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**A Groupware to Support Multi-User Communication with a Network WhiteBoard
(CommunityBoard)**

BY

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Abstract

“Collaboration is all about people working together. The end result is information sharing, problem solving, and support for ad hoc processes.”

CSCW 2000 Conference

Collaboration of distributed workgroup needs group management tools to maintain their own workgroup. The definition of group managements here is restricted to methods of group working rather than simply communicating. For example, working together on documents or sharing application such as whiteboard. Thus, we are looking for a way to having effective communication between each member in the workgroup and an accomplished mature group management tools to internet users.

Nowadays, many of the new collaboration tools are provided on a server and accessed with a web browser. Some are also available using browser plug-ins, or using special purpose client software. This project steps towards developing a groupware which can support multi-users communication with a network whiteboard. The main aspect of this project is to produce a whiteboard system which processed multiple whiteboard sessions or groups concurrently, enabling users to communicate with people over the internet via a graphical whiteboard. It provides a powerful mechanism for group management distance learning and other areas of application.

In conclusion, this project integrating group management tools and the whiteboard tools to producing effectively multimedia web-based application.

Acknowledgement

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Table of Content

Abstract	ii
Acknowledgement	iii
Table of Content	iv
List of Table	vii
List of Figure	viii
Chapter 1: Introduction	
1.1 Project Overview	1
1.2 Problems Statement	2
1.3 Project Objectives Statement	3
1.4 Project Scope	4
1.5 Expected Outcome	5
1.6 Project Schedule	6
1.7 Report Layout	8
Chapter 2: Literature Review	
2.1 Domain Studies	11
2.1.1 Definition & Terminologies	11
2.1.1.1 Group Management	11
2.1.1.2 Groupware	12
2.1.1.3 WhiteBoard	13
2.1.1.4 Computer Supported Cooperative Work	14
2.1.1.5 Criteria to Fulfill	15
2.1.2 Review of the existing system	16
2.1.3 Proposed System	21
2.2 Technology Review	22
2.2.1 Operating System Platform	22
2.2.2 Database Management System	29
2.2.3 Web Server	31
2.2.4 Web Client (Browser)	35
2.2.5 Programming Technologies and Languages	37

2.2.6 System Architecture	44
2.2.7 Web Editor Tool	45

Chapter 3: Methodology

3.1 Software Development Life cycle	48
3.2 Methodology Consideration	48
3.2.1 Design Technique Consideration	49
3.2.2 Methodology Used	53
3.3 Research Methodology	56
3.3.1 Information Gathering	56
3.3.2 Research on Existing System	56

Chapter 4: System Analysis

4.1 System Requirement Analysis	57
4.1.1 Functional requirements	57
4.1.1.1 Group Management Module	57
4.1.1.2 Network WhiteBoard Module	58
4.1.1.3 Use Case Diagram	59
4.1.1.4 Functional Requirement Definition	60
4.1.2 Non-Functional Requirements	73
4.2 Hardware Requirements	75
4.3 Software Requirements	76
4.4 Tools and Technology to be used	76
4.4.1 Network Architecture Analysis	76
4.4.2 Development Tools Analysis	76

Chapter 5: System Design

5.1 System Architecture	83
5.1.1 Adapting Client/Server Architecture to CommunityBoard System	83
5.1.2 The CommunityBoard's Server	84
5.1.2 The CommunityBoard's Client	84
5.2 System Functionality Design	86
5.2.1 Activity diagram	86

5.3 Database Design	99
5.3.1 Data Dictionary	101
5.3.2 Entity-Relationship Diagram	105
5.4 Interface Design	106
5.4 Graphical User Interface	106
Reference	137

List of Table

Table 2-1	Category of Groupware Techniques	11
Table 2-2	Comparison between Windows 2000, Unix and Linux	27
Table 3-1	Four major phases in Unified Process	52
Table 5-1	Table of Account	99
Table 5-2	Table of Member	99
Table 5-3	Table of Announcement	100
Table 5-4	Table of Invitation	100
Table 5-5	Table of Membership	101
Table 5-6	Table of Group	101
Table 5-7	Table of Leader	102
Table 5-8	Table of Message	102

List of Figure

Figure 1-1	Project Schedule	7
Figure 2-1	Screen Shot for CommunityZero.com	15
Figure 2-2	Screen Shot for GroupBoard.com	17
Figure 2-3	Screen Shot for Yahoo!Groups	18
Figure 2-4	Screen Shot for Eteamz.com	19
Figure 3-1	System Development Process Model	48
Figure 3-2	Core Workflows and the Phases of the Unified Process	51
Figure 4-1	Use Case Diagram for CommunityBoard System	57
Figure 5-1	Activity Diagram for Register	84
Figure 5-2	Activity Diagram for Login	85
Figure 5-3	Activity Diagram for Manage Announcement	86
Figure 5-4	Activity Diagram for Delete Message	87
Figure 5-5	Activity Diagram for Delete Group	88
Figure 5-6	Activity Diagram for Create Group	89
Figure 5-7	Activity Diagram for Edit Personal Info	90
Figure 5-8	Activity Diagram for Send Invitation	91
Figure 5-9	Activity Diagram for Join Group	92
Figure 5-10	Activity Diagram for Post Message	93
Figure 5-11	Activity Diagram for Search	94
Figure 5-12	Activity Diagram for Navigate White Board	95
Figure 5-13	Activity Diagram for View Member	96
Figure 5-14	Database Relationship Diagram created using Microsoft SQL Server	98
Figure 5-15	Entity-Relationship Diagram	105
Figure 5-16	Home Page for Community Board	107
Figure 5-17	Register Page for Community Board	107
Figure 5-18	Administrator Login Page for Community Board	108
Figure 5-19	Administrative Workspace for Community Board	108
Figure 5-20	Message Board for Community Board	109
Figure 5-21	WhiteBoard for CommunityBoard	109

Chapter 1 Introduction

1.1 Project Overview

This CommunityBoard is a web-based groupware or a collaboration tool, which enables users from different geographical location to communicate, interact and work upon a network whiteboard.

By using a client server architecture platform, this web-based groupware is made possible to be used for professional groups (such as graphic designer) and non professional groups (such as ordinary users).

Through this system, users are able to hold meeting, ongoing discussion, develop and manage their own workgroup by using whiteboard. Users also can just visit the message board or post announcements (only for administrators). Users privacy is always been protected through the system authentication.

This system contains two main modules:-

(a) Electronic Group Management

- ❖ A user group management with security control.
- ❖ Announcement board and message board is developed with news update facilities among users in that group.

(b) White Board

- ❖ An electronic drawing tool that can be drew, shared, viewed, modified in real-time by users at different geographical areas.

1.2 Problems Statement

Nowadays, many groupware have been developed. For instance, Microsoft Net Meeting, GroupBoard.com, Eteamz.com and etc. So, the wheel has been invented. Yes, it's works! It's rolls! But it does still can be improved, it's still not perfect and it's still need a lot of enhancement.

In today web-based technology, many web sites were having less securities and privacy protection during users perform their activities. Some of the E-group web sites are full of spam message or garbage message or information sent by anonymous person. Besides that, controlling of inactive users or members seems useless. It made a lot of E-group web sites have to shut down because of space limitation. So, this system is tries to overcome this type of questions by adding system administrators in order to control and manage inactive users and workgroups.

A white board tool is one important technology which brings us one step towards new millennium. But, majority of the online whiteboard is not equipped with the real-time communication among users. Besides, most of the E-group websites are not integrated whiteboard session together in order to speech up communication and exchanging information between users. More over, majority online white board web sites are not provide the message board to users to update themselves or seek help from members.

Besides, latency of the system become another major problem faces by internet users and internet developer. User inputs always reach their partner's site at different transfer rate. Users need to wait long time during conversation. This may cause the system slow down overall.

In conclusion, perhaps this system can design to provide a secure collaborative and multimedia environment which support group management tool, online whiteboard, and useful message board.

1.3 Project Objectives Statement

Objective statement of a project is the goal & vision that the project aims to achieve. The objective of this project is to design and develop a distributed groupware that support multi-users communication with a network whiteboard. It's aim to engage in real time session so as to support the articulation and negotiation of ideas for working on whiteboard and also to support communication in general.

- ❖ Create a real-time, online, web-based platform where users can share, discuss, collaborate in their work in an efficiency manner which support paperless environment.
- ❖ Create a group management tool that is complete with privacy and individual security protections to avoid unauthorized users from enter the ongoing session.
- ❖ Create a groupware that contains tools to meet the needs of all kind of users.
- ❖ Create a groupware whiteboard that have good performance, easy and cost effective.
- ❖ Create nice, neatly and interactive user-friendly graphics interfaces to make groupware more effective.

1.4 Project Scope

CommunityBoard is a system that interacts and deals with target users. The potential or target users of this system are:-

(a) Professional Working User

- To conduct meeting, share ideas or propose design

(b) Educational Users

- As a virtual class room, discussion forum for students

(c) Social Users

- To communicate or contacts friends at different areas

The system boundaries of CommunityBoard include:-

❖ Front-end website for the users

Front end website will include the whole complete set of web pages that are to be viewed by users and administrator. It involves only information sharing as the users are read-only access, they are not allowed to modify anything of the site. Users need to log in the system for further activities such as post and reply message, network whiteboard and etc. All the modifications can only be done by authorized users.

❖ Back-end web-based system for the administrator

Back end will include a web-based system which allows only authorized administrator to maintain the website dynamically. The authorized administrator can update the announcements by maintaining it through this web-based system. Therefore, administrators can maintain the website easily through this web-based system. The entire system will be in the form of menu-driven system.

- ❖ Password protected website for authorizer access for valid user.

This is a password protected website. Only the registered users or administrators can access the website for private used. Authorizers can create their workgroups, maintenance (if user is administrator of the group) and joining the existing group.

- ❖ Real-time interactive and communication

The system enable real-time interactive and communication between each user separated by geographical factors with a network whiteboard. The system also provides a message board and announcement board where user can update information among members.

1.5 Expected Outcome

In today's technology, many are searching for and developing a good and easy system that enables people from all over the world to communicate and work on something together in a world wide network. In this fast paced growth of technology, we speak about efficiency, performance of network and synchronize process in real-time environment with small delay, cost effective, least effort and user friendly.

Thus, the expected outcomes from this project are:-

- ❖ Standard and user-friendly graphical user interface (GUI) displayed by multiple browsers across all web pages.
- ❖ A network whiteboard application which accommodating for multi-user.
- ❖ System transparency. Users only need to utilize this system in their daily work but need not to know the underlying system structure.
- ❖ Smooth and fast enough for data transfer to provide the acceptable response time when users request information from web server.
- ❖ A scalable website which is easy for enhancement and maintenance.
- ❖ A reliable system with minimum errors.
- ❖ The database of this system can be scalable to meet more demand and needs that may grow in the future.

1.6 Project Schedule

A project is a planned undertaking of scheduled activities and managed to reach the goal. Since a project may involve extensive effort, it must be properly managed. Project management is the coordination of all aspects of a project. So that it can be completed under the constraints defined.

For this project, planning is done to:

- ❖ Define the goals
- ❖ Define the allocate resources
- ❖ Establish timetable, schedule work
- ❖ Track and monitoring project
- ❖ Report and document the project

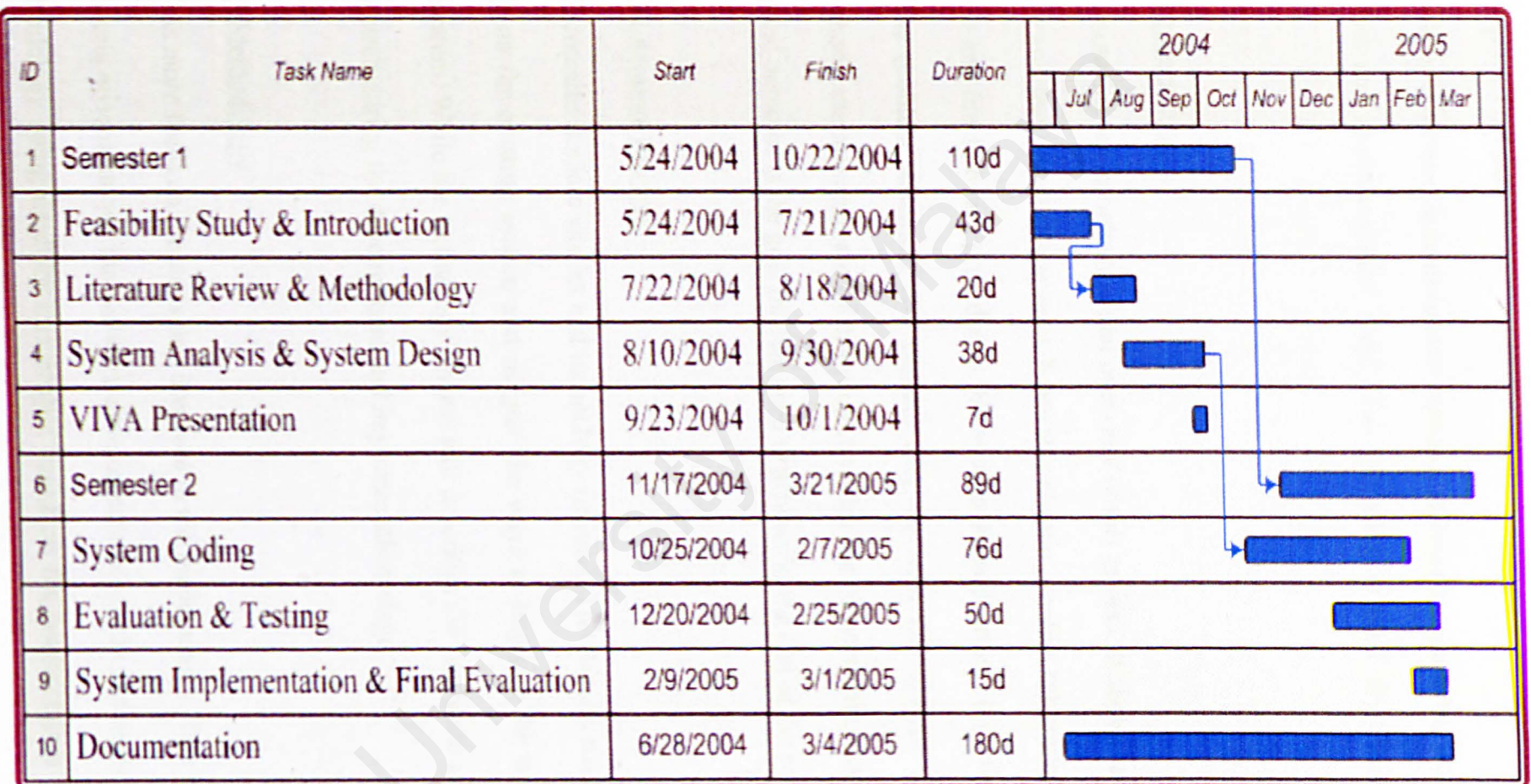


Figure 1-1 : Project Schedule

1.7 Report Layout

The purpose of this report is to document essential information gathering during system development and implementation stage. The following is brief description of each chapter.

Chapter 1 Introduction

Chapter 1 contains the introduction and overview of this project. It shows readers about the surface and features of this system. From this chapter, readers can understand what the features and functions are provided in this system through project objectives, project scopes. The problem statement will explain why we need this system. The project schedule shows the management of this project within the planned tasks and activities. The expected outcome is the goal that we need to achieve at the end of the project.

Chapter 2 Literature Review

Chapter 2 contains domain studies and technology reviews. The domain studies include reviewing on the existing system and suggest the ways to improve the lack of those existing system. While the technology review will describes the hardware and software that being used during the development and implementation stage.

Chapter 3 Methodology

Chapter 3 is more focus on the steps that involved in the methodology. This chapter will do many comparisons among the software development life cycle and lastly getting the best methodology being used for this project based on the consideration from many aspects. Besides, the information gathering process and research strategies that are relevant to the project also been explained briefly in this chapter.

Chapter 4 System Analysis

Chapter 4 is describing the analysis of system requirement based on the information gather during Chapter 3. The system requirement will include functional requirements and non-functional requirements of this system. In addition, the hardware requirements and software requirements for users or developers are list at this stage. During this phase, the decisions for tools and technology to be used to develop this system are made.

Chapter 5 System Design

Chapter 5 covers system designing. During this design phase, the architecture, functionality and the database of this system are designed and explained briefly here. At the end of this stage, the prototypes of this system are designed with the proper interface.

Chapter 6 System Implementation

Chapter 6 covers system implementation. Chapter 6 describes the approaches used in writing codes, scripts languages used to enhance the whole web pages system and algorithms used in implementing the system. The design of the algorithm is important to make sure a stable system to be developed and minimized the problems occur in future enhancement. All the coding, architecture, functionality and the database of this system are designed and explained briefly here. At the end of this stage, the prototypes of this system are designed with the proper interface.

Chapter 7 System Testing

Chapter 7, System testing is one of the important steps in developing a system. Precision and accuracy of output data is considered during this process. Unit, module and integration testing has been carried out for the Community Board System. The objective of a system will only achieve after all the thorough testing done by different user with different aspects.

Chapter 8 System Evaluation

After the system implementation of the system, the end product of the project was brought up for evaluation by End Users. The following section will explain in detail about the system strength, constraints and future enhancements. Besides, there were some problems encountered during and after the process of development for this CommunityBoard system.

Chapter 2 Literature Review

2.1 Domain Studies

Domain studies give an overview of the study done prior to develop CommunityBoard. It presents the information and facts that gathered through many resources like internet, books, and magazines that is relevant and useful for this system.

2.1.1 Definition & Terminologies

This section defines the concept of a groupware with the whiteboard facility. The group management tools are use to create CommunityBoard.

2.1.1.1 Group Management

Group management is a way to organize the activities of a group of people in a workgroup environment. This technique use to manage multi-user participation in a computer-mediated conversation or privacy threading, managing groups of people in proper way are important. More over, collaboration tools have benefited groups of all sizes and types from across the globe.

Group management tries to ensure all users can work in a comfortable environment without having to worry about interruptions, security or privacy threat. Each user can join their own group or community without disturbing other group members, and users are free to creating their own group or community. Through group management skills, users can share exchange and gaining new knowledge through group discussion.

Examples of such applications are whiteboard tools (to exchanging graphic information), audio and chatting (to enhanced communication skills), and message board (to getting latest news).

2.1.1.2 Group ware

Groupware is a technology designed to facilitate the work of groups. This technology may be used to communicate, cooperate, coordinate, solve problems, compete, or negotiate. While traditional technologies like the telephones qualifies as a groupware, the term is ordinarily used to refer to a specific class of technologies relying on modern computer networks, such as email, newsgroups, videophones, or chat. *(Internet reference: 9/8/2004)*

Groupware techniques are typically categorized along two primary dimensions:

- ✗ Place
- ✗ Time

Table 2-1: Category of Groupware Techniques

	Same time “synchronous”	Different time “asynchronous”
Same place “collocated”	voting, presentation support	shared computer
Different place “distance”	video phones, Chat	email, Workflow

2.1.1.3 Whiteboard

In our day-today life, a whiteboard is only a board for writing on, which similar to a chalkboard or blackboard but with a white plastic surface that is written on with erasable marker pens, used in teaching and in giving presentations. This concept of whiteboard has been brought into Information Technology (IT) world.

In the IT environment, a whiteboard is one type of groupware that allows groups of users to share a common, dynamic graphical palette in real time. The current toolkit includes many of the functions found in standalone drawing tools, including the ability to insert text and graphics, choose fonts and colors, fill and infill objects, move objects, and modify them. This is a useful tool for online group discussions where diagrams are needed.

As soon as finish drawing on the whiteboard (and release the mouse button), the new figure appears on everyone's whiteboard. At this point, all connected users can modify this object. The whiteboard always displays the most recently drawn objects. Currently, there is no function that allows anyone to lock an object to prevent others from modifying it but can save it as a figure. It has found wide acceptance as a tool for Computer Supported Cooperative Work. (*Internet reference: 9/8/2004*)

2.1.1.4 Computer Supported Cooperative Work (CSCW)

Computer Supported Cooperative Work (CSCW), also called Computer Supported Collaborative Work is the study of tools and techniques of groupware as well as their psychological, social and organization effects. It is also defined as a generic term, which combines the understanding of the way people work in groups with the enabling techniques. Despite the name, this field of study is not restricted to issues of “cooperation” or “work”, but also examines competition, socialization, and play.

The field typically attracts those interested in software design and social and organizational behavior, including business people, computer scientist, organizational psychologist, communications researchers, and anthropologists, among other specialties. Examples of CSCW tools include group decision support systems, project management tools, electronic conferencing systems, and shared editors. CSCW is another term used to describe work involving the use of computer networks to support cooperative or collaborative work or learning. (*Internet reference: 9/8/2004*)

2.1.1.5 Criteria to Fulfill

CommunityBoard is developed to support multi-user communication with a network whiteboard. Besides, it is essential to build a good relationship between the internet users. These targets can be achieved if the criteria below are fulfilled:

- ❖ The system should perform the smooth and real time environment when using the network whiteboard.
- ❖ The system should support multipoint communication.
- ❖ The system should provide a good security control to protect the information for internet users.
- ❖ The system should perform as a good group management tool.
- ❖ The system should have the efficiency of data storing and retrieving.
- ❖ The system should have different accessibility level for internet users.
- ❖ The system should be menu-driven to achieve the user interfaces friendliness.
- ❖ The system should be a freeware where every internet user can use it without installation fees.

2.1.2 Review of the existing system

(I) CommunityZero.com – <http://communityzero.com/>

CommunityZero is an interactive website that allows a group of people to communicate and exchange information over the Internet in their own private and secure area. Within each area, called an online community, participants are provided access to a suite of powerful tools that enable a group to effectively get organized, share knowledge and communicate.

Advantages

- ✗ Open channel for organization-to-member, and member-to-member communication.
- ✗ Enables user to publish document and real-time chatting.
- ✗ Interfaces are simple and easy to understand.
- ✗ Privacy and information are protected.
- ✗ Free ware and no installation needed.

Disadvantages

- ✗ Do not have whiteboard session.
- ✗ May reveal to garbage workgroup circumstances.

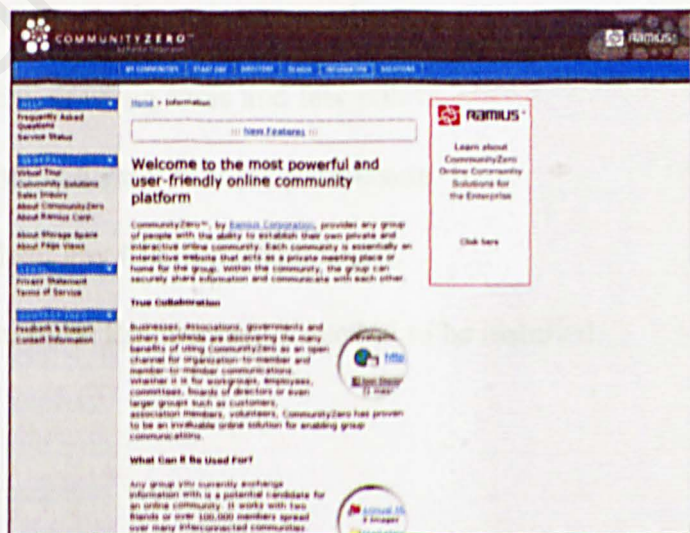


Figure 2-1: Screen Shot for CommunityZero.com

(II) GroupBoard.com – <http://www.groupboard.com>

Interactive website tools for education, **business and fun**. Add chat, whiteboards, games and message boards to user's **site by simply copying** a few lines of HTML code - no downloads or plugins **needed!**

Groupboard is a set of multi-user java applets including whiteboard, chat, message board and games. Users can also run the Groupboard on their own web server. Can be used for distance learning, training, or simply for fun!

Advantages

- ✗ Provide white board, chat room, message board.
- ✗ Can create group based on different interest.
- ✗ Let users identify each others who are online.
- ✗ Can search any existing group board to join.
- ✗ Real-time information sharing.
- ✗ Provided group board search engine.
- ✗ Free ware.

Disadvantages

- ✗ No privacy protection.
- ✗ Any person can be a group member.
- ✗ Only few drawing tools and few colors.
- ✗ Any user can clear without permission.
- ✗ Can't load any file into white board.
- ✗ Java Runtime Environments needed to be installed.



Figure 2-2: Screen Shot for GroupBoard.com

(III) Microsoft Net Meeting

NetMeeting delivers a complete Internet conferencing solution for all Windows users with multi-point data conferencing, text chat, whiteboard, and file transfer, as well as point-to-point audio and video.

Advantages

- ✗ Real-time and multipoint communication.
- ✗ Review, create and update graphic information.
- ✗ Manipulate contents by click, drag, and drop information with mouse.
- ✗ Cut, copy, and paste information.
- ✗ Use different-colored pointers to differentiate participants' comments.
- ✗ Save contents for future references.
- ✗ Loads saved pages, enabling conference preparation, then drag and drop.

Disadvantages

- ✗ Must installation.
- ✗ Not allow to create own group.

(IV) **Yahoo!Groups** – <http://groups.yahoo.com>

This is a website to provide the easiest way for groups of people to communicate on the Internet. They can:-

- ✍ Discuss sports, health, current events, and more
- ✍ Share photos & files, plan events, send a newsletter
- ✍ Stay in touch with friends and family

Advantages

- ✍ Provided most of the workgroup management tools.
- ✍ User friendly interfaces.
- ✍ Consistent interfaces.

Disadvantages

- ✍ No white board provided.
- ✍ User may reveal to spam message or advertisement threats.



Figure 2-3: Screen Shot for Yahoo!Groups

(V) Eteamz.com – <http://eteamz.active.com/company/community/>

Aside from the web site services, eteamz offers an amazing network of partners, experts and members to provide you with the best sports community online.

Advantages

✗ Security control by authentication method.

Disadvantages

- ✗ Processes of registration as member are trouble some.
- ✗ Too many advertisements.
- ✗ Only for sports fans.
- ✗ Lack of group management tools.

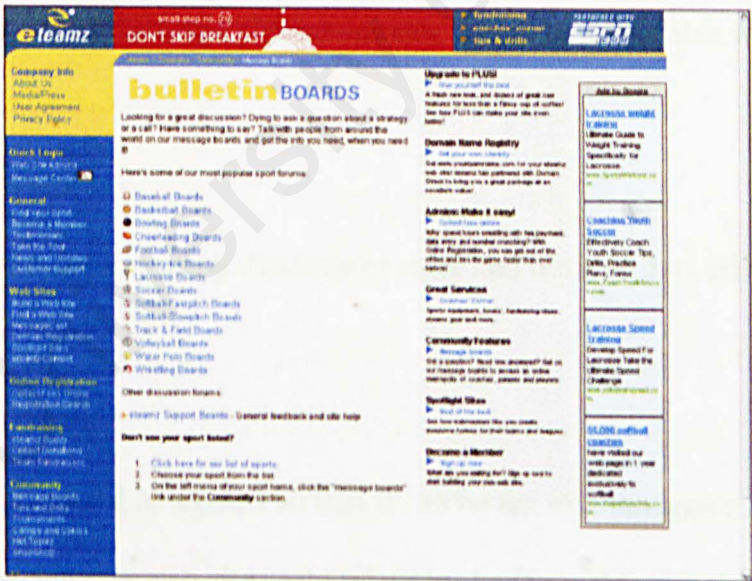


Figure 2-4: Screen Shot for Eteamz.com

2.1.3 Proposed System

Based on the domain studies and analysis that had been done, hence all the weakness of the existing system could be improve in this web-based system. Though the observation, there are many strengths and weakness in the existing sites. Thus, this proposed system try to mitigate the problems occur and combine all the strengths to make this system more attractive. Besides, this system also enhances some new features to make this web site easy to use and user friendly.

Below are the features of the proposed system:

- ❖ Web –based System

This proposed system is a web-based system. It does ensure the accessibility of the Internet users. User with all kind of Operating System and web browser such as Internet Explorer or Netscape Communicator is able to access this web site.

- ❖ Updated Database

The proposed system is using database to store and retrieve data efficiently.

- ❖ Functionality Menu

Main menu is resided in a panel so that it can be act as a navigator for visitors while they are browsing this web site. Administrator has to make sure that all the links are consistent and are resided in every page. Visitors may not lose themselves if the menu and the link are organized based on user friendly.

2.2 Technology Review

Technology review has given a deeper insight of what is required to develop the CommunityBoard. It directs the most effective way to build a good application. It equips with some knowledge of strengths and limitation of development tools.

2.2.1 Operating System Platform

An operating system (sometimes abbreviated as “OS”) is the program that, after being initially loaded into the computer by boot program, manages all the other programs in a computer. The other programs are called applications or application programs. The application programs make use of the operating system by making requests for services through a defined application program interface (API). In addition, users can interact directly with the operating system through a user interface such as a command language or a graphical user interface (GUI).

An operating system performs these services for applications:

- ❖ In a multitasking operating system where multiple programs can be running at the same time, the operating system determines which applications should run in what order and how much time should be allowed for each application before giving another application a turn.
- ❖ It manages the sharing of internal memory among multiple applications.
- ❖ It handles input and output to and from attached hardware devices, such as hard disks, printers, and dial-up ports.
- ❖ It sends messages to each application or interactive user (or to a system operator) about the status of operation and any errors that may have occurred.

- ❖ It can offload the management of what are called batch jobs (for example, printing) so that the initiating application is freed from this work.
- ❖ On computers that can provide parallel processing, an operating system can manage how to divide the program so that it runs on more than one processor at a time.

All major computer platforms (hardware and software) require and sometimes include an operating system. Linux, Windows 2000, VMS, OS/400, AIX, and z/OS are all examples of operating systems. (*Internet reference: 11/8/2004*)

2.2.1.1 Windows XP Professional

Windows XP Professional is a commercial version of Microsoft's evolving Windows operating system. Windows XP Professional is designed to appeal to small business and professional users as well as to the more technical.

Windows XP is the latest version of the Windows desktop operating system for the PC. Microsoft and trade publication writers view Windows XP as the most important version of Windows since Windows 95. Windows XP is built on the Windows 2000 kernel but brings a new, more personalized look to the desktop that will also make it easier for users to scan or import images and to acquire music files on the Web and transfer them to portable devices. The new Windows allows different family members to use their own desktop and personal sets of files. In addition to the "My Computer" and "My Documents" views provided in Windows 2000, Windows XP users see "My Music" and "My Pictures." The Start Menu has been redesigned to make the most-used programs easiest to find. Windows XP comes in a Professional version and a Home Edition version. (*Internet reference: 11/8/2004*)

Windows XP includes a plethora of other enhancements that make it the most reliable Windows yet. Many of these are inherited from Windows 2000:

- ❖ Application compatibility technologies
- ❖ Shutdown Event Tracker
- ❖ Control of unresponsive applications
- ❖ Windows Installer
- ❖ Auto Update, Dynamic Update, and Windows Update
- ❖ Shadow Copy Integration
- ❖ Last Known Good Configuration
- ❖ Automated System Recovery

The features and Benefits of Windows XP Professional:

Hardware Support:

- Supports Universal Serial Bus (USB), an external bus standard that eliminates many constraints of earlier computer peripherals.
- Supports Plug and Play hardware, which Windows XP automatically detects, installs, and configures.

Networking and Communication Services

- Provides built-in support for the most popular network protocols, including TCP/IP and IPX/SPX.
- Provides connectivity with Novell Netware, UNIX, and AppleTalk.

Internet Integration

- Integrates users' desktops with the Internet, thereby removing the distinction between the local computer and the Internet. Users can securely browse the network, Intranet, and Internet for resources, as well as send and receive e-mail messages.
- Windows XP Professional includes Microsoft Internet Information Server (IIS), which is a secure web server platform used to host Internet and Intranet web sites on network servers.

Security

- Authenticates users before they gain access to resources or data on a computer or the network.
- Provides local and network security and auditing for files, folders, printers, and other resources.
- Supports the Kerberos protocol and Public Key Infrastructure (PKI) security.

Integrated Administration Tools

- Provides the means to create customized tools to manage local and remote computers with a single standard interface.
- Provides the means to incorporate third-party administrative tools into the standard interface.

2.2.1.2 Unix

Unix is an operating system that originated at Bell Labs in 1969 as an interactive time-sharing system. Ken Thompson and Dennis Ritchie are considered the inventors of Unix. The name was a pun based on an earlier system, Multics. In 1974, Unix became the first operating system written in the C language. Unix has evolved as a kind of large freeware product, with many extensions and new ideas provided in a variety of versions of Unix by different companies, universities, and individuals.

Partly because it was not a proprietary operating system owned by any one of the leading computer companies and partly because it is written in a standard language and embraced many popular ideas, Unix became the first open or standard operating system that could be improved or enhanced by anyone. A composite of the C language and shell (user command) interfaces from different versions of Unix were standardized under the auspices of the IEEE as the Portable Operating System Interface (POSIX). In turn, the POSIX interfaces were specified in the X/Open Programming Guide 4.2. These interfaces are also known as the "Single UNIX Specification" and, in the most recent version, "UNIX 03"). The trademarked "UNIX" is now owned by The Open Group, an industry standards organization, which certifies and brands Unix implementations.

Unix operating systems are used in widely-sold workstation products from Sun Microsystems, Silicon Graphics, IBM, and a number of other companies. The Unix environment and the client/server program model were important elements in the development of the Internet and the reshaping of computing as centered in networks rather than in individual computers. Linux, a Unix derivative available in both "free software" and commercial versions, is increasing in popularity as an alternative to proprietary operating systems. (*Internet reference: 11/8/2004*)

2.2.1.3 Linux

Linux is a Unix-like operating system that was designed to provide personal computer users a free or very low-cost operating system comparable to traditional and usually more expensive Unix systems. Linux has a reputation as a very efficient and fast-performing system. Linux's kernel (the central part of the operating system) was developed by Linux Torvalds at the University of Helsinki in Finland. To complete the operating system, Torvalds and other team members made use of system components developed by members of the Free Software Foundation for the GNU Project.

Linux is a remarkably complete operating system, including a graphical user interface, an X Window System, TCP/IP, the Emacs editor, and other components usually found in a comprehensive Unix system. Although copyrights are held by various creators of Linux's components, Linux is distributed using the Free Software Foundation's copyleft stipulations that mean any modified version that is redistributed must in turn be freely available.

Unlike Windows and other proprietary systems, Linux is publicly open and extendible by contributors. Because it conforms to the Portable Operating System Interface standard user and programming interfaces, developers can write programs that can be ported to other operating systems. Linux comes in versions for all the major microprocessor platforms including the Intel, PowerPC, Sparc, and Alpha platforms. It's also available on IBM's S/390. Linux is distributed commercially by a number of companies. A magazine, Linux Journal, is published as well as a number of books and pocket references.

Linux is sometimes suggested as a possible publicly-developed alternative to the desktop predominance of Microsoft Windows. Although Linux is popular among users already familiar with Unix, it remains far behind Windows in numbers of users. However, its use in the business enterprise is growing. (Internet reference: 11/8/2004)

Table 2-2: Comparison between Windows 2000, Unix and Linux

Features	Windows XP	Unix	Linux
Compatibility with Web Development Tools	Compatible because it offers many development tools.	Incompatible because it does not offer much development tools.	Less compatible because it does not offer much development tools.
Graphical User Interface	User-friendly	Not user-friendly, too cryptic.	Not user-friendly, too cryptic.
Cost	Cost effective OS, a fully functional Server is running in matter of days.	Not cost effective - the whole OS need to be recompiled with certain modification.	Cost effective because it is freeware.
Security	Vulnerability is low because most of the applications are not truly available in Internet.	Vulnerability is high because distribution of source code is widely available.	Vulnerability is high because distribution of source code is widely available.

2.2.2 Database Management System

Databases used to manage the data for this CommunityBoard system.

2.2.2.1 Microsoft SQL Server

Microsoft SQL Server is a defining release for Microsoft's database products; building in the solid foundation established by SQL Server is the relational database management system (RDBMS) of choice for a broad spectrum of corporate customers and independent software vendors (ISVs). Customer needs and requirements have driven significant product innovations in ease of use, scalability and reliability, and data warehousing. Important areas of leadership and innovation in Microsoft SQL Server include:

- ❖ The first database to scale from the laptop to the enterprise using the same code base, offering 100 percent code compatibility.
- ❖ The first database to support auto-configuration and self-tuning.
- ❖ The first database with an integrated online analytical processing (OLAP) server.
- ❖ The Data Warehousing Frameworks the first comprehensive approach to solving the metadata problem.
- ❖ The first database to provide multi server management for large numbers of servers.
- ❖ Wide array of replication options of any database.
- ❖ Universal Data Access, Microsoft's strategy for enabling high-performance access to a variety of information sources.

2.2.2.2 Microsoft Access 2003

Microsoft Access 2003 is a powerful relational database application that a desktop user can use to efficiently create and manipulate database systems. Microsoft access targets the desktop category and works best for individuals and workshops managing megabytes of data.

As a leader in the desktop database category, Microsoft Access makes it easy for users to find and manage their data. It provides ease-of-use wizards throughout, such as the Database Wizard for getting up and running quickly, and the Simple Query Wizard for easily finding information from the data. The combination of ease-of-use and power in Microsoft Access makes it the top choice among developers who frequently use Microsoft Access as a front-end to SQL Server in a client/server scenario.

With the release of Microsoft Access 2003, users and developers will have the choice of two data engines in the product, an improved version of the existing Microsoft Access engine, called Jet, or the Microsoft Data Engine (MSDE), which is compatible with Microsoft SQL Server 7.0.

MSDE is a data store based on Microsoft SQL Server technology, but it is designed and optimized for use on smaller computer systems, such as a single-user computer or a small workgroup server. Because MSDE is based on the same database engine as SQL Server, most Microsoft Access projects and client/server applications run on either MSDE or SQL Server without modification.

MSDE incorporates technology from SQL Server 7.0 that provides local data storage and offers compatibility with SQL Server. This is similar to Microsoft Jet, the data engine that currently exists in Microsoft Access. Although Access 2003 uses and installs the Jet data engine by defaults, developers who want to develop a single application that is also compatible with Microsoft SQL Server will want to use SQL Server 7.0 features like Data Transformation Services, Microsoft SQL Server OLAP Services, English Query and Parallel Queries.

Advantages of using the Microsoft Access:

- ❖ It is easy-to-use and easy-to-manage database management system.
- ❖ It is a scalable database management system designed specially for distributed client/server computing.
- ❖ It integrates with Windows and Windows-based applications, helping to reduce the cost and complexity of deploying sophisticated applications.

2.2.3 Web Server

A Web server is a program that, using the client/server model and the World Wide Web's Hypertext Transfer Protocol (HTTP), serves the files that form Web pages to Web users (whose computers contain HTTP clients that forward their requests). Every computer on the Internet that contains a Web site must have a Web server program. Two leading Web servers are Apache, the most widely-installed Web server, and Microsoft's Internet Information Server (IIS). Other Web servers include Novell's Web Server for users of its NetWare operating system and IBM's family of Lotus Domino servers, primarily for IBM's OS/390 and AS/400 customers.

Web servers often come as part of a larger package of Internet- and intranet-related programs for serving e-mail, downloading requests for File Transfer Protocol (FTP) files, and building and publishing Web pages. Considerations in choosing a Web server include how well it works with the operating system and other servers, its ability to handle server-side programming, security characteristics, and publishing, search engine, and site building tools that may come with it. (*Internet reference: 11/8/2004*)

2.2.3.1 Internet Information Server (IIS)

IIS (Internet Information Server) is a group of Internet servers (including a Web or Hypertext Transfer Protocol server and a File Transfer Protocol server) with additional capabilities for Microsoft's Windows NT and Windows 2000 Server operating systems. IIS is Microsoft's entry to compete in the Internet server market that is also addressed by Apache, Sun Microsystems, O'Reilly, and others. With IIS, Microsoft includes a set of programs for building and administering Web sites, a search engine, and support for writing Web-based applications that access databases. Microsoft points out that IIS is tightly integrated with the Windows NT and 2000 Servers in a number of ways, resulting in faster Web page serving.

A typical company that buys IIS can create pages for Web sites using Microsoft's Front Page product (with its WYSIWYG user interface). Web developers can use Microsoft's Active Server Page (ASP) technology, which means that applications - including ActiveX controls - can be imbedded in Web pages that modify the content sent back to users. Developers can also write programs that filter requests and get the correct Web pages for different users by using Microsoft's Internet Server Application Program Interface (ISAPI) interface. ASPs and ISAPI programs run more efficiently than

common gateway interface (CGI) and server-side include (SSI) programs, two current technologies. (However, there are comparable interfaces on other platforms.)

Microsoft includes special capabilities for server administrators designed to appeal to Internet service providers (ISPs). It includes a single window (or "console") from which all services and users can be administered. It's designed to be easy to add components as snap-ins that you didn't initially install. The administrative windows can be customized for access by individual customers.

IIS includes security features and promises that it is easy to install. It works closely with the Microsoft Transaction Server to access databases and provide control at the transaction level. It also works with Microsoft's Netshow in the delivery of streaming audio and video, delayed or live. (*Internet reference: 11/8/2004*)

2.2.3.2 Apache

Apache is a freely available Web server that is distributed under an "open source" license. Version 2.0 runs on most Unix-based operating systems (such as Linux, Solaris, Digital UNIX, and AIX), on other UNIX/POSIX-derived systems (such as Rhapsody, BeOS, and BS2000/OSD), on AmigaOS, and on Windows 2000. According to the Netcraft (www.netcraft.com) Web server survey in February, 2001, 60% of all Web sites on the Internet are using Apache (62% including Apache derivatives), making Apache more widely used than all other Web servers combined.

Apache complies with the newest level of the Hypertext Transport Protocol, HTTP 1.1. Free support is provided through a bug reporting system and several Usenet newsgroups. Several companies offer priced support. (*Internet reference: 11/8/2004*)

2.2.3.3 Sun Solaris

Solaris is the computer operating system that Sun Microsystems provides for its family of Scalable Processor Architecture-based processors as well as for Intel-based processors. Sun has historically dominated the large Unix workstation market. As the Internet grew in the early 1990s, Sun's SPARC/Solaris systems became the most widely installed servers for Web sites. Sun emphasizes the system's availability (meaning it seldom crashes), its large number of features, and its Internet-oriented design. Sun advertises that its latest version, the Solaris 8 Operating Environment, is "the leading UNIX environment" today.

Sun emphasizes these features of Solaris:

- ❖ Its availability. Special features make it easy to add new capability or to fix problems without having to restart the system. Because it has evolved through a number of versions, it is "stable" - that is, like IBM's well-known mainframe operating system, MVS, Solaris has exercised and fixed almost any code path that might break. It can be upgraded, monitored, and controlled from a remote console.
- ❖ Its scalability. If you move to a larger processor, your applications should not only run, but run faster.
- ❖ It is built for network computing. As part of the first and most successful Web server system in history, the latest Solaris systems are built on the company's experience with early Web sites and network demands.
- ❖ It includes security features. These include support for IPsec, Kerberos, AMI, and smart cards.

- ❖ Sun provides three extensions for its Solaris operating system:
 - The Easy Access Server, which is designed to run in a network that also has Windows NT systems
 - The Enterprise Server, which is aimed at the "business-critical" environment, and includes support for clustering
 - The Internet Service Provider (ISP) Server

Since Sun originated the platform-independent Java programming language and runtime environment, Solaris systems come with a Java virtual machine and the Java Development Kit (JDK). Solaris replaced SunOS, a system still in use on many Sun machines today. (*Internet reference: 11/8/2004*)

2.2.4 Web Client (Browser)

A browser is an application program that provides a way to look at and interact with all the information on the World Wide Web. The word "browser" seems to have originated prior to the Web as a generic term for user interfaces that let you browse (navigate through and read) text files online. By the time the first Web browser with a graphical user interface was generally available (Mosaic, in 1993), the term seemed to apply to Web content, too. Technically, a Web browser is a client program that uses the Hypertext Transfer Protocol (HTTP) to make requests of Web servers throughout the Internet on behalf of the browser user.

A commercial version of the original browser, Mosaic, is in use. Many of the user interface features in Mosaic, however, went into the first widely-used browser, Netscape Navigator. Microsoft followed with its Microsoft Internet Explorer. Today, these two

browsers are the only two browsers that the vast majority of Internet users are aware of. Although the online services, such as America Online, originally had their own browsers, virtually all now offer the Netscape or Microsoft browser. Lynx is a text-only browser for UNIX shell and VMS users. Another recently offered and well-regarded browser is Opera.

While some browsers also support e-mail (indirectly through e-mail Web sites) and the File Transfer Protocol (FTP), a Web browser is not required for those Internet protocols and more specialized client programs are more popular. *(Internet reference: 11/8/2004)*

2.2.4.1 Microsoft Internet Explorer

Internet Explorer (IE) -- sometimes referred to as Microsoft Internet Explorer (MSIE) -- is the most widely used World Wide Web browser. It comes with the Microsoft Windows operating system and can also be downloaded from Microsoft's Web site. The IE browser competes with an earlier browser, Netscape, now owned by AOL. (As of December 2000, Internet Explorer was the dominant browser in terms of numbers of users and has apparently dominated the browser market. *(Internet reference: 11/8/2004)*)

2.2.4.2 Netscape Navigator

Netscape, now part of America Online (AOL), is one of the two most popular Web browsers. Currently, almost all Internet users use either Microsoft's Internet Explorer (MSIE) browser or Netscape, and many users use both. Although Netscape was initially the predominant product in terms of usability and number of users, Microsoft's browser is generally considered superior by many users (although many other users see them as roughly equivalent) and has taken a significant lead in usage.

Netscape's browser, called "Navigator," was developed in 1995 by a team led by Marc Andreessen, who created Mosaic, the first Web browser that had a graphical user interface, at the University of Illinois' National Center for Supercomputing Applications (NCSA) in 1993.

AOL envisions the Netscape Web site, now transformed into a leading Web portal, as a leading source of revenue through advertising and e-commerce. (*Internet reference: 11/8/2004*)

2.2.5 Programming Technologies and Languages

This section gives an overview of current programming technologies and language that can be used to develop this CommunityBoard.

2.2.5.1 Active X

Active X is a computing technology composed of several different components, each performing a specialized task with common elements that are programmed similarly. Some components add computing power to web pages, others allow document objects to call viewing programs from across the Internet, and others add new capabilities to Web servers. All the components use methods that are, if not capable of being shared among each other, at least similar to each other. All use Object Linking and Embedding (OLE) technology to some degree to perform their tasks and are usually programmed in a language fine-tuned to Windows and OLE, such as Microsoft Visual C++. With Active X technologies, Windows programmers will have a much easier time combining traditional Internet connectivity programs with powerful desktop software packages, and Internet users will find it easier to use the Internet to create business documents and

use Web browsers to perform computing task. These technologies exist today and are being put into use for innovative programs and Web programs that can explore with Internet Explorer and other programs available from Microsoft. Microsoft Active X platform includes a number of technologies and software products that support the Component Object Model (COM) specification. The platform is a number of technical initiatives for controls, scripting, document object and database.

2.2.5.2 ASP.NET (Active Server Page)

ASP.NET (originally called ASP+) is the next generation of Microsoft's Active Server Page (ASP), a feature of their Internet Information Server (IIS). Both ASP and ASP.NET allow a Web site builder to dynamically build Web pages on the fly by inserting queries to a relational database in the Web page. ASP.NET is different than its predecessor in two major ways: it supports code written in compiled languages such as Visual Basic, C++, C#, and Perl, and it features server controls that can separate the code from the content, allowing WYSIWYG editing of pages. Although ASP.NET is not backwards compatible with ASP, it is able to run side by side with ASP applications. ASP.NET files can be recognized by their .aspx extension. (*Internet reference: 11/8/2004*)

ASP.NET are server generated pages, which can call other programs to do things like access databases, serve different pages to different browsers and basically anything we used to do with Common Gateway Interface (CGI). It solves all the problems associated with CGI and server APIs to communicate with other applications running on the server.

ASP.NET is also almost as efficient as writing code directly to the server's application program interface and it is a lot more efficient than CGI because it runs as a service and can take advantage of multithreaded architectures.

2.2.5.3 Java Server Pages (JSP)

Java Server Page (JSP) is a technology for controlling the content or appearance of Web pages through the use of servlets, small programs that are specified in the Web page and run on the Web server to modify the Web page before it is sent to the user who requested it. Sun Microsystems, the developer of Java, also refers to the JSP technology as the Servlet application program interface (API). JSP is comparable to Microsoft's Active Server Page (ASP) technology. Whereas a Java Server Page calls a Java program that is executed by the Web server, an Active Server Page contains a script that is interpreted by a script interpreter (such as VBScript or JScript) before the page is sent to the user. An HTML page that contains a link to a Java servlet is sometimes given the file name suffix of .JSP.

Java Server Pages is a new technology that allows the user to combine markup (HTML or XML) with Java code to dynamically generate web pages. The JSP specification is implemented by several web servers, and plug-ins are available that allow the user to use. JSP supports the same modularity, reusability, platform-independence and access to Java APIs that Java programming supports. This provides developers great advantages to rapidly develop and easily maintain information-rich, dynamic web pages in Java in a more relaxed, script-like environment.

2.2.5.4 Java

Java is a programming language expressly designed for use in the distributed environment of the Internet. It was designed to have the “look and feel” of the C++ language, but it is simpler to use than C++ and enforces an object-oriented programming model. Java can be used to create complete applications that may run on a single computer or be distributed among servers and clients in a network. It can also be used to build a small application module or applet for use as part of a Web page. Applets make it possible for a Web page’s user to interact within a site.

The major characteristics of Java are:

- ❖ The programs that created are portable in a network. Source program is compiled into what Java calls bytecode, which can be run anywhere in a network on a server or client that has a Java Virtual Machine (JVM). The JVM interprets the bytecode into code that will run on the real computer. This means that individual computer platform differences such as instruction lengths can be recognized and accommodated locally just as the program is being executed. Platform-specific versions of your program are no longer needed.
- ❖ The code is robust, meaning that unlike programs written in C++ and perhaps some other languages, the Java objects can contain no references to data external to themselves or other known objects. This ensures that an instruction can not contain the address of data storage in another application or in the operating system itself, either of which would cause the program and perhaps the operating system itself, to terminate or “crash”. The JVM makes a number of checks on each object to ensure integrity.
- ❖ Java is object- oriented, which means that, among other characteristics, an object can take advantage of being part of a class of objects and inherit code that is

common to the class. Objects are thought of as “nouns” that a user might relate to rather than the traditional procedural “verbs”. A method can be thought of as one of the object’s capabilities or behaviors.

- ❖ In addition to being executed at the client rather than the server, a Java applet has other characteristics designed to make it run fast.
- ❖ Relative to C++, Java is easier to learn.

Java was introduced by Sun Microsystems in 1995 and instantly created a new sense of the interactive possibilities of the Web. Both major Web browsers include a JVM. Almost all major operating system developers (IBM, Microsoft, and others) have added Java compilers as part of their product offerings.

The JVM includes an optional just-in-time compiler that dynamically compiles bytecode into an executable code as an alternative to interpreting one bytecode instruction at a time. In many cases, the dynamic Just-In-Time (JIT) compilation is faster than the virtual machine interpretation.

2.2.5.5 JavaScript

JavaScript is an interpreted programming or script language from Netscape. JavaScript is an easy to use object scripting language designed for creating live online applications that link together objects and resources on both clients and servers. JavaScript is designed for use by HTML page authors and enterprise application developers to dynamically script the behavior of objects running on either a client or a server.

JavaScript gives developers the ability to do things such as check form contents, communicate with the user based on their action, and modify the web page dynamically without the webpage being reloaded and without the use of java, plug-ins or Active X controls.

What makes JavaScript special is the way it integrates with the web. JavaScript code is included as parts of a standard HTML document, just like other HTML tags and elements. JavaScript scripts run on the browser and are portable across any browser that includes JavaScript support, regardless of the operating system. JavaScript resides inside the HTML file, and can provide levels of interactivity far beyond typically flat HTML pages. JavaScript also supports functions, again without any special declarative requirements. Functions can be properties of objects, executing as loosely typed methods.

2.2.5.6 Visual Basic

Visual Basic is a Microsoft Windows programming language. Visual Basic programs are created in an Integrated Development Environment (IDE). The IDE allows the programmer to create, run and debug Visual Basic program conveniently. IDEs allow a programmer to create working programs in a fraction of the time that it would normally take to code programs without using IDEs. The process of rapidly creating an application is typically referred to as Rapid Application Development (RAD). Visual Basic is the world's most widely used RAD language.

Visual Basic is derived from the BASIC programming language. Visual Basic is a distinctly different language providing powerful features such as graphical user interfaces, event handling, access to the win32 API, object-oriented features, error handling, structured programming, and etc.

The Microsoft Visual Basic development system version 6.0 is the most productive tool for creating high-performance components and applications. Visual Basic 6.0 offers developers the ability to create robust applications that reside on the client or server, or operate in a distributed n-tier environment.

The benefits of using the Visual Basic 6.0 include:

- ❖ Use of the Visual Basic 6.0 integrated Visual Database Tools and new Data Environment Designer to visually design Oracle and Microsoft SQL Server database and create reusable data access queries-all without learning the VB environment.
- ❖ Build server-side web applications that are easily accessible from any browser on any platform with VB6.0 web classes. Program highly interactive web pages as easily as a Visual Basic form with the new Dynamic HTML Page Designer.
- ❖ Quickly develop rich data forms, or use the new integrated report to develop sophisticated, hierarchical reports- all with drag and drop ease.

2.2.6 System Architecture

2.2.6.1 Client Server Architecture Vs Stand- Alone Architecture

❖ Stand- Alone Architecture

Stand-alone computer is where a computer that **does not connect** to other computer.

The data and programs in a stand-alone computer are not shared with the other computers. The hard disk, printers and other hardware connected to a stand-alone computer can only be utilized through the computer they are connected to and inaccessible to other computer. *(Internet reference: 14/8/2004)*

❖ Client/Server Architecture

A computer in a network can function either as a server computer or client computer according to the role that it plays. Usually the resources (data, program, hardware) to be shared are kept in one particular computer. The other computer that resources to the other computers are called a server computer (server) whereas the other computer that uses the services provided by the server are called the client computer (client). *(Internet reference: 14/8/2004)*

2.2.6.2 Characteristics of Client/Server Architecture

- ❖ Combination of a client or front-end portion that interacts with the user, and a server or back-end portion that interacts with the shared resource. The client process contains solution-specific logic and provides the interface between the user and the rest of the application system. The server process acts as a software engine that manages shared resources such as databases, printers, modems, or high-powered processors.

- ❖ The front-end task and back-end task have fundamentally different requirements for computing resources such as processor speeds, memory, disk speeds and capacities, and input/output devices.
- ❖ The environment is typically heterogeneous and multi vendor. The hardware platform and operating system of client and server are not usually the same. Client and server processes communicate through a well-defined set of standard application program interfaces (API's) and Remote Procedure Calls (RPC's).
- ❖ An important characteristic of client-server systems is scalability. They can be scaled horizontally or vertically. Horizontal scaling means adding or removing client workstations with only a slight performance impact. Vertical scaling means migrating to a larger and faster server machine or multi servers.

2.2.7 Web Editor Tool

Web editor tool is a software application used to create multimedia content typically for delivery on the World Wide Web.

2.2.7.1 Dreamweaver MX

Dreamweaver MX is the latest release from the Macromedia and it has some significant improvements over version 4. It delivers a complete set of tools for creating and managing any professional web site. This powerful development solution combines renowned visual layout tools of Dreamweaver, the rapid web application features of Dreamweaver UltraDev, and the extensive code editing support of HomeSite in one integrated package.

Below are the advantages of Dreamweaver MX:

- It is a powerful tool to create, build and manage websites.
- Built-in reference guides.
- Site setup wizard helps to configure site information instantly.
- Provide the ability to work on multiple sites.
- Integrated workspace shared with Flash MX and Fireworks MX.
- Code validator and built-in validating mechanisms make it easy to check a page.

2.2.7.2 Microsoft FrontPage 2003

Microsoft FrontPage 2003 provides the features, flexibility, and functionality to help to build better Web sites. It includes the professional design, authoring, data, and publishing tools needed to create dynamic and sophisticated Web sites.

Below are the advantages of Microsoft FrontPage 2003:

- Design better-looking sites.
- Generate code faster and easier.
- Extend the Power and Reach of the Web Site.

2.2.7.3 Microsoft Visual Studio .NET 2003

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 2003 Professional enables developer build a broad range of applications for Microsoft Windows®, Web, and the devices rapidly. 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 2003 Professional delivers improved reliability, security, and performance.

Visual Studio .NET 2003 enables you to address today's most pressing application development and deployment challenges, streamline business processes, and realize new business opportunities. The unified Visual Studio .NET 2003 integrated development environment (IDE) and a choice of programming languages—including Microsoft Visual Basic® .NET 2003, Microsoft Visual C++® .NET 2003, Microsoft Visual C#® .NET 2003, and Microsoft Visual J#™ .NET 2003—enable developer to build professional applications .

Chapter 3 Methodology

3.1 Software Development Life Cycle

Systems Development Life Cycle - (SDLC) Any logical process used by a systems analyst to develop an information system, including requirements, validation, training, and user ownership.

An SDLC should result in a high quality system that meets or exceeds customer expectations, within time and cost estimates, works effectively and efficiently in the current and planned Information Technology infrastructure, and is cheap to maintain and cost-effective to enhance.

SDLC is overall process of developing information systems through a multi step process from investigation of initial requirements through analysis, design, implementation and maintenance. There are many different models and methodologies, but each generally consists of a series of defined steps or stages.

A number of system development life cycle (SDLC) models have been created: waterfall, fountain, spiral, build and fix, rapid prototyping, incremental, and synchronize and stabilize.

The oldest of these, and the best known, is the **waterfall**: a sequence of stages in which the output of each stage becomes the input for the next. These stages can be characterized and divided up in different ways, including the following:

- ❖ **Project planning, feasibility study:** Establishes a high-level view of the intended project and determines its goals.
- ❖ **Systems analysis, requirements definition:** Refines project goals into defined functions and operation of the intended application. Analyzes end-user information needs.
- ❖ **Systems design:** Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudo code and other documentation.
- ❖ **Implementation:** The real code is written here.
- ❖ **Integration and testing:** Brings all the pieces together into a special testing environment, then checks for errors, bugs and interoperability.
- ❖ **Acceptance, installation, deployment:** The final stage of initial development, where the software is put into production and runs actual business.
- ❖ **Maintenance:** What happens during the rest of the software's life: changes, correction, additions, and moves to a different computing platform and etc.

The structure imposed by this SDLC is specifically designed to maximize the probability of a successful software development effort. To accomplish this, the SDLC relies on four primary concepts:

- ❖ Scope Restriction
- ❖ Progressive Enhancement
- ❖ Pre-defined Structure
- ❖ Incremental Planning

These four concepts combine to mitigate the most common risks associated with software development efforts.

3.2 Methodology Consideration

The system development methodology is a method to create a system with a series of steps or operations or can be defined as system life cycle model. Every system development process model includes system requirements (user, needs, resource) as input and a finished product as output.

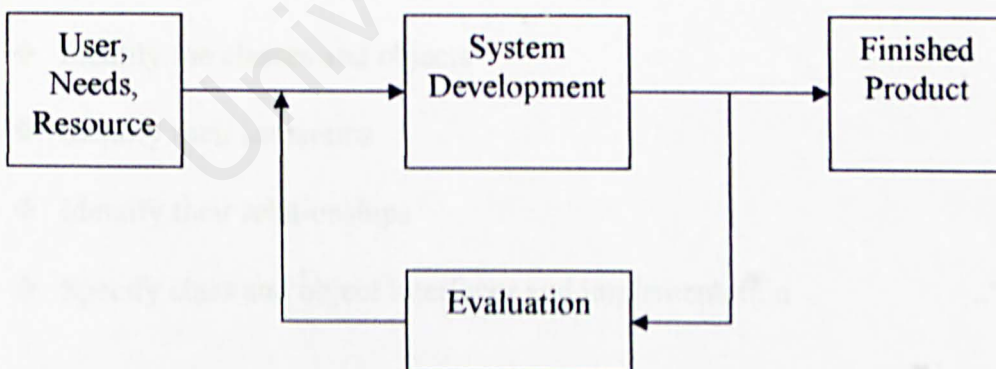


Figure 3-1 System Development Process Model

The main objectives to a system development methodology are to make sure that all objectives progress and problems can be detected during the development. After planning, a process model is identified for the development of this system.

3.2.1 Design Technique Consideration

Object-oriented analysis (OOA) is concerned with developing software engineering requirements and specifications that expressed as a system's object model (which is composed of a population of interacting objects), as opposed to the traditional data or functional views of systems.

Object-oriented design (OOD) is concerned with developing an object-oriented model of a software system to implement the identified requirements. Object Oriented Design is a design method in which a system is modeled as a collection of cooperating objects and individual objects are treated as instances of a class within a class hierarchy.

Four stages can be identified:

- ❖ Identify the classes and objects
- ❖ Identify their semantics
- ❖ Identify their relationships
- ❖ Specify class and object interfaces and implementation

Analysis and design are closer to each other in the object-oriented approach than in structured analysis and design. For this reason, similar notations are often used during analysis and the early stages of design. Design can be thought of :

- ❖ The first, called high-level design, deals with the decomposition of the system into large, complex objects.
- ❖ The second phase is called low-level design. In this phase, attributes and methods are specified at the level of individual objects.

This is also where a project can realize most of the reuse of object-oriented products, since it is possible to guide the design so that lower-level objects correspond exactly to those in existing object libraries or to develop objects with reuse potential. As in OOA, the OOD artifacts are represented using CASE tools with object-oriented terminology.

OOD and OOA can yield the following benefits:

- ❖ maintainability through simplified mapping to the problem domain, which provides for less analysis effort, less complexity in system design, and easier verification by the user;
- ❖ reusability of the design artifacts, which saves time and costs; and
- ❖ productivity gains through direct mapping to features of Object-Oriented Programming Languages

Potential benefits in an OO based development environment:-

- ❖ better modeling of the problem domain (equals happier users)
- ❖ better overall software design with a strong focus on class structure
- ❖ more flexible and maintainable systems through better class partitioning
- ❖ good documentation (the notations) - and a single central overall design notation (the Object Model)
- ❖ a flexible approach to project phasing
- ❖ assistance in tie-ing down requirements, and
- ❖ less work (in the long run)

Object Modeling allows us to focus on exactly what problem we are trying to solve, before look at the best way of implementing the model in a particular programming language.

3.2.2 Methodology Used

Unified Software Development Process or just called Unified Process (UP) is an object-oriented methodology that adopted in the development of CommunityBoard.

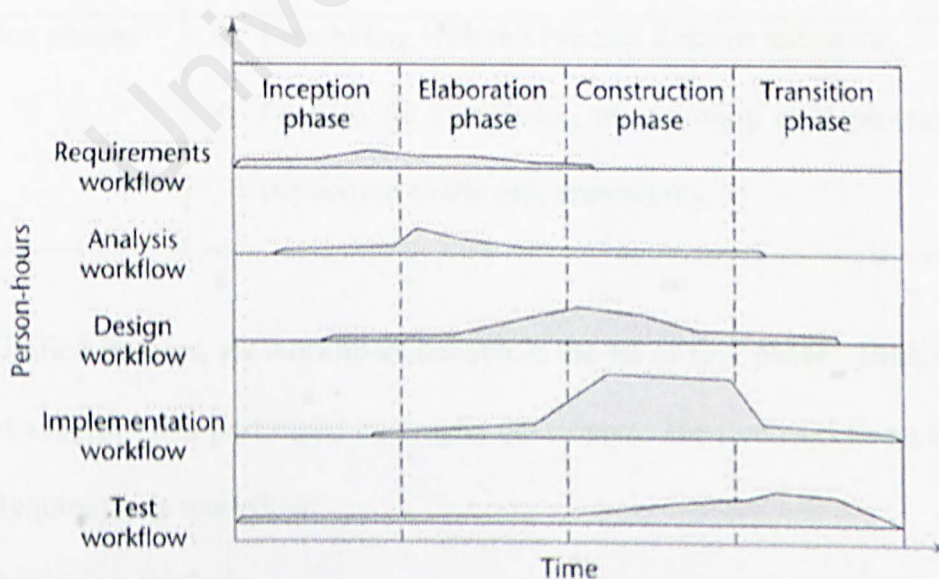


Figure 3-2 : The Core Workflows and the Phases of the Unified Process

Unified Process, each cycle contains four phases which are described in table below:

Table 3-1: Four major phases in Unified Process

Phases	Goal
Inception phases	<ul style="list-style-type: none">❖ Concluding with the project objective milestone.❖ Focuses on establishing the project's scope and vision; that is, establishing the system feasibility of the effort and stabilizing the objectives of the project.
Elaboration phases	<ul style="list-style-type: none">❖ Concluding with the architecture milestone.❖ Focuses on establishing the system's requirements and architecture; that is, establishing the technical feasibility of the effort and stabilizing the architecture of the system.
Construction phases	<ul style="list-style-type: none">❖ Concluding with the Initial Operational Capability milestone.❖ Focuses on completing construction or building of the system.
Transition phases	<ul style="list-style-type: none">❖ Concluding with the Product Release milestone.❖ Focuses on completing transitioning or deployment of the system to the user community.

Within Unified Process, six workflows cut across the set of four phases. Each workflow is a set of activities that performed by project developers. The five workflows are:

- ❖ Requirements workflow
- ❖ Analysis workflow
- ❖ Design workflow

- ❖ Implementation workflow
- ❖ Test workflow

Within each phase are a number of iterations. **Iteration** represents a complete development cycle, from requirements capture in analysis to implementation and testing that result in the release of an executable project.

Why Unified Process?

- ❖ UP provides the detailed steps for going from an idea to a delivered software application.
- ❖ UP is characterized by 3 primary elements that can bring a success to the software development :
 - i. *Use-case driven*
Functional requirements are captured as instructions to a black box.
 - ii. *Architecture Centric*
The environment, tools, and components available are used to avoid re-inventing what already exists.
 - iii. *Incremental and Iterative*
Instead of mandating perfection, the process uses continual iteration to achieve refined excellence.

3.3 Research Methodology

3.3.1 Information Gathering

Effective and appropriate techniques must be used to define and elicit user's requirement. Research methods that usually used are library research, discussion and internet surfing.

❖ Library research

By collecting journals, magazine and news paper related web-based application, security of web-based system, current group board web-based application, and the web technology using nowadays, provided a lot of useful information in my researched.

❖ Discussion

Discussions were held with project supervisor, classmates regarding development system. The discussions help me to understand more about the system requirements, user requirements, and development requirements.

❖ Internet surfing

The last techniques had been used are internet surfing. Through internet surfing, the latest news and information regarding electronic whiteboard group system (or group board system), e-group system and current web technologies.

3.3.2 Research on Existing System

The literature review was done to gather more information about the collaborative tools. The information from the researches of existing Group Management System is needed to overcome the shortages of the current systems. Besides, the pros or advantages of the current system can be reused too or even enhanced in the system in order to develop a better system.

Chapter 4 System Analysis

4.1 System Requirement Analysis

CommunityBoard system is a web-based multimedia system. The system requirements for this whiteboard system can be divided into two categories:

- ❖ Functional requirement
- ❖ Non-functional requirement

4.1.1 Functional Requirement

Functional requirement describe the interactions between the system and its environment. Since the requirements describe a system's behavior, the functional requirements also explain how the system should behave under certain stimuli. The following sub-sections explain the requirements in detail.

4.1.1.1 Group Management Module

4.1.1.1.1 Community

Each user can join their own group or community without disturbing other group members, and users are free to creating their own group or community.

4.1.1.1.2 Message Board

The message board will provide a space where can share exchange and gaining new knowledge through group discussion.

4.1.1.2 Network WhiteBoard Module

4.1.1.2.1 Real Time Drawing Editor

The whiteboard will provide an area for users to draw and display the output. It is a real time environment where every connected user belonging to the same group can see the output on the whiteboard at the same time.

4.1.1.2.2 Drawing Tools

There is variety of drawing tools available in this module. Users can select freehand drawing tools or shape drawing. The basic shape includes rectangle, circle, polygon and so on. Users can select the basic shape and drag it into the drawing area instead of using freehand drawing tools.

4.1.1.2.3 Text Editor

Users can input text into the drawing area as the description of the drawing.

4.1.1.2.4 Eraser Tool

This feature allows users to improve their drawing.

4.1.1.2.5 Color and Drawing Tools Setting

Users can select the color and other setting according to their preference. For example, users can select different pens or brushes to draw. Users are allowed to select different line widths.

4.1.1.2.6 Current Users Section

This section will display all the current users that are using the whiteboard system.

4.1.1.3 Use Case Diagram

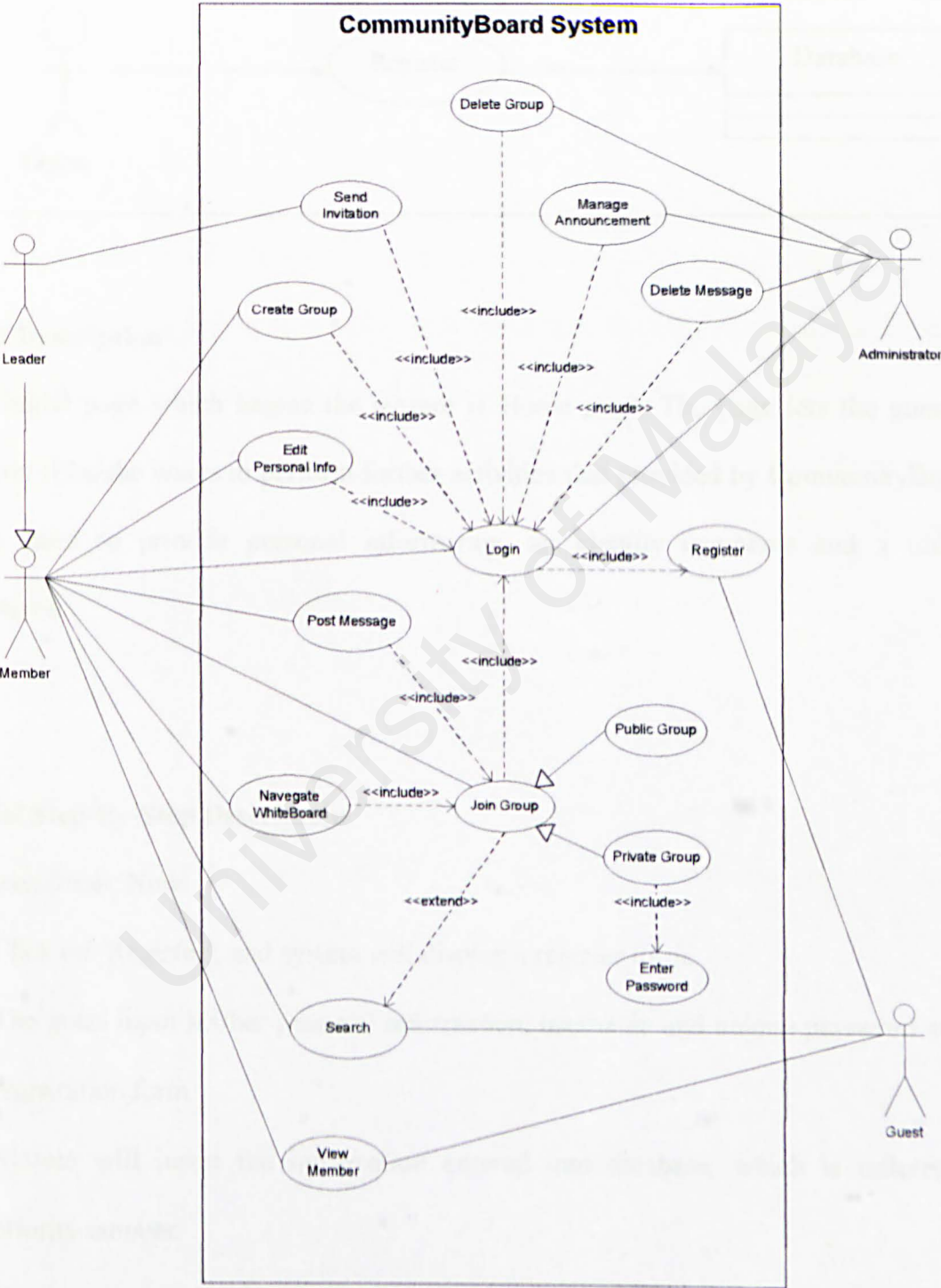
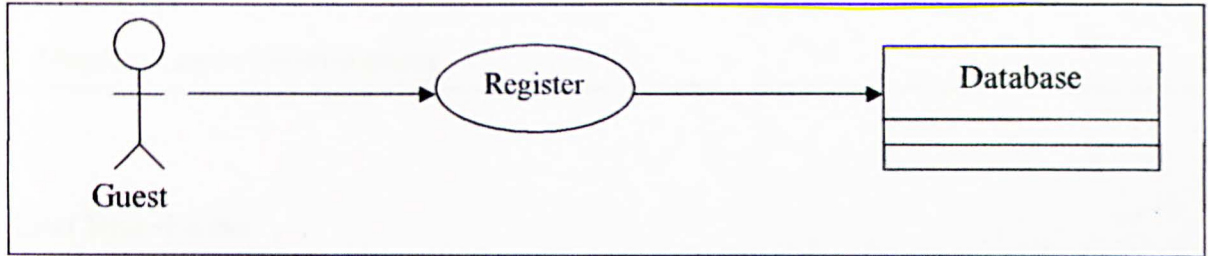


Figure 4-1: Use Case Diagram for CommunityBoard System

4.1.1.4 Functional Requirement Definition

4.1.1.4.1 Register



Brief Description

The initial page which begins the system is Home page. The page lets the guest to register if he/she wants to perform further activities that provided by CommunityBoard. They need to provide personal information, an identity username and a unique password.

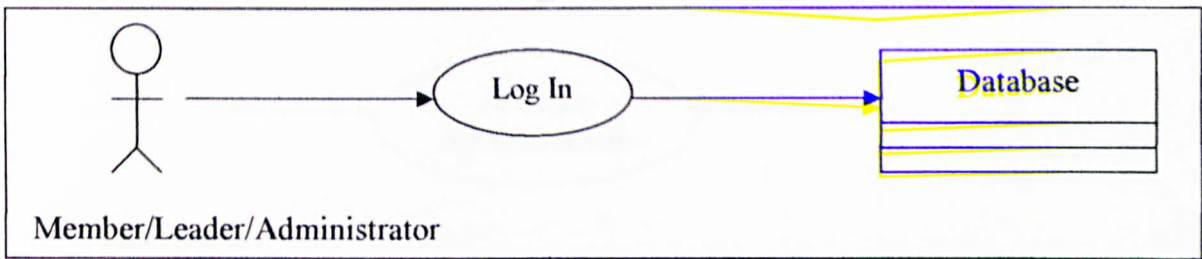
Initial Step-By-Step Description

Pre-condition: None

- 1) Click on 'Register', and system will display a register form.
- 2) The guest input his/her personal information, username and unique password at the registration form.
- 3) System will insert the information entered into database, which is ordered by priority number.
- 4) Database updated and guest is sent to home page for log in purpose.

Post-condition: The guest is now registered to be a member of CommunityBoard.

4.1.1.4.2 Login



Brief Description

The initial page which begins the system is Home page with the login in function. The page lets the user to log in as an authorized member or administrator. Depending on the log in status, the system sends the user in two different directories.

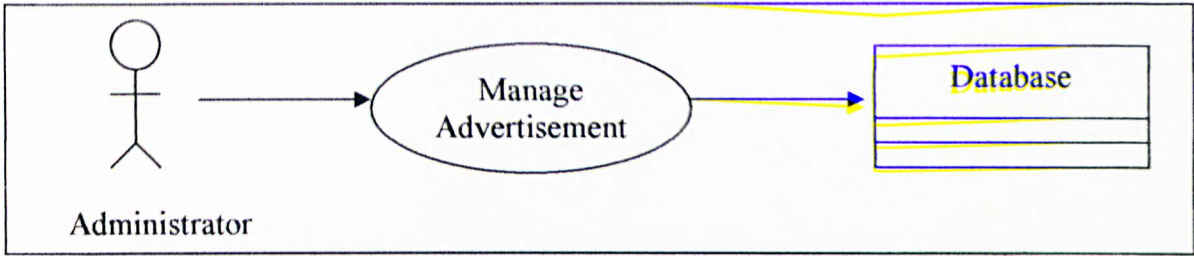
Initial Step-By-Step Description

Pre-condition: The user has already registered

- 1) The user inputs his / her nickname and password into login box.
- 2) When the user finishes the entry, he / she selects “Login” button.
- 3) If Login success, the system will then refresh the page and display username on the top corner.

Post-condition: The user is now authorized to browse the web site.

4.1.1.4.3 Manage Advertisement



Brief Description

Administrators of CommunityBoard are able to update the announcements to communicate with the members. This function will broadcast the important message to members. The announcement will be displayed on Home Page by a marquee function.

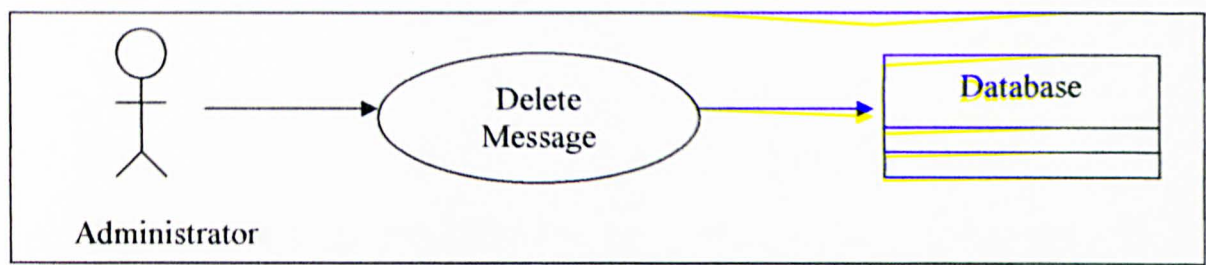
Initial Step-By-Step Description

Pre-condition: The administrator is required to log in.

- 1) Administrator gets into the administrative workspace. He/She can select to manage announcements by click the “Announce” button.
- 2) On select, system will display the workspace to update the announcement.
- 3) Administrator required to fill in the latest announcement to be published and submit by click the “Update” button.

Post-condition: The announcement updated and ready to publish to members.

4.1.1.4.4 Delete Message



Brief Description

Administrators are required to delete unwanted message posted by irresponsible members. These messages are not suitable to be viewed by public or maybe the message is highly inactive for a certain time period. This function will help monitoring user's activities and reduces database burden.

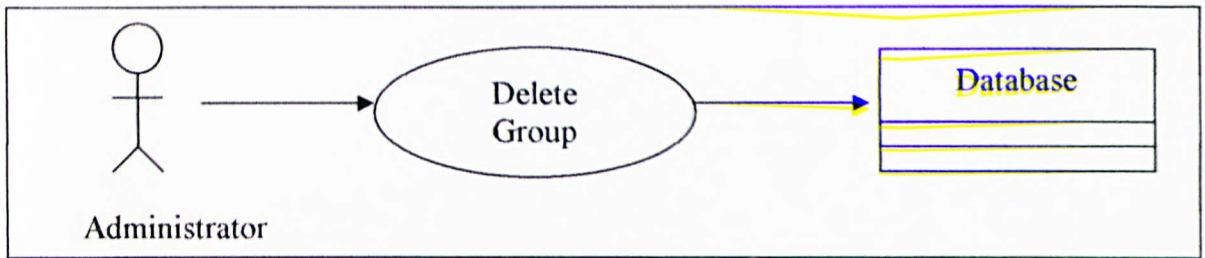
Initial Step-By-Step Description

Pre-condition: The administrator is required to log in.

- 1) Administrator gets into the administrative workspace. He/She can select to delete topics or messages.
- 2) On select, system will display all the required messages items within a certain time period.
- 3) Admin can select the messages which need to be deleted.

Post-condition: The messages database updated and ready to publish to members.

4.1.1.4.5 Delete Group

**Brief Description**

Administrators are required to delete the group which is inactive for a long time period. Only administrators are allowed to delete a group. This function will help monitoring group's activities and reduces database burden.

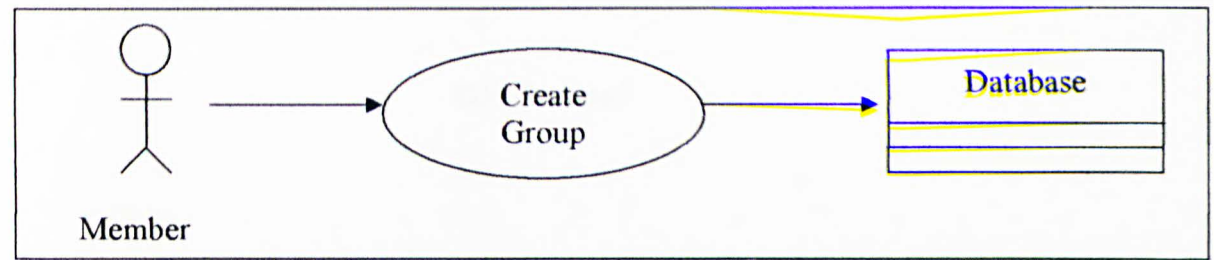
Initial Step-By-Step Description

Pre-condition: The administrator is required to log in.

- 1) Administrator can select to view all the groups.
- 2) Before administrator decides to delete a group, he/she must make announcement to alert the leader first. If the leader still take no action to active the group for a certain time period, admin can delete the group.
- 3) Administrator can select the groups which is inactive for a long time or some groups which is simply created by irresponsible members.

Post-condition: The group deleted and the database updated.

4.1.1.4.6 Create Group

**Brief Description**

Every member has the rights to create a group. Once the group success created, he/she will be the leader of that group. He/ She are required to manage the group properly.

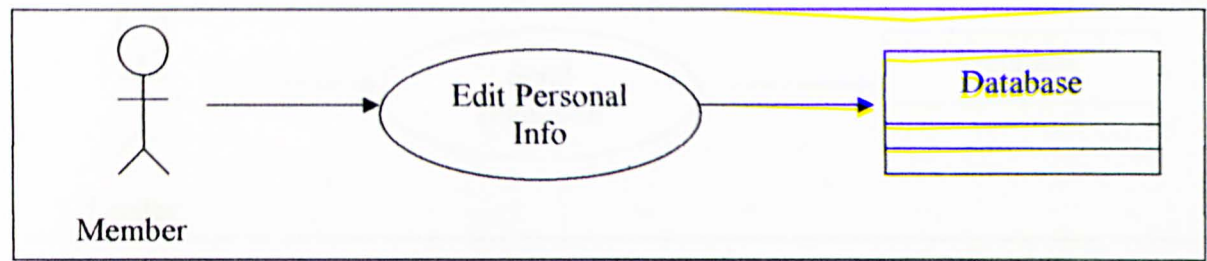
Initial Step-By-Step Description

Pre-condition: The leader or member is required to log in.

- 1) Member can create a group but he/she must be a leader after the group success created. He/She is responsibility to monitor the group properly.
- 2) Once they found some messages that need to be deleted, he/she can email the administrator manually to perform the monitoring task.
- 3) To create new group, member needs to complete the application forms and submit.
- 4) System will precede the application and database will be updated after success.

Post-condition: The group created and the database updated.

4.1.1.4.7 Edit Personal Info

**Brief Description**

Member can edit his/her personal profile. It includes the personal information, contact information, password and so on.

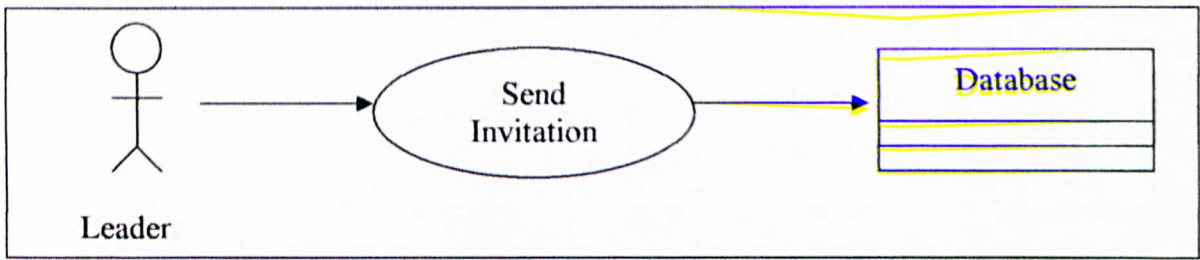
Initial Step-By-Step Description

Pre-condition: The member is required to log in.

- 1) After login, system will display his/her Personal Information at the left corner.
- 2) If he/she wants to edit it, just simply click "Edit Profile", system will display edit form.
- 3) Member is required to make modification and click the update button to submit.

Post-condition: The user profile updated.

4.1.1.4.8 Send Invitation



Brief Description

Leaders can invite his/her friends to join the private group together. Leaders need to complete the invitation form with the email address of their friends. Leaders required transferring the invitation message generated by system to a outlook service. Then send to all the receivers using the outlook services.

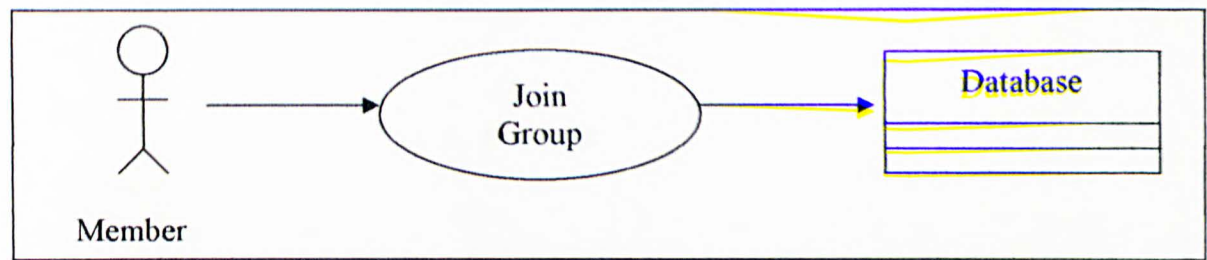
Initial Step-By-Step Description

Pre-condition: The leader is required to log in.

- 1) If members click the Invite button at the private group page, system will display a invitation form.
- 2) Members need to complete it with few email address of the receivers.
- 3) After submit, all the email address will add to invitation list.
- 4) Invitation message generated by system automatic, and leader required to transfer it to an outlook service and send it to all the receivers.

Post-condition: Invitation list updated and email sent using outlook service.

4.1.1.4.9 Join Group

**Brief Description**

Members can join every public group for this system. To join the private group, members need a unique password which is generated during system send the invitation. This is to protect the contents for the private groups.

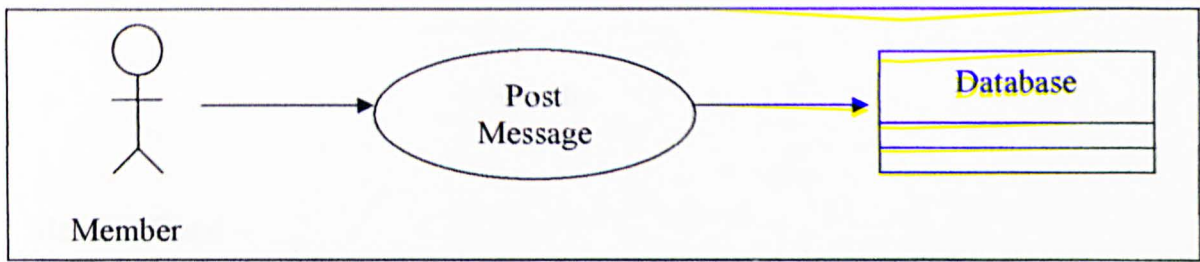
Initial Step-By-Step Description

Pre-condition: The member is required to log in.

- 1) After browse on the group list, members can select a group to join.
- 2) Members just need to click the link for the group, and then the system will verify whether the selected group is a private group or public group.
- 3) If the group is private, system will request the password. Members need to enter the password that received.
- 4) After submit, system will add the entire member to that selected group.
- 5) If the group is public, system will direct precede the membership and add the member into that selected group.

Post-condition: Member joined a group and able to perform all the activities of this system.

4.1.1.4.10 Post Message



Brief Description

Member can communicate with others group members using a message board. He/She can post a new topic or reply to existing topics.

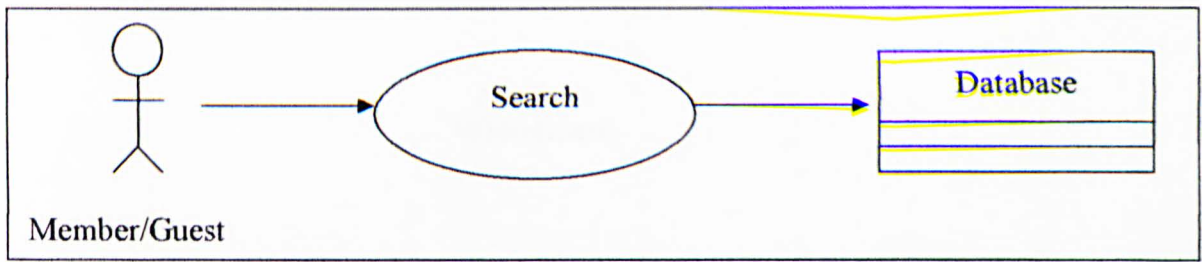
Initial Step-By-Step Description

Pre-condition: The member is required to log in and join a group.

- 1) After join a group, group welcome message is displayed.
- 2) Besides, members are sent to a message board which only belongs to that group.
- 3) Members can select to post a new topic or reply to existing topics.
- 4) System will display a message form, and member needs to complete it and submit.

Post-condition: Message sent to related topics. And database updated and all the messages are ready to display.

4.1.1.4.11 Search

**Brief Description**

Member can search the existing groups, topics or messages by using keyword or created user. The filter will match to the description of each different search items. But if the guest wants to join a group, he/she need to register become a member first.

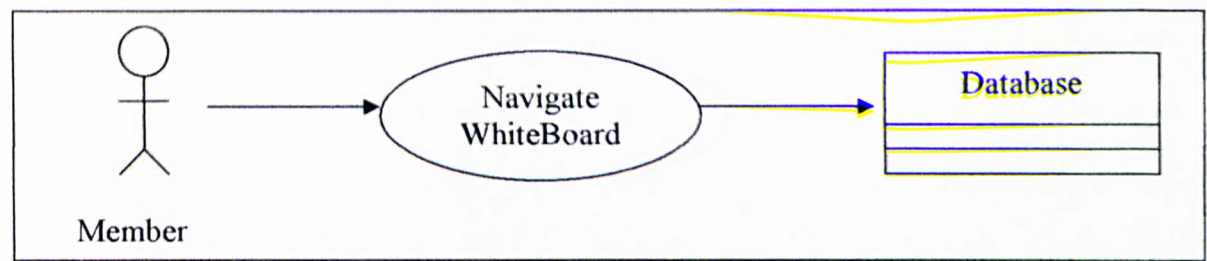
Initial Step-By-Step Description

Pre-condition: None.

- 1) Member or Guest can search the existing groups, topics or messages by using keyword or created user.
- 2) At search page, he/she just needs to enter the keyword and click Search button.
- 3) System will send the filter to database and find the matched results.
- 4) But the guest can not join a group before he/she register as a member.

Post-condition: Matched result displayed.

4.1.1.4.12 Navigate Whiteboard

**Brief Description**

Member can communicate with others group members using a network white board.

He/She can navigate the whiteboard after join the group.

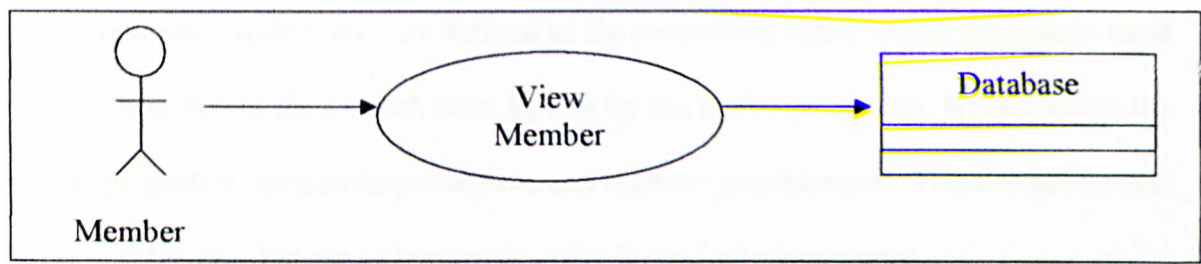
Initial Step-By-Step Description

Pre-condition: The member is required to log in and join a group.

- 1) After join a group, at the group's welcome page, member can click the WhiteBoard button to navigate a group white board.
- 2) Inside the whiteboard, member can draw, erase, save and so on.
- 3) Member also can use the chat room provided by the groupboard service.

Post-condition: Member able to navigate the whiteboard.

4.1.1.4.13 View Member



Brief Description

Inside the whiteboard session, the online group members are displayed. But after member leave the white board system, he/she still can view the member who is online/offline by click the “Member” link on the menu bar.

Initial Step-By-Step Description

Pre-condition: The member is required to log in and join a group.

- 1) Member can direct view that who is online during he/she is in the whiteboard system.
- 2) But after they leave the white board system, they can view the entire member.
- 3) Member can simply send email to others group members by click the displayed email link.

Post-condition: Member able to view online group member.

4.1.2 Non-functional Requirement

Non-functional requirements are defined as the constraints under which the system must operate, and the standard which must be met by the delivered system. It also covers the system properties, such as response time and memory requirements. These requirements are very subjective but are as important as the functional requirement.

4.1.2.1 Inter-Operability

CommunityBoard is able to operate using any web browsers, any operating system platforms and computers from different suppliers. Users have the capability to work together, share data and processes as appropriate through the internet.

4.1.2.2 Scalability

A system is described as scalable if it remains effective when there is a significant increase in the number of resources and the number of users. CommunityBoard is designed with the scalability feature. The whiteboard can accommodate a lot of users at one time.

4.1.2.3 Reliability

A system is said to be reliable if it does not produce dangerous or costly failures when it is used in a reasonable manner, that is, in a manner that a typical user expects is normal. This definition recognizes that a system may not always be used in the ways that the designer expects.

The application system, software and hardware shall be reliable and shall not cause unnecessary and unplanned downtime of the overall environment.

4.1.2.4 User-Friendliness

The design of CommunityBoard and its interface aim to be “friendly” and easily understood. Generally, the design of the whiteboard interface conforms to the following criteria:

- ❖ Consistent, in term of screen design and error messages displayed.
- ❖ Accommodation of any level of user.
- ❖ Appropriate error handling with associated error messages.
- ❖ High degree of understandability.
- ❖ Avoid too much memorization of event and commands.

4.1.2.5 Response Time

The response time to retrieve the latest drawing on the whiteboard has to be within a reasonable interval time. It means that all drawing should be available to users at any point in time.

4.1.2.6 Efficiency

Efficiency in this information technology world means a process or procedure that can be call or accessed in an unlimited of times to produce similar outcomes or output at a creditable speed.

4.2 Hardware Requirements

The development environment can be divided into two main parts:

- ❖ Hardware requirements
- ❖ Software Requirements

The recommended hardware requirements for the development environment are list as the following:

- ❖ IBM compatible PC with a Pentium 166 MMX processor or higher.
- ❖ 64MB RAM or higher.
- ❖ 420MB of hard disk space or higher.
- ❖ SVGA Graphic Adapter.
- ❖ Keyboard and mouse as input devices.

4.3 Software Requirements

The recommended software requirements for the development environment are list as the following:

- ❖ Java Development Kit 1.4.2 as the development kit.
- ❖ Microsoft Visio Studio .NET as the development software.
- ❖ Windows XP as the network operating system.
- ❖ Microsoft Internet Information Server as web server.
- ❖ Any Java –capable web browser.

4.4 Tools and technology to be used

4.4.1 Network Architecture Analysis

Three-tier client-server architecture is chosen to implement CommunityBoard. A single tier host system is not feasible as this web-based system is in a client/server environment a two-tier (client centric or server centric) needs the software to be installed on multiple clients. Three-tier is chosen because of the following advantages:

- ❖ Some upgrades can be done entirely at the server level
- ❖ An increasing number of homogeneous products are available off the shelf pre-made software is cheap.
- ❖ Since only the information to be displayed is sent on the network, there is little network bandwidth compared to the client-centric model. The load may however, be higher between the business logic and data services systems if they are on different servers.
- ❖ Allows for (actually encourages) component-based development, which can increase reusability.
- ❖ Two medium servers are often cheaper than one larger server. The separation of business and data services make two servers an option.

4.4.2 Development Tools Analysis

An analysis was carried out on the development tools for this CommunityBoard system. After reviewing and analyzing the system requirements, the tools for developing the whiteboard have been decided. These tools include the operating system platform, web server, programming language and the development software. Besides considering the suitability of the tools to the system requirements, the tools used must be able to support each other.

4.4.2.1 Operating System Platform – Windows Professional XP

Windows Professional XP discovered to be most appropriate application platform for CommunityBoard system. Windows Professional XP is suitable for businesses of all sizes due to its manageability, reliability and security features.

Advantages of Windows Professional XP are:

- ✗ Currently enjoys a dominant position as the preferred network operation by most corporations.
- ✗ It is based on 32-bit computing architecture and a fully protected memory model.
- ✗ More reliable and more easily recover from system problems.
- ✗ Supports innovative web publishing features, customizable tools and the newer technologies.
- ✗ Windows 95 and Windows 98 not chosen because they are unable to provide web services and do not have a web server's feature.
- ✗ Windows NT4 and Windows 2000 has the features to be server but not selected because Windows Professional XP is more stable.
- ✗ Comprise a user friendly graphic user interfaces (GUI) which make it easy for both consumer and computer professional to use.
- ✗ Linux did have user friendly GUI but it undoubtedly has a much lower usage percentage in market.
- ✗ UNIX was not chosen because it doesn't provide user a proper GUI.

4.4.2.2 Database – Microsoft SQL Server

The Database Management Systems that has been selected in this project is Microsoft SQL Server. Provide data management and analysis solution that will deliver increased security, scalability, and availability to enterprise data and analytical applications while making them easier to create, deploy, and manage.

Advantages of Microsoft SQL Server are:

- ✍ This is a step further by providing dynamic sizing for databases and transaction logs. This means that databases and transactions logs can grow and shrink without requiring any intervention by an administrator.
- ✍ Able to reduce the amount of time required to administrator SQL server. It has many wizards to assist the administrator in his/her work.
- ✍ The amount of RAM used by SQL server can be automatically adjusted on an is-needed basic.
- ✍ Online backups can now take place with 95% throughput rate. This is a big benefit for sites that must be available around the clock.
- ✍ SQL server has a security model that is more tightly integrated with Windows OS Platform.

4.4.2.3 Web Server – Microsoft Internet Information Server (IIS) 6.0

Microsoft Internet Information Services (IIS) 6.0 is chosen to provide a comprehensive web services and it is designed to support multiple web server scenarios ranging from simple sites on a corporate intranet to larger ISP web forms. It can be considered as a high-end enterprise-level server. IIS is considered by experts to be just as powerful as and much easier to set up and maintain than many of its UNIX-based competitors.

Advantages of Microsoft Internet Information Services (IIS) 6.0 are:

- ✍ Its suitability for medium size to large size high volume sizing or corporate web developers looking for ease of use.
- ✍ Its bundled with Windows Operating System Platform and this makes CommunityBoard easy to implement even faced with the limited budget problem.
- ✍ IIS 6.0 is the fastest web server and completely integrated with Windows Professional XP directory service. This combination of web server and OS services makes it possible to deploy scalable and reliable web-based application.
- ✍ IIS 6.0 supports SSL 3.0, which provides a secure communications channel between a browser and server.
- ✍ Accessible since all kinds of browsers can work with it.
- ✍ Allows for hosting multiple sites.

4.4.2.4 Programming Language – Java

Java has been selected as programming languages that develop CommunityBoard system. It standardizes the development and deployment of the kind of secure, portable, reliable, and scalable applications required by the networked economy.

Advantages of Java are:

✍ Distribution of whiteboard on the web

The web is revolutionary medium for the distribution of information whiteboard that are created on the java platform allows anyone with a web browser to access. This means an instant world wide audience and it is a vase important over writing traditional whiteboard.

✍ Multi-User Interaction

The java platform facilitates interaction by multiple users. Java has libraries that support web and internet protocol. Thus, applets running on different computers can communicate with each other via the whiteboard.

✍ Multiple platform

In this case, the whiteboard must cater for the widest possible variety of browsers and client platform. Active X, however, can only be accessed via Microsoft Internet Explorer browser running on 32-bit machines. These are still many trade-off if Active X is used, such as a lack of support for non-Microsoft browser and limited functionality for users of Macintosh and Window 3.1 machines. For this reason, Java appears as the best tools for the whiteboard development because Java supports multiple platforms. In Java environment, a

Java program compiles to bytecode, which is executed by Java Virtual Machine (JVM). Thus, any platform that implements the JVM will be able to run the bytecode. In addition, by using Java's Abstract Windowing Toolkit (AWT), a white board can have appropriate look and feel regardless of the underlying windows system. In concrete terms, this means that the programmers can compile a Java whiteboard once and it will run on any computers that have a Java-enabled browser, such as the Netscape Navigator. The combination of multi platforms support and the world wide distribution over the web gives Java whiteboard the widest possible audience.

✗ Object-Oriented Programming

The Java platform support object-oriented programming. This makes Java a great language to develop CommunityBoard since it helps to manage complexity and code-reuse. Thereby, it helps cutting down development time. The object metaphor is ideal for creating graphics.

✗ Simplicity - Java is viewed as a simple language in several ways.

- First, Java's syntax resembles that of C and C++. Thus, it is not too difficult to learn for C and C++ programmers.
- Second, Java eliminatory features from C and C++ which are redundant or led to poorly written or in secure code. The result is a smaller, simpler language than either C or C++.
- Third, Java makes memory management simple with the elimination of pointers and the use of garbage collection to reclaim unused allocated memory. This reduces common sources of bugs and frustration. The simplicity of Java platform makes whiteboard easier to understand and debug.

4.4.2.5 Web Application Programming Language

Due to the comparison done on the constraints, limitations and advantages of the programming language, it is decided that ASP.NET technology with JavaScript are chosen as main server-side scripting language for this project. The approach choice is due to the fact that it is simple to implement and no extra addition software requirements needed besides Windows XP Professional and Internet Information Server (IIS) 6.0.

4.4.2.6 Web Browser – Microsoft Inter Explorer 6.0

Internet Explorer 6 (IE 6.0) is selected as the web browser of this project. IE 6.0 consist of many new and enhanced features and capable to maintain the privacy of personal information on the Web. Advantages of IE 6.0 are:

- ✗ It incorporates media player in its "media bar" for playing videos and music.
- ✗ IE6 has good support for XML and XHTML.
- ✗ IE comes with a lot of plug-in ready installed.
- ✗ Fault collection services of IE 6.0 help identify potential problems that need to be fixed in future Internet Explorer Service Packs.

4.4.2.7 Web Authoring Tools – Microsoft Visio Studio .NET

The web authoring tool that has been chosen in this project is Microsoft Visio Studio .NET. It is an efficient program as well as allowing working faster and diving into code when needed. Advantages of Microsoft Visio Studio .NET are:

- ✗ It is a powerful tool to create, build and manage websites.
- ✗ Site setup wizard helps to configure site information instantly.
- ✗ Built-in reference guides and simply diving into code when needed

Chapter 5 System Design

5.1 System Architecture

The CommunityBoard system is designed to support multi user communication. This design is based on the client/server architecture, where a central server manages partial actions (events) generated from users to whiteboard and each user runs a client program that interacts with him/her through a Graphical User Interfaces (GUI). Users may connect to the client program and they should be able to communicate with other users.

5.1.1 Adapting Client/Server Architecture to CommunityBoard System

This section discusses in brief detail the basic networking architecture of CommunityBoard system by carrying the client/server approach a step forward and design a complete network whiteboard. As far as concerned about the traditional role of a server strictly providing information to a 'dumb' client. When it comes to a whiteboard, however, the concept of what the clients and servers are responsible for changes some what. For this case, a whiteboard server is responsible for receiving client's (user's) events and dispatches them to the other users. In turn, the clients are responsible for generating and sending the events to the server, as well as updating themselves based on other users events received from the server.

In fact, the design of whiteboard can be divided cleanly into the client side and the server side. These two components are logically separate, communicating entirely through a whiteboard protocol defined between them.

5.1.2 The CommunityBoard's Server

CommunityBoard system is designed to support multi-users. The server side of the whiteboard acts almost like a middleman, managing the different users and helping them communicate effectively. This system is designed to be completely client-driven, all the server will do is echoing any message it receives. Most specifically, a whiteboard server takes on the role of handling the network connection through sockets for each user, along with querying for any responding to events for the users.

The role of the generic whiteboard server can be broken down into the following activities:

1. Initiate the server socket.
2. Create groups of whiteboard.
3. Wait for users to connect.
4. Accept the user connection.
5. Place the users into the group they choose.
6. Manage the flow of the whiteboard and communication each user with other users.
7. Notify the users of the state of the whiteboard.
8. Do garbage collection on users that have disconnected.
9. Go back to step 3.

The most crucial aspect of this series of events is step 2, 5, 6, when the server creates groups of whiteboard to hold the connected users. Thread will be generated to control each connection and each group. This is important because there is no facility to enable clients to communicate with each other and these threads serve as a communications channel between the users involved in the whiteboard.

5.1.3 The CommunityBoard's Client

The client portion of the whiteboard corresponds to the applet being run by each user. Because whiteboard users interact with the client, the client program is usually more important than the whiteboard server in regard to how information is displayed. The basic responsibility of a whiteboard client is to connect to the server and communicate the user's actions along with receiving whiteboard state information from the server and updating graphics and managing the entire whiteboard interfaces for the users.

Strictly from the design perspective, the whiteboard clients actually tend to require the most work. The following is a summary of what functionality the whiteboard client needs to provide:

1. Connect to the server through a client socket.
2. Notify the user of the connection/whiteboard state.
3. Communicate the user's interaction to the server.
4. Receive the other users' interaction from the server.
5. Update the whiteboard with the state receives from the whiteboard server.

5.2 System Functionality Design

5.2.1 Activity Diagram

5.2.1.1 Register

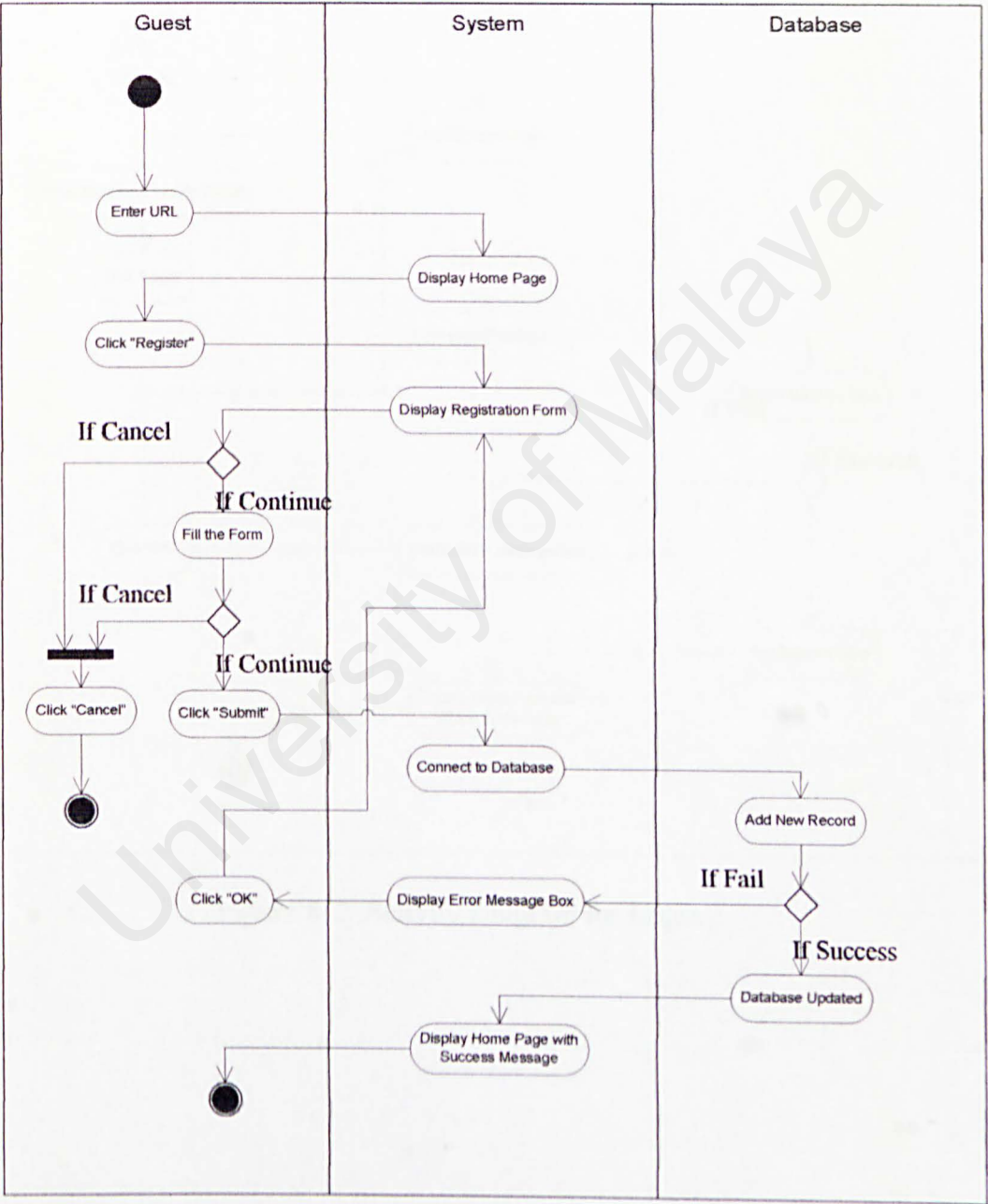


Figure 5-1: Activity Diagram for Register

5.2.1.2 Login

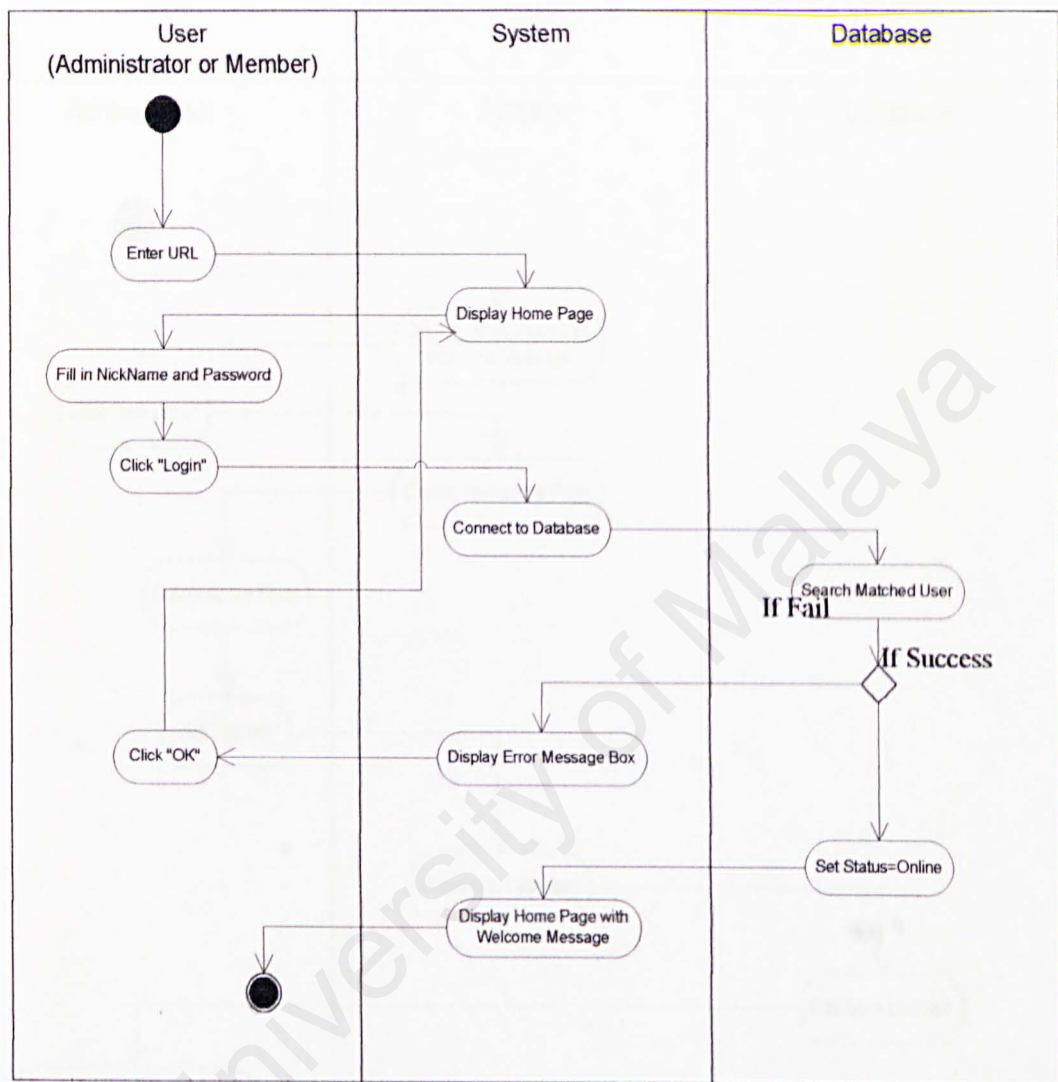


Figure 5-2: Activity Diagram for Login

5.2.1.3 Manage Announcement

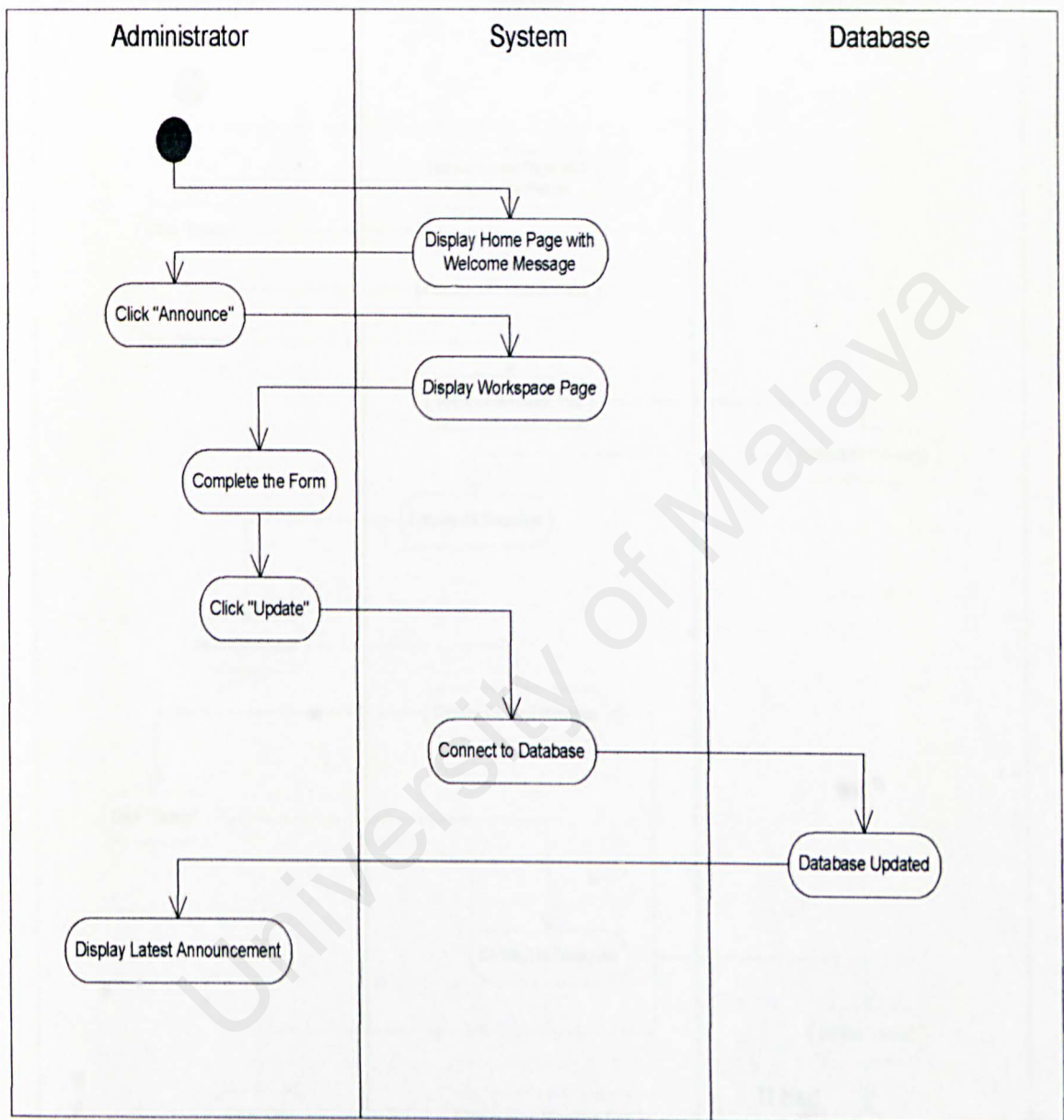


Figure 5-3: Activity Diagram for Manage Announcement

5.2.1.4 Delete Message

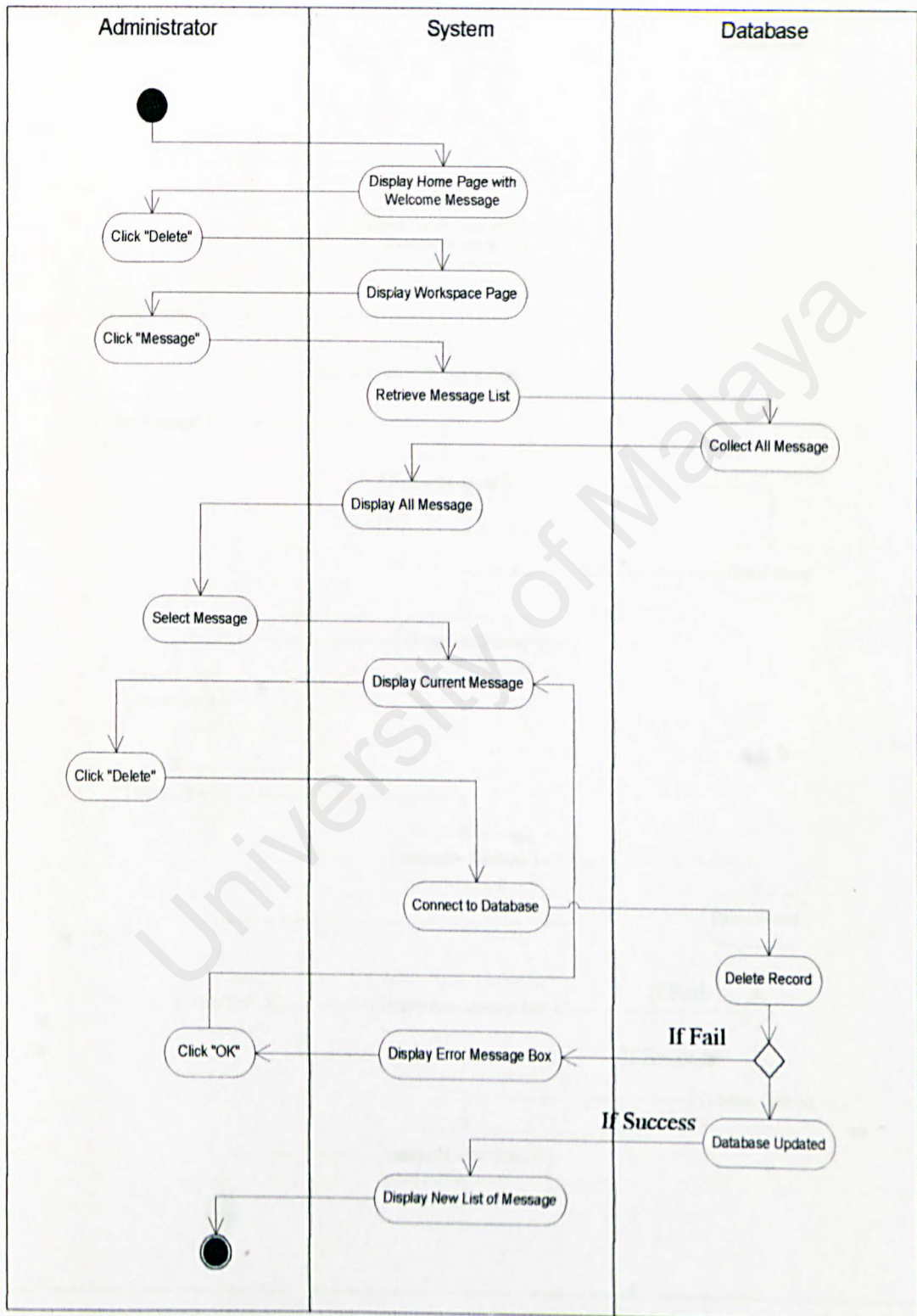


Figure 5-4: Activity Diagram for Delete Message

5.2.1.5 Delete Group

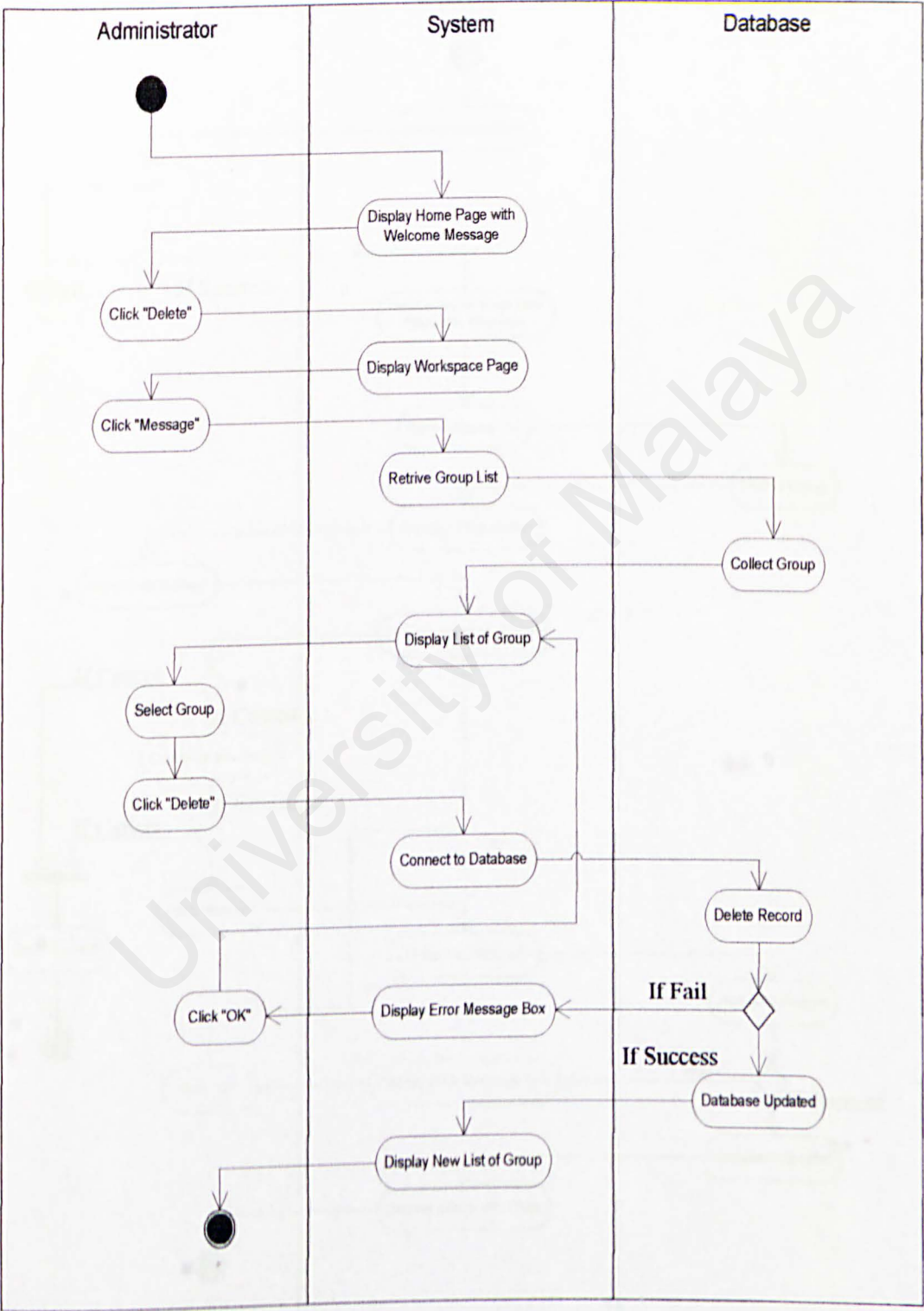


Figure 5-5: Activity Diagram for Delete Group

5.2.1.6 Create Group

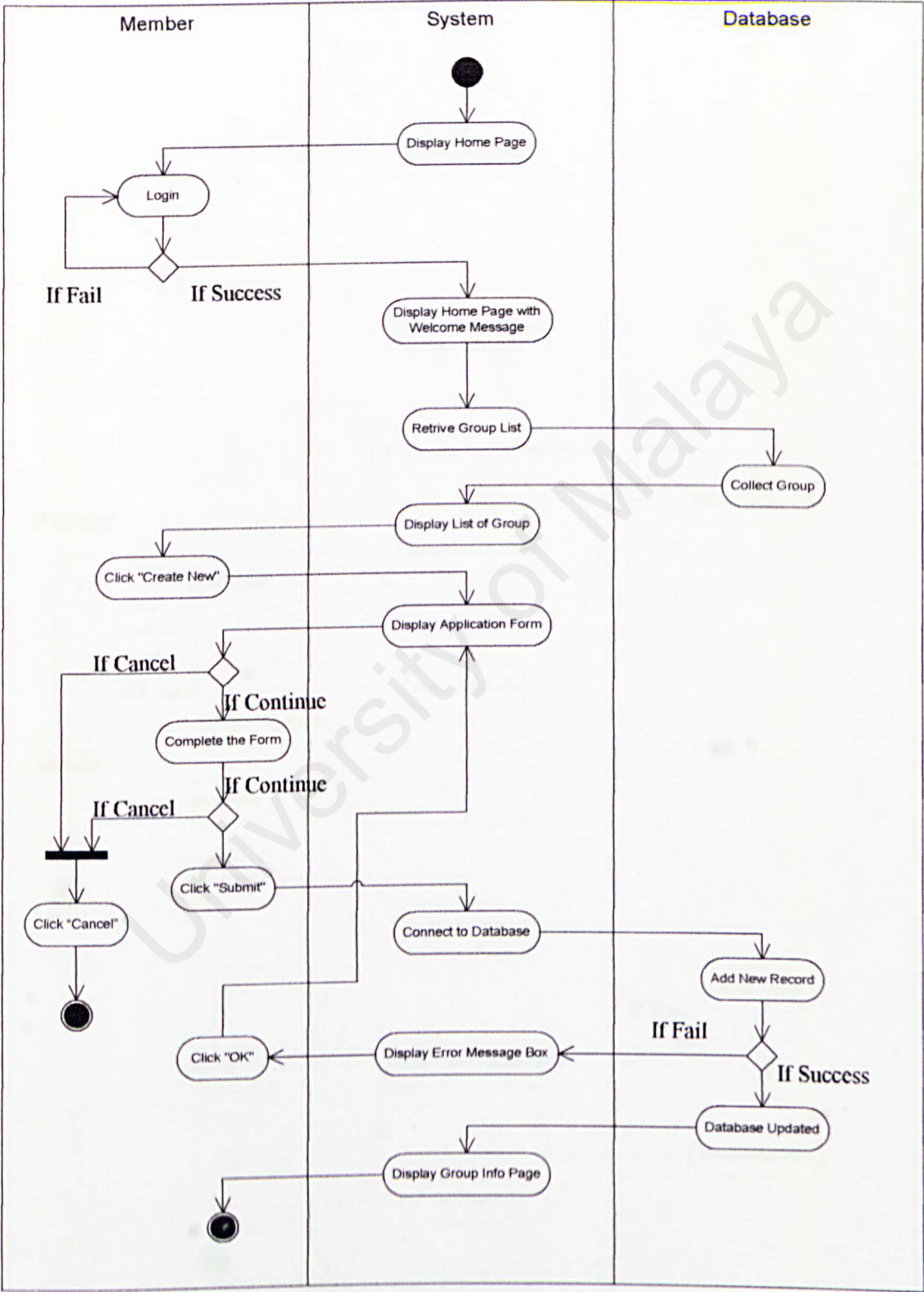


Figure 5-6: Activity Diagram for Create Group

5.2.1.7 Edit Personal Info

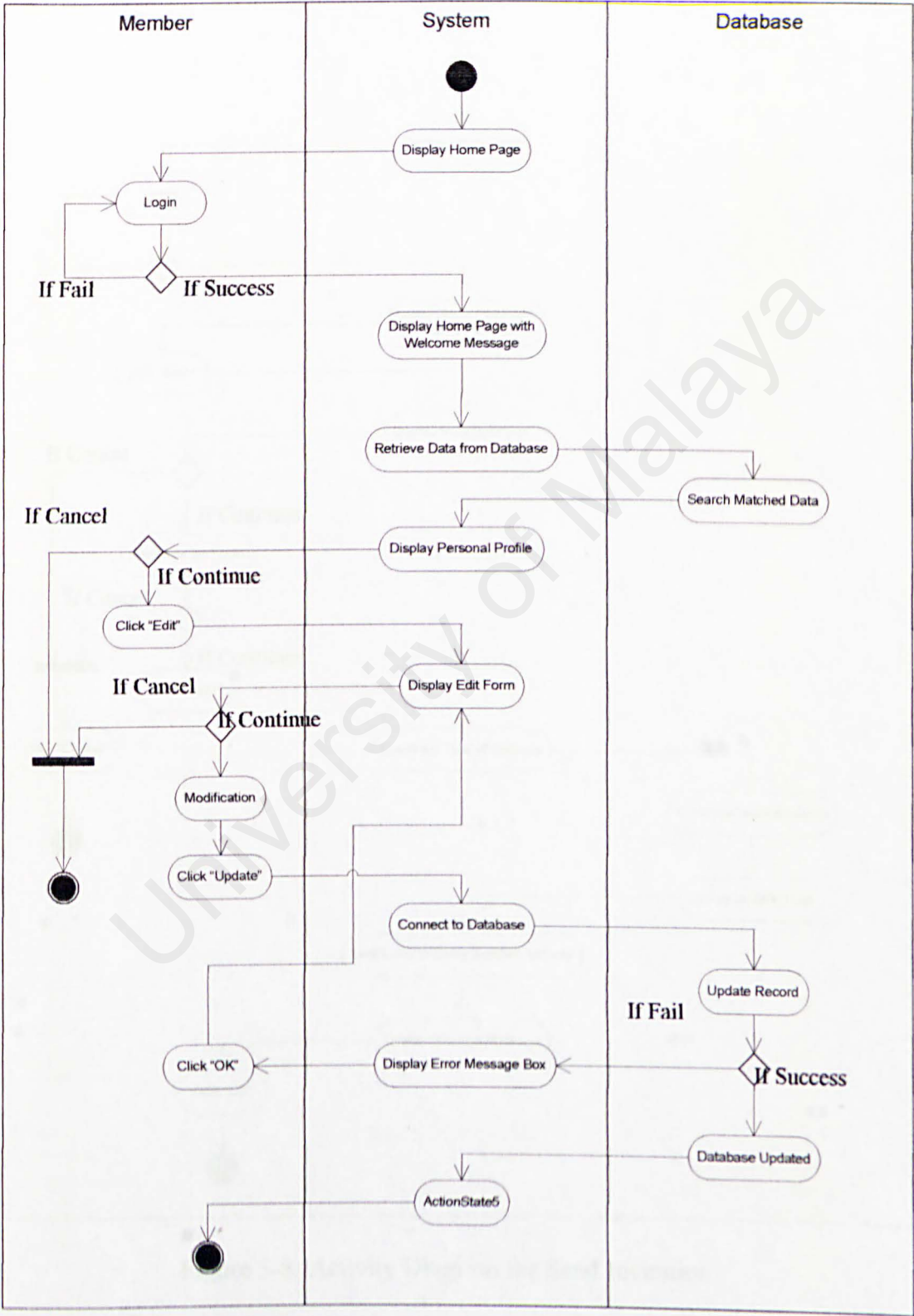


Figure 5-7: Activity Diagram for Edit Personal Info

5.2.1.8 Send Invitation

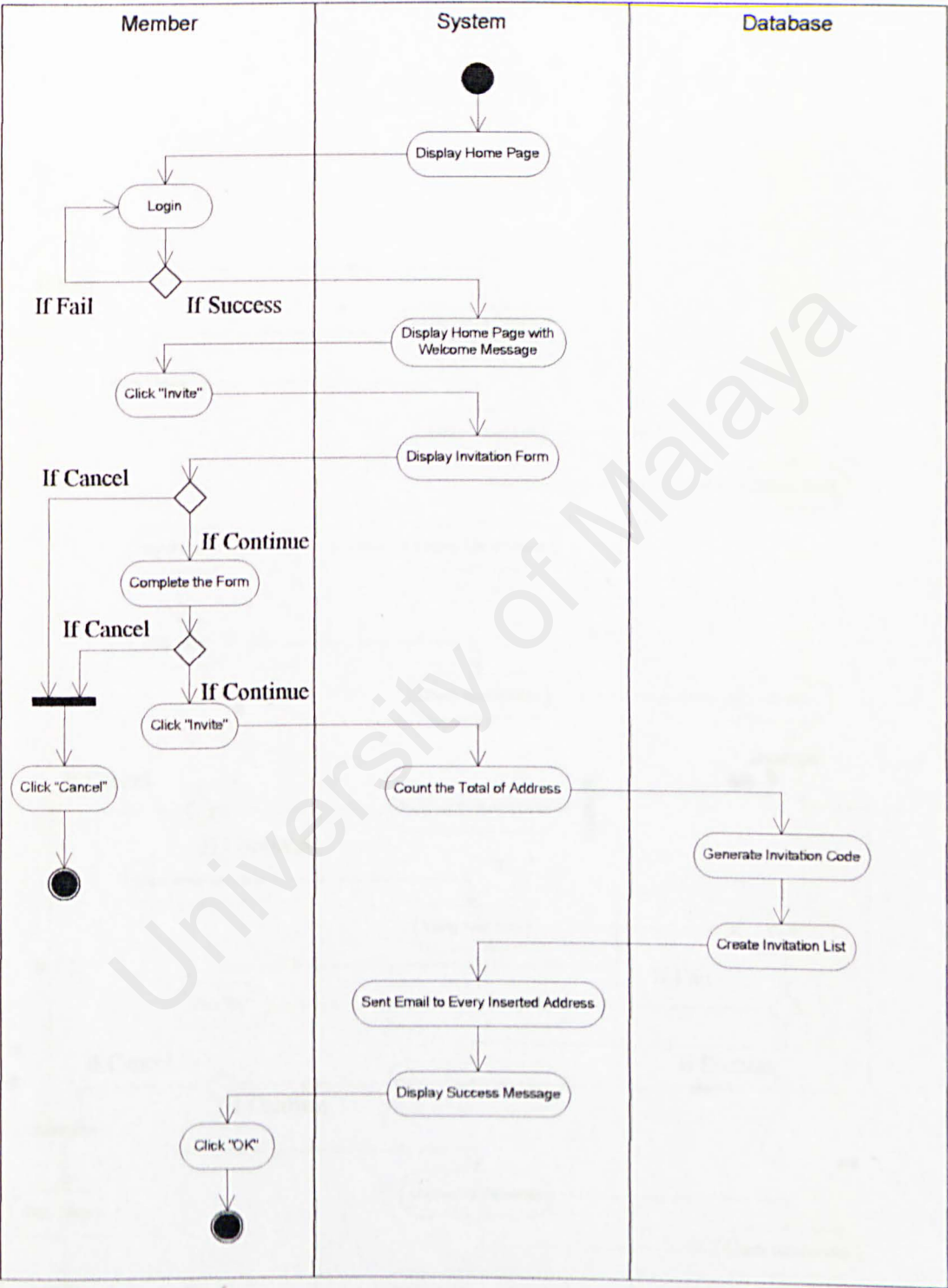


Figure 5-8: Activity Diagram for Send Invitation

5.2.1.9 Join Group

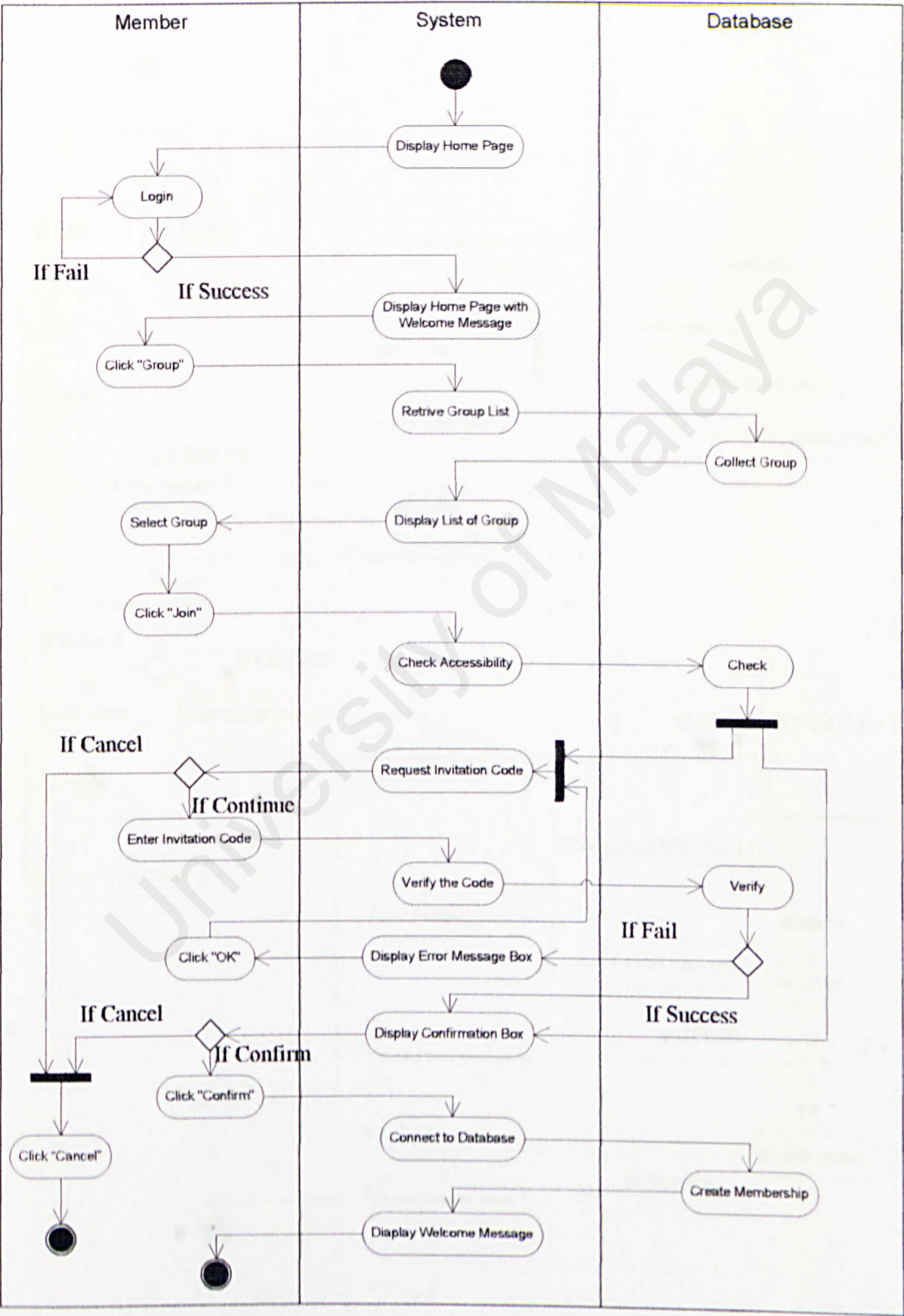


Figure 5-9: Activity Diagram for Join Group

5.2.1.10 Post Message

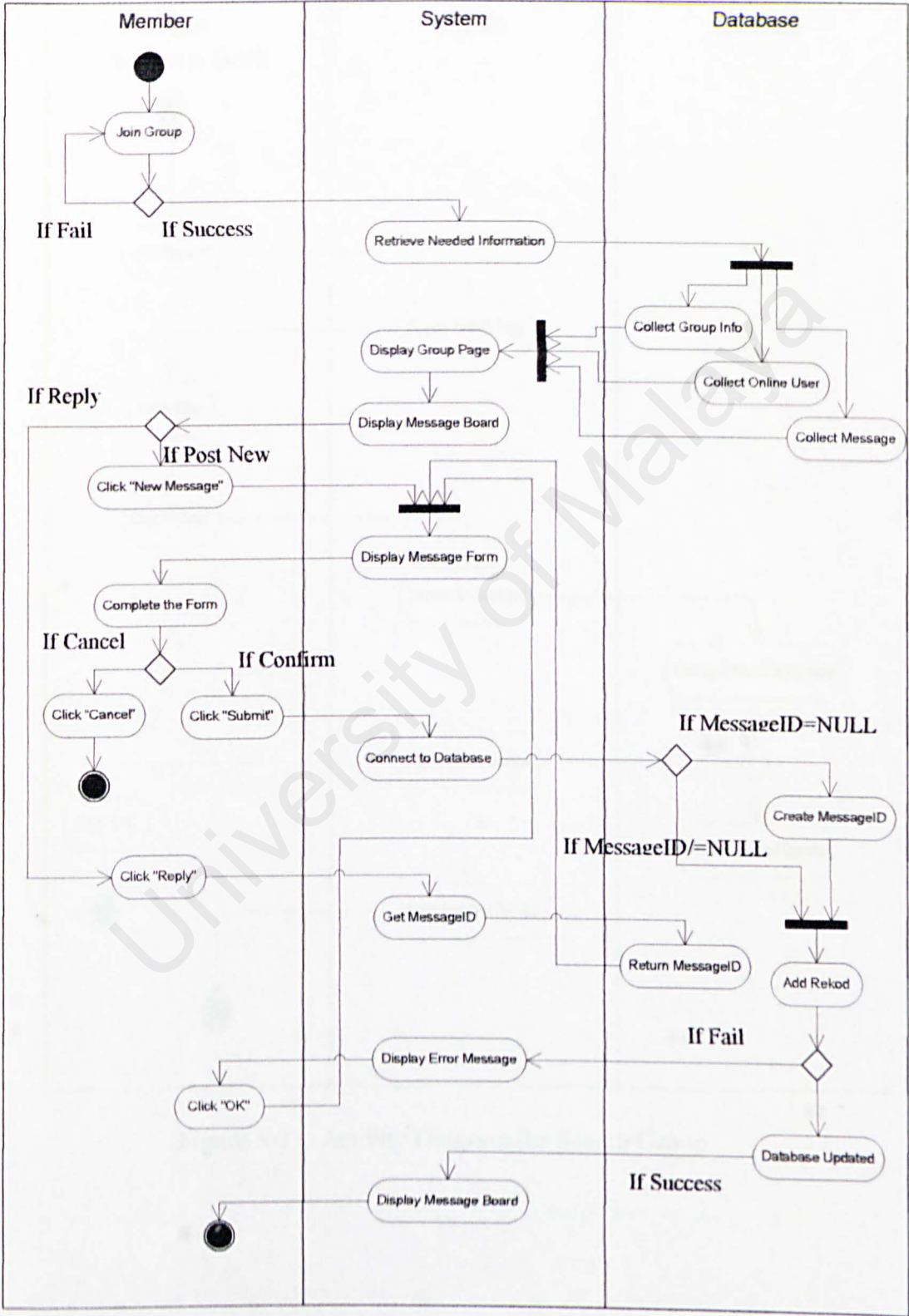


Figure 5-10: Activity Diagram for Post Message

5.2.1.11 Search

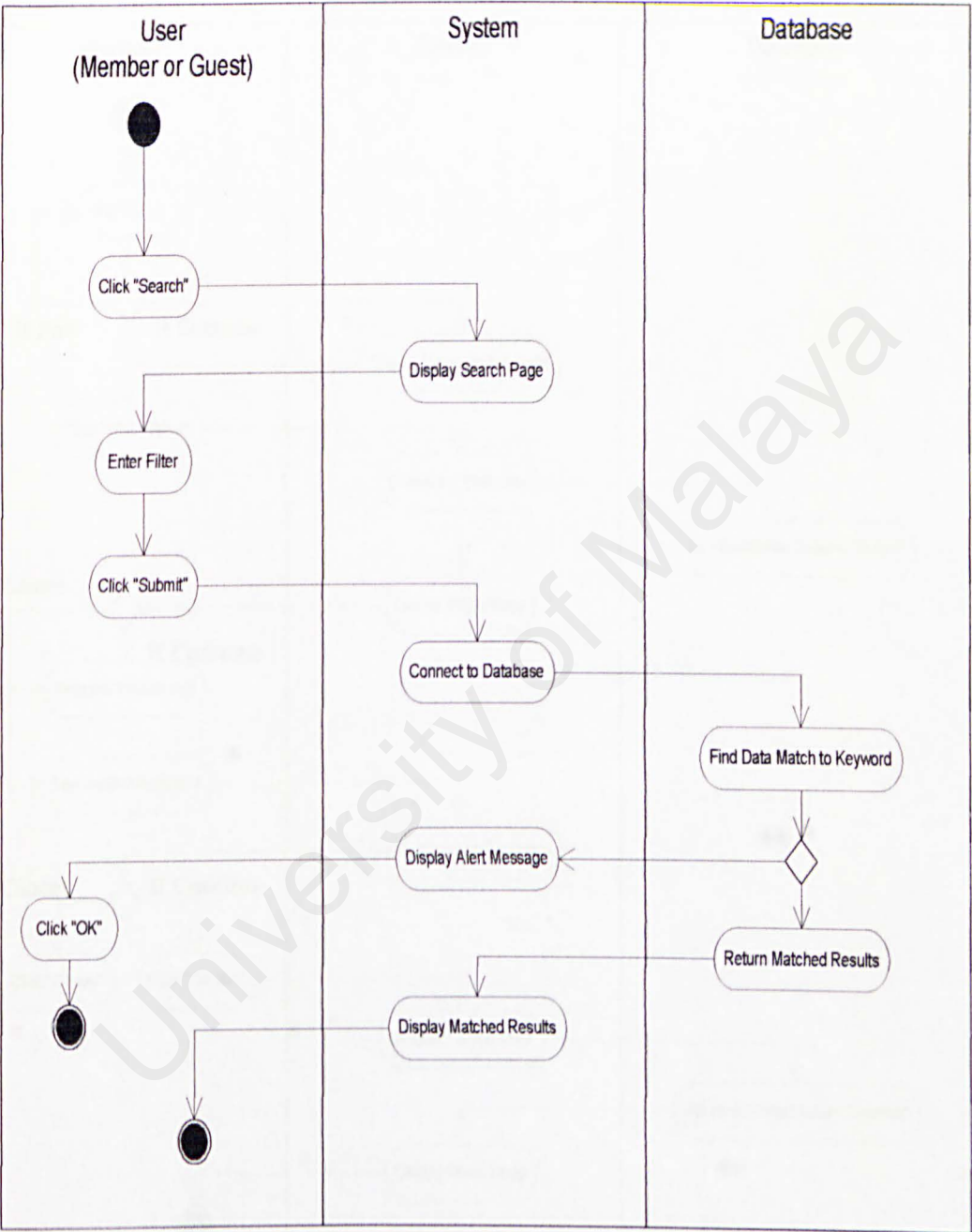


Figure 5-11: Activity Diagram for Search Group

5.2.1.12 Navigate WhiteBoard

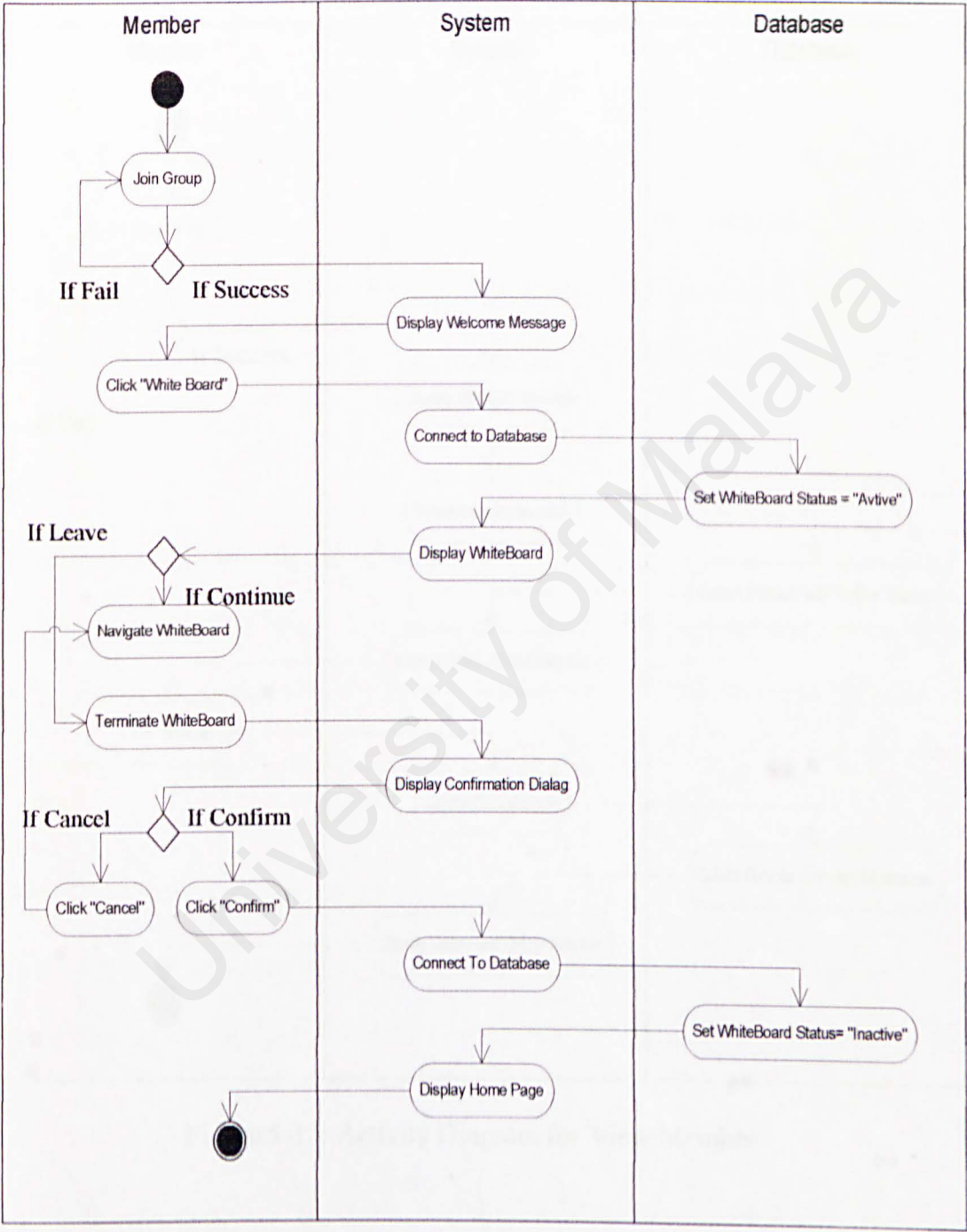


Figure 5-12: Activity Diagram for Navigate White Board

5.2.1.13 View Member

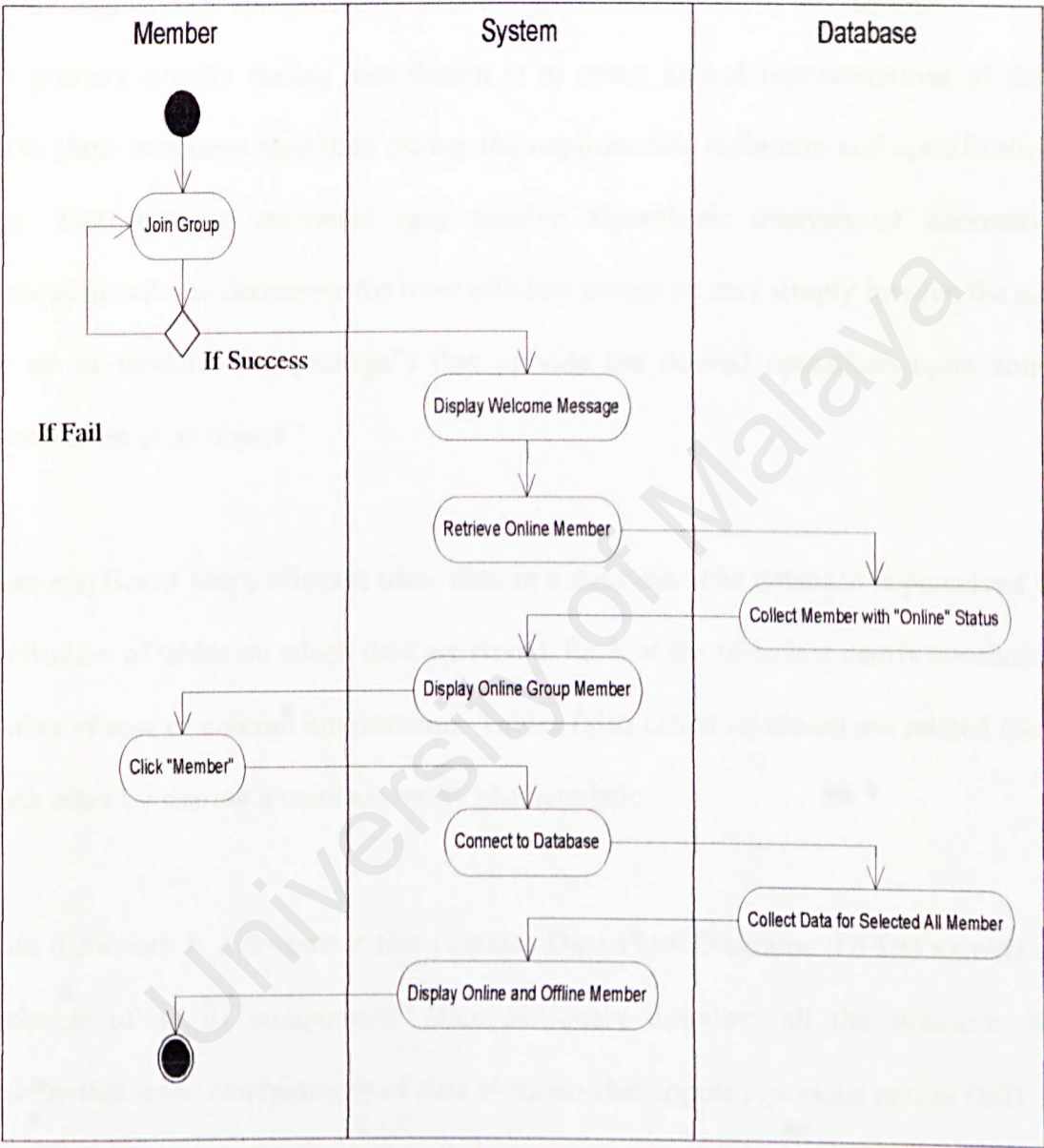


Figure 5-13: Activity Diagram for View Member

5.3 Database Design

Data design is one of the most important design activities that are conducted during software engineering. The process of data design is summarized by Wasserman:

“The primary activity during data design is to select logical representations of data objects (data structure) identified during the requirements definition and specification phase. The selection processes may involve algorithmic analysis of alternative structures in order to determine the most efficient design or may simply involve the use of a set of modules (a “package”) that provide the desired operations upon some representation of an object.”

CommunityBoard keeps relevant users data in a database. The database is perceived to be collection of tables on which data are stored. Each of the table is a matrix consisting of series of row or column intersections. Tables (also called relations) are related back to each other by sharing a common entity characteristic.

A data dictionary is a document that contains Data Flow Diagrams (DFDs) as well as description of all its components. Data dictionary describes all the structures by hierarchy that is the combinations of data elements that appear in various part in DFD.

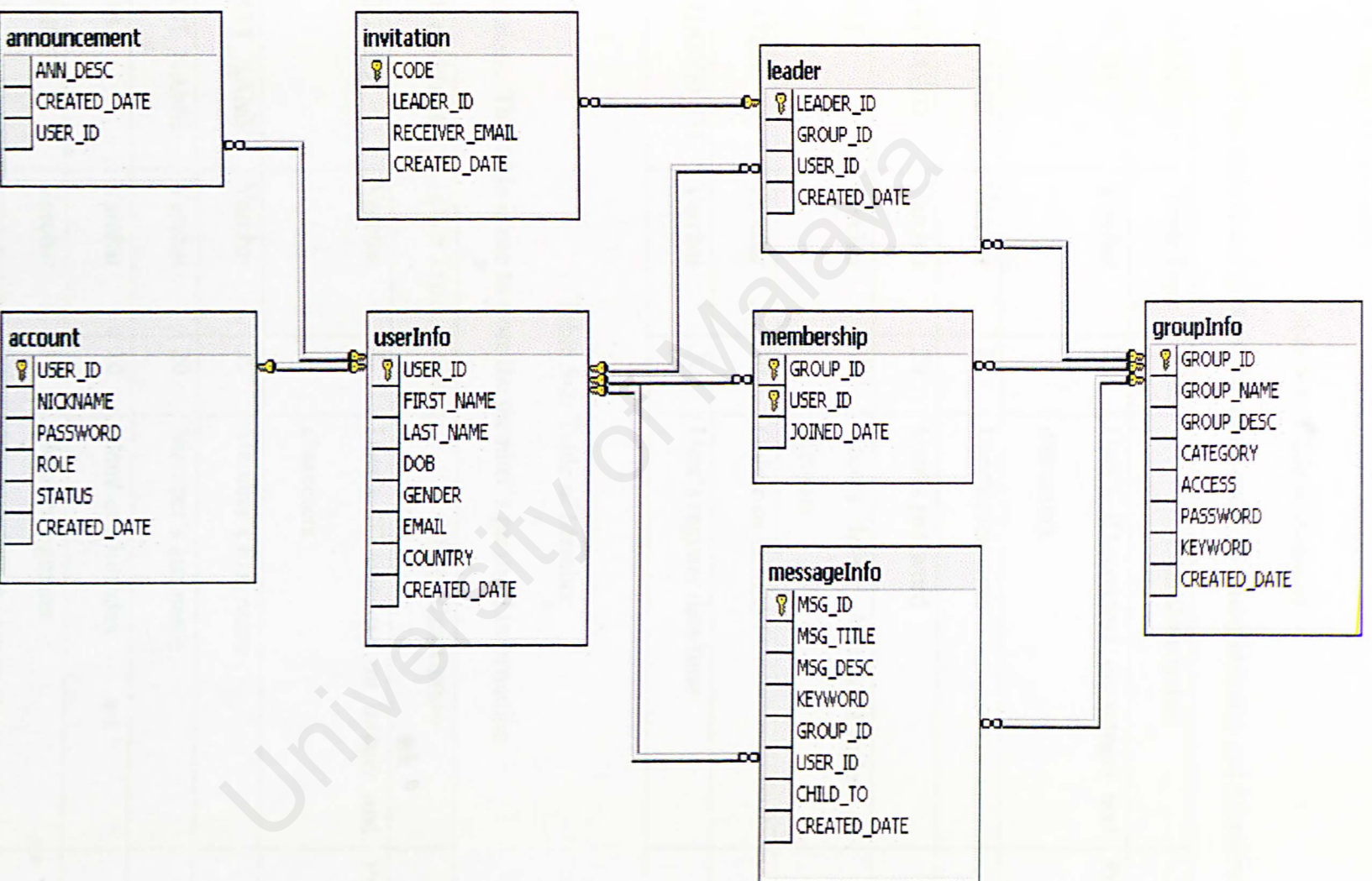


Figure 5-14: Database Relationship Diagram created using Microsoft SQL Server

5.3.1 Data Dictionary

Table 5-1: Table of Account

Functions: This table is use to store the user’s account. (Administrator and Member)

Field Name	Data Type	Size	Data Description	Key
USER_ID	Varchar	8	User’s ID consists on integer and characters.	Primary
NICKNAME	Varchar	20	User’s nickname	
PASSWORD	Varchar	20	User’s password	
ROLE	Varchar	10	Access level: Admin, Leader or Member	
STATUS	Varchar	10	Online or Offline	
CREATED_DT	Varchar	30	User’s register date/time	

Table 5-2: Table of Member

Functions: This table is use to store the member’s personal information.

Field Name	Data Type	Size	Data Description	Key
USER_ID	Varchar	8	User’s ID consists on integer and characters.	Primary
FIRST_NAME	Varchar	20	Member’s first name	
LAST_NAME	Varchar	20	Member’s last name	
DOB	Varchar	10	Member’s birthday	
GENDER	Varchar	10	Member’s gender	
EMAIL	Varchar	30	Member’s email	
COUNTRY	Varchar	30	Where the member from?	
CREATED_DT	Varchar	30	User’s register date/time	

Table 5-3: Table of Announcement

Functions: This table is use to store the announcement which ready to publish.

Field Name	Data Type	Size	Data Description	Key
ANN_DESC	Varchar	500	Announcement's description	
CREATED_DT	Varchar	30	Publish date/time.	
USER_ID	Varchar	8	User's ID consists on integer and characters.	Foreign

Table 5-4: Table of Invitation

Functions: This table is use to store the invitation list.

Field Name	Data Type	Size	Data Description	Key
CODE	Varchar	8	ID of Invitation List.	Primary
LEADER_ID	Varchar	8	Leader's ID which user to detect invitation to which group	Foreign
RECEIVER_EMAIL	Varchar	30	Receiver's email.	
CREATED_DT	Varchar	30	Invitation date/time.	

Table 5-5: Table of Membership

Functions: This table is use to store the involvement member for each group.

Field Name	Data Type	Size	Data Description	Key
GROUP_ID	Varchar	8	Group's ID	Primary
USER_ID	Varchar	8	User's ID	Primary
JOINED_DT	Varchar	30	Date/time when user join group.	

Table 5-6: Table of Group

Functions: This table is use to store the group's information.

Field Name	Data Type	Size	Data Description	Key
GROUP_ID	Varchar	8	Group's ID consists on integer and characters.	Primary
GROUP_NAME	Varchar	50	Name of the group.	
GROUP_DESC	Varchar	500	Description of the group.	
CATEGORY	Varchar	10	Category of group.	
ACCESS	Varchar	10	Private or Public	
PASSWORD	Varchar	20	Password for Private Group.	
KEYWORD	Varchar	50	Keyword for search purpose.	
CREATED_DT	Varchar	30	Date/time when group created.	

Table 5-7: Table of Leader

Functions: This table is use to store the member's who is a leader.

Field Name	Data Type	Size	Data Description	Key
LEADER_ID	Varchar	8	Leader's ID consists on integer and characters.	Primary
GROUP_ID	Varchar	8	Group's ID	Foreign
USER_ID	Varchar	8	User's ID	Foreign
CREATED_DT	Varchar	30	Date/time start to be a leader.	

Table 5-8: Table of Message

Functions: This table is use to store the posted messages and topics.

Field Name	Data Type	Size	Data Description	Key
MSG_ID	Varchar	8	Message's ID consists on integer and characters.	Primary
MSG_TITLE	Varchar	80	Title of the message	
MSG_DESC	Varchar	500	Description of the message	
KEYWORD	Varchar	50	Keyword for search purpose.	
GROUP_ID	Varchar	8	Group's ID	Foreign
USER_ID	Varchar	8	User's ID	Foreign
CHILD_TO	Varchar	8	Consist of the MSG_ID of the topic.	
CREATED_DT	Varchar	30	Date/time when message created.	

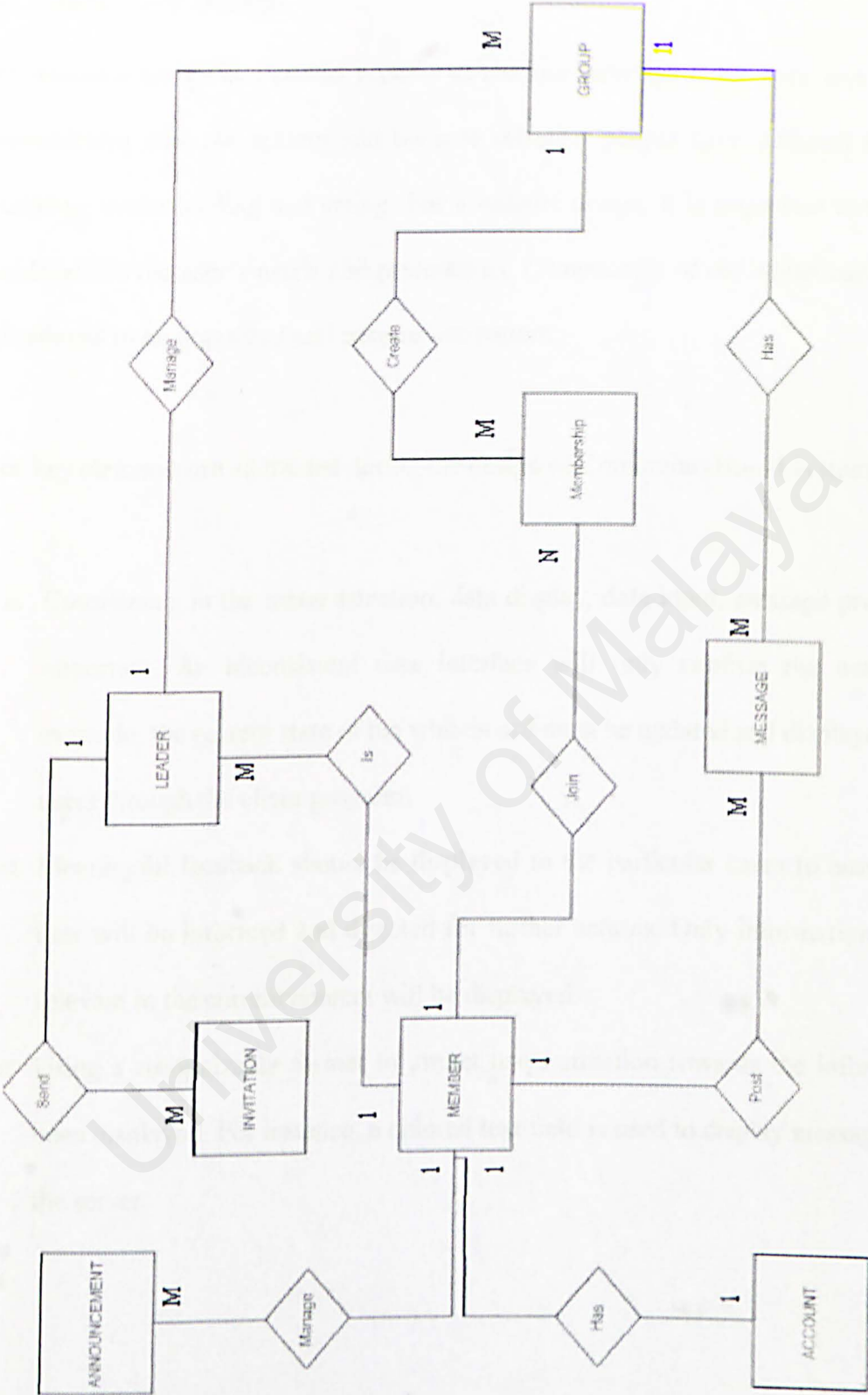


Figure 5-15: Entity-Relationship Diagram

5.4 Interface Design

User interface design is a crucial process as the user interface is the **only way the user** communicates with the system and because different people have **different styles of** perceiving, understanding and acting. For a website design, it is important to take into considerations the user's needs and preferences. Components of the whiteboard should be displayed in an organized and easy-to-use pattern.

Three key elements are addressed during the design of CommunityBoard system:

- ✗ Consistency in the menu selection, data display, data input, message prompts is important. An inconsistent user interface will only confuse the users. For example, the current state of the whiteboard must be updated and displayed to all users through the client program.
- ✗ Meaningful feedback should be displayed to the particular cases to ensure that user will be informed and directed for further actions. Only information that is relevant to the current content will be displayed.
- ✗ Using a recognizable format to attract users attention towards the information been displayed. For instance, a colored text field is used to display message from the server.

5.4.1 Home Page



Figure 5-16: Home Page for Community Board

5.4.2 Register Page

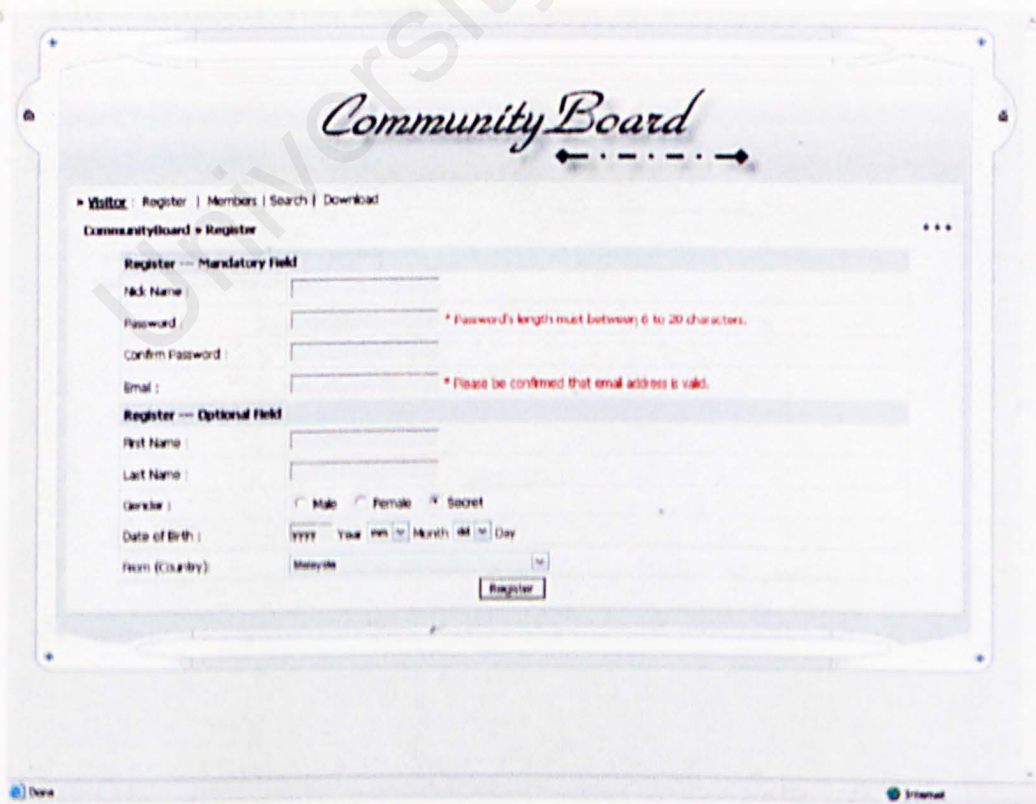


Figure 5-17: Register Page for Community Board

5.4.3 List of Topic in a Group



Figure 5-18: List of Topic for Community Board

5.4.4 Administrative Workspace

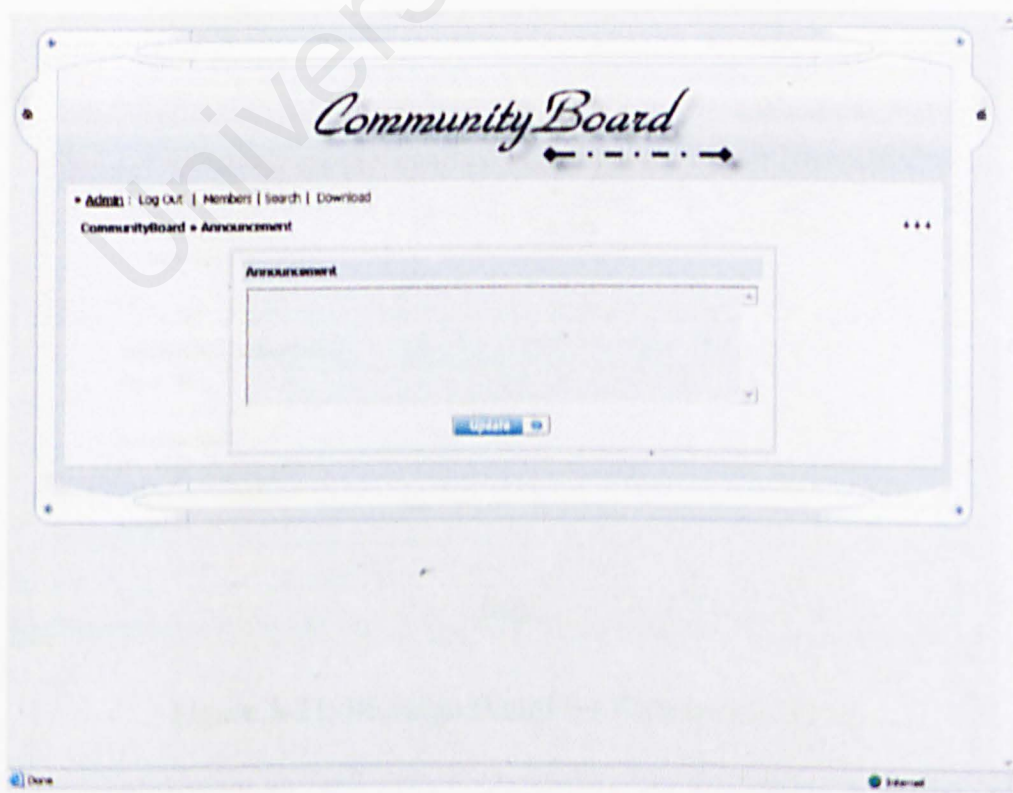


Figure 5-19: Update Announcement for Community Board

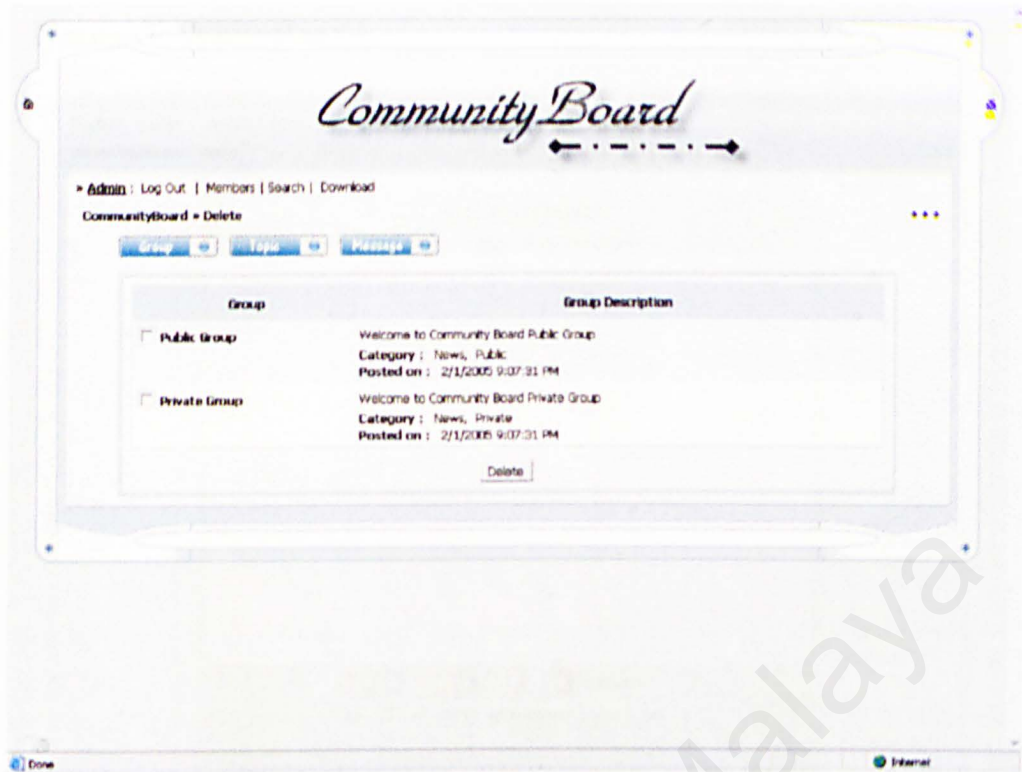


Figure 5-20: Delete for Community Board

5.4.5 MessageBoard

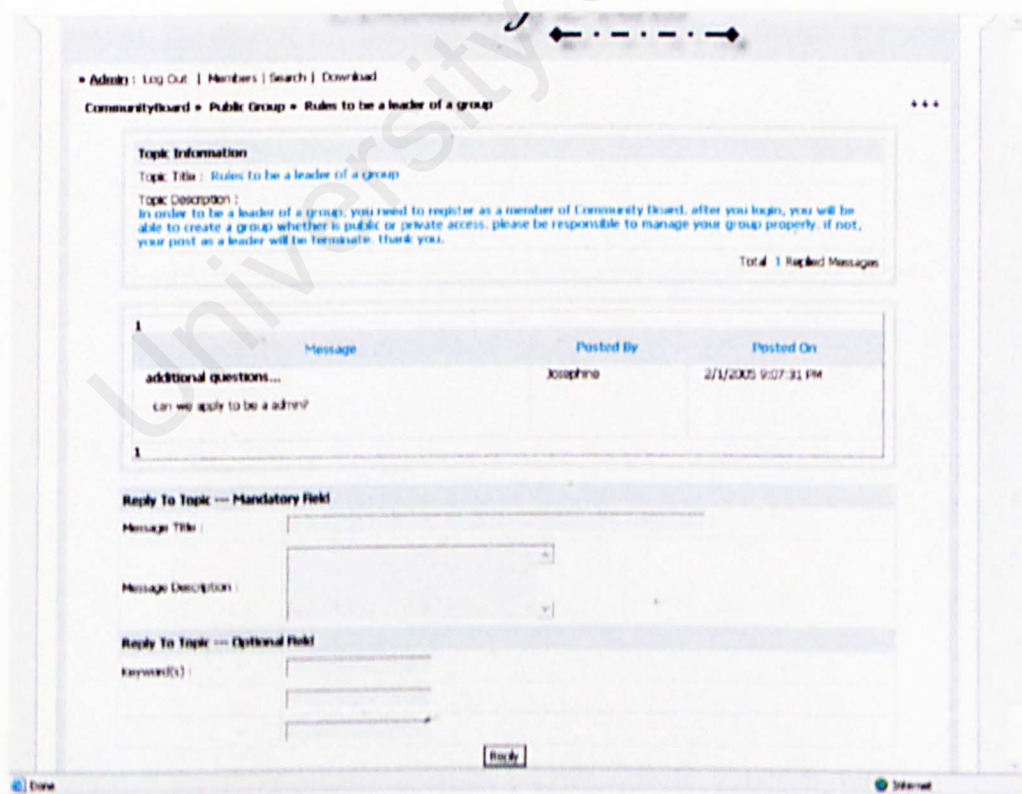


Figure 5-21: Message Board for Community Board

5.4.6 Network WhiteBoard

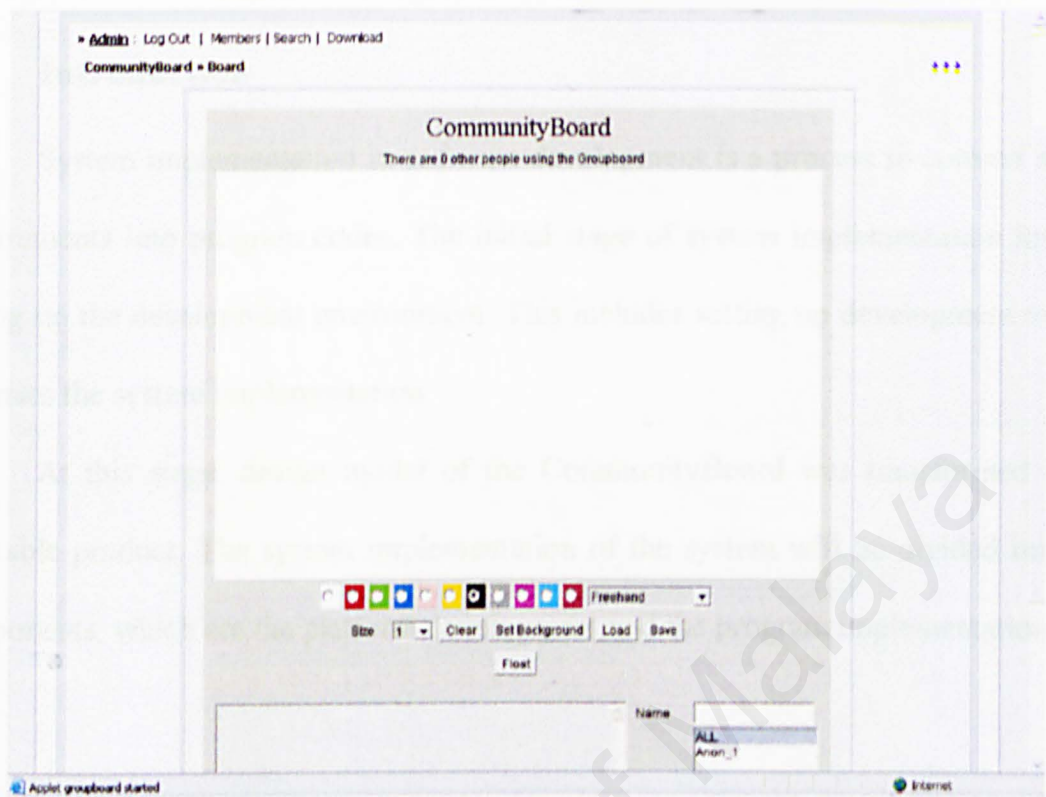


Figure 5-22: WhiteBoard for Community Board

Chapter 6 System Implementation

6.1 Introduction

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

At this stage, design model of the CommunityBoard was transformed into a workable product. The system implementation of the system will be divided into two components, which are the platform development and the program implementation.

6.2 Platform Development

The platform development will include setting up the Windows XP, Microsoft Access and configure the IIS server. Servers and development tools installations are the early first step before starting off with any development work. When using Microsoft's products, it is essential to know the sequence of products installations to ensure smooth execution without system errors.

6.2.1 Install Window XP

Install Window XP Professional version for development purposed. Use Online Window Update to let windows updated with the latest features that can performed.

6.2.2 Configure IIS 6.0

After configuration of the IIS, the virtual directory was created so that the user can access the application. The users can access the application through the following address, <http://localhost/CommunityBoard/Index.aspx>

Internet Information Server (IIS) for free from the Windows XP Pro installation CD and configure it to run on the system by following the instructions below:

1. Place the Windows XP Professional CD-Rom into your CD-Rom Drive.
2. Click 'Start', click 'Control Panel' and select 'Add or Remove Programs'.
3. Click 'Add/Remove Windows Components'. The Windows Components Wizard appears.
4. Place a tick in the check box for 'Internet Information Services (IIS)' leaving all the default installation settings intact as follow:

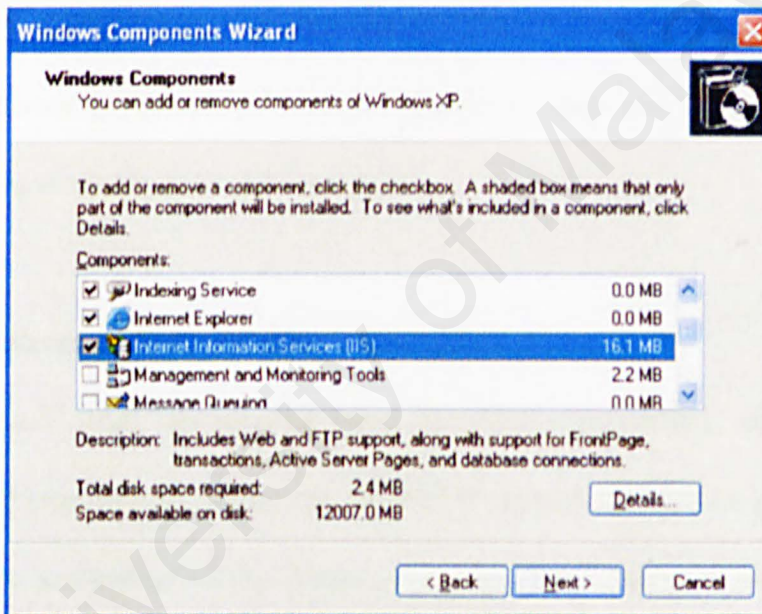


Figure 6-1 Windows Components Wizard

5. Then follow the on-screen instructions to install IIS.
6. To ensure the IIS is being installing, click 'Administration Tools' in the 'Control Panel'. (The 'Internet Information Services' console can be found in the 'Administration Tools' in the 'Control Panel' under 'Performance and Maintenance', if you do not have the control panel in Classic View).
7. Double-click on the 'Internet Information Services' icon.

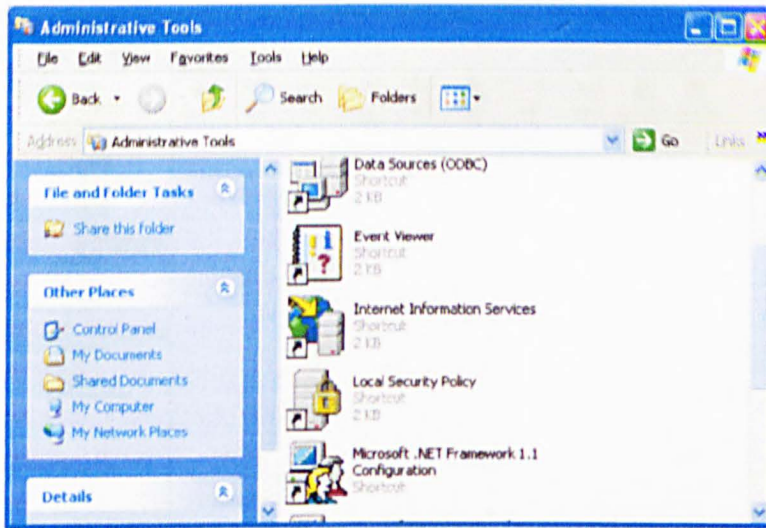


Figure 6-2 Administrative Tools

8. Once the 'Internet Information Services' console is open you will see any IIS web services you have running on your machine.

6.2.3 Setting Microsoft SQL Server

After the Microsoft SQL Server had been installed successfully, database named *CommunityBoard* was created under the SERVER named *SYUEN* or *(local)*. Then, I created the tables according to the database design. This database will become the database storage for the system. The tables were created for keeping the data used in all modules of this web application. I allocated the hard disk space for the database to maximize the performance of the SQL Server and to ensure there is enough of space to store the record.

To ensure that the SQL Server has been installed:

1. Click 'Start' follow by the 'All Program' click.
2. Go to 'Microsoft SQL Server' and click the 'Enterprise Manager'
3. 'Microsoft management console' will be display.

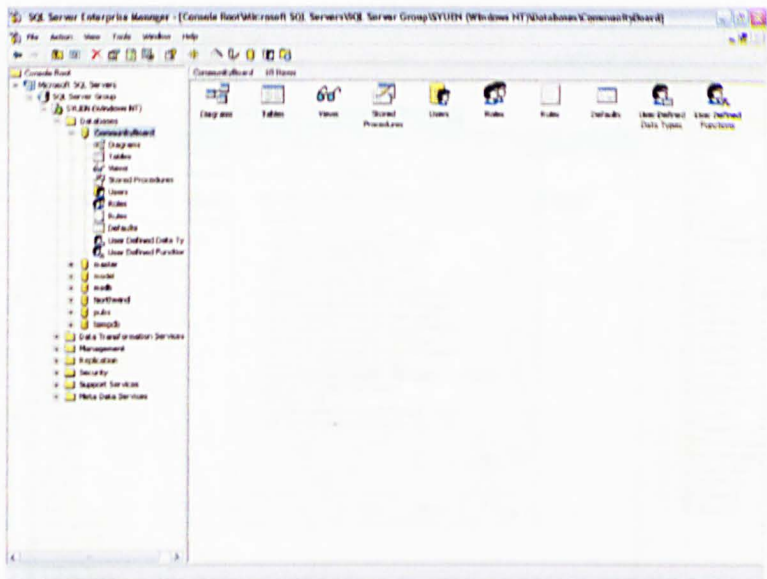


Figure 6-3: Console Root/Microsoft SQL Server

6.2.4 Setting Microsoft Visio Studio .NET

Install Microsoft Visio Studio .NET framework will take some times. Start a new Visual Basic Project with the ASP.NET Web Application named CommunityBoard. Then connect it to the database created in Microsoft SQL Server.

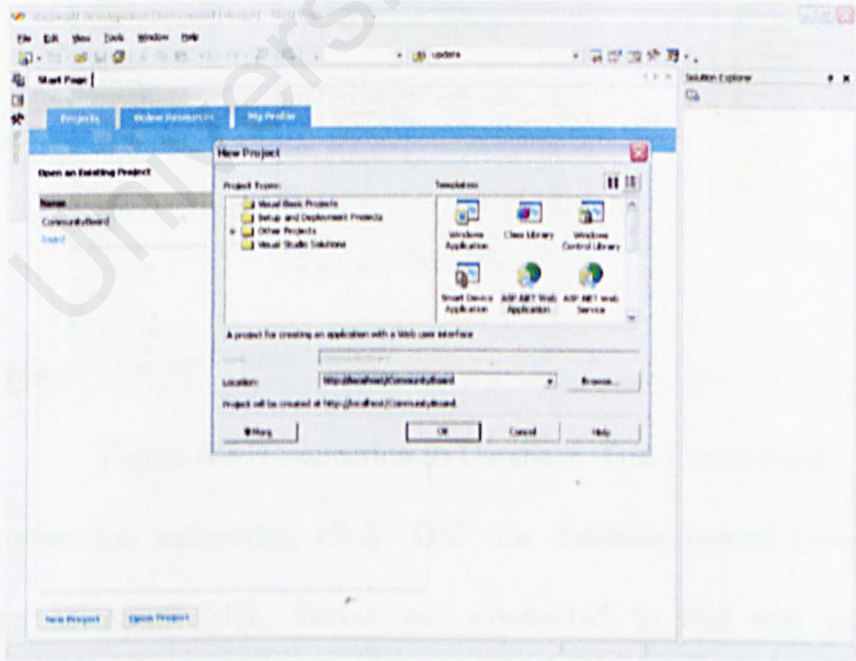


Figure 6-4: Start a new Visual Basic Project

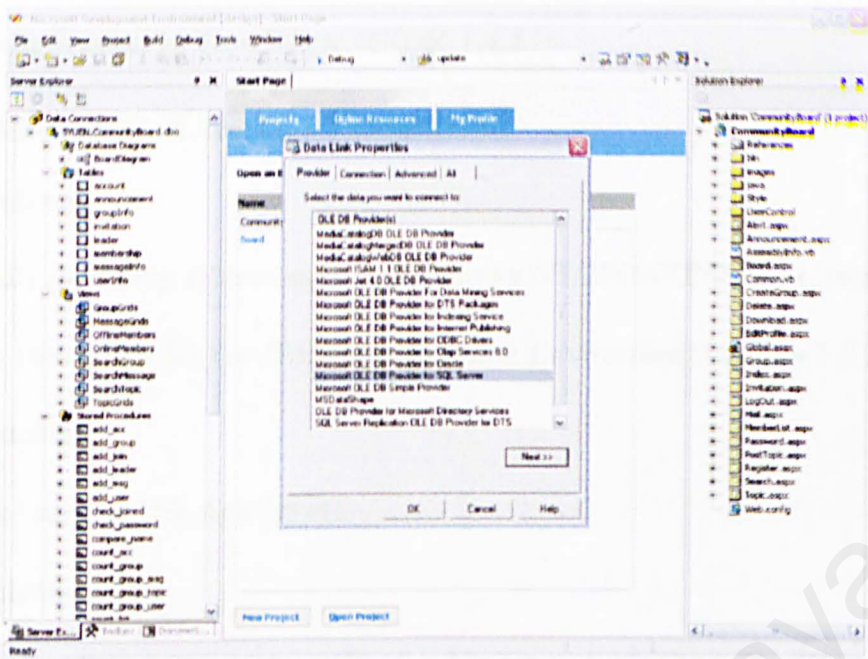


Figure 6-5: Connection to Database, Select Provider

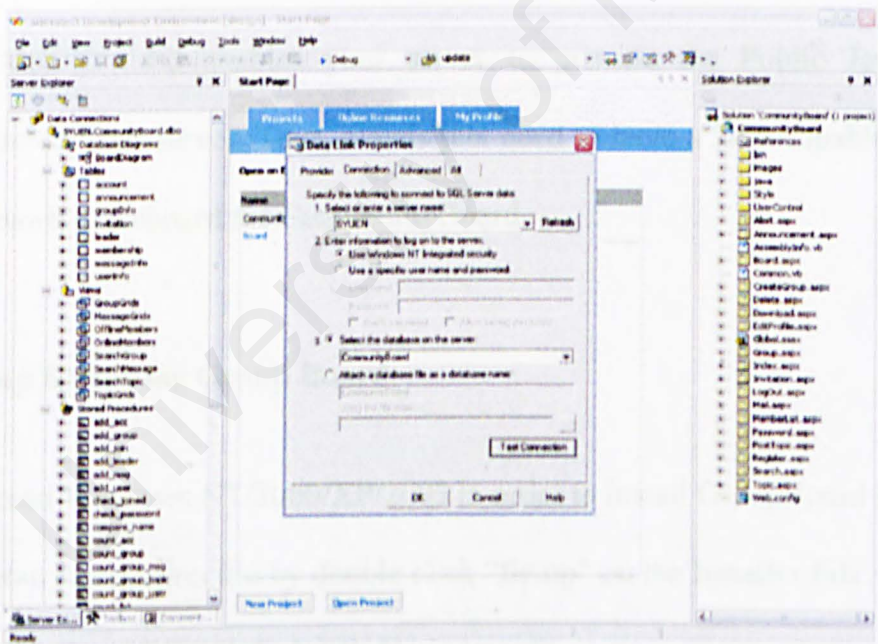


Figure 6-6: Connection to Database, Test Connection

After test connection successful, click “OK” the database named CommunityBoard created using Microsoft SQL Server was connected to this new project named CommunityBoard.

6.2.5 Configuration to Run With J2SDK 1.4.2

System requirements to run java GroupBoard

Server requirements

- Java friendly operating system such as Windows NT/2000/XP/2003, Linux
- JDK (Java Developer Kit) or JRE (Java Runtime Enviroment) version 1.2.2+ installed on server machine.
- Web Server such as IIS, Apache etc.

Client requirements

- Java enabled web browser such as IE 4.0+, Netscape 4.08+, Mozilla, Opera, HotJava or browser that installed embedded JRE.

Installing J2SDK 1.4.2 enables your server to provide the Public Java Runtime Environment on your server. Thus, clients just need to have a Java-capable browser to run the network whiteboard for CommunityBoard.

6.2.6 Setup Server for Group Board

1. You need Windows NT/2000/XP/2003 in order to install GroupBoard server.
2. Run your installation file by double click "Setup" on the Installer File.
3. Enter the directory as default "C:\Groupboard".
4. And enter the directory to contain java class file in "C:\inetpub\wwwroot".
5. Enter the Licenses Key. (For Example:
 AGJBLFLKAGJCLAAAAAAAAAABJPPPPPPPPDBDJDCCODBDGDICODBC
 ODEAACKAAAOAMDFBG).
6. If you don't have one, go to <http://www.groupboard.com> and register one month free trial or you may purchase the groupboard service.

7. Enter the server address. (For Example: 10.100.210.8) It's IP of your own PC.
8. After installation complete, Go to "Start" -> "Settings" -> "Control panel" -> "Administrative tools" -> "Services", and make sure the server is started.

Service Name	Service Description	Status	Startup Type	Log On As
Groupboard gbmanager service	Provides management for the Groupboard service.	Started	Automatic	Local System
Groupboard gbproxy service	Provides proxy service for the Groupboard service.	Started	Automatic	Local System
Groupboard gbserv service	Provides the Groupboard service.	Started	Automatic	Local System

Figure 6-7: Start the groupboard services in administrative tools

9. You must start all the three gbmanager, gbproxy, and gbserv service.
10. Then, go to your directory of C:\Inetpub\wwwroot\groupboard, copy the file named "java" and put into your VB .NET project file, CommunityBoard. C:\Inetpub\wwwroot\CommunityBoard\java created.
11. Finally, replace the "data" in C:\Groupboard\ with the "data" file inside the installation CD.
12. Installation completed, groupboard service is ready to use.

6.2.7 Synchronize the Server Address

Board.aspx in the CommunityBoard Project file contains GroupBoard for each group.

To access the groupboard server, the server address must be synchronized. Open the

Board.aspx.vb file with any editor. (For example : WordPad)

- `buffer.Append("<applet codebase=""http://localhost/Commu.....>")`
- `buffer.Append("<param name=""server_address"" value=""localhost"">")`

Change these two lines of code to the corresponding server address which the server address is the IP of the PC where the groupboard service installed.

(For example: localhost --> 10.100.210.8)

6.3 Program Implementation

Since CommunityBoard is classified as a web application, most of the scripts are coded decided using ASP.NET, code behind VB.NET that could support and enhance web application. Good coding approach provides easy identification and clear guide for programmers during the maintenance phase of the system.

6.3.1 Coding Approach

The coding approach that was used is top-down approach. The top-down approach entails the development of the simple modules first followed by the complex module. The purpose of using the top-down approach is to enable tests to be done on the simple module while the complex modules are still in the process of coding. Besides, completing the simple modules first enables us to check whether the flows of the system are the same as designed and the connectivity of each of the pages can be seen clearly.

6.3.2.1 Coding to Connect to Database

A data provider in the .NET Framework serves as a bridge between an application and a data source. A data provider is used to retrieve data from a data source and to reconcile changes to that data back to the data source. The SQL Server .NET Data Provider provides connectivity to Microsoft SQL Server using the SqlConnection object to connect to the database.

```
<appSettings>
<add key="strConn" value="Server=(local);
Database=CommunityBoard;uid=sa;password=admin05"/>
</appSettings>

Dim MyConn As SqlConnection = New
SqlConnection(ConfigurationSettings.AppSettings("strConn"))

MyConn.Open()
MyConn.Close()
```

Use forms to get input from users and perform add, update and delete action using store procedures created in SQL Server. All parameters pass into store procedure get from HtmlControls and WebControls which handled by server control.

Add

```
Dim password As String
' Declare Required Variables
' Access appSettings of Web.Config for Connection String (Constant)
Dim MyConn As SqlConnection = New
SqlConnection(ConfigurationSettings.AppSettings("strConn"))
MyConn.Open()

' Create a SqlDb Command Object
' Pass in Stored procedure
' Set CommandType to Stored Procedure
Dim AccCmd As New SqlCommand("add_acc", MyConn)
AccCmd.CommandType = CommandType.StoredProcedure

AccCmd.Parameters.Add("@userID", SqlDbType.VarChar, 8).Value =
txtUserID.Value ' Get Value From TextBox

AccCmd.Parameters.Add("@password", SqlDbType.VarChar, 20).Value =
password ' Get Value From String assignment

AccCmd.Parameters.Add("@createdDate", SqlDbType.VarChar, 30).Value
= System.DateTime.Now ' Get Value From System Time

AccCmd.ExecuteReader(CommandBehavior.CloseConnection)
MyConn.Close()
```

Update

```
MyConn.Open()
Dim UpdateCmd As New SqlCommand("update_user", MyConn)
UpdateCmd.CommandType = CommandType.StoredProcedure
UpdateCmd.Parameters.Add("@userid", SqlDbType.VarChar, 8).Value =
userid
. . . . .

UpdateCmd.ExecuteReader(CommandBehavior.CloseConnection)
MyConn.Close()

Shared Sub changeStatus(ByVal user As String, ByVal
status As String)

Dim MyConn As SqlConnection = New
SqlConnection(ConfigurationSettings.AppSettings("strConn"))
MyConn.Open()
```


Delete (Using check box to perform collection delete)

```

Dim isDeleted As Boolean
Dim anItem As DataListItem

' Check each box and see if the item should be deleted.
For Each anItem In dlDeleteGroup.Items
    isDeleted = CType(anItem.FindControl("cbxDeleteGrp"),
        WebControls.CheckBox).Checked
    If isDeleted Then
        ' Add code here to delete the item, using anItem.ItemIndex.
        Dim MyConn As SqlConnection = New
            SqlConnection(ConfigurationSettings.AppSettings("strConn"))
        MyConn.Open()
        Dim DeleteCmd As New SqlCommand("delete_group", MyConn)
        DeleteCmd.CommandType = CommandType.StoredProcedure

        DeleteCmd.Parameters.Add("@groupID", SqlDbType.VarChar, 8).Value =
            CType(anItem.FindControl("lblGroupID"), WebControls.Label).Text

        DeleteCmd.ExecuteNonQuery()
        MyConn.Close()
    End If
Next

LoadGroupList()

```

6.3.2.3 Coding to Bind DataGrid

Bind the data get from database one the page load.

Bind Data Grid (vb File)

```

BindGrid("GROUP_ID", sql, "GroupGrids", GroupDetail)

Shared Sub BindGrid(ByVal sortfield As String, ByVal sql As String,
    ByVal table As String, ByVal datagrid As
    System.Web.UI.WebControls.DataGrid)
    Dim MyConn As SqlConnection = New
        SqlConnection(ConfigurationSettings.AppSettings("strConn"))
    MyConn.Open()

    'Create DataAdapter to fetch data from table
    Dim MyCmd As SqlDataAdapter
    MyCmd = New SqlDataAdapter(sql, MyConn)

    'Create dataset and fill it with data
    Dim DS As New DataSet
    MyCmd.Fill(DS, table)

    'Bind data to Datagrid
    Dim Source As DataView
    Source = DS.Tables(table).DefaultView
    Source.Sort = sortfield
    datagrid.DataSource = Source
    datagrid.DataBind()
    MyConn.Close()
End Sub

```


Bind Data Grid (aspx file)

```

<asp:datagrid id="GroupDetail" runat="server" BackColor="#F1F2F4"
BorderColor="#D3D5DA" Width="100%" DataKeyField="GROUP_ID"
AllowSorting="True" AllowPaging="True" AutoGenerateColumns="False">

<ItemStyle Height="30px"></ItemStyle>

<AlternatingItemStyle
BackColor="WhiteSmoke"></AlternatingItemStyle>

<HeaderStyle Font-Bold="True" Wrap="False" HorizontalAlign="Center"
Height="35px" ForeColor="#116B97" ssClass="header"
BackColor="#D3D5DA"></HeaderStyle>

<Columns>
<asp:TemplateColumn Visible="False" HeaderText="Group ID"
ItemStyle-HorizontalAlign="Justify">

<HeaderStyle HorizontalAlign="Center" Width="5%"></HeaderStyle>
<ItemTemplate>

    <%# DataBinder.Eval(Container.DataItem, "GROUP_ID") %>

</ItemTemplate>
</asp:TemplateColumn>
</Columns>

<PagerStyle NextPageText="" Font-Bold="True" PrevPageText=""
Position="TopAndBottom" Mode="NumericPages"></PagerStyle>

</asp:datagrid>

```

6.3.2.4 Buffer to append an aspx file to embedded a html Applet

```

Dim buffer As New StringBuilder(1024)
buffer.Append("<table align=""center"" width=""100%"" border=""0""
cellspacing=""1"" cellpadding=""4"">")
buffer.Append("<tr>")
buffer.Append("<td>")
buffer.Append("<applet
codebase=""http://localhost/CommunityBoard/java""
code=""groupboard.class"" archive=""groupboard.jar"" width=""620""
height=""800"">")
buffer.Append("<param name=""BOARD_ID"" value=""")
buffer.Append(access)
buffer.Append(">")

buffer.Append("<param name=""BOARD_WIDTH"" value=""600"">")
buffer.Append("<param name=""BOARD_HEIGHT"" value=""400"">"). . .
buffer.Append("<param name=""server_address""
value=""localhost"">")
buffer.Append("<H1>ERROR: You must have a Java-capable browser in
order to use the Groupboard!</H1>")

buffer.Append("</applet>")
buffer.Append("</td>")
buffer.Append("</tr>")
buffer.Append("</table>")

Return buffer.ToString()' Return a string object to the caller.

```

6.3.2.5 Coding to use User Control

A user control is a custom, reusable control in ASP.NET, saved in a file with an extension .ascx. User controls are compiled the first time they are accessed and then saved in client memory until any changes are made to the control. Either way, the development of user controls allows for easily reused web components.

```
<%@ Control Language="vb" AutoEventWireup="false"
Codebehind="uc.ascx.vb" Inherits="CommunityBoard.uc"
TargetSchema="http://schemas.microsoft.com/intellisense/ie5" %>

<div id="Layer1" style="Z-INDEX: 1; LEFT: 100px; WIDTH: 673px;
POSITION: absolute; TOP: 65px; HEIGHT: 1px">
    <OBJECT height="104" width="673" VIEWASTEXT>
        <embed src="images/header.swf" width="673" height="104"
quality="high"
pluginspace="http://www.macromedia.com/go/getflashplayer"
type="application/x-shockwave-flash" menu="false"
wmode="transparent"> </embed>
    </OBJECT>
</div>
```

The **TagPrefix** determines a unique namespace for the user control (so that multiple user controls with the same name can be differentiated from each other). The **TagName** is the unique name for the user control (you can choose any name). The **Src** attribute is the virtual path to the user control. After registering the user control, you may place the user control tag in the Web Forms page just as you would an ordinary server control.

```
<%@ Register tagprefix="UserControl" Tagname="footer"
Src="userControl/footer.ascx"%>

<%@ Register tagprefix="UserControl" Tagname="menu"
Src="userControl/menu.ascx"%>

<%@ Register tagprefix="UserControl" Tagname="header"
Src="userControl/header.ascx"%>

<%@ Register tagprefix="UserControl" Tagname="uc"
Src="userControl/uc.ascx"%>

<%@ Page Language="vb" AutoEventWireup="false"
Codebehind="LogOut.aspx.vb" Inherits="CommunityBoard.LogOut"%>
```


6.3.2 Coding Style

Coding style is an important attribute of source code where it determines the intelligibility, readability and maintainability of program. An easy to read source code makes the system easier to be maintained and enhanced. The elements of coding style include internal documentation (source code level), methods for data declaration and approach to statement construction. Some of good coding practices that had been applied are as followed:

- Comment code
- Indent coding – by formatting and indenting the codes, it helps to find and detected a place where an error occurred. In addition, the indent codes will be easier to read and it is useful in coding which involves a lot of conditional structure and loop structure.
- Use a variable naming convention – using a good naming convention provides easier identification for the programmer. The naming convention is created with coding consistency and standardization in mind.

Scripting Language and CSS(Cascading Style Sheets)

Scripting language used for CommunityBoard is Javascript. Javascript used in CommunityBoard system to change the display panel when the radio button onchange.

```
<SCRIPT language="javascript">
function password(to_rdb, from_rdb)
{
    document.all(to_rdb).style.display = "block";
    document.all(from_rdb).style.display = "none";
}
</SCRIPT>
```


CSS (*Cascading Style Sheets*) is also used to gain better control of the interface design.

```
<LINK href="Style/text.css" type="text/css" rel="stylesheet">
```

```
a:link,a:visited
```

```
{
    text-decoration: none;
    color: #000000
}
```

```
a:hover
```

```
{
    text-decoration: underline
}
```

```
body
```

```
{
    scrollbar-base-color: #E8ECF0;
    scrollbar-arrow-color: #A6ABB5;
    font-size: 12px;
    background-color: #DEDFE1
}
```

```
table
```

```
{
    font-family: Tahoma, Verdana;
    color: #000000;
    font-size: 12px
}
```

```
textarea,input,object
```

```
{
    font-family: Tahoma, Verdana;
    font-size: 12px; color: #000000;
    font-weight: normal;
    background-color: #E8ECF0
}
```

```
select
```

```
{
    font-family: Arial;
    font-size: 11px;
    color: #000000;
    font-weight: normal;
    background-color: #E8ECF0
}
```

```
.nav
```

```
{
    font-family: Tahoma, Verdana;
    font-size: 12px;
    font-weight: bold
}
```

```
.bold
```

```
{
    font-weight: bold
}
```

```
.header
{
    font-family: Tahoma, Verdana;
    font-size: 12px;
    color: #000000;
    font-weight: bold;
    background-color: #D3D7DC
}

.category
{
    font-family: Arial;
    font-size: 12px;
    color: #000000;
    background-color: #E8E9ED
}

.multi
{
    font-family: Arial;
    font-size: 11px;
    color: #000000;
}

.smalltxt
{
    font-family: Arial;
    font-size: 11px
}

.mediumtxt
{
    font-family: Tahoma, Verdana;
    font-size: 12px;
    color: #116B97
}

blockquote
{
    margin-left: 20px;
    margin-right: 20px;
    border: #A6ABB5 dashed 1px;
    padding: 5px;
    background-color: #E8F2F5
}

.code
{
    margin-left: 20px;
    margin-right: 20px;
    padding: 5px;
    background-color: #E8F2F5
}

.onlysee
{
    border: 1px solid #4F74AC;
}
```

6.4 Module Implementation

For this system, there are two module implementations; there are Group Management Module and the RealTime Drawing Module.

6.4.1 Module Implementation for Group Management

- (A) Create Group
- (B) Delete Group, Topic and Message
- (C) Update Announcement
- (D) Invitation to Private Group
- (E) Navigate WhiteBoard
- (F) Edit Personal Profile
- (G) Topic Posting
- (H) Message Replying
- (I) View Members
- (J) Search

6.4.2 Module Implementation for Real Time Drawing

- (A) Freehand Drawing
- (B) Shape Drawing
- (C) Color Choosing
- (D) Color Filling
- (E) Erasing
- (F) Text Writing
- (G) Chatting

Chapter 7 System Testing

7.1 Introduction

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

During developing a system, testing usually involves several stages. First, each program component is tested on its own, isolated from the other components in the system, unit testing. This stage of testing verifies that the component functions properly with the types of input and output expected from studying the component's design. When all components have been unit-tested, the next step is ensuring that the interfaces among the components are defined and handled properly. This step is called module testing and following by integration testing, which verifies that the all the components work together as described in the module or system design specifications.

Finally, system testing is performed to make certain that the whole system works according to users' specifications. Developers will join the users to perform this stage of testing where the system is checked against the users' requirements description. If there is a need for change, system modification will then be carried out if the users' requirements were not met as described in the specifications. If the users are satisfied with the system's characteristics, the system is ready to be deployed for use.

Top-down approach is adopted in system testing for CommunityBoard. Each module at the highest level of the system hierarchy is tested individually. Then, all the tested modules would be related to the next module testing. This approach is repeated recursively until all the modules are tested successfully and the bottom-level components are implemented.

7.2 Testing Process

In general, the testing process of CommunityBoard can be shown in the following figure. All the details will be further explained in subsequent sub-sections.

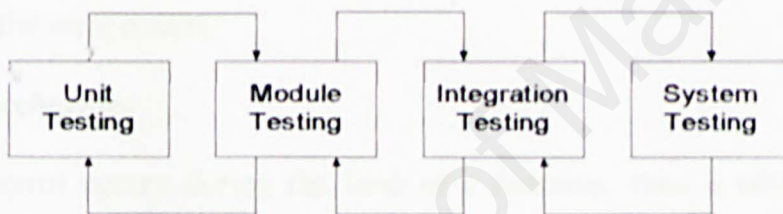


Figure 6-1: Testing Process

The testing processes include Unit Testing, Module Testing, Integration Testing and System Testing.

7.2.1 Types of Testing

7.2.1.1 Unit Testing

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

Techniques used during the process of performing unit testing are as follows:

- Code Review

Before a java file is compiled into java class, codes are reviewed line by line to discover any syntax error as well as semantic error. If errors are discovered, they are corrected immediately.

- Compilation of Java Class

This method is faster compared to code review techniques and it is efficient in discovering errors. During the compilation, the Java compiler will detect type of errors in a program and display the error type as well as the line number in which the error occurs.

- Other techniques

If the error occurs during the loop of a function, then it will be difficult to identify the actual error. This is important as it helps to trace the program and allows the developer to identify the actual step in which an error has occurred.

The code was also examined and debugged in order to identify any fault coding. In the development of this CommunityBoard, unit testing was done after the development of each module and not the end of the development of the whole system. The object and ASP.NET codes were thoroughly checked and tested to ensure that the functions and data were implemented properly as indicated in the design. If there were errors, debugging would be carried out to identify the error before testing the units again.

Other units that were independently unit-tested are:

- Opening of connection to the database.
- Insertion of new records into database.
- Modification of existing records.
- Delete record from database
- Execution of SQL statements.
- Bind data to the data grids and data lists.
- Normal data test: Test by using normal data to check whether the system works properly under normal situation.
- Extreme data test: Test with invalid data (includes large amount of data, input non-numerical data into a numerical field, redundancy of the key item) that is not supported by the input field.

7.2.1.2 Module Testing

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

All the VB objects (basic and class modules), Java scripts and VB scripts were integrated and tested to ensure the success of the integration. The next step was to combine the execution of ASP.NET scripts and the modules to make sure that the ASP.NET scripts can “communicate” with the modules.

7.2.1.3 Integration Test

Integration test is needed when all modules are integrated. The main focus in integration test is to navigate the interfaces repeatedly to detect any interface mismatch problem. Several important aspects are checked to ensure that the flow of the data in CommunityBoard is well organized and are user friendly to all the system users.

The criteria taken in this testing phase are:

- Interface integrity – Internal and external interfaces are tested as each modules to check if there is any lost of data across interfaces.
- Functional validity – Tests designed to uncover functional errors are conducted.
- Information content – Tests designed to uncover errors associated with local or global data structures are conducted.
- Performance – Tests designed to verify performance bounds established during software design are conducted.

7.2.1.4 System Test

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

The two system tests performed are as below:

- Security Testing

This system is tested to be secured from improper penetration and unauthorized access, for example the implementation of user login.

- **Compatibility Testing**

This test was performed, and the interface functions according to the requirements.

The accuracy of data retrieval was best without an error, and the speed of data retrieval was acceptable.

Finally, a performance test is performed to compare the integrated modules with the non-functional system requirements. These requirements include security, interoperability, flexibility and reliability.

7.3 Test Cases

As there are too many test cases involved, only three test case examples will be shown.

- **EXAMPLE 1**

Users try to access whiteboard before login or try to access the administrative workspace with a member's role. The access is denied.

- **EXAMPLE 2**

The password for private group to access must match to the corresponding group.

- **EXAMPLE 3**

All the insert, update and delete action which need to connect to database are tested to make sure the connection are active.

Chapter 8 System Evaluation

8.1 Introduction

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

8.2 Evaluation by End User

As CommunityBoard is proposed to provide a group management space with a multi-user communication's network whiteboard to make discussion process more effective, the final stage of system development which is the system testing becomes critical and it needs feedbacks from all respective users in judging the correctness of these functionalities, precise data flow as well as user friendliness of the system's interfaces.

Anyway, as the scope of CommunityBoard is large, development was conducted with the objective to cover the scope briefly, which means that the whole system was developed quickly to have the overall structure and potential of the system but the system was not refined to show its full efficiency.

The overall feedback from the end users is satisfied and CommunityBoard is expected to serve the targeted group well after refining.

8.3 System Strength

- **Web Enabled**

The system was based on the web technology. It was using the client server approach that allowed processing load to be shared between the client and the server, thus reducing the burden on the server and allow it to provide better service.

- **Friendliness of User Interface**

The graphic interface design of the system was designed to let the users feel comfortable and easy-to-use. The GUI ensured user friendliness. Thus, the users should find it easy to use.

- **Significant validation on input data**

Check for the validation of every data input in the field and prompt the user of invalid data being input and ask for valid data. Data field that required will also prompt the user about the error if the user does not fill the required field.

- **Support high volume of users**

CommunityBoard is deployed using the latest database from Microsoft SQL Server, which is the most powerful database in the market. This makes it ready to cope with large amount of user in the future.

8.4 System Constraints and Future Enhancements

As mentioned before, CommunityBoard is still not fine enough to work at its full efficiency. Some refining work needs to be done to the system to increase its usability and reliability. The aspects to be refine and some suggestions to upgrade the system are as below:

- **JavaScript Drawing Toolbox for the Whiteboard**

The drawing tools now are select from the drop down list. The toolbox of drawing tools using JavaScript enables users select the colors, shape and others easily.

- **Urgent notice using SMS**

The SMS feature among members make communication more privacy and easy. Once members login to system, if received a SMS from others, system can ring a sound to alert for new received message.

- **Voice Conferencing**

Voice conferencing discussion is proposed as a future enhancement target. During using the real time drawing network whiteboard, voice conferencing can make the discussion process more effective and no misunderstanding among the users.

- **Administrator management**

Tool should be added to the system to enable the administrator manage the site well. More administrative functions can be added. For example, administrator can check the members' IP to avoid site hacking events.

- **Better security**

The online test can be improved to make it more secure from time to time to avoid fraud especially the encryption and decryption of password.

8.5 Problem Encountered

During the entire development of this system, many and various problems were encountered. Some of it could be overcome through certain solution while some of it was not. The problems that encountered can be divided into different types. The following are some of the problems that arose during the development process.

✍ **Set Up and Configuration**

The set up of the server of groupboard are critical for the operation of the application development. However, the setup process took a long time because lacked of experience. Besides, the repeated failure of the server required re-installation as a remedy and this consumed time and effort.

✍ **Requirement Changes from the User**

It is very difficult to develop and implement the system when the requirement changes very frequently. Sometimes it is easy to change the requirement, however, the coding need to be changed a lot in order to follow the new requirement.

✍ **Design Views of Interface**

Different individual will have different perspective of design view. Some of the coursemates said that the interface of this CommunityBoard which use the combination of grey colors make people look comfortable. But during the viva section, my supervisors Pn.Azlina mentioned that this interface not attractive. So, many information should gather before design the interface especially the favorite colors of the targeted users.

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USER MANUAL : TABLE OF CONTENTS

Table of Contents	<u>I</u>
List of Figures	<u>II</u>
Chapter 1: Introduction	1
Chapter 2: Getting Started	2
2.1 Connect to internet.	2
2.2 Access Home Page	2
2.3 Before Login	3
2.4 Login to CommunityBoard	4
2.4.1 Login as Admin	4
2.4.2 Login as Member/Leader	5
2.5 After Login (Admin's Tasks)	6
2.5.1 Update Displayed Announcement	6
2.5.2 Delete Groups, Topics and Messages	7
2.6 After Login (Member's Tasks)	8
2.6.1 Edit Profile	8
2.6.2 Download Plug-In	8
2.6.3 Navigate WhiteBoard	10
2.6.4 Join Public and Private Group	11
2.6.5 Create Groups	13
2.6.6 Post Messages	14
2.6.7 Reply Messages to Posted Topics	14
2.6.8 Search	15
2.6.9 View Members	15
2.7 After Login (Leader's Task)	16
2.7.1 Invite Guest to Join Private Group	16

List of Figures

Figure 2.1	Home Page of CommunityBoard	2
Figure 2.2	Register Form of CommunityBoard	3
Figure 2.3	Home Page of CommunityBoard after Login by Admin	4
Figure 2.4	Home Page of CommunityBoard after Login by Member/Leader	5
Figure 2.5	Administrative Workspace for Update Announcement	6
Figure 2.6	Administrative Workspace for Delete Groups	7
Figure 2.7	Administrative Workspace for Delete Topics	7
Figure 2.8	Administrative Workspace for Delete Messages	8
Figure 2.9	Edit Personal Information Form	9
Figure 2.10	Plug-In Download Directories	9
Figure 2.11	Navigate WhiteBoard	10
Figure 2.12	Public Group Page	11
Figure 2.13	Password Required to Access Private Group	12
Figure 2.14	Private Group Page	12
Figure 2.15	Create a Public Group	13
Figure 2.16	Create a Private Group	13
Figure 2.17	Form to Post a New Topic	14
Figure 2.18	Form to Reply to Posted Topic	14
Figure 2.19	Search Form	15
Figure 2.20	Display Members on Online and Offline Grid	15
Figure 2.21	Invitation Form	16

Chapter 1: Introduction

This CommunityBoard is a web-based groupware or a collaboration tool, which enables users from different geographical location to communicate, interact and work upon a network whiteboard.

By using a client server architecture platform, this web-based groupware is made possible to be used for professional groups (such as graphic designer) and non professional groups (such as ordinary users).

Through this system, users are able to hold meeting, ongoing discussion, develop and manage their own workgroup by using whiteboard. Users also can just visit the message board or post announcements (only for administrators). Users privacy is always been protected through the system authentication.

This system contains two main modules:-

(a) Electronic Group Management

- ❖ A user group management with security control.
- ❖ Announcement board and message board is developed with news update facilities among users in that group.

(b) White Board

- ❖ An electronic drawing tool that can be drew, shared, viewed, modified in real-time by users at different geographical areas.

Chapter 2: Getting Started

2.1 Connect to internet.

2.2 Access Home Page. <http://localhost/CommunityBoard/Index.aspx>

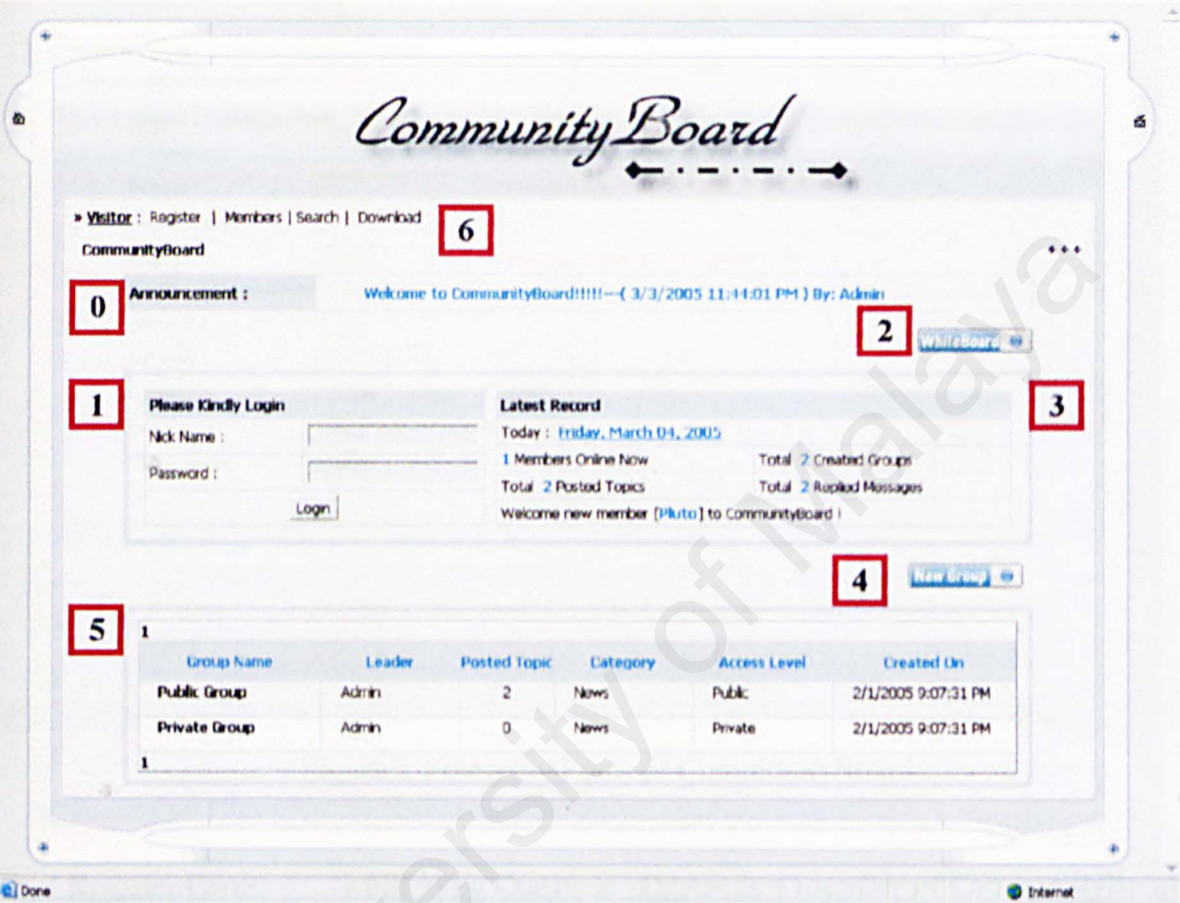


Figure 2.1 Home Page of CommunityBoard

0	Announcement	The announcement text will continuously marquee on the bar.
1	Login Panel	User required filling in the Nick Name and Password to login.
2	WhiteBoard Button	Navigate to the Board Page. The pre-condition is user must logon. If not, system will display an alert message.
3	Record Panel	Display the latest database record for Community Board.
4	New Group Button	Used to Create New Group. Must Login before perform this action. System will display the group creation form.
5	Group Panel	Display the Group List.
6	Menu Bar	Used to navigate CommunityBoard system.

2.3 Before login, Quests can Register to be member of CommunityBoard

CommunityBoard

» Visitor : Register | Members | Search | Download

CommunityBoard » Register

Register --- Mandatory Field

Nick Name :

Password : * Password's length must between 6 to 20 characters.

Confirm Password :

Email : * Please be confirmed that email address is valid.

Register --- Optional Field

First Name :

Last Name :

Gender : ☐ Male ☐ Female ☒ Secret

Date of Birth : Year Month Day

From (Country): Malaysia

Register

Figure 2.2 Register Form of CommunityBoard

7	Register Form	Fill in by Quests to register as a member of CommunityBoard to use all the features of this system.
---	---------------	---

2.4 Login to CommunityBoard.

2.4.1 Login as Admin



Figure 2.3 Home Page of CommunityBoard after Login by Admin

8	NickName Active	Nickname will display on the top-left corner after login.
9	Personal Detail	System will displayed correspondent user's profile at this panel after login.
10	Announce Button	Announce Button will be displayed as the users are login as Admin. Admin can simply click it to perform update announcement.
11	Delete Button	Delete Button also will be displayed only as the users are login as Admin. Admin can simply click it to perform delete group, topic and message. System will display the workspace.

2.4.2 Login as Member/Leader

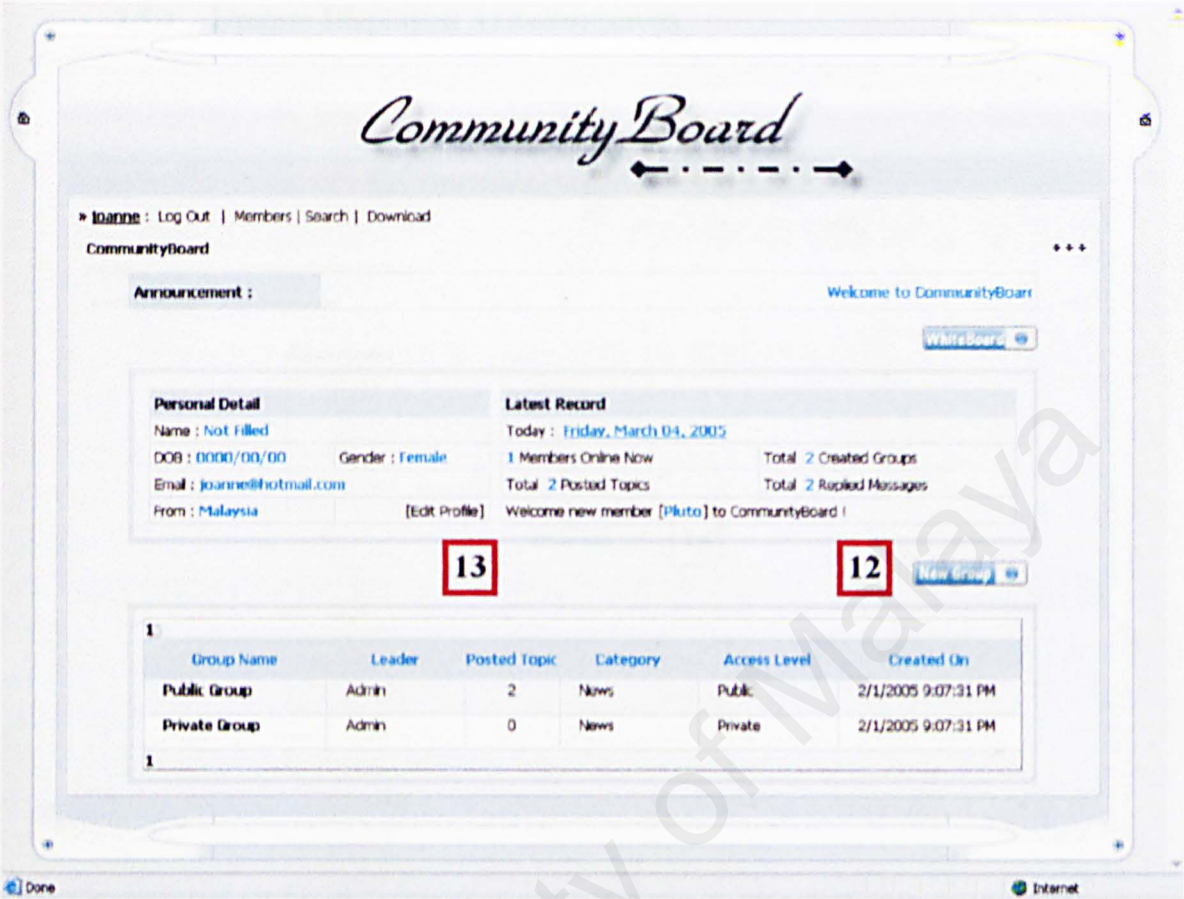


Figure 2.4 Home Page of CommunityBoard after Login by Member/Leader

12	Administrative Button	The administrative buttons (Delete and Announce) were not displayed as users are login as member/leader.
13	Edit Personal Detail	Member can perform to edit the personal detail by click this link. System will display the edit form.

2.5 After login, admin can perform the following tasks.

2.5.1 Update Displayed Announcement



Figure 2.5 Administrative Workspace for Update Announcement

14	Administrative Workspace	To update the displayed announcement, simply fill in the text area then click Update Button. Once click, announcement updated, page will redirect to homepage with display the latest announcement.
----	--------------------------	---

2.5.2 Delete Groups, Topics and Messages

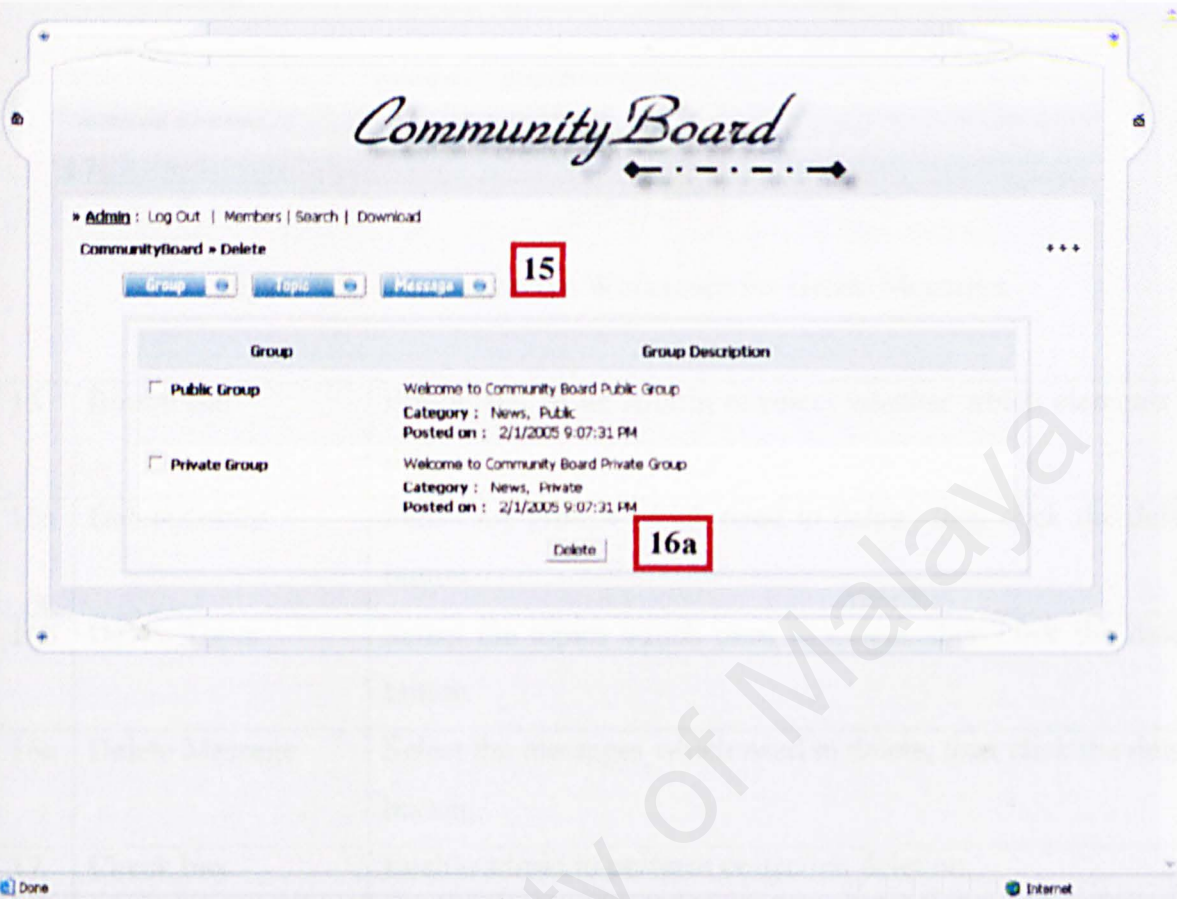


Figure 2.6 Administrative Workspace for Delete Groups

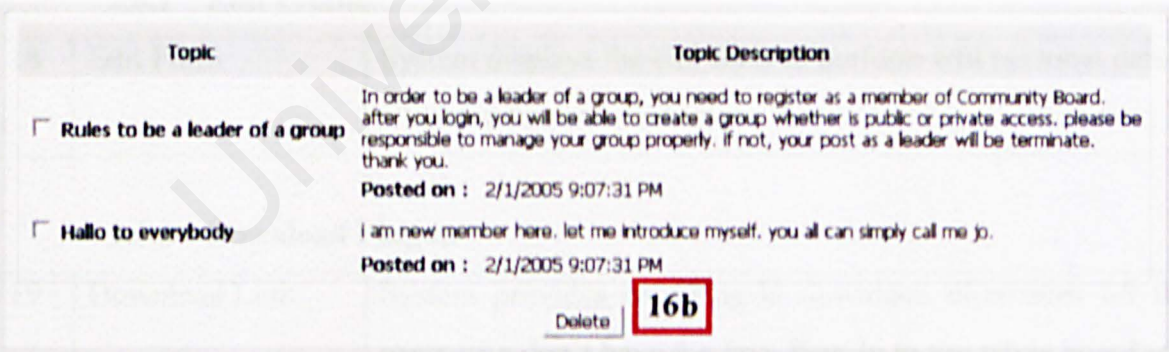


Figure 2.7 Administrative Workspace for Delete Topics

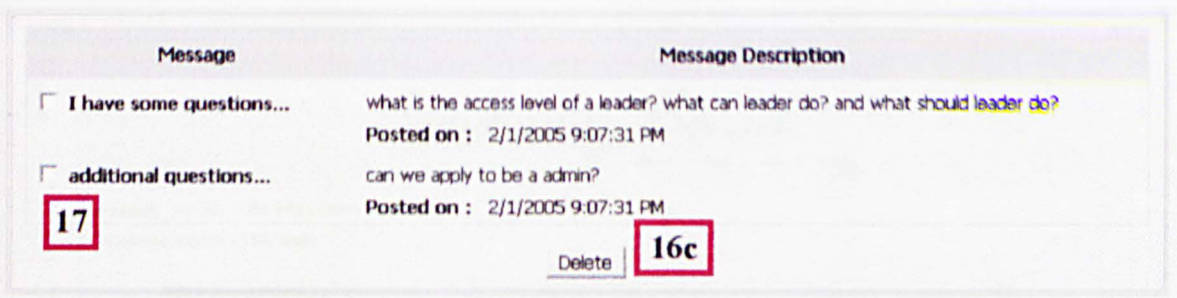


Figure 2.8 Administrative Workspace for Delete Messages

15	Button Bar	Button Bar to let Admin to select whether which elements to delete.
16a	Delete Group	Select the groups which need to delete, then click the delete button.
16b	Delete Topic	Select the topics which need to delete, then click the delete button.
16c	Delete Message	Select the messages which need to delete, then click the delete button.
17	Check box	Enable admin to perform collection deletion.

2.6 After login, member/leader can perform the following tasks

2.6.1 Edit Profile

18	Edit Form	System displays the edit form to perform edit personal detail. Click Update once complete.
----	-----------	---

2.6.2 Download Plug-in

19	Download Link	System provides two Plug-In download directories for the users who don't have the Java Plug-In to use white board and Flash Plug-In to display site properly.
----	---------------	---

CommunityBoard

joanne : Log Out | Members | Search | Download

CommunityBoard » Edit Profile

Edit Personal Profile

Nick Name : joanne

Change Password? : ☒ No ☐ Yes

Password : You are choosing not to change the password.

Email : * Please be confirmed that email address is valid.

Edit Personal Profile --- Optional Field

First Name :

Last Name :

Gender : ☐ Male ☐ Female ☒ Secret

Date of Birth : Year Month Day

From (Country): Malaysia

Update

18

Figure 2.9 Edit Personal Information Form

CommunityBoard

Admin : Log Out | Members | Search | Download

CommunityBoard » Download

Plug-In Download Directory

J2EE Download the SDK From Sun Microsystems

Flash Player From Macromedia Homepage

19

Figure 2.10 Plug-In Download Directories

2.6.3 Navigate WhiteBoard

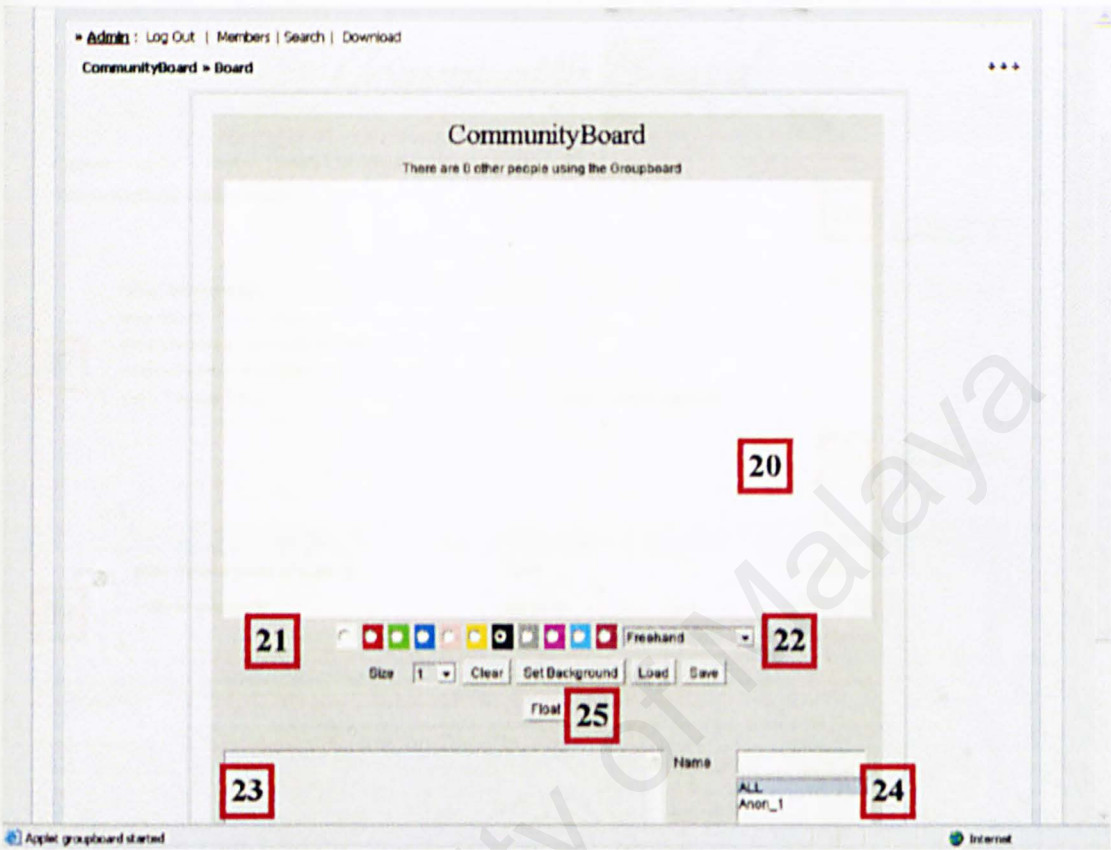


Figure 2.11 Navigate WhiteBoard

20	Drawing Workspace	Network whiteboard which to support multi-users communication with a drawing and color methods.
21	Colors selection	Simply choose the color that used to represents you or as a good looking purposed.
22	Tools selection	Simply use the embedded tools to draw. The tools include free hand writing, shape drawing, shape filling, and etc.
23	Chat space	A chat room to provide communication using text without graphics.
24	Current user	A tool to display who are using the network whiteboard now.
25	Float function	Let the board float out from snap to the windows. Thus, users can continue navigate to other window without terminate the board.

2.6.4 Join Public and Private Group



Figure 2.12 Public Group Page

26	Whiteboard button	Navigate to the whiteboard which is just belongs to the category of this group.
27	Group Description	Display the description and information of this public group.
28	New Topic Button	Navigate to the Post New Topic Form where user must be login to CommunityBoard before perform this action.
29	Topic's List	Display all the posted topics which belongs to this public group.

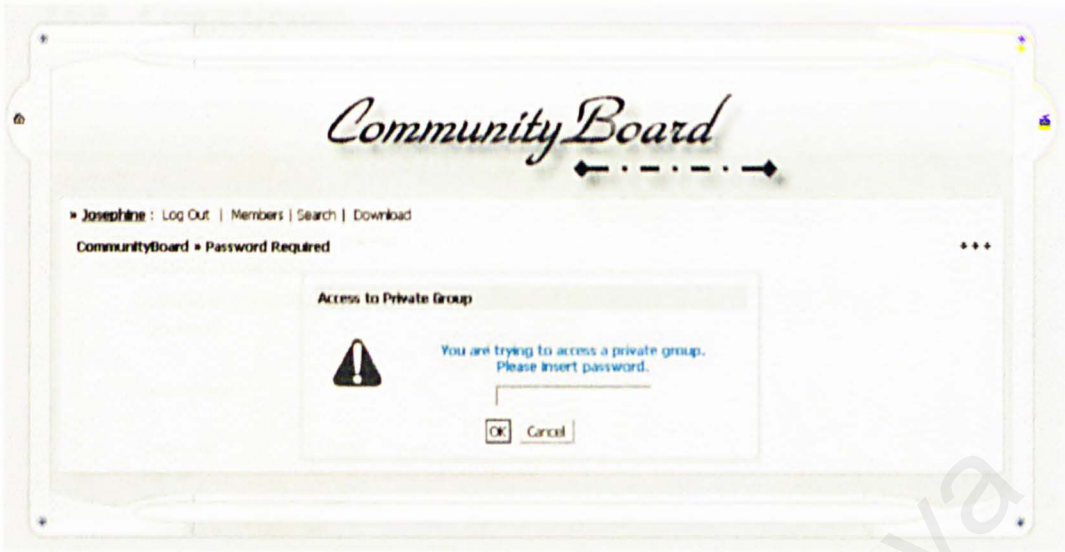


Figure 2.13 Password Required to Access Private Group



Figure 2.14 Private Group Page

30	Invite Button	Only Private Group will display Invite Button where leader used it to invite users to join correspondent private group.
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2.6.5 Create Groups

The screenshot shows the 'CommunityBoard' application interface. At the top, there is a navigation bar with links: 'Admin', 'Log Out', 'Members', 'Search', and 'Download'. Below this, the page title is 'CommunityBoard » Create Group'. The form is divided into two sections: 'Create Group --- Mandatory Field' and 'Create Group --- Optional field'. In the mandatory section, there are fields for 'Group Name', 'Group Description', 'Access Level' (with 'Public' selected), 'Password', and 'Category' (set to 'Others'). A red error message 'Password is Not Required for Public Group.' is displayed next to the password field. The optional section has a 'Keyword(s)' field. A 'Create' button is at the bottom right of the form. The status bar at the bottom shows 'Done' and 'Internet'.

Figure 2.15 Create a Public Group

This screenshot shows the same 'Create Group' form as Figure 2.15, but with 'Private' selected under 'Access Level'. In this configuration, the 'Password' and 'Confirm' fields are both required and are visible. The 'Group Name' and 'Group Description' fields are also present. The 'Category' is still 'Others'. The 'Keyword(s)' field is in the optional section. The 'Create' button is at the bottom right. The status bar at the bottom shows 'Done' and 'Internet'.

Figure 2.16 Create a Private Group

2.6.6 Post Messages

The screenshot shows the 'Community Board' interface. At the top, there's a navigation bar with links: 'Log Out', 'Members', 'Search', and 'Download'. Below this, the breadcrumb trail reads 'CommunityBoard > Public Group > Post Topic'. The main form is titled 'Post Topic --- Mandatory Field' and contains two input fields: 'Topic Title' and 'Topic Description'. Below these is a section titled 'Post Topic --- Optional Field' with a 'Keyword(s)' input field. A 'Post' button is located at the bottom right of the form. The browser's status bar at the bottom shows 'Done' and 'Internet'.

Figure 2.17 Form to Post a New Topic

2.6.7 Reply Messages to Posted Topics

The screenshot shows the 'Community Board' interface for replying to a topic. The breadcrumb trail is 'CommunityBoard > Public Group > Rules to be a leader of a group'. The 'Topic Information' section displays the topic title 'Rules to be a leader of a group' and a description: 'In order to be a leader of a group, you need to register as a member of Community Board, after you login, you will be able to create a group whether is public or private access, please be responsible to manage your group properly, if not, your post as a leader will be terminate, thank you.' It also shows 'Total: 1 Replied Messages'. Below this is a table with one row of replies:

Message	Posted By	Posted On
additional questions... can we apply to be a admin?	Josephw	2/1/2006 9:07:31 AM

Below the table is the 'Reply To Topic --- Mandatory Field' section with 'Message Title' and 'Message Description' input fields. Below that is the 'Reply To Topic --- Optional Field' section with a 'Keyword(s)' input field. A 'Reply' button is at the bottom right. The browser's status bar at the bottom shows 'Done' and 'Internet'.

Figure 2.18 Form to Reply to Posted Topic

2.6.8 Search

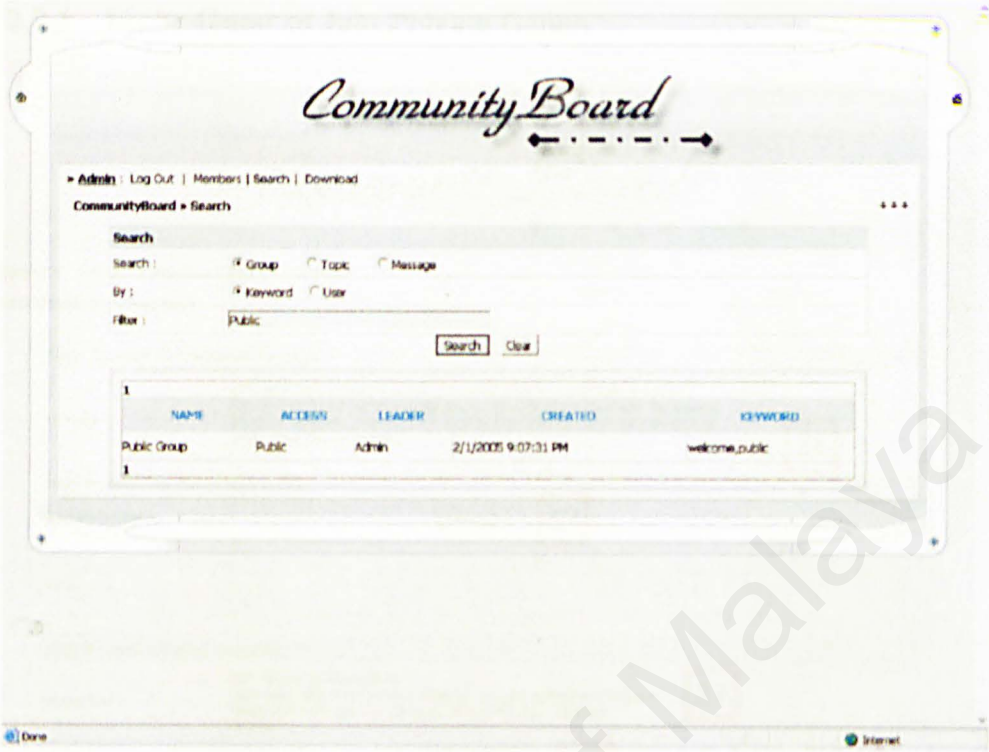


Figure 2.19 Search Form

2.6.9 View Members

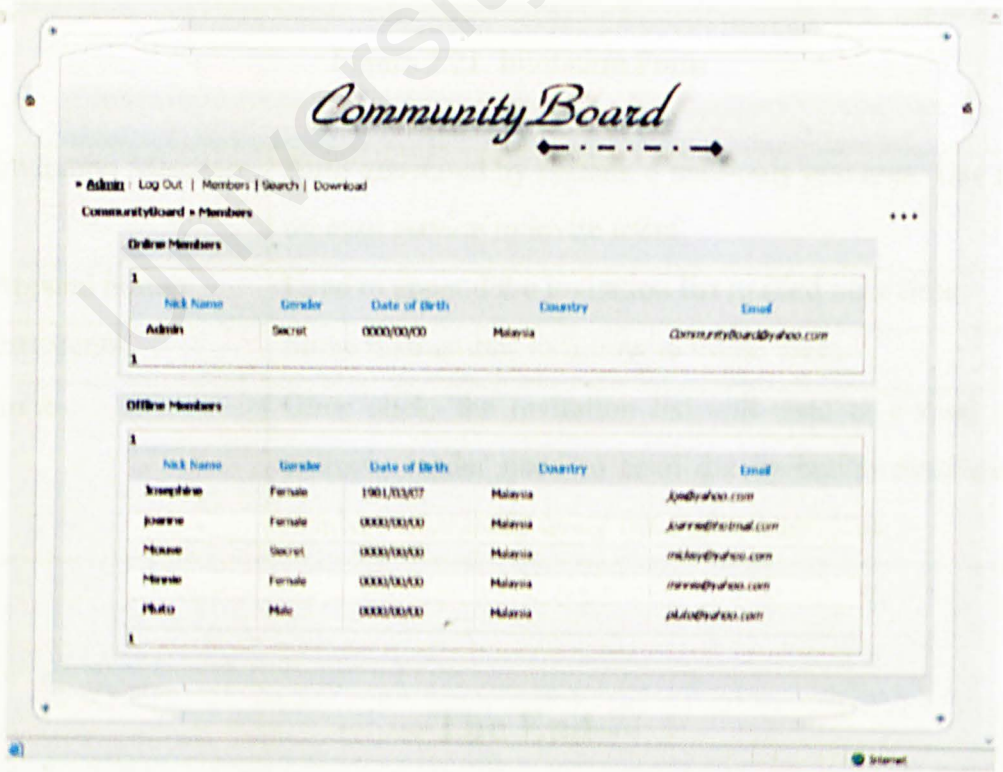


Figure 2.20 Display Members on Online and Offline Grid

2.7 After login, only leader can perform the following tasks

2.7.1 Invite Guest to Join Private Group



Figure 2.21 Invitation Form

31	Invitation Message	Auto generated by system, a read-only text area. Use to paste on mail service to invite users.
32	Append button	Used to append the invitation list to send once time.
33	Instruction	Some instructions to follow to invite users.
34	Invite	Once click, the invitation list will send to a mail service, outlook, leader need to send the invitation message to all receivers manually using the outlook services.

---The End---