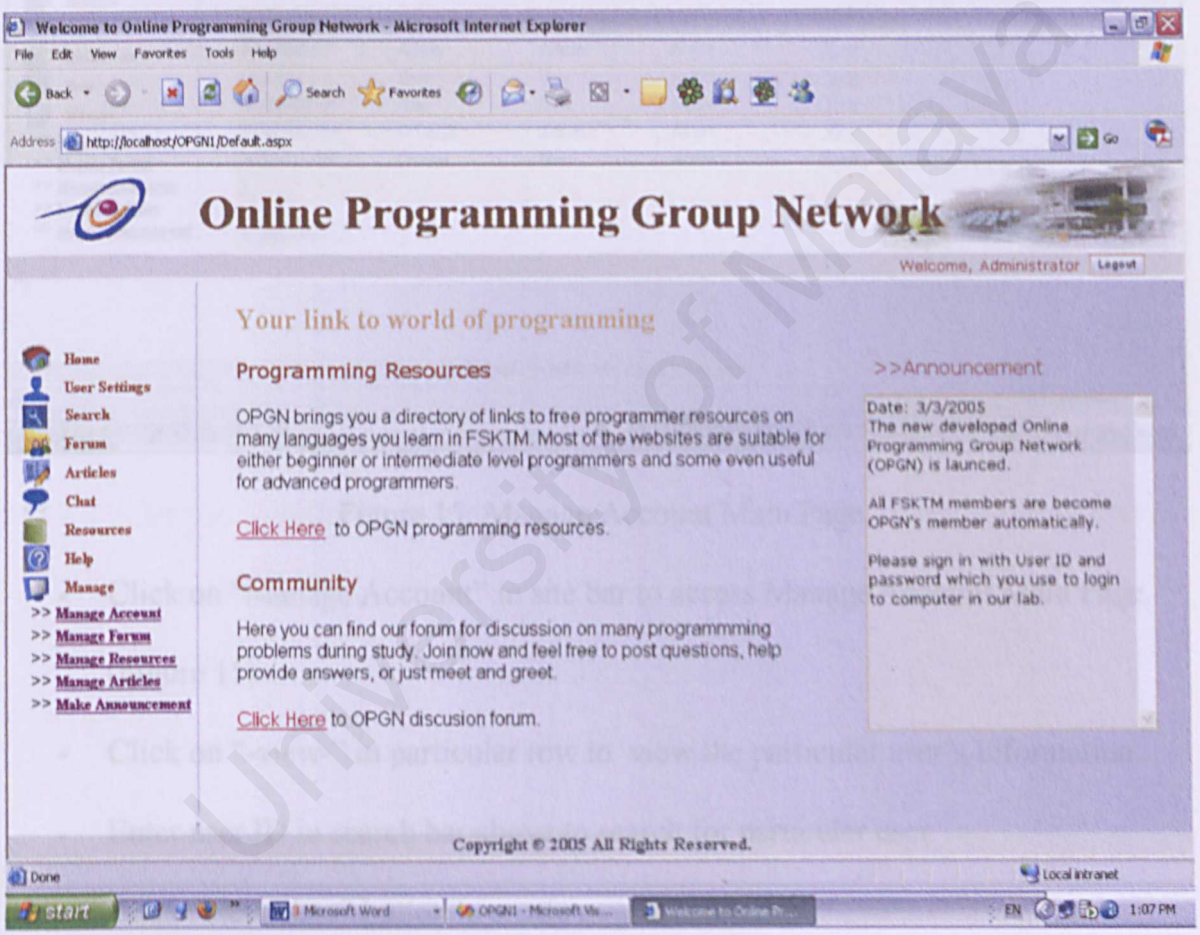

Figure 14: Different side bar for administrator

3.11.1 Manage Account

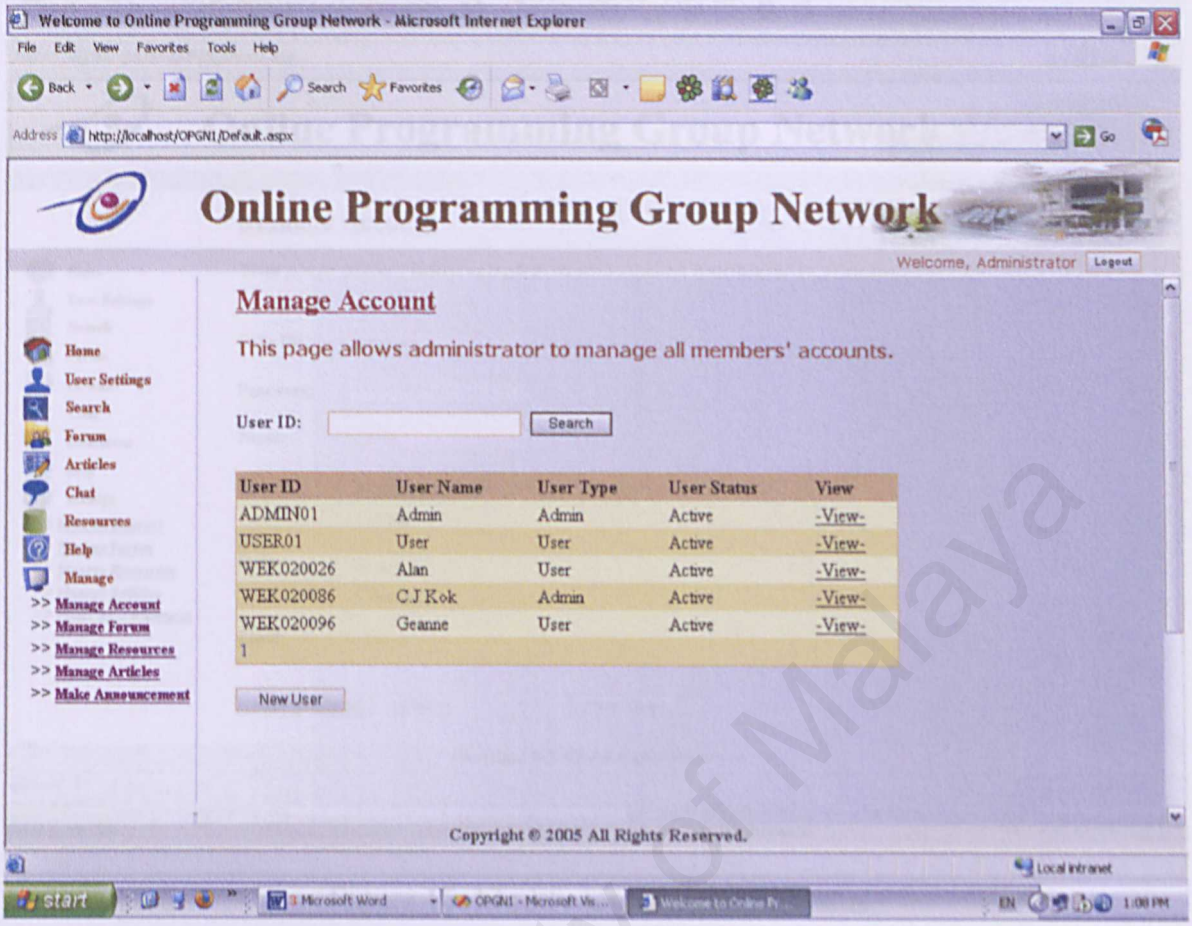

Figure 15: Manage Account Main Page

- Click on "Manage Account" in site bar to access Manage Account Main Page. (Figure 15)
- Click on "-view-" in particular row to view the particular user's information.
- Enter user ID in search bar above to search for particular user.
- Click "New User" button to create new user account.

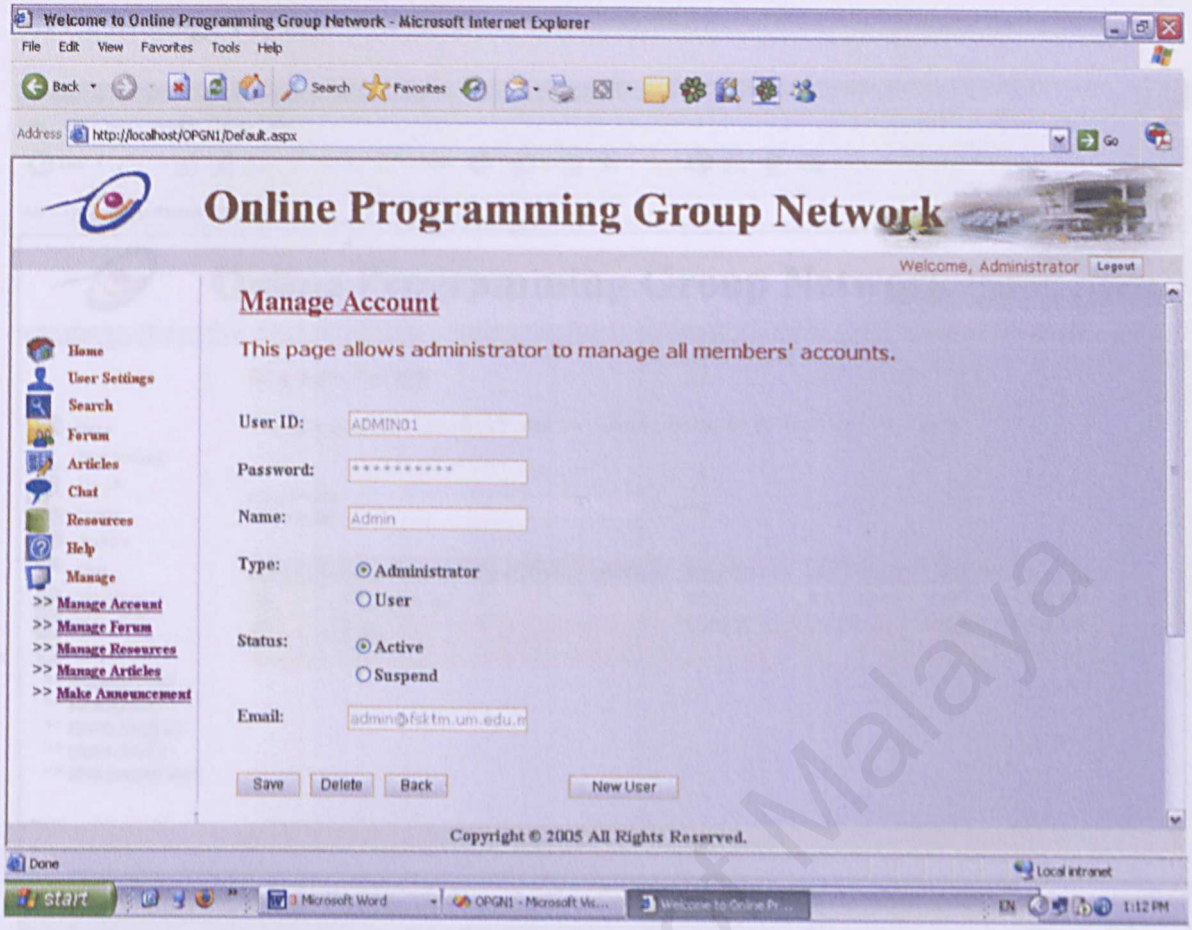

Figure 16: Modify User Type and Status

- After the "-view-" in particular row is clicked, the user's information is displayed. (Figure 16)
- Administrator can only adjust user type and status.
- Click "Save" button to save the modified information. (Caution: Information is not saved if "Save" is not clicked)
- Click "Delete" to delete the user account.
- Click "Back" button to back to Manage Account Main Page.
- Click "New User" button to create new user account.

3.11.2 Manage Forum

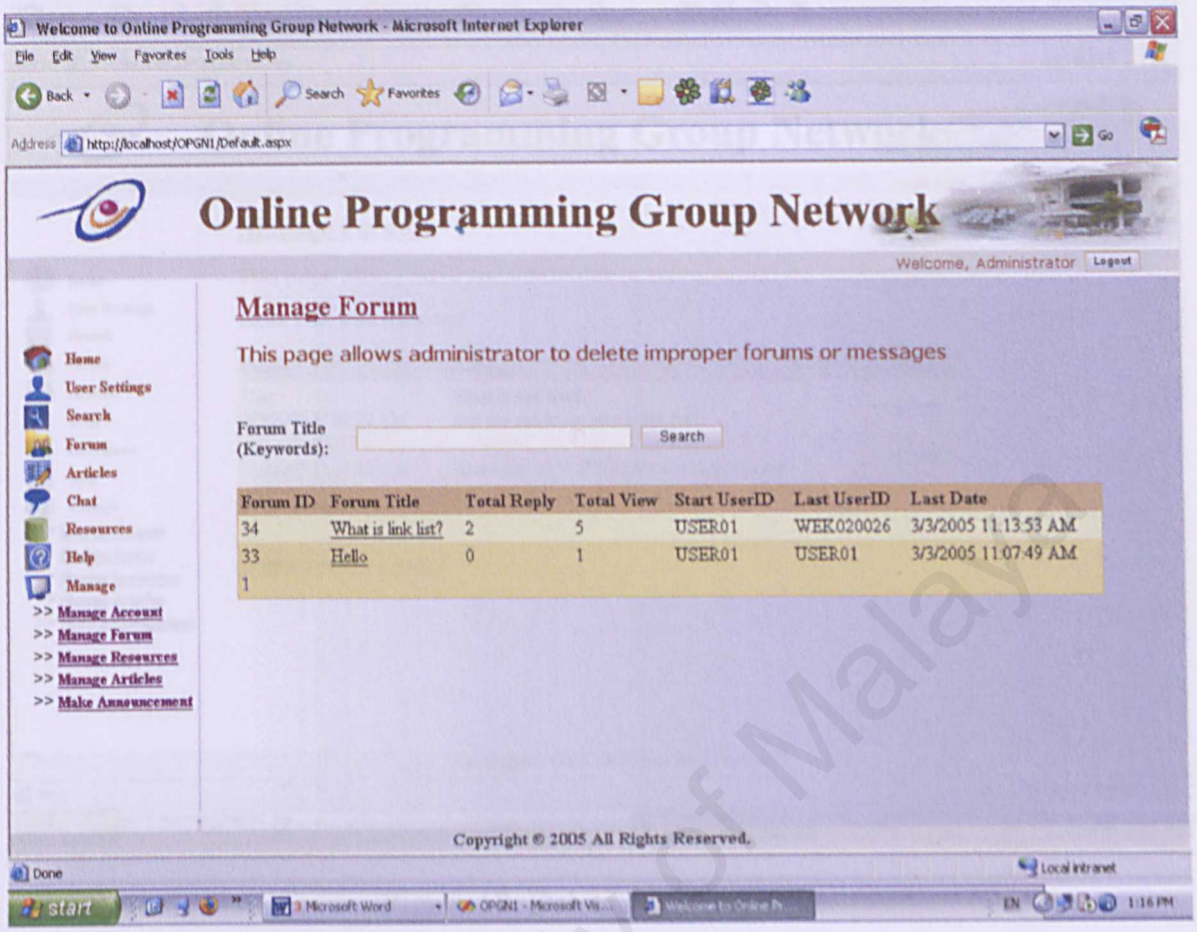

Figure 17: Manage Forum Main Page

- Click on "Manage Forum" in site bar to access Manage Forum Main Page. (Figure 17)
- Click on the forum title in particular row to view the particular forum.
- Enter keyword of forum title in search bar above to search for particular forum.

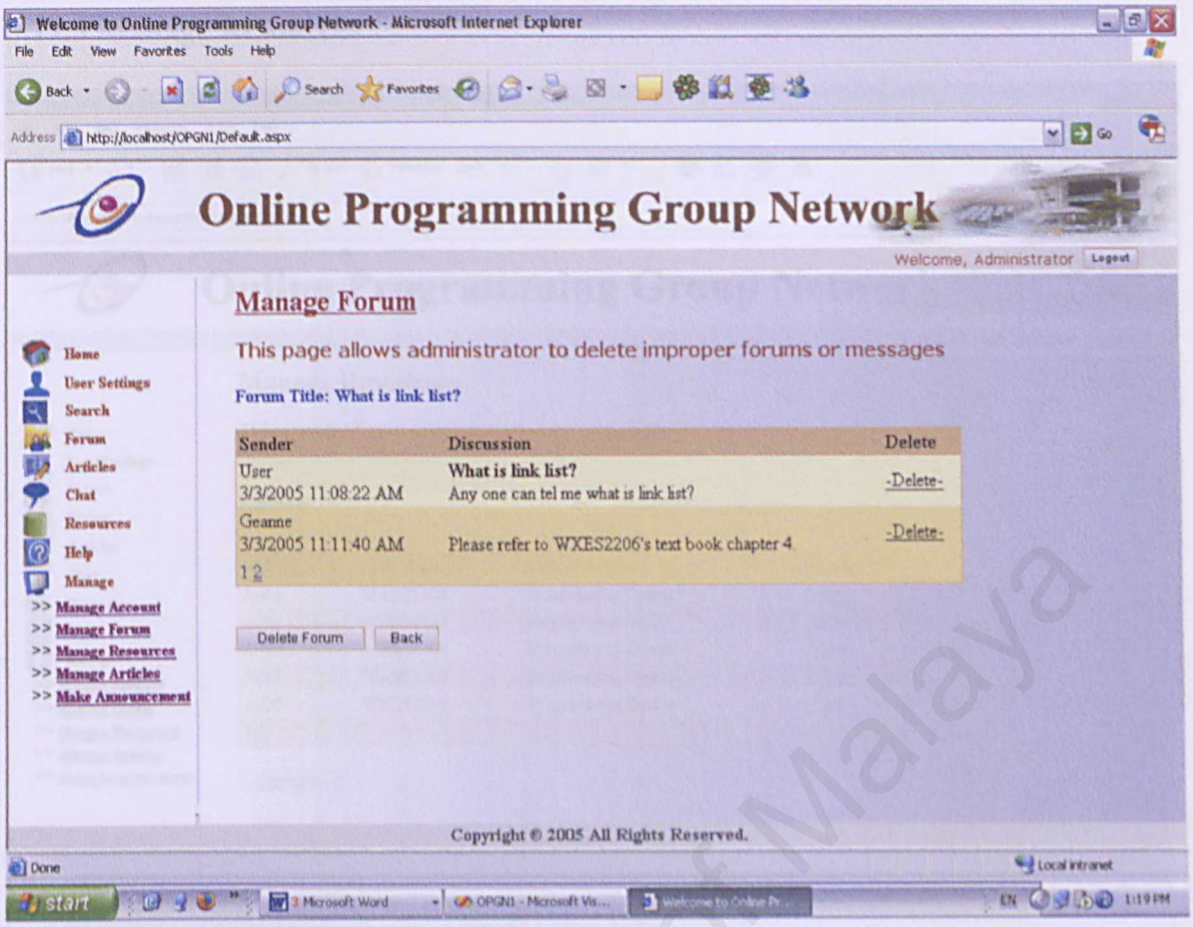

Figure 18: Delete forum message

- After the "-view-" in particular row is clicked, the forum is displayed. (Figure 18)
- Click "-delete-" in particular row to delete the message.
- Click "Delete Forum" to delete the whole forum
- Click "Back" button to back to Manage Forum Main Page.

3.11.3 Manage Resources

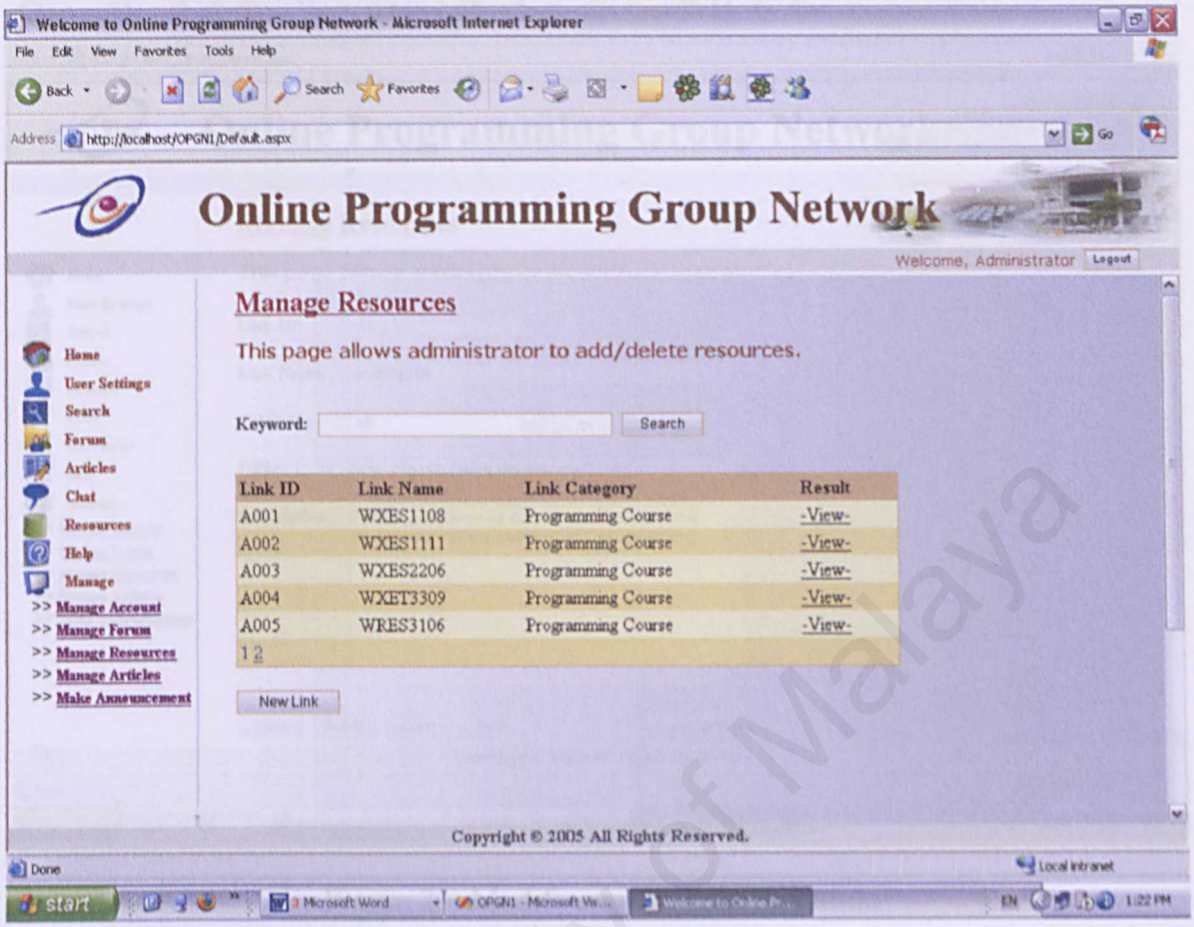

Figure 19: Manage Resources Main page

- Click on "Manage Resources" in site bar to access Manage Resources Main Page. (Figure 19)
- Click on "-view-" in particular row to view the particular resource.
- Enter keyword of resources in search bar above to search for particular resource.
- Click "New Link" button to create new resource (link).

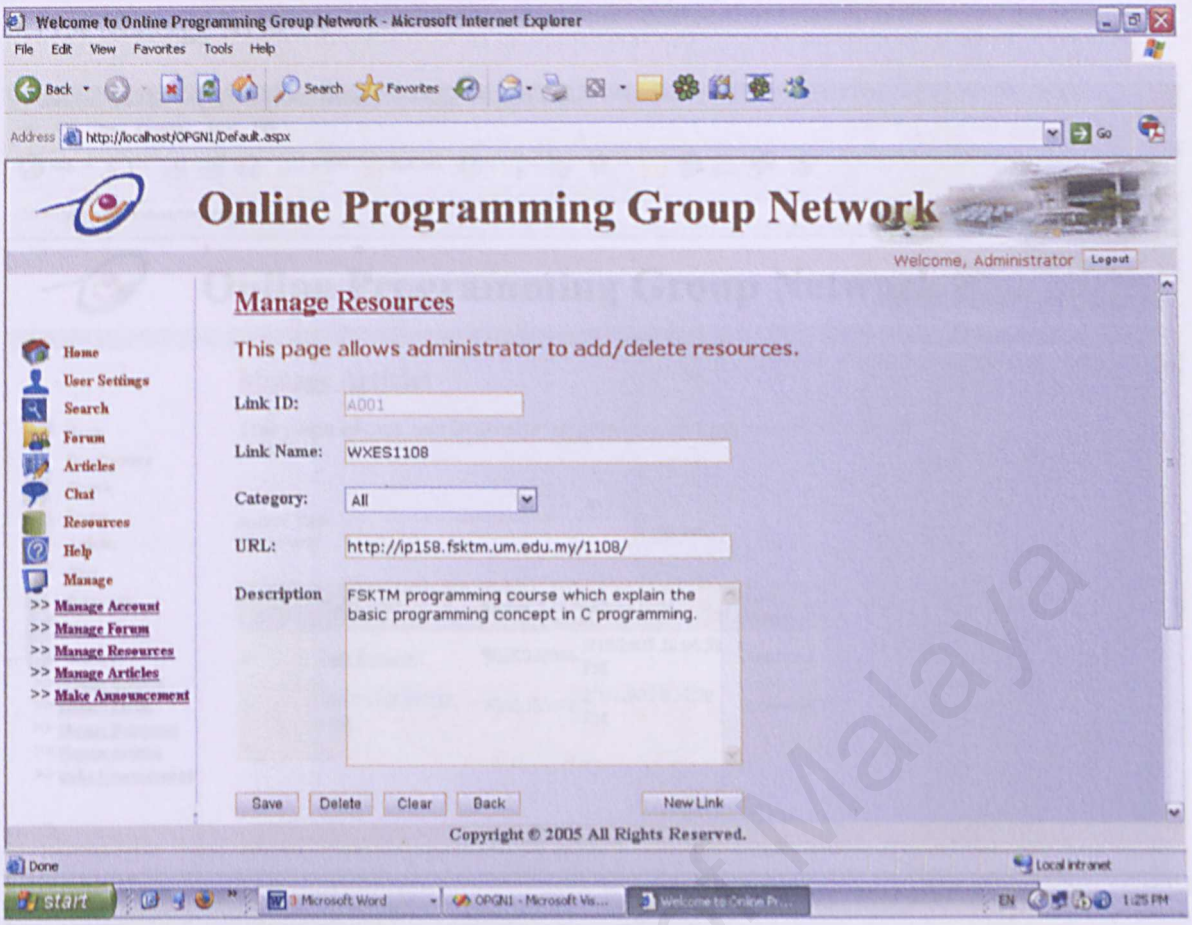

Figure 20: Modify resource's information

- After the "-view-" in particular row is clicked, the resources information is displayed. (Figure 20)
- Click "Save" button to save the modified information. (Caution: Information is not saved if "Save" is not clicked)
- Click "Delete" to delete the resource.
- Click "Clear" to clear data in all text boxes.
- Click "Back" button to back to Manage Resource Main Page.
- Click "New Link" button to create new resource (link).

3.11.4 Manage Articles

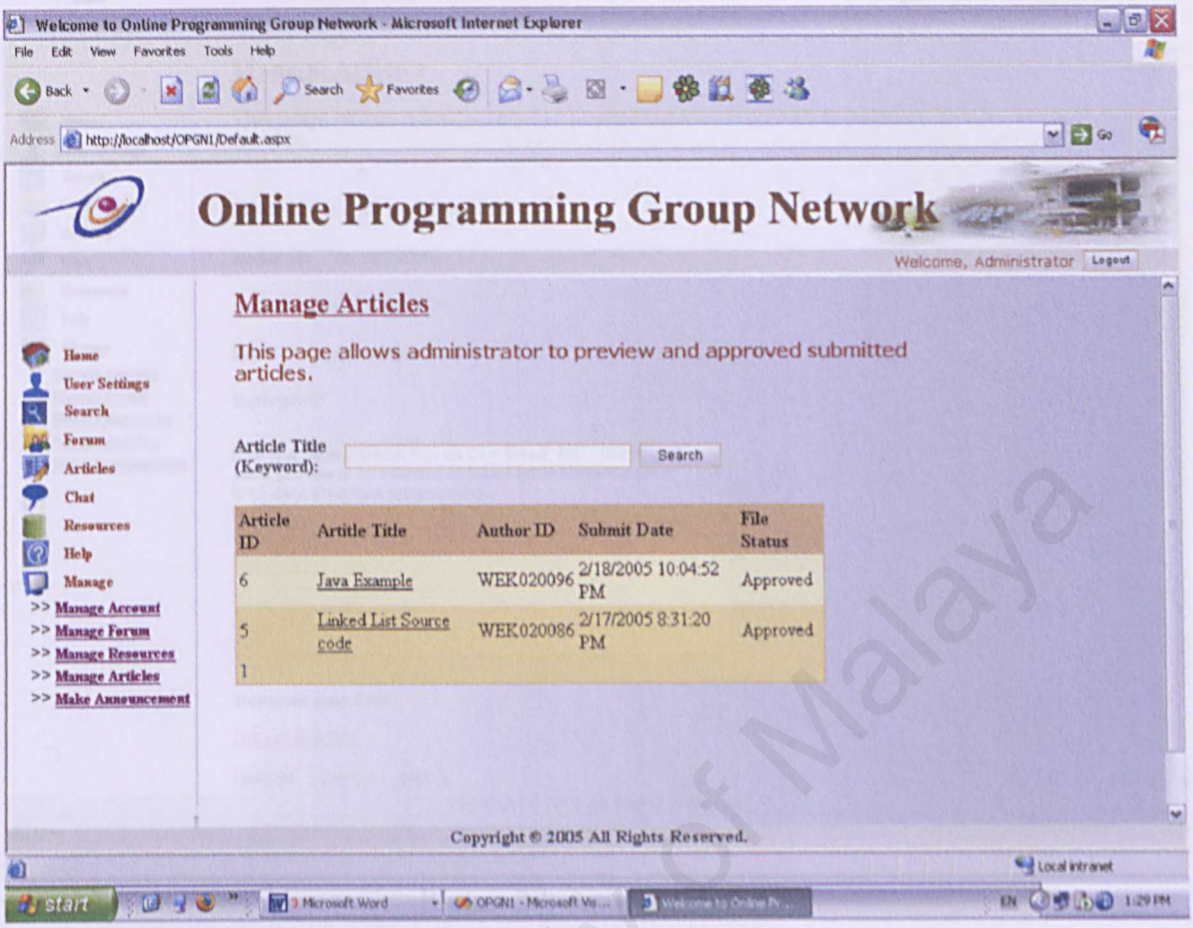

Figure 21: Manage Articles Main page

- Click on "Manage Articles" in site bar to access Manage Articles Main Page. (Figure 19)
- Click on the Article title in particular row to view the particular article.
- Enter keyword of article title in search bar above to search for particular article.

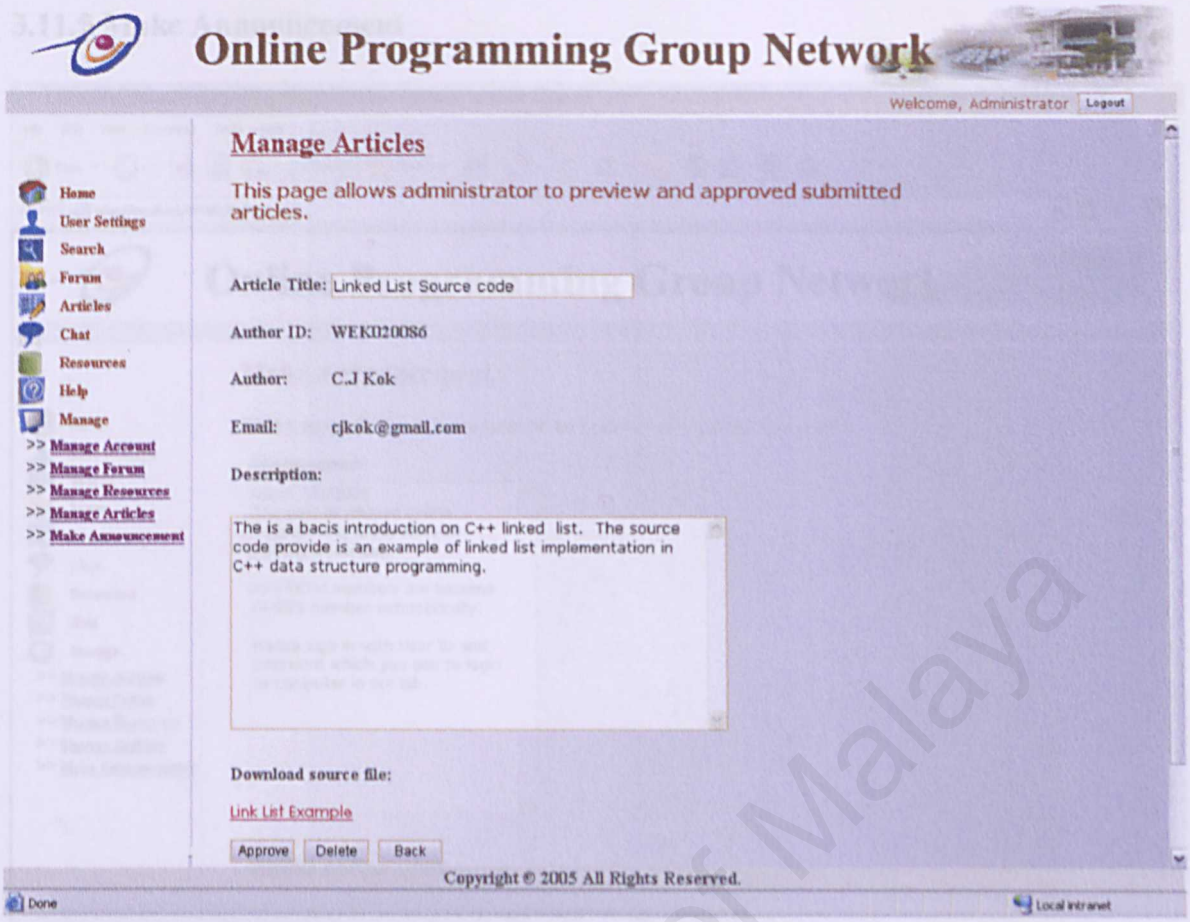

Figure 22: Approve Article

- After the article title in particular row is clicked, the article information is displayed. (Figure 22)
- Click "Approve" button to approve the article to be download.
- Click "Delete" to delete the article
- Click "Back" button to back to Manage Resource Main Page.

3.11.5 Make Announcement

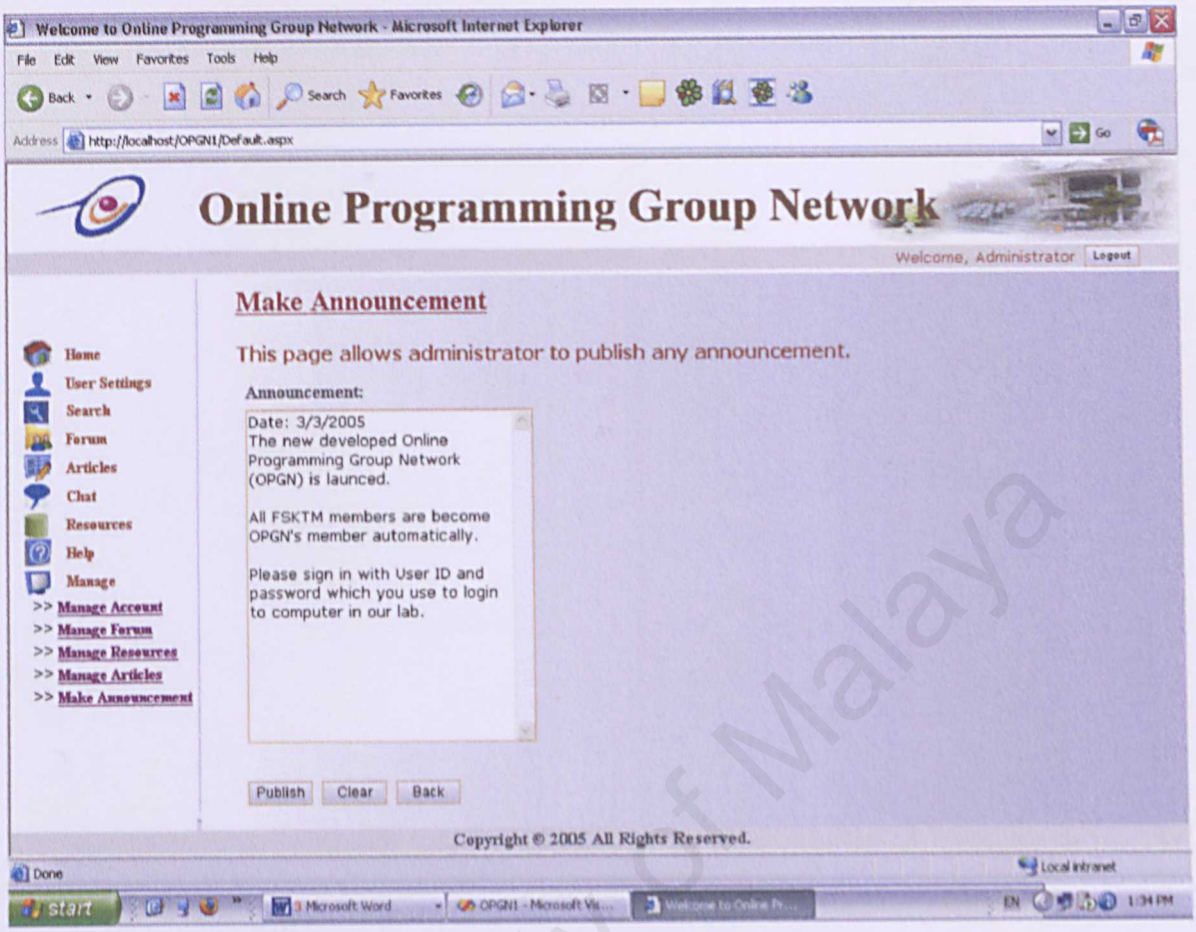

Figure 23: Make Announcement

- Click on "Make Announcement" in site bar to access Make Announcement Main Page. (Figure 23)
- Key in the announcement information in textbox.
- Click "Publish" button to save the announcement.
- Click "Clear" to clear the announcement.
- Click "Back" button to back to System Home Page.