Online Movie Rental System

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Abstract

The online movie rental system is actually a web site that consists of a number of web pages; the idea of developing this online system is come out with the observation to the current movie rental system that normally a close system (not a web enabled system), especially the reservation method that is usually carried out manually at video center. Nowadays, so many online movie rental systems can be found on Internet, as their usages are basically for publishing products (movies as well) by service provider, advertising services and products, and communicates with either website visitors or members.

The architecture of online system of this project is two-tier client/server architecture. First tier of the architecture is a user of this online system, visitor, member or administrator. Second tier will be the database, which store key data essential for the system.

The project of developing this online system is separated into a few phases (chapters). Each phase discusses different but related issues and activities that is essential for the whole project. The first chapter of this project documentation discusses the project introduction and definition. The second chapter discusses about literature review of the existing systems and the potential development tools for this project. The following chapter, chapter 3 discusses the methodology of software engineering. Chapter four is about the system analysis to capture functional and non-functional requirements of the system, and also determine the development requirements, including

hardware and software consideration for developing this project. Chapter 5 discusses the system design and database deign describing in tables, figures and UML diagrams.

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Chapter 1 Introduction

1.1 Project Definition

Online movie rental system can be defined as an open system that directly integrates and communicates with users through web. It is the extended service provided by video center that allows customers rent (reserve) movies through Internet. This is an alternative way being provided to customers, despite of having movies reservation in the conventional way, which means that customers can only make reservation at the video center.

With the online rental system, users may obtain the same, or even better services available at the video center. Of course there are certain major advantages can be found from this online system, such as movie reservation through Internet regardless of location at any time. This means that customers can reserve movies they want anytime and at any places where are Internet ready. Another benefit is that customers can get latest information through web in the fastest time. Customers also can check their account status and keep track of the transaction records have been made previously.

This project is to develop a web-based information system with a centralized database, which is designed based on client-server architecture. The database contains diverse data types, such as customer related data that store customer's personal information, transaction data that store every reservation records and rental records.

The users for this system can be customer for the video center, the administrator, and also non-customer who surfs the online web page. At the client side, customers can obtain the reservation service and other member services by logging in their account ID, while the non-member may assign new account for membership before they can reserve movie. The administrator may need to maintain the system from time to time since the availability and the accessibility of related information are increased. Certain exchange of information can be updated directly to the database through the administration.

1.2 Project Motivation

- **To build a safety and secured online movie rental system**

  The system provides useful and effective services as well as movie rental to users. The protection to the privacy and confidential of users is considered an essential issue that must be included in the system design.

- **To extend and replace conventional method of movie reservation**

  The conventional movie reservation method require customers going to the service spot (movie center) manually to order their reservation and customers may feel inconvenient to this method. By realizing the online movie rental system, this limitation can be eliminated at all.

- **Provide faster transaction process**

  This transaction is pointing to the physical movie rental at the movie center. The faster transaction process means that business transaction between customers and providers become faster and smoother. Through this system the concept of cash-and-carry can be realized.

- **Enable online advertising and promotion to movie rental services**

  Acting as one kind of media to convey information to the public, this online system is suitable for advertising and promoting business product and services. The business providers may gain a great amount of benefits trading since the Internet is a very wide network system.

1.3 Project Objective

The objectives of developing online movie rental system are:

- To enable customers/ members rent (reserve) movie through web.
- To advertise variety type of movies for rental, including latest and most popular movies.
- To enlarge the size of business for the video center by increasing the number of customers and expanding the services area.
- To enable faster transaction of movie rental can be done at the video center.
- To provide online information, including updated news and services regardless of location.

1.4 Project scope

The online movie rental system will be developed according to the following scope parameter:

a) A few web based user interfaces with several modules will be designed to serve as the main mode of communication between users and the database.

b) The users are either visitors or members from client side, or administrator from server side.

c) A centralized database will be designed to store all the key data and system related data. This database will be connected and manipulated by the online system. The database manipulation includes addition, updates and deletion of data.

d) To design an online system with administration utilities that enabled administrator to maintain website and secure database.

e) To provide a user friendly online system that enable users to easily handle and use the features and services being designed, such as login module, reserve movies, find movie by using search engine and other useful functionalities.

The scope/features of the online movie rental system are as below:

- ✓ Allow visitors (both members and non-members) to view the services provided by the video center, and also all movies listing that available in the video center including the movie's information.
- ✓ Allow visitors (non-member) to pre-assign new account to become new member to the video center.
- ✓ Allow members to make or cancel their movie reservation.
- ✓ Allow members to check their account status.
- ✓ Allow members to update their account information such as personal information like address, telephone number, and other changeable information.
- ✓ Allow members to quick search movies they are looking at by browsing through an internal search engine. Members may search movies by keying in keyword such as the movie's title, actors/ actresses name and director.
- ✓ Allow members to give their comments and suggestions about the system.

1.5 Project limitation

The limitations of the online movie rental system are:

- It does not incorporate with any online payment system as the system is configured to reserve movies through web. Customers are still required to get the movie including the payment at the movie center.
- The system does not include the shipment of the products (movies). Customer must get the movies from the video center.
- This online service is available in limited areas only, for example, in the Kuala Lumpur only.
- Language selection is not available. Only English language is used as the system default.

1.6 Project schedule

A project schedule that consists of whole development activities is essential as it acted as time management and control to developer. A carefully planned out project will achieve a system progress and ensure the project delivery is on time.

The project schedule is planned as shown below:

Table 1.1 Project schedule

	2002							2003	
Key Activities	Jun	July	Aus	Sep	Oct	Nov	Dec	Jan	Feb
Research									
Literature Review									
System Analysis									
Proposal Finalization									
System design									
Coding									
Testing									
System integration & testing									
Report documentation									

1.7 Project overview

The first chapter gives an overview of the definition of the online movie rental system. It also gives an idea of the project motivation, the objective of this dissertation, scopes and schedule for the project.

The second chapter represents the literature review. This chapter discusses the terms, concepts and technologies used in this project. It also discusses literature for this dissertation and review of the existing system.

The chapter 3 discusses the methodology and the development model being chosen as well as the reason for the choice being made.

Chapter 4 focuses on system analysis and information gathering approaches. Furthermore, it discusses the functional and non-functional requirements that need to be considered for the whole project. At the end of this chapter, the system development tools for this project will be discussed.

Chapter 5 is focusing on the discussion of the system design. This discussion will include the system architecture, program design, database design and finally the user interface design for the whole system.

Chapter 6 describe on the system development and implementation, including the description of the processes and techniques of dividing system into workable and integrated modules and programming codes. At last, it will discuss on the system setup.

Chapter 7 will discuss various system testing techniques that will be carry out throughout the whole system development process in order to develop a precise, accurate system and also secure system from any error and failure.

Last chapter, chapter 8 brings out the conclusion for this project and summarizes the whole dissertation.

Chapter 2 Literature Review

2.1 Online movie rental system

Online movie rental system is a web application system running through Internet. This kind of system provides movie rental and other related services through Internet, with the purposes of extending the existing conventional movie rental services, enhancing the services by improving the quality of the services, and eliminates the limitations that conventional system faced.

Nowadays, this online service has been developed and implemented by thousands of movie rental companies in order to maintain and increase their business profits and interests. Peoples can easily rent or reserve movies from the services provided by this online system.

2.2 Existing system review

2.2.1 Risk's Video Center (www.risksvideo.com)

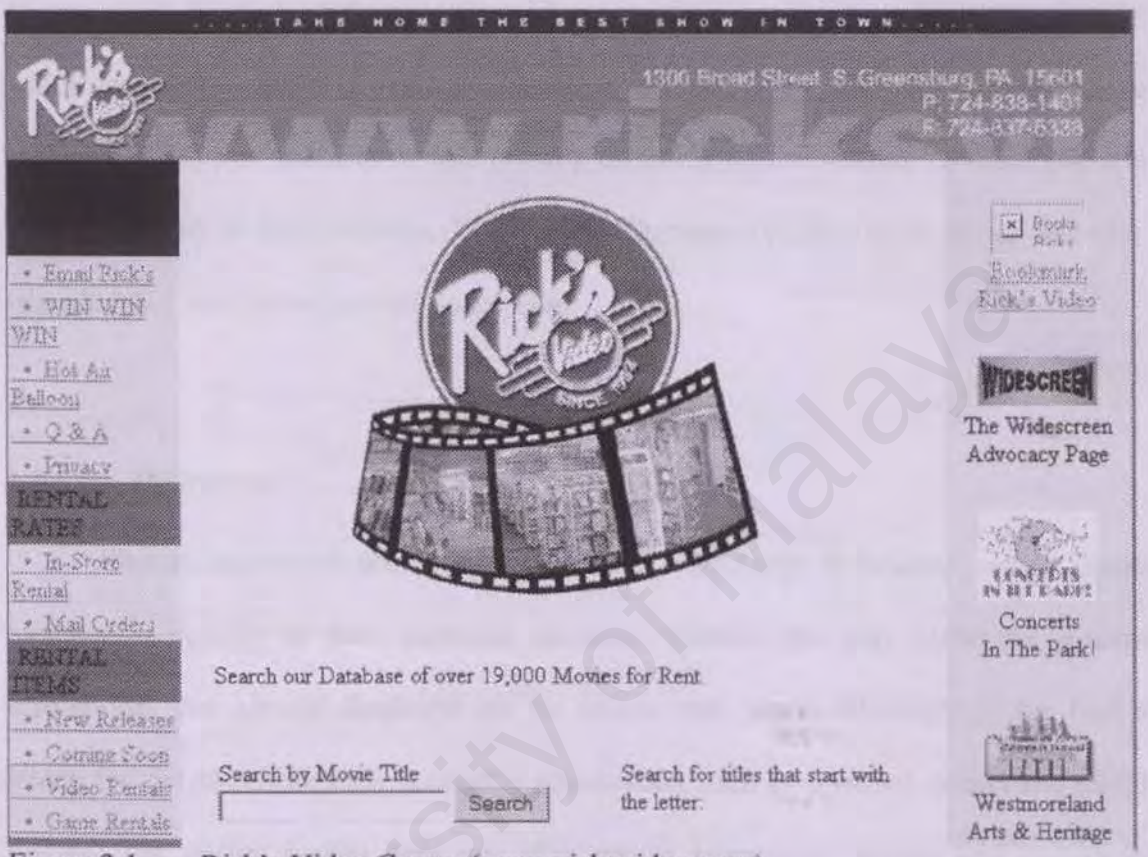


Figure 2.1 Risk's Video Center (www.risksvideo.com)

Www.risksvideo.com is a website for Risk's Video Inc, a video center in S.Greenburg, US. The objectives of this website are to advertise their business products and services. The major offered services include rental and sales for product like movies, games and magazines.

2.2.1.1 Advantages

This online system uses the mail-order method to carry out their sale and rental service. Customers only need to purchase their order by sending mail order form. Payment will be charged from credit card and the form is sent through a secure server, which protects customer's privacy. Another advantage is that Rick's Video, Inc (ricksvideo.com) is sensitive to the privacy concerns of the visitors to their physical location as well as their websites. This Privacy Statement applies to all of our websites, including but not limited to Ricksvideo.com.

2.2.1.2 Weakness

This online system does not have member login / sign in function, which allows members accessing to their personal account. Visitors can only view the general information that already displayed on the online web pages. Members of the Risk's Video Inc cannot check their account's information such as personal details and rental history. The online system does not offer movie reservation service and customers usually do not know their rental status after sending their ordering mail until they are informed through replied mail, normally in 3 to 7 days. Furthermore, the search movie function is not smart enough to give correct results as users wish, and it is a bit slow to get the search results.

2.2.2 www.hollywoodvideo.com

Figure 2.2 www.hollywoodvideo.com

Www.holiwoodvideo.com is a website owned by Hollywood Video Inc, a video center in US. Hollywood Video Inc offers services to rent and sale products: movie and game. The online system advertises all kind of services and features that the video center being offered. The main purpose of this online idea is to expand the business and services, and provide latest information to visitors and customers.

2.2.2.1 Advantages

This online system offers member authentication login module to allow members to access to their personal account, which allows members view personal pages such as

personal details, rental history, and other benefits. Members are allowed to make their rental to movies and games by submitting a rental form. The designs of the web pages are tidy and the information is well grouped, according to their category. Furthermore, the online system contains information that offers jobs to visitors.

2.2.2.2 Weakness

The Hollywoodvideo.com have a few weaknesses on the web page design. First, the web page was designed improperly especially in choosing the colors between background and text. Colors between background and text are not contrast enough causing the text to be displayed unclear and loss focus. In addition, the some texts are displayed in shallow color until user cannot read them. Another weakness is that the information is not well grouped, this lead to the confusion of user while visiting the web page especially when they wish to look for certain information.

2.2.3 www.blockbuster.com

Figure 2.3 www.hollywoodvideo.com

Www.blockbuster.com is an online movie rental and sales website for Blockbuster Inc. in US. This online web page is not only rent and sales movie but also games. The main objectives of publishing this web page are to advertise their products and services to the public, to attract visitors buy or rent their products, or to become their member.

2.2.3.1 Advantages

There are plenty of advantages can be found in the www.Blockbuster.com website. For example, the website allows member login into protected member page to get more services besides the general services. The member page is protected from access by third party other then the login person. The description to the products, either movie or game are quite clear and their catalogues are shown on the web page. The style of displaying information on this web page is effective in attracting visitor's view such as using the contrast colors between background and text, and well information grouping.

2.2.4 www.plsinfo.org

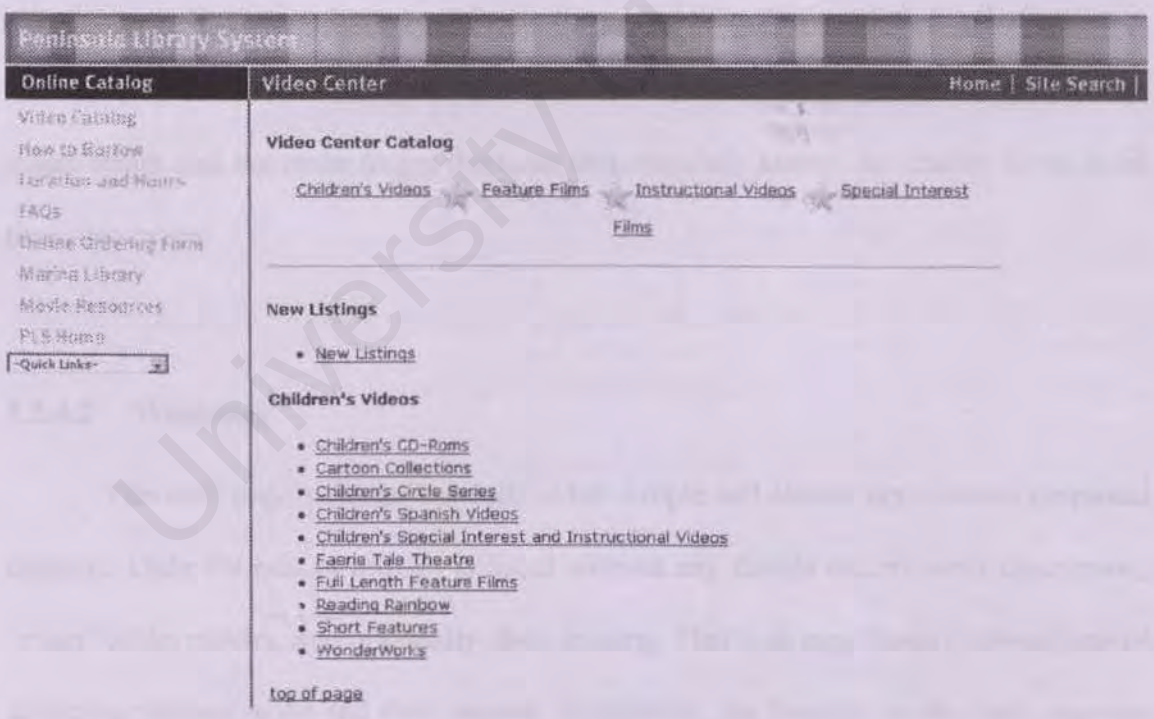


Figure 2.4 www.plsinfo.org

Www.plsinfo.org is a web page for Peninsular Library system. Peninsular Library system is a large system that provides several services to the public as well as its member. The system services scope includes book rental, CD rental, and other things. Www.plsifo.org is a web site that provides movie rental as sub-service for the library system but it is only open for the members of the library. The types of movies available in the web site are mostly not commercial but classical movies.

2.2.4.1 Advantages

The most convenient feature can be found on this website is the well listing of the movies available in the library. All the movies is already categorized and listed at different pages or section. This system also allows member to reserve movies by submitting a reservation form or ordering form, and then they need to get those movies at the library or the associated video center. The web page also displays the map of the video center and the route to get there, so that members knows the exactly location of the video center.

2.2.4.2 Weakness

This web page's design basically is too simple and almost not contains graphical displays. Only the title of movies is listed without any details like movie's description, actors for the movies, and optionally, their catalog. This web page faces the weakness of attracting visitors' sight and their interest. In addition, the features on this web page are less such as providing member log in, search movie and assign new account.

2.3 The Internet

The Internet, sometimes called simply "the Net," is a worldwide system of computer networks - a network of networks in which users at any one computer can, if they have permission, get information from any other computer. Through the Internet, messages could be routed or rerouted in more than one direction, the network could continue to function even if parts of it were destroyed [1].

Physically, the Internet uses a portion of the total resources of the currently existing public telecommunication networks. While technically, TCP/IP (Transmission Control Protocol/Internet Protocol) distinguishes the Internet. The intranet and the extranet, also make use of the TCP/IP protocol.

Sending electronic mail (e-mail) through Internet has practically replaced the Postal Service for short written transactions. They can also carry on live "conversations" with other computer users, using Internet Relay Chat (IRC). Furthermore, Internet telephony hardware and software allows real-time voice conversations. The most widely used part of the Internet is the World Wide Web (often abbreviated "WWW" or called "the Web"). Its outstanding feature is hypertext, a method of instant cross-referencing, which will be transferred to the site or page that is relevant to this word or phrase.

Web browsing is done with a Web browser, the most popular of which are Microsoft Internet Explorer and Netscape Navigator. Also, later versions of a particular

browser are able to render more "bells and whistles" such as animation, virtual reality, sound, and music files, than earlier versions.

2.4 Client server computing

Client/server describes the relationship between two computer programs in which one program, the client, makes a service request from another program, the server, which fulfills the request. In another word, a client is defined as a requester of services and a server is defined as the provider of services. A single machine can be both a client and a server depending on the software configuration.

In a network, the client/server model provides a convenient way to interconnect programs that are distributed efficiently across different locations. The transactions using the client/server model are very common. The client/server model has become one of the central ideas of network computing. Most business applications being written today use the client/server model. In the usual client/server model, server is activated and awaits client requests.

Typically, multiple client programs share the services of a common server program. Both client programs and server programs are often part of a larger program or application. Relative to the Internet, Web browser is a client program that requests services from a Web server in another computer somewhere on the Internet.

2.4.1 Client/server architecture

As a result of the limitations of file sharing architectures, the client/server architecture is emerged and database server replaces the file server. By using a relational database management system (DBMS), user queries could be answered directly. The client/server architecture reduced network traffic by providing a query response rather than total file transfer. It improves multi-user updating through a GUI front end to a shared database. In client/server architectures, Remote Procedure Calls (RPCs) or standard query language (SQL) statements are typically used to communicate between the client and server.

2.4.2 Two-tier architecture

The two-tier architecture contains two computers, a client and a server, with areas of logic combined on the client. With two tier client/server architectures, the user system interface is usually located in the user's desktop environment and the database management services are usually in a server that can service many clients. Processing management is split between the user system interface environment and the database management server environment. The database management server provides stored procedures and triggers.

The two-tier client/server architecture is a good solution for distributed computing but it does have limitations. For example, when the number of users become more, like exceeds 100, performance begins to deteriorate. A second limitation of the two tier architecture is that implementation of processing management services using

vendor proprietary database procedures restricts flexibility and choice of DBMS for applications. It causes limited flexibility in moving (repartitioning) program functionality from one server to another without manually regenerating procedural code.

2.4.3 Three-tier architecture

The three-tier architecture (also referred to as the multi-tier architecture) emerged to overcome the limitations of the two-tier architecture. In the three-tier architecture, a middle tier was added between the user system interface client environment and the database management server environment. There are a variety of ways of implementing this middle tier, such as transaction processing monitors, message servers, or application servers. The middle tier can perform queuing, application execution, and database staging. In addition the middle layer add scheduling and prioritization for work in progress. The three-tier client/server architecture has improved performance for groups with a large number of users and improves flexibility when compared to the two-tier architecture.

2.5 Platform

Platform can be defined as the operating system a computer is running on. The operating system is the heart and soul of the machine, computer and software cannot run without it. A platform consists of an operating system, a set of hardware that performs logic operation and manages data movement in the computer [2].

Most application programs have been written to run on particular platform. Each platform provides different application program interface for different system services. However, most of them allow programs to run on different platform or interoperate with different platform through mediating or 'broker' programs.

2.5.1 Windows 2000 server

Windows 2000 Server is a product of Microsoft Corporation, which supports up to 4 ways processing and up to 4 GB of memory [21]. Windows 2000 Server is the multipurpose network operating system for businesses of all sizes and provides services that enable users to build and deploy servers more quickly. Furthermore, this version contains all the components needed to run a variety of applications and business ventures, and in addition to a wide range of new administrative components. Windows 2000 allows easier network configuration with the plug and play network adapter. There are some new features containing in all versions, such as:

- Active Directory, an enterprise class directory service that is scalable and configurable.

- Asynchronous Transfer Mode (ATM), which transport multiple types of traffic across LANs and WANs simultaneously.
- Dynamic DHCP, which works with the Active Directory and DNS on IP networks. This relieves administrators of the need to assign and track static IP addresses.
- Encrypting File System (EFS), which add new access controls users can use to enhance file security.
- Internet Connection Sharing, with which allows users to share Internet connection throughout the network.

Windows 2000 Server lets users to:

- Share files and printers reliably and securely.
- Choose from thousands of business applications compatible to run today on Windows 2000 Server.
- Build Web applications and connect to the Internet.

This combination and flexibility delivers a strong business value proposition for today's IT customer.

2.5.2 Windows NT 4

Microsoft Windows NT Server 4.0 is a multipurpose server operating system. A multipurpose operating system integrates a variety of network services. The services it provides are designed to address customer requirements and are managed in a single way [3].

Now with the 4.0 release of NT, Microsoft has made a concerted effort to make Windows NT the standard by which all others are judged. NT Server 4.0 includes not only the Windows 95 user interface, but a host of other features, such as Network OLE, Internet Information Server (IIS) 2.0, RAS multi-link and RAS autodial, Point-to-Point Tunneling Protocol (PPTP), fully integrated DNS and WINS, integrated multi protocol router, expanded driver support, improved performance, and much more [4].

The features of Windows NT Server 4.0 include:

- **User Interface and Management**

  Windows NT4 supports Microsoft Management Console allows administrators to create task-based consoles that can be delegated to the appropriate administrator. It also integrates with Microsoft Windows 95 operating system user interface. Windows NT4 provides Administrative wizards that group the common server management tools into a single place. Other features such as Network Monitor, System Policy Editor and User Profiles, Printing Features and Task Manager can be found in Windows NT4.

- **Improved performance**

  Windows NT4 supports File and Printer sharing that enables higher network throughput. Windows NT Server 4.0 provides scalability on multiprocessor systems through APIs for server application developers and server performance.

- **Intranet/Internet Services**

  Windows NT Server 4.0 combines with its built-in Web server, Microsoft Internet Information Server 4.0 (IIS). IIS 4.0 Publishes information to the web using Web browser, Web publishing wizard, or FTP. It also Shares files and data on Windows NT, Novell NetWare and UNIX servers, and more than 55 databases, including Microsoft SQL Server, Oracle, and Sybase databases. Another services are Digital certificates that give users a method of logging onto a Web site without having to remember logon IDs and passwords, Microsoft Index Server 2.0 that indexes the full text and properties of files on your server.

- **Application Services**

  Windows NT4 integrates with Microsoft Transaction Server (MTS) that builds and deploys scalable, component-based applications, and Microsoft Message Queue Server (MQS) that allow applications to communicate with each other asynchronously through messages.

2.5.3 Linux

Linux is an operating system that was initially created as a hobby by a young student, Linus Torvalds, at the University of Helsinki in Finland. Version 1.0 of the Linux Kernel was released in 1994 and until now the current full-featured version is 2.4 (released January 2001) and the development continues.

Linux is developed under the GNU General Public License and its source code is freely available to everyone. Anyway, the companies and developers may charge money for it as long as the source code remains available. Linux has the multi-purpose usage including networking, software development, and as an end-user platform. Linux is considered an excellent, low-cost alternative to other more expensive operating systems [5].

Since Linux provides great functionality and availability, it has become popular worldwide and a vast number of software programmers have taken Linux's source code and adapted it to meet their individual needs. Right now, there are dozens of ongoing projects for porting Linux to various hardware configurations and purposes.

2.6 Web server

A Web server is a program that use 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 must have a Web server program to display web sites. Two leading Web servers nowadays are Apache and Microsoft's Internet Information Server (IIS). Others Web server such as Novell's Web Server is purposely used by users of its NetWare operating system, IBM's family of Lotus Domino servers is primarily used by IBM's OS/390 and AS/400 customers. [6]

Web servers often come as part of a larger package of Internet and intranet-related programs for services like 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.

2.6.1 Microsoft Internet Information Server (IIS 5.0)

Internet Information Server 5.0(IIS) is a Windows 2000 web service that can publish information on the Internet. It represents a new Internet architecture that is in place for Windows 2000 and fully integrated at the Windows 2000 Server. IIS 5.0 is installed as a networking service of Windows 2000 Server. It provides many improved

and new features that provide a robust and scalable architecture for web, FTP, and other related Internet technologies. Also, as an integral part of Windows 2000, it supports a number of Internet standards, clustering and much more.

2.6.2 Netscape Enterprise Server

Netscape Enterprise Server is powerful web server software essential for enterprises moving their business to the Internet. By providing high performance, reliability, and manageability, Netscape Enterprise Server solves the business-critical needs of some of the world's busiest web sites. Netscape Enterprise Server also enables rapid development and deployment of web-based applications that can enhance communication, streamline processes, and reduce costs [7].

Netscape Enterprise Server delivers high performance through optimized caching, symmetric multiprocessor support, advanced use of kernel threads, HTTP 1.1 support, and sophisticated memory management. In addition, Enterprise Server supports several third-party SSL hardware accelerator devices that capable to improve performance significantly during SSL computations. Besides, Netscape Enterprise Server provides High-availability features include support for multiple processes and process monitors. To further enhance availability, Netscape Enterprise Server features a dynamic log rotation feature that enables administrators to rotate server logs without shutting down the server. Netscape Enterprise Server also supports features like Centralized Server Management to easily add, change, and delete user information, Rapid Application Development and Information Sharing and Management.

2.6.3 Apache Web Server

Apache is a very popular Web server on Linux, Novell, and Solaris systems but except on Windows, where Microsoft Internet Information Server (IIS) dominates. Both are included with the network OS: IIS comes with Windows, and Apache ships with most non-Windows OSs. Apache 2.0 has better performance and scalability on Windows and non-Windows platforms compared with previous version Apache 1.3 [8].

Apache 2.0 has multiprocessing modules specific to the underlying OS while Apache 1.3 has to use a POSIX emulation to support the Windows platform. Allocating the native Windows API for underlying tasks such as file I/O should improve performance. Also, Apache now can use both OS processes and threads, leading to better scalability.

Apache's setup is easier after its configuration utility has evolved but still foreign to those accustomed to GUI interfaces. Its configuration is done through directives entered into the main Apache configuration file (httpd.conf).

Apache can move to other languages with its support of Unicode implemented in the OS for Windows NT, 2000, and XP. The changes in Version 2.0 may lead to significantly better scalability for Web applications and Web sites.

2.7 Browsers

A browser is an application program that provides a way to look at and interact with all the information on the World Wide Web. 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. Netscape Navigator and Microsoft Internet Explorer are the examples of the browser nowadays. 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 and the File Transfer Protocol (FTP), a Web browser is not required for those Internet protocols and more specialized client programs are more popular [1].

2.7.1 Netscape Navigator 6

Netscape Navigator 6 come in a package with Netscape 6.2 and built on the innovative Netscape Gecko browser engine. Sporting a new user interface through the use of Themes and an open Application Programming Interface (API), Netscape 6 gives third parties the ability to create custom looks for the browser.

Netscape 6 provides a new, simpler, slicker look of its Modern Theme, which can be switched easily from the view menu that allows third parties can create custom looks that lets a user express his or her own style in the browser.

Another new feature in Netscape 6, "My Sidebar" is a resizable window that displays a collection of customizable tabs that can keep user connected to what's important to them on the Web. My Sidebar supports the same standards as the main browser, so tabs can be mini-applications as well as just HTML pages. Netscape Instant Messenger is now integrated through a tab on My Sidebar. The integrated messenger client provides basic messaging and text formatting from browser, mail and address book. Netscape 6 lets users do a search directly from the URL line by entering their keywords and clicking the search button. If the search tab loaded on My Sidebar, it opens with results, as well as displaying a Web page with the collected results in the main browser window.

Netscape Navigator 6 provides features for developer, like support for Themes in Netscape, developers and companies can create personalized or branded looks with the Theme Builder. Independent Service Providers (ISPs) and consultants can create their own branded versions of the Netscape 6 browsers using the Netscape Client Customization Kit. Web-site developers can create custom Tabs for the Netscape 6 Side Bar since My Sidebar supports the same Web technology the main browser does.

2.7.2 Internet Explorer 5.5

Internet Explorer is a web browser included with Windows 2000 that enables users to access sites on the Internet, including Web, FTP, and gopher sites. It also can be used to browse local folders and network shares.

Microsoft Internet Explorer 5.5 is the later version of IE and it introduces powerful new features while retaining the superior performance and stability of Internet Explorer 5 [9]. Internet Explorer 5.5 enables users to create rich, Web-based applications and services faster and easier. The features that help Internet Explorer 5.5 achieve this goal include continued innovation of the Internet Explorer component model, enhanced multimedia support and improved editing services.

There are a number of new features offered by IE 5.5, such as:

- An enhanced HTML and components HTC model that uses element behaviors and View link.
- More control over user interface (UI) components, such as scroll bars, frames, and pop-up windows and menus.
- Improved rendering and layout interfaces for binary behaviors.
- More Cascading Style Sheets (CSS) styles, such as the first-letter and first-line pseudo-elements.
- Vertical text, made possible by using the writing Mode property.
- Enhanced HTML+TIME (Timed Interactive Multimedia Extensions) support.

- Print preview.
- New HTML editing features.

2.8 Web application programming language

2.8.1 HTML

HTML (Hypertext Markup Language) is the set of markup symbols or codes inserted in a file intended for display on a World Wide Web browser page. The markup tells the Web browser how to display a Web page's words and images for the user. Each individual markup code is referred to as an element (also refer to it as a tag). Some elements come in pairs that indicate when some display effect is to begin and when it is to end [1].

HTML is a formal Recommendation by the World Wide Web Consortium (W3C). Microsoft's Internet Explorer and Netscape's Navigator are two major browsers adhered the HTML and provide some additional non-standard codes. However, both Internet Explorer and Netscape implement some features in different way and provide non-standard extensions.

HTML 4 is the current version of HTML. Since the Internet Explorer and Netscape Navigator implement the HTML features differently, Web developers using features of HTML 4 may have to design pages for both browsers and send out the appropriate version to a user. Significant features in HTML 4 are sometimes described in general as dynamic HTML.

2.8.2 Active Server Page

Microsoft Active Server Pages (ASP) is a server-side scripting environment that enables users to create dynamic and interactive Web pages and build powerful Web applications. It combines standard HTML code with a variety of different scripts such as JavaScript, Jscript, VBScript and also components like C++ and Java. In addition, it can customize user's experience by creating browser independent content. When the server receives a request for an ASP file, it processes server-side scripts contained in the file to build the Web page that is sent to the browser. In addition to server-side scripts, ASP files can contain HTML and related client-side scripts as well as calls to COM components that perform a variety of tasks, such as connecting to a database or processing business logic.

ASP is Microsoft's answer to Common Gateway Interface (CGI) AND Internet Server Application Programming Interface (ISAPI). It provides an easier, more flexible approach to publishing Web content. With IIS 5, ASP has been enhanced with features like:

- Program flow control
- Enhanced error handling
- Script less ASP
- Performance-enhanced object
- Extensive Markup Language (XML) integration
- Windows script components

2.8.3 Java Server Page

Java Server Pages (JSP) is a technology that allows web developers and designers to rapidly develop and easily maintain information-rich, dynamic web pages. Besides that, this technology enables rapid development of web-based applications that are platform independent. Java Server Pages technology separates the user interface from content generation; it enables designers to change the overall page layout without altering the underlying dynamic content.

Java Server Pages technology uses XML-like tags and scriptlets written in the Java programming language to encapsulate the logic that generates the content for the page. JSP technology separates web page logic from its design and display, also supports a reusable component-based design. These features make its web page development faster and easier than ever to build web-based applications.

Java Server Pages technology is an extension of the Java Servlet technology that is platform-independent and hundred percent pure Java server-side modules. Servlet can fit seamlessly into a web server framework and extend the capabilities of a web server with minimal overhead, maintenance, and support. Furthermore, Servlets involve no platform-specific consideration or modifications; they are Java application components that are downloaded to the part of the system that needs them. Together, JSP technology and Servlets provide an attractive alternative to other types of dynamic web scripting/programming that offers platform independence, enhanced performance,

separation of logic from display, ease of administration, extensibility into the enterprise and the ease of use.

2.8.4 VBScript

Microsoft VBScript is a subset of the Visual Basic programming language. It is a fast, portable and lightweight interpreter for use in Internet browsers and other applications that use Microsoft ActiveX Controls, Automation servers, and Java language applets. It also provides a run-time engine for parsing and translating Microsoft Visual Basic Scripting Edition 5.5. Microsoft Visual Basic Scripting Edition brings active scripting to environments such as Web client scripting in Microsoft Internet Explorer and Web server scripting in Microsoft Internet Information Service.

Browser Control Host (SHDOCVW) in Internet Explorer 5.5 is host of VBScript. VBScript talks to this host applications using Windows Script. Windows Script is used in Microsoft Internet Explorer and in Microsoft Internet Information Service. It enables browsers and other host applications run each scripting component without requiring special integration code. In addition, it enables host to compile scripts, obtain and call entry points, and manage the namespace available to the developer. Microsoft provides binary implementations of VBScript for the 32-bit Windows API, the 16-bit Windows API, and the Macintosh. VBScript and Windows Script can also be used as a general scripting language in other applications.

2.8.5 JavaScript

JavaScript is an interpreted programming or script language from Netscape with capability similar to Microsoft's Visual Basic, Sun's Tcl, the UNIX-derived Perl, and IBM's REX. Generally, script languages like JavaScript are easier and faster to code in than the more structured and compiled languages such as C and C++. Script languages generally take longer to process than compiled languages, but are very useful for shorter programs [1].

JavaScript is used in Web site development to do such things as:

- Automatically change a formatted date on a Web page
- Cause a linked-to page to appear in a popup window
- Cause text or a graphic image to change during a mouse rollover

JavaScript uses some of the same ideas found in Java. JavaScript code can be imbedded in HTML pages and interpreted by the Web browser (or client), such as Microsoft Internet Explorer and Netscape Navigator. It can also be run at the server as in Microsoft's Active Server Pages before the page is sent to the requestor.

2.8.6 JScript

JScript is the Microsoft implementation of the ECMA 262 language specification (ECMA Script Edition 3). It is a full implementation of the ECMA standard and also an interpreted, object-based scripting language. JScript is not a cut-down version of another language and cannot be used to write stand-alone applications in it. Also, it has no built-in support for reading or writing files. Moreover, JScript scripts can run only in the presence of an interpreter or "host", such as Active Server Pages (ASP), Internet Explorer, or Windows Script Host.

JScript is a loosely typed language. Users do not have to declare the data types of variables explicitly. Moreover, JScript performs conversions automatically when needed in many cases.

2.9 Web application development tools

2.9.1 Microsoft Visual InterDev 6

Visual InterDev 6.0 is a web development tool that allows users to create, publishes, and manages dynamic web applications. It also comes out with powerful tools for creating robust database applications [10].

One of the most important features included in Microsoft Visual InterDev 6.0 is the Rapid Application Development (RAD). Rapid Application Development is the breaking down of the development process into smaller stages. Visual InterDev provides many tools to assist developers at each stage, such as improved HTML editor to write HTML by hand, as well as a WYSIWYG editor to add in content. Another tool like debugging tool is used to debug both client and server scripts. Besides that, VI 6.0 also supports feature like add watches to scripts that allow users to examine the state of variables at that point in the execution of the program.

Another useful features can be found in Visual InterDev 6.0 is the IDE (Integrated Development Environment). IDE lets users access to all the needed tools to build web application from within the same interface. Users can switch from HTML pages to a Java, C++ or database project.

The database tools included with Visual InterDev 6 are more advance, not only support server databases, but also can work with the client IE4 data-binding techniques.

Users can design and modify databases from within Visual InterDev using a variety of tools.

MS Personal Web Server is included with Visual InterDev. It lets developers create web applications on their Windows NT4/95/98 based machine without having a full-scale web server such as IIS installed. Visual InterDev also integrates with Visual SourceSafe that provides a safe environment for multiple authors on a project.

2.9.2 Microsoft FrontPage 2000

Microsoft FrontPage is an all-purpose web site authoring package that is used to create, manage, and navigate Web pages and Web sites by offering unprecedented ease of use and leading-edge support for the latest Web technologies. FrontPage 2000 provides features such as customizable themes, and improved layout tools. It enables users to control Web site's navigation, layout, and formatting more easily. In addition, FrontPage 2000 had already improved components and seamless integration with Microsoft Office; FrontPage 2000 makes successful Web site creation and management easy and accessible [11].

FrontPage 2000 allows users to create great-looking Web sites exactly the way they want. Users can position elements exactly where they want them on the page to give web site an overall professional look, import and edit HTML, and use the latest tools in Web technology.

FrontPage 2000 also allows users to set up and maintain site as a whole, easily monitor the condition of web site, and make updates to the web site. Most FrontPage users also have experience with one or more Microsoft Office applications (such as Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and Microsoft Access). FrontPage 2000 was designed to function like a Microsoft Office program so that users can get up and running more quickly than ever.

2.9.3 Dreamweaver

Macromedia Dreamweaver is the professional choice for building web site and Internet application. It combines its renowned visual layout tools with the rapid web application development features of Dreamweaver UltraDev and the extensive code-editing support of Macromedia HomeSite. It Enhance productivity using the new integrated workspace, which is shared with Macromedia Flash MX and Fireworks MX. Moreover, it Jumpstart the design and production using professional-quality, pre-built layouts and code, including site structures, forms, accessible templates, and JavaScript functions for client-side interactivity. Besides, it enables code to be written faster than ever before using high-powered coding features [12].

Macromedia Dreamweaver can rapidly develop Internet applications for the latest server technologies. Furthermore, it Uses integrated development environment to develop HTML, XHTML, XML, ASP, ASP.NET, JSP, PHP, and Macromedia ColdFusion websites. It can also develop common Internet applications quickly by using

libraries of code to create database insertion and update forms, recordset navigation pages, and user authentication pages.

Macromedia Dreamweaver Unlock the benefits of emerging standards and new web technologies, including XML, web services, XHTML, and accessibility compliance. Also, it can accelerate next-generation development with support for XML.

2.10 Database

A database is a collection of data that is organized so that its contents can easily be accessed, managed, and updated. There are many type of database such as relational database, distributed database, and object-oriented programming. Databases contain aggregations of data records or files. Typically, a database manager provides users the capabilities of controlling read/write access, specifying report generation, and analyzing usage. Database can be presented on mainframe, workstation or personal computer. Structured Query Language (SQL) is a standard language for making interactive queries from and updating a database such as IBM's DB2, Microsoft's Access, and database products from Oracle, Sybase, and Computer Associates [13].

2.10.1 Oracle 9i Database

Oracle9*i* Database Release 2 is the first major follow-on release to the award-winning Oracle9*i* Database. Oracle9*i*DB Release 2 features full XML database functionality with the new XML DB feature, enhancements to the groundbreaking Oracle9i Real Application Clusters and additional self-tuning and self-management capabilities to help improve DBA productivity and efficiency. In addition, the built-in OLAP functionality has been expanded and significant enhancements and tunings have been made for Windows and Linux systems.

Oracle9*i* has been designed with focus on certain key development areas, such as:

Application Development

Oracle9*i* continues to offer the best development platform for Internet and traditional application development. Key focus areas include:

· XML

· Enterprise Java Engine

· SQL and PL/SQL improvements

· Globalization

Internet Content management

Oracle9*i* Database Release 2 rounds out the content management platform that is part of the database. New features and capabilities in this second release includes the improvements to Oracle Text that enhance its manageability and scalability, the new formats supported by interMedia AVI, as well as improved image processing performance.

Availability

Oracle9*i* extends Oracle's leadership in Internet database availability that is critical for any Internet application. Oracle9*i* Database Release 2 's availability include providing an industry leading data protection environment, upgrading applications and database with minimal downtime and enabling end-users to identify and correct their own mistakes.

The rest of features and characteristics in Oracle9i include Data Integration, Manageability, Scalability and Performance, and Security.

2.10.2 Microsoft SQL Server 2000

Microsoft SQL Server 2000 is an enterprise-level database and is the latest version of Microsoft SQL 7. It provides agility to data management and analysis, the ability to adapt quickly and gracefully to derive competitive advantage in a fast-changing environment. From a data management and analysis perspective, it is capable to turn raw data into business intelligence and take full advantage of the opportunities presented by the Web. Furthermore, it provides rapid development of a new generation of enterprise-class business applications. SQL Server 2000 is a fully Web-enabled database product, providing core support for Extensible Markup Language (XML) and the ability to query across the Internet and beyond the firewall.

Fully Web-Enabled

SQL Server 2000 provides extensive database programming capabilities built on Web standards. Rich XML and Internet standard support give the ability to store and retrieve data in XML format easily with built-in stored procedures. Users can also use XML updategrams to insert, update and delete data easily.

- **Easy access to data through the Web.** SQL Server 2000 provides abilities accessing to data; such as using HTTP to send queries to the database, perform full-text search on documents stored in database, and run queries over the Web with natural language.

- **Powerful, flexible Web-based analysis.** SQL Server 2000 Analysis Services capabilities are extended to the Internet with ability to access and manipulate cube data by means of a Web browser.

Highly Scalable and Reliable

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

- **Scale up.** SQL Server 2000 takes advantage of symmetrical multiprocessor (SMP) systems. SQL Server Enterprise Edition can use up to 32 processors and 64 GB of RAM.
- **Scale out.** Scale out distributes the database and data load across servers.
- **Availability.** SQL Server 2000 achieves maximum availability through enhanced failover clustering, log shipping, and new backup strategies.

Fastest Time-to-Market

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

- **Integrated and extensible analysis services.** SQL Server 2000 can build end-to-end analysis solutions with integrated tools to create value from data. Additionally, it can automatically drive business processes based on analysis results and flexibly retrieve custom result sets from the most complex calculations.

- **Quick development, debugging, and data transformation.** SQL Server 2000 features the ability to interactively tune and debug queries, quickly move and transform data from any source, then define and use functions as if they were built in to Transact-SQL. Users can visually design and code database applications from any Visual Studio tool.
- **Simplified management and tuning.** With SQL Server 2000, it is easy to manage databases centrally alongside all enterprise resources. Stay online while easily moving and copying databases across computers or between instances.

2.10.3 Microsoft Access 2000

Microsoft Access 2000 is a relational database application that allows users to create and manipulate data in database. Microsoft Access 2000 is capable to build powerful business solutions easily and find answers faster. It enables web collaboration and improves productivity with new tools, making data immediately available to any coworker. Furthermore, it can customize views and formats to show precisely the needed information. The built-in Microsoft SQL server integration helps to create a scalable database that grow with business [14].

Seamless integration between data source and interactive Web pages makes building and sharing a Microsoft Access database easier than ever. Through the use of web technology, information can be accessed faster for specific purpose. Office 2000 Web Components is added to visually analyze data in Web browser.

Microsoft Access 2000 makes information easier to find and use, also quickly analyze details and see vital relationships. It takes advantage of new tools for customizing forms and reports.

Microsoft Access 2000 includes built-in Microsoft SQL Server integration that brings the power of high-end database management to the familiar Access environment. It takes advantage of scalable SQL Server technology to create enterprise-level databases.

2.11 Summary

The starting of this chapter is discussing the typical online movie rental system that can be found on Internet nowadays, with the analysis over a few existing system to find out the advantages and even weaknesses of those systems, so that the system for this ongoing project can be more powerful and reliable, and also fulfills with other suitable features. Then the next discussion is about the literature review to development tools that needed to develop this ongoing system. Each development tool is compared with the other before choosing it.

Chapter 3 Methodology

3.1 Methodology

Software engineering methodology is a serial of process that can lead the development of an application. The processes describe how the work is to be carried out to achieve goal based on system requirement and each process consists of a number of steps and rules that should be perform during development [15]. In another words, software engineering methodologies are the framework that tells us how we should go about developing our software systems. These frameworks define different phases of the development process, such as planning, requirements analysis, design, testing and maintenance [16].

3.2 Object Oriented Methodology (OOM)

Object Oriented Methodology (OOM) is a new system development approach encouraging and facilitating reuse of software components. This methodology allows a computer system to be developed on a component basis, which enables the effective reuse of existing components and facilitates the sharing of its components by other systems. By the adoption of OOM, higher productivity, lower maintenance cost and better quality can be achieved.

The ultimate objective of OOM is application assembly - the construction of new business solutions from existing components. The components are combined in different

ways to meet the new requirements specified by the user community. Only completely new functionality will have to be built to complete the solution [15].

Software components can be assembled to form applications.

Figure 3.1 Application assembly illustration

OOM applies a single object model that evolves from the analysis and design stage to the programming level. An object contains both the data and the functions that operate upon that data. An object can only be accessed via the functions defined in the class of the object or other functions publicly available for it, so that all details of its implementation are hidden from all other objects. This strong encapsulation provides the basis for the improvements in trace ability, quality, maintainability and extensibility that are key features of well-designed Object Oriented systems.

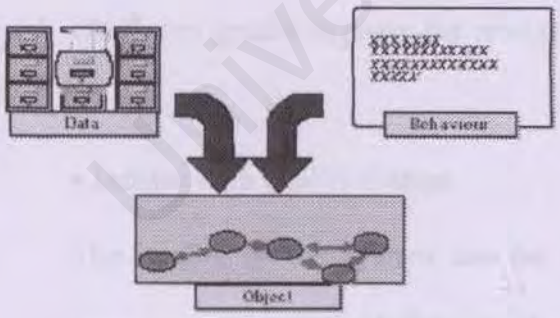


Figure 3.2 Object' definition

3.2.1 History of OOM

The use of OOM for analyzing and designing systems began to mature towards 1990 with the launch of methodologies from the three industry-leading methodologists: Ivar Jacobson, Grady Booch and James Rumbaugh.

Object Management Group (OMG) was founded In 1989. The mission of OMG is to establish industry guidelines, detailed object management specifications and common frameworks for application development. One of the best-known specifications maintained by OMG is the Unified Modeling Language (UML).

3.2.2 Benefits of OOM

The following benefits can be achieved by adopting OOM:

- Improve productivity

Application development is facilitated by the reuse of existing components, which can greatly improve the productivity and facilitate rapid delivery.

- Deliver high quality system

The quality of the system can be improved as the system is built up in a component manner with the use of existing components, which are well tested and proven.

• Lower maintenance cost

The associated property of trace ability of OOM can help to ensure the impact of change is localized and the problem area can be easily traced. As a result, the maintenance cost can be reduced.

• Facilitate reuse

With this approach, a computer system can be developed on a component basis that enables the effective re-use of existing components. The accumulation and proper management of an inventory of reusable components either developed internally or acquired externally facilitate opportunities for the reuse.

• Manage complexity

The use of OOM eases the process in managing complexity. By the breaking down of a complex solution into different components and with each component encapsulated (e.g. treated as a black box) from others, complex development can be better managed.

3.2.3 Structure of OOM

The structure of OOM is divided into Stages. Each Stage consists of a number of tasks and each task is further decomposed into sub-tasks. The following diagram depicts clearly the structure of OOM.

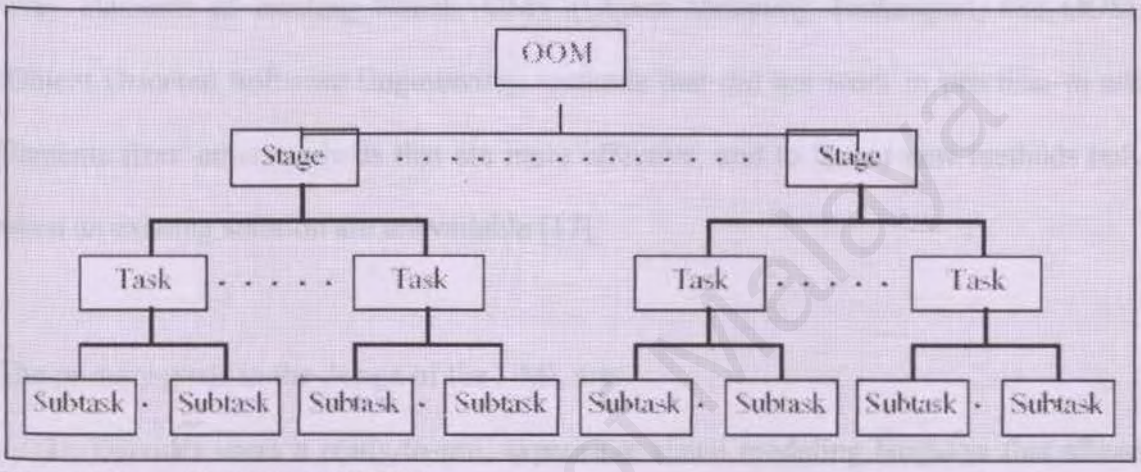


Figure 3.3 Structure of OOM

3.3 UML (Unified Modeling Language)

The Unified Modeling Language (UML) is a language for specifying, constructing, visualizing, and documenting a software system and its components. UML consists of a set of rules and semantics, which is expressed in graphical language and in form known as Object Constrain Language (OCL). The goals of the UML are to cast away elements of existing Booch, OMT (Object Modeling Technique), and OOSE (Object Oriented Software Engineering) methods that did not work in practice; to add elements from other methods that are more effective; and to invent new methods only when an existing solution are unavailable [17].

The primary goals in the design of the UML are:

1. Provides users a ready-to-use, expressive visual modeling language that allows them to develop and exchange meaningful models.
2. Provide extensibility and specialization mechanisms to extend the core concepts.
3. To be independent of particular programming languages and development processes.
4. Provide a formal basis of the OO tools market.
5. Support higher-level development concepts.
6. Integrate best practices and methodologies.

The UML has been designed to be independent of any particular software development process [18]. The key features of this unified process can be described in three phases:

- Use case driven
- Architecture-centric
- Iterative and incremental

3.3.1 The four phases

The life of a software system can be represented as a series of cycle. Each cycle contains four phases as defined in unified process. Figure 3.4 illustrates the phases and major milestones as defined in the unified process. A phase is the span of time between two major milestones, points at which decisions have to be made whether to proceed with development or not. Each phase contains one or more iterations, which are mini project that is a part of workflow. Each iteration results in an increment, which means a release of system being developing contains added or / and improved functionality over and above the previous release. The illustration for iteration and increment development are shown in figure 3.5.

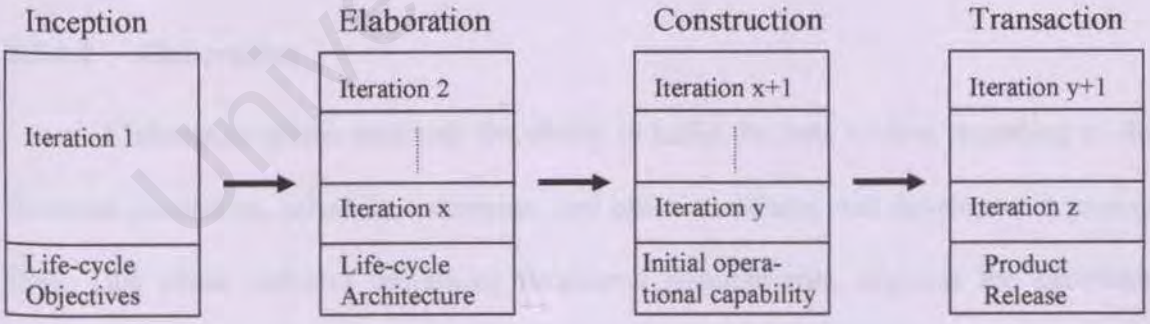


Figure 3.4 Four phases in Unified Process

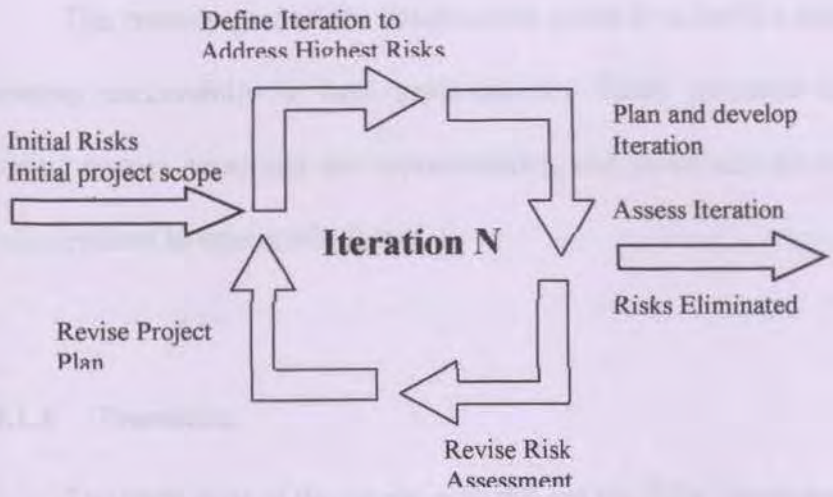


Figure 3.5 Iteration and incremental

3.3.1.1 Inception

The goal of the inception phase is to establish the case for the viability of the proposed system. The task to be performed during this phase include define scope of the system, outline a candidate architecture, identify critical risks and make business case.

3.3.1.2 Elaboration

Elaboration phase establish the ability to build the new system regarding to the financial constrains, schedule constrains, and other constrains that development project face. This phase captures remaining functional requirements, expends the candidate architecture into full architecture baseline, address significant risks on ongoing basis, and finalize the business case for a project include preparing a project plan.

3.3.1.3 Construction

The primary goal of the construction phase is to build a system that is capable of operating successfully in beta environments. Tasks involved in this phase include building system iteratively and incrementally, and make sure the viability of a system is always evident in executable form.

3.3.1.4 Transition

The main goal of this phase is to roll out the fully functional system. The tasks to be performed during this phase focus on correcting defeats and modifying system to correct unsolved problems.

3.3.2 Workflows in UML

There are five workflows cut across the set of four phases within the unified process. Each workflow consists of set of activities and is performed by various project workers.

3.3.2.1 Requirements

The primary activities of the requirements workflow are focused on building use case model to capture system requirements. The use case model logically explains the functional capabilities of the system being developed, and also defines the conditions to be achieved in order to success the system development. The use case model sits at the center of the use case view of system's architecture.

3.3.2.2 Analysis

The primary activities of Analysis workflow are to build analysis model that helps developers to refine and structure functional requirements captured within the use case model. The analysis model contains realization of use cases that lend themselves better than the use case to design and implementation work. Analysis model is the main element of the design view and the process view of the system architecture.

3.3.2.3 Design

The main activities of Design workflow are to build design model that describes the physical realizations of the use cases, from the use cases, and also the contents of the analysis model. The design model serves as an abstraction of the implementation model. Design workflow also focuses on the deployment model that defines the physical organization of the system in terms of computational nodes. The design model is the key element of design view of the design model but also relevant in process view, while the deployment model is the heart of the deployment view.

3.3.2.4 Implementation

The primary activities of the Implementation workflow are aimed at building implementation model that describes the how the elements of the design model are packaged into software components. Implementation model is the key element of the implementation view of the system's architecture.

3.3.2.5 Test

The main activities of the Test workflow are to build the test model. Test model describes how integration and system tests will exercise executable components from the implementation model; it also describes how developers perform the tests as well as unit test.

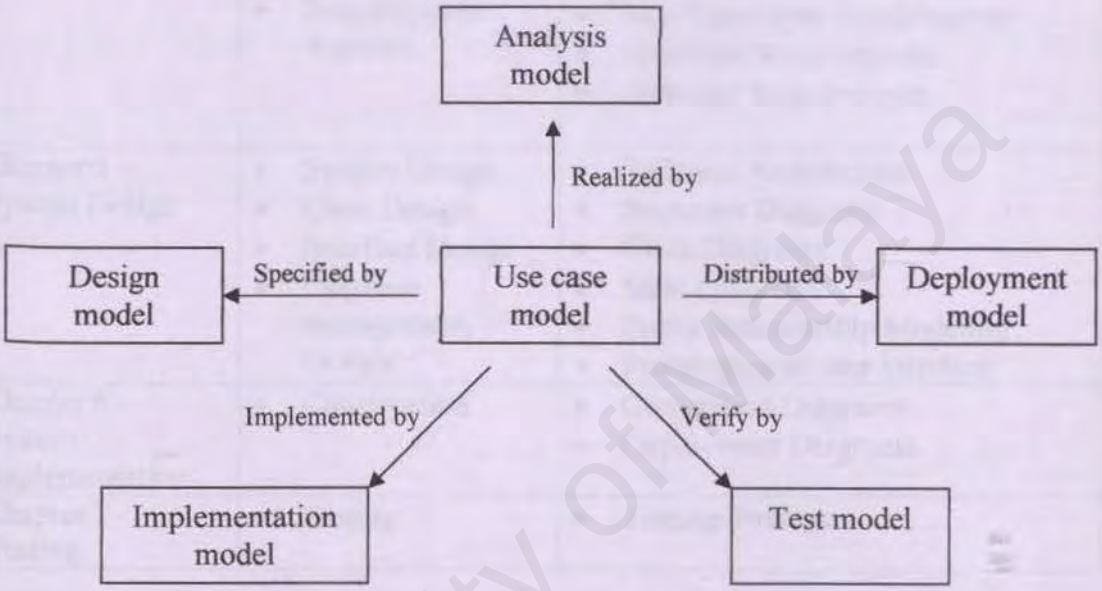


Figure 3.6 The six basic unified process model

3.4 Implementation of Unified Process in the Project

Table 3.1 shows how the Unified Process be implemented and realized in this project.

Table 3.1 Implementation of Unified Process in the Project

Project phase	Activities	Diagrams/Discussion
Chapter 4 - System Analysis	• Requirements Capture and Modeling • Requirements Analysis	• Gathering Information • Use Case Diagrams • Functional Requirements • Non Functional Requirements • Hardware Requirements • Software Requirements
Chapter 5 – System Design	• System Design • Class Design • Interface Design • Database management Design	• Software Architecture • Sequence Diagrams • Class Diagrams • State Diagrams • Entity-Relationship Modeling • Prototyping of user interface
Chapter 6 – System Implementation	• Construction	• Component Diagrams • Deployment Diagrams
Chapter 7 - Testing	• Testing	• Testing Strategy

3.5 Summary

This chapter discusses the methodology used to develop the online movie rental system. The methodology that has been chosen is UML (Unified Modeling Language), including the Unified Process. UML is one of the OOM (Object Oriented Methodology), a methodology that encourages and facilitates reuse of software components. Then the chapter discussed the each phases and workflows for the cycle of development in UML approach. Finally the discussion is about the implementation of the unified process in this project, every activities involved in each phase of unified process are listed in table.

Chapter 4 System analysis

System analysis is the process of gathering and interpreting facts, diagnosing problems and using the information to recommend improvement of the system [19]. Extensive system analysis is necessary to get an overview of the system requirement. The reason of system analysis is to capture both functional and non-functional requirements of the online movie rental system. The scope of system analysis also includes the choosing of development tools, programming languages, database, hardware and software for this ongoing project.

4.1 Information Gathering Approach

Gathering information is one essential activity of the phase of the system analysis. The purpose of carrying out this activity is to gather and analyze relevant information to determine the requirements of the system. Following are the approaches used to define the system requirements:

4.1.1 Reading printed materials

The author gathers relevant information about online movie rental system and the reviews over the features and description of development tools being considered through reading printed materials. The author gathers the information about the existing systems, methods of developing the system, programming languages and web application

technologies through reading books, thesis, magazines and other relevant printed materials.

4.1.2 Surfing Internet

Surfing Internet is a efficient way of getting and gathering the relevant information. Much more updated or lattes information and references can be easily found from Internet. The existing systems and some other necessary information such as the software development methodology and development tools description are found through Internet.

4.2 Requirement analysis and specifications

Requirement can be defined as a condition or capability needed by user to solve problems or achieve objective; requirement can also be a condition or capability that must be met by a system being developed to satisfy contract, standard, specification or formally imposed document [IEEE83]. Requirements analysis is a set of techniques to identify system problems and solutions from user community.

Requirements can be described in two ways: functional requirement and non-functional requirement. Before describing those requirements, the actors those involved or play role within the system to be developed are defined as below:

4.2.1 The actors

After carrying out the analysis to the system, three types of actors has been defined to participate within the system and they are visitor, member, and administrator. Each type of actor plays different role and has different tasks and manipulations to the system.

4.2.1.1 Visitor

Visitor in this online system is point to the person who access to the system web site on Internet through a web browser. Visitor can access the general functions and information without logging in account ID and password.

4.2.1.2 Member

Member of this system are the person who already sign up an account for this system to become a member to the video center. Each member are provided with a unique account ID and a self-created password for logging in the online system to enter into member page and get the member services.

4.2.1.3 Administrator

Administrator of this system is the person who has the authority to access to the administration page of this system. Same as member, each administrator needs to log in the system before getting into the administrator page. The task of administrator includes maintaining this online system and the web site, editing information on web pages, and secures the database.

4.2.2 Functional requirements (use case diagram)

Visitor

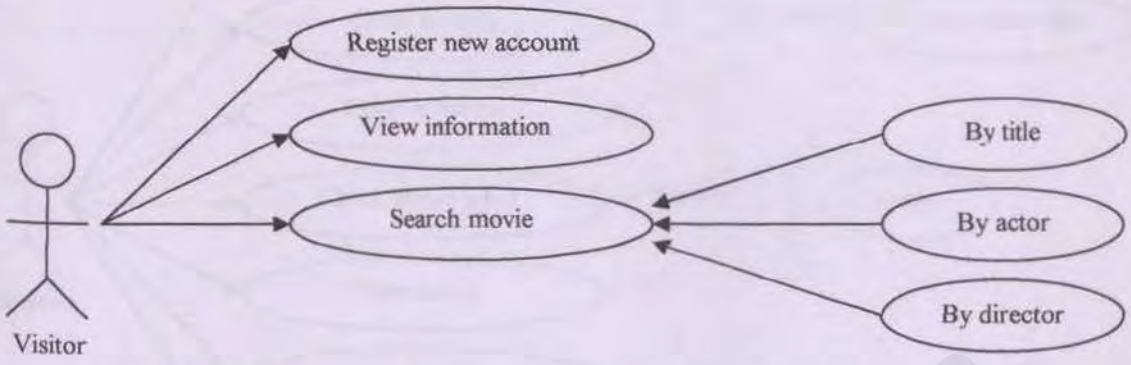
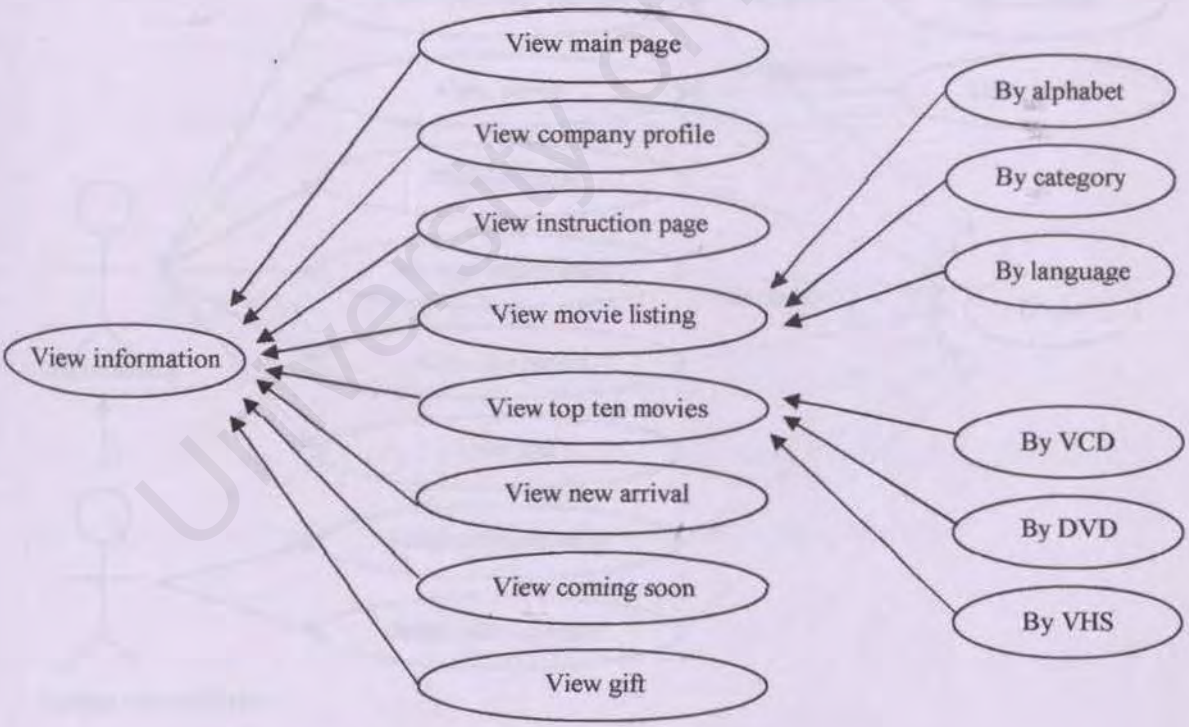


Figure 4.1 Use case for visitor



Member

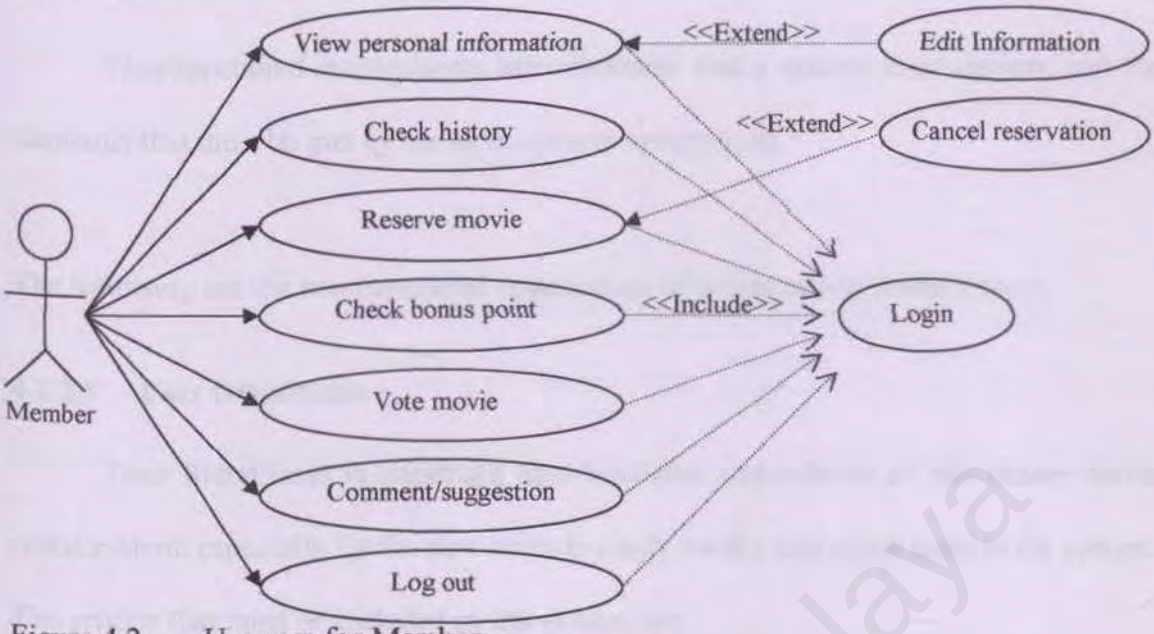


Figure 4.2 Use case for Member

Administrator

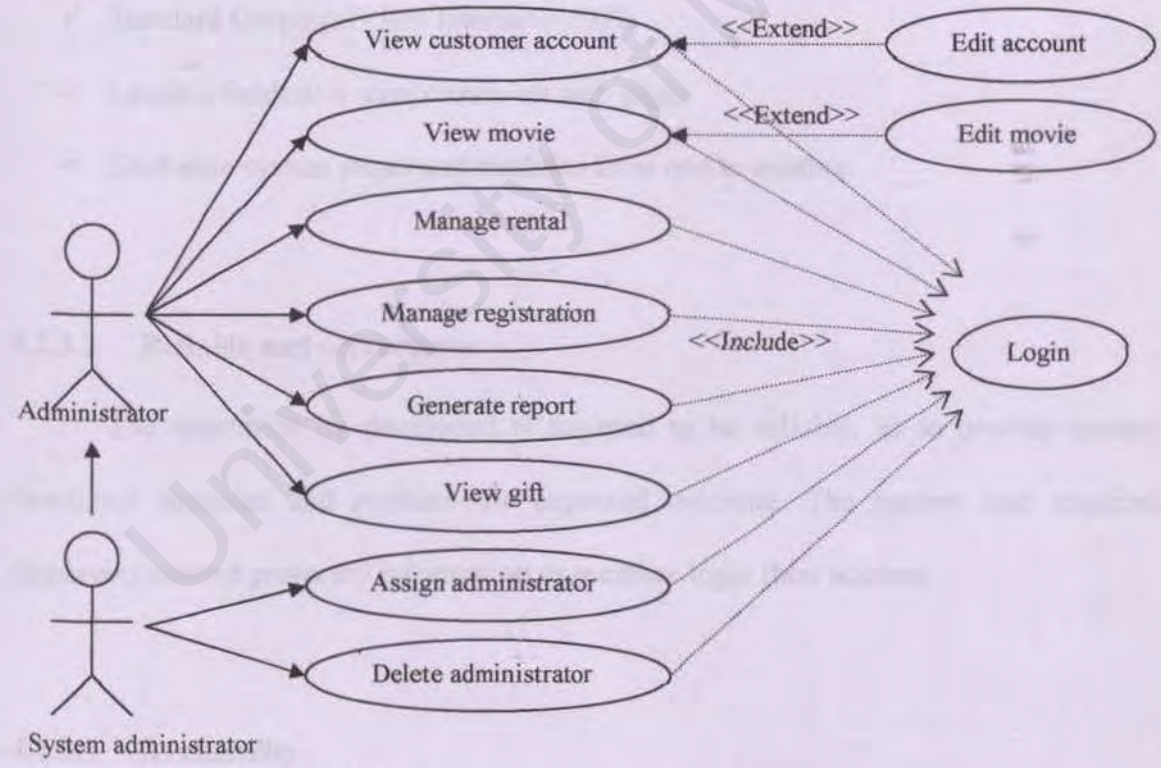


Figure 4.3 Use case for administrator

4.2.3 Non-functional requirements

Non-functional requirements are constrains that a system must operate and the standards that must be met by the development system [20].

The following are the non-functional requirement of online movie rental system:

4.2.3.1 User friendliness

User friendliness is important non-functional requirement of this online movie rental system, especially for the new users to easily handle and quick learn to the system. The criteria that must be included in this system are:

- ✓ Attractive, simple and tiny user interface design.
- ✓ Standard Graphical User Interface (GUI)
- ✓ Labeled fields and components on web pages.
- ✓ Shift-able system pages and modules from one to another.

4.2.3.2 Reliable and correctness

The system to be developed is required to be reliable, as to provide correct functional modules and produce the expected outcome. The system also required displaying correct protected information as member login their account.

4.2.3.3 Availability

The system should be available to be accessed at anytime and anywhere as long as the place is Internet ready. This feature is important to the online movie rental system

because the purpose of developing it is to provide users especially member the convenient to rent or reserve movie regardless of location.

4.2.3.4 Efficiency

The efficiency of the online system means that the system should be able to provide good response time for user request. The online system provides real time transaction and communication to the server site, so that it does not delay user request.

4.2.3.5 Expandability

The system can be expanded in future to increase and improve system's functionality base on the request and suggestion of users.

4.3 Consideration on system development tools

After reviewing on several system development tools that has been discussed in previous chapter, chapter 2 – literature review, consideration to suitable tools to be used as development tools for this system is made according to their features and functionalities. The following section will discuss the tools have been chosen and the reason as well:

4.3.1 Platform

Windows 2000 Server was chosen as the platform for the system development. The reasons of choosing it are:

- **Better performance**

  It is a multipurpose network operating system for businesses of all sizes and provides services that enable users to build and deploy servers more quickly.

- **User friendly**

  The user interface of Windows 2000 Server is similar to Windows 95 and Windows 98. Therefore, Windows 95 and Windows 98 users will not face the difficulty in adapting to Windows 2000 Server as they may familiar themselves quickly with the new operating system environment.

- **Development tools ready**

  Various development tools are released along with the Windows 2000 Server. Standard development tools are installed automatically to the system while users set up Windows 2000 Server.

- **Skilled professional**

  Microsoft boats of extensive resources of skilled professional as its products are widely used. It supports web-publishing features, customizing tools and new wizard technologies to publish information over the Internet.

4.3.2 Web server

The consideration in choosing web server include how well it works with the operating system and other server, its ability to handle server side programming and scripting. The publishing, search engine and web site building tools that may come with it also are concerned.

The Internet Information server 5.0 (IIS 5.0) is chosen as the web server supporting this ongoing system after the consideration and comparison with the other web servers. The reasons are:

- It represents a new Internet architecture that is in place for Windows 2000 and fully integrated at the Windows 2000 Server.
- It provides many improved and new features that provide a robust and scalable architecture for web, FTP, and other related Internet technologies.
- It provides web-publishing features, customizable tools, and comes out with new wizard technologies that make Windows 2000 Server to be the easiest way to publish information and share it securely over the Internet.

4.3.3 Web application technology

Active Server Page (ASP) is chosen as the web application technology to be implemented on the online system after considering to several web application technologies as mentioned in chapter 2. ASP is a programming environment that provides the ability to combine HTML (Hyper Text Markup Language), scripting and other components to create Internet applications that run on server.

The reasons of choosing ASP are:

- It enables users to create dynamic and interactive Web pages and build powerful Web applications.
- It provides an easier, more flexible approach to publishing Web content. It is easy to learn compare with other web application technologies such s Common Gateway Interface (CGI).
- It provides fast execution time. Users can save time while accessing the online system and communicates with the system's modules.
- It come out with new features like program flow control, enhanced error handling, script less ASP, and Extensive Markup Language (XML) integration.

4.3.4 Programming language

Visual Basic Script (VBScript) is the programming language been chosen to develop the online system after consideration to several kind of web application programming languages. VBScript is suitable for the development because:

- It is easy to learn and the coding techniques are easier to learn compared wih other language such as Java. VBScript is based on the easy-to-learn BASIC (Beginner's All Purpose Symbolic Instruction Code) that can help developer to finish the development on time.
- It is a fast, portable and lightweight interpreter for use in Internet browsers and other applications that use Microsoft ActiveX Controls, Automation servers, and Java language applets.
- It enables browsers and other host applications run each scripting component without requiring special integration code.

4.3.5 Database server

Database server that is chosen for this online system is Microsoft SQL Server 2000. The reasons of choosing Microsoft SQL Server 2000 are:

- It provides rapid development of a new generation of enterprise-class business applications.

- It is a fully Web-enabled database product, providing core support for Extensible Markup Language (XML) and the ability to query across the Internet and beyond the firewall.
- It provides abilities accessing to data; such as using HTTP to send queries to the database, perform full-text search on documents stored in database, and run queries over the Web with natural language.
- It meets the needs of demanding e-commerce and enterprise applications with scale up and scale out capabilities.

4.3.6 Development tools

After considering on several kinds of development tools, Microsoft Visual InterDev 6.0 is chosen to develop the online system. Visual InterDev 6.0 is a web development tool that allows users to create, publishes, and manages dynamic web applications. It also comes out with powerful tools for creating robust database applications. The reasons of choosing it are:

- It offers user interface that is similar to Visual Studio 6.0 development tools.
- It provides many tools to assist developers at each stage, such as improved HTML editor to write HTML by hand, as well as a WYSIWYG editor to add in content.
- It provides IDE (Integrated Development Environment that lets users access to all the needed tools to build web application from within the same interface. Users can switch from HTML pages to a Java, C++ or database project.

4.4 System requirement

4.4.1 Development requirement

4.4.1.1 Hardware requirement

The specifications of hardware that will be used for system development are stated in the following table:

Table 4.1 Hardware specifications for the development requirements

Minimum Requirements	
Computer/processor	Pentium 166 MHz or higher Pentium Compatible CPU
Memory	Minimum 128 Megabytes (MB) of RAM recommended
Hard disk	2 GB hard disk with minimum of 1 GB free space.
CPU Support	Windows 2000 Server supports up to four CPUs on one machine
Input Devices	Mouse, keyboard
Output Devices	Printer
Video Monitor	EGA, VGA or compatible display

4.4.1.2 Software requirement

The specifications of software that will be used for system development are stated in the following table:

Table 4.2 Software specifications for the development requirements

Platform	**Microsoft 2000 Server**
Web server	Microsoft Internet Information Server 5.0
Server scripting engine	Active Server Page (ASP)
Database server	Microsoft SQL server 2000
Development tool	Microsoft Visual InterDev 6.0

4.4.2 Runtime requirement

4.4.2.1 Server hardware requirement

The specifications of hardware for server site that suggested to be used at the runtime are stated in the following table:

Table 4.3 Hardware specifications for the server hardware requirements

Minimum Requirements	
Computer/processor	Pentium 266 MHz or higher Pentium Compatible CPU
Memory	Minimum 128 Megabytes (MB) of RAM recommended
Hard disk	2 GB hard disk with minimum of 1 GB free space.
CPU Support	Windows 2000 Server supports up to four CPUs on one machine
Input Devices	Mouse, keyboard
Output Devices	Printer
Video Monitor	EGA, VGA or compatible display
Internet connection	ISDN line

4.4.2.2 Server software requirement

The specifications of hardware that suggested to be used at the runtime are stated in the following table:

Table 4.4 Software specifications for the server software requirements

Platform	**Microsoft 2000 Server**
Web server	Microsoft Internet Information Server 5.0
Server scripting engine	Active Server Page (ASP)
Database server	Microsoft SQL server 2000

4.4.2 Runtime requirement

4.4.2.1 Server hardware requirement

The specifications of hardware for server site that suggested to be used at the runtime are stated in the following table:

Table 4.3 Hardware specifications for the server hardware requirements

Minimum Requirements	
Computer/processor	Pentium 266 MHz or higher Pentium Compatible CPU
Memory	Minimum 128 Megabytes (MB) of RAM recommended
Hard disk	2 GB hard disk with minimum of 1 GB free space.
CPU Support	Windows 2000 Server supports up to four CPUs on one machine
Input Devices	Mouse, keyboard
Output Devices	Printer
Video Monitor	EGA, VGA or compatible display
Internet connection	ISDN line

4.4.2.2 Server software requirement

The specifications of hardware that suggested to be used at the runtime are stated in the following table:

Table 4.4 Software specifications for the server software requirements

Platform	**Microsoft 2000 Server**
Web server	Microsoft Internet Information Server 5.0
Server scripting engine	Active Server Page (ASP)
Database server	Microsoft SQL server 2000

4.4.2.3 Client hardware requirement

The specifications of hardware for client site that suggested to be used at the runtime are stated in the following table:

Table 4.5 Hardware specifications for the client hardware requirements

Minimum Requirements	
Computer/processor	Pentium 166 MHz or higher Pentium Compatible CPU
Memory	Minimum 128 Megabytes (MB) of RAM recommended
Hard disk	2 GB hard disk with minimum of 1 GB free space.
CPU Support	Windows 2000 Server supports up to four CPUs on one machine
Input Devices	Mouse, keyboard
Output Devices	Printer
Video Monitor	EGA, VGA or compatible display
Internet connection	56K modem

4.4.2.4 Client software requirement

The specifications of hardware for client site that suggested to be used at the runtime are stated in the following table:

Table 4.6 Software specifications for the client software requirements

Platform	**Microsoft 2000 Server**
Web browser	Internet Explorer 5.5

4.5 Summary

This chapter discusses about system analysis to the online movie rental system. The beginning of this chapter mentioned the information gathering approach being carried out as a part of system analysis. The followed discussion is about the system requirements that line out the actors involved in the system, the functional and non-functional requirements representing in use case diagrams.

The next discussion is about the consideration on chosen development tools and the reasons for the choices made. Then, the chapter discusses the system requirement needed and it is split into development requirements and runtime requirements. The requirements include hardware requirements and software requirements.

Chapter 5 System design

Design phase is the stage of system development where the requirements for the system are translated into the system characteristics to meet user requirements.

5.1 System architecture

The system architecture of the online movie rental system is designed based on the traditional client/server architecture and extends it to the web. The system architecture of this online system is 2-tier client/server systems where the first tier is web client and the second tier is the database server.

At the client side, client or called the user of the online movie rental system is equipped with web browser to view the online web page through Internet. User can view information displayed on the screen, receiving data from server, and running application offered by the system. User is running the GUI on the client side, calling functions to send SQL, or HTTP commands over Internet the server. At the server side, database server will process commands such as SQL to manipulate data sending to or requesting from client side.

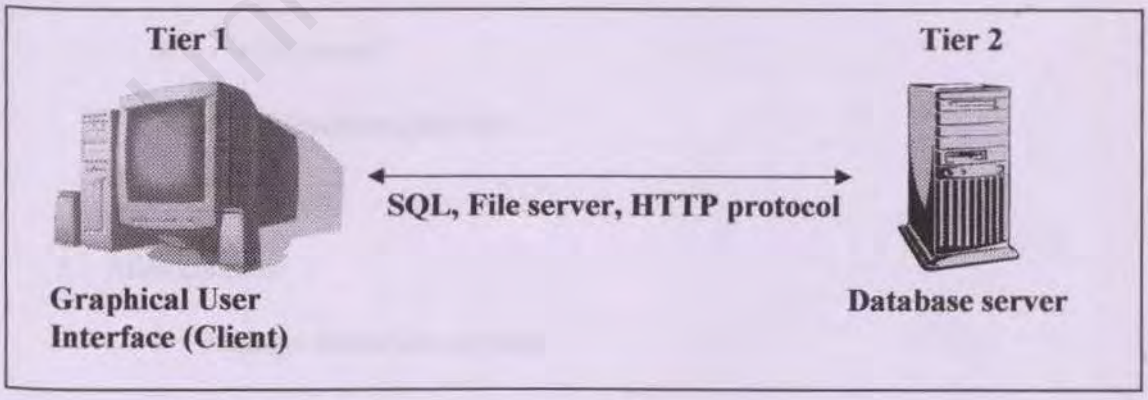


Figure 5.1 A 2-tier client/server system architecture.

5.2 Program design

The program design of the online movie rental system is based on the functional requirements of the system as stated in use case diagrams (chapter 4). The process flows of the online system are described in sequence diagrams and state diagrams at next section.

The online movie rental system can be divided into several modules as following:

1. Visitor:
    - Register new account
    - View information
    - Search movie
2. Member:
    - View personal information
    - Check history
    - Reserve movie
    - Check bonus point
    - Vote movie
    - Comment/suggestion
    - Log out
3. Administrator:
    - Manage customer account
    - Manage movie

- Manage rental
- Manage gift
- manage administration
- Generate report
- Log out

View movie listing

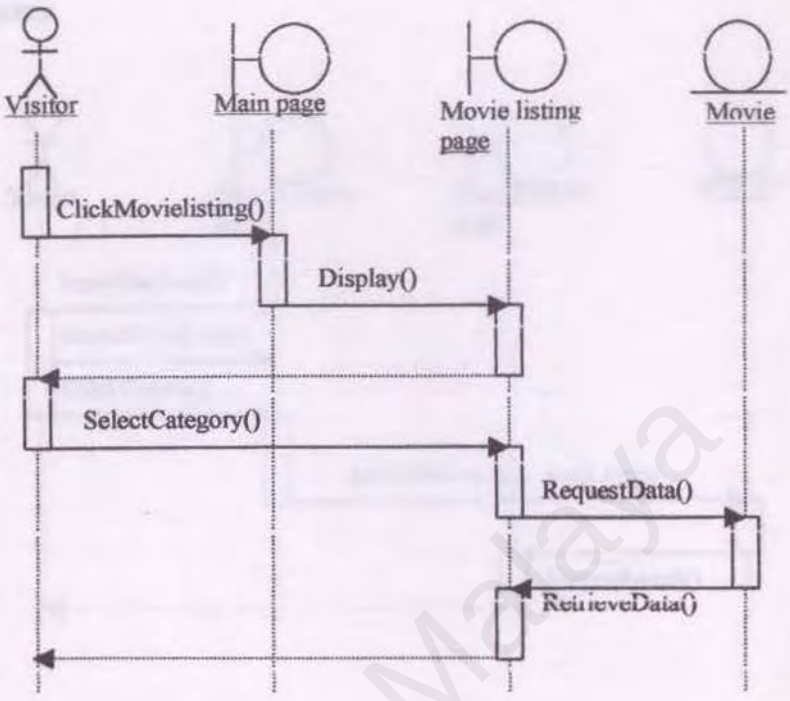
Visitor clicks Movie Listing button on main page.

System displays the Movie Listing page.

Visitor select category of movie to be displayed.

System will request data to be displayed from movie table

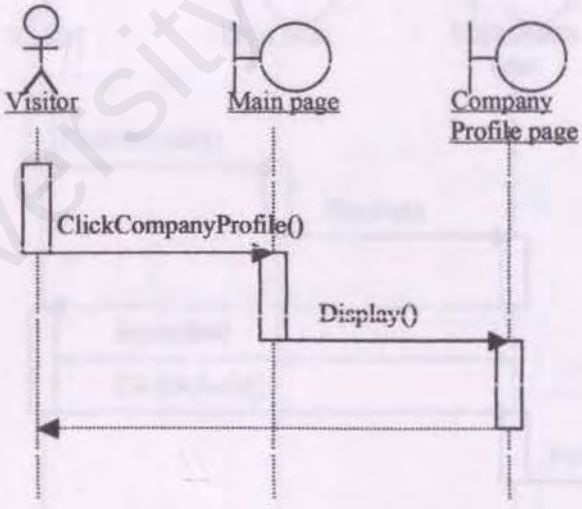
System returns movies list and display it on Movie Listing page.



View Company Profil page

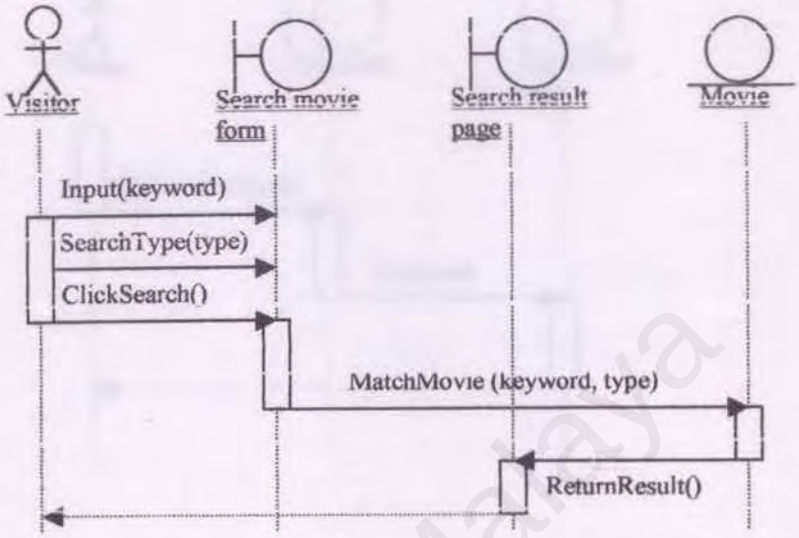
Visitor clicks Company Profile button on main page.

System displays the Company Profile page



5.2.1 Sequence Diagrams

Search movie

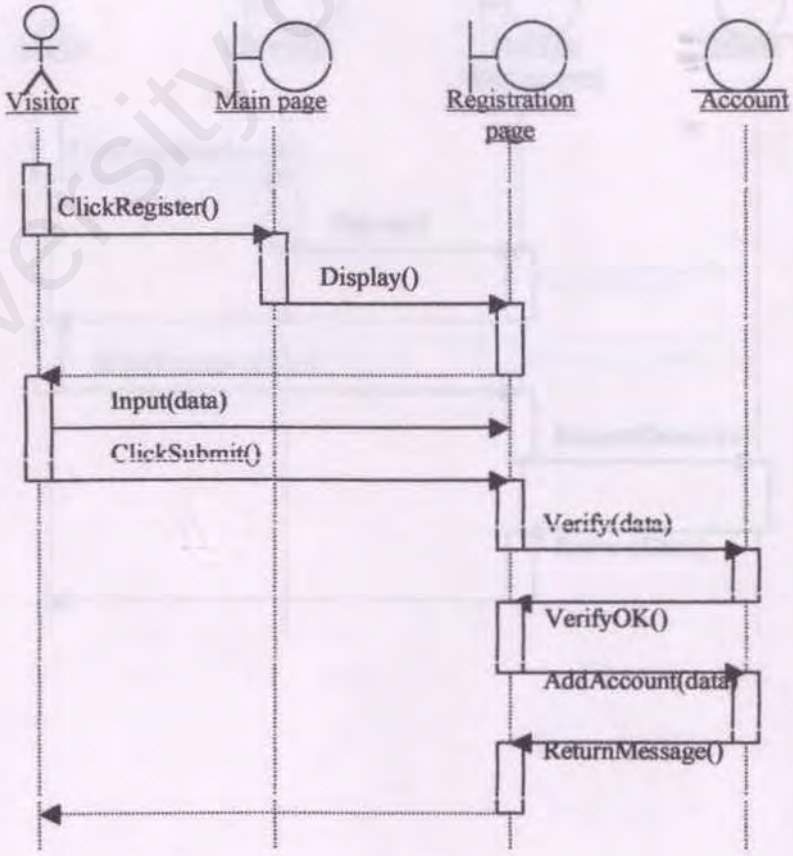


Visitor inputs keyword into search movie form, select search type, then click search button.

System will match the keyword and type with the data in movie table.

System returns matches result and display on Search Result page.

Register new account



Visitor clicks Register button on main page.

System displays the Registration page.

Visitor input data into register form and click Submit button.

System will verify the data

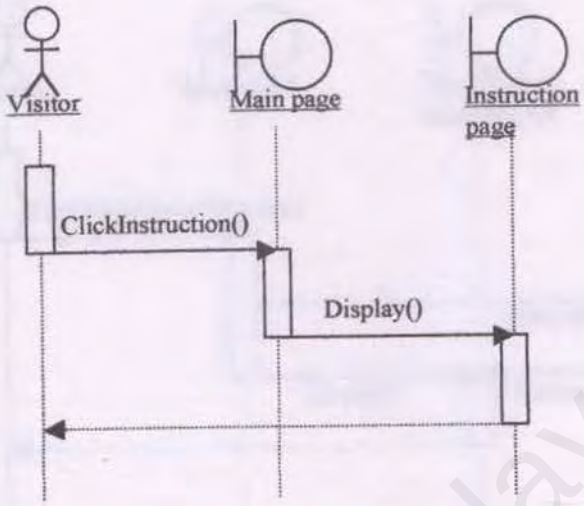
If verification OK, system will add new account to the Account table.

System returns message and display it on Registration page.

View Instruction page

Visitor clicks Instruction button on main page.

System displays the Instruction page.



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View top ten movies

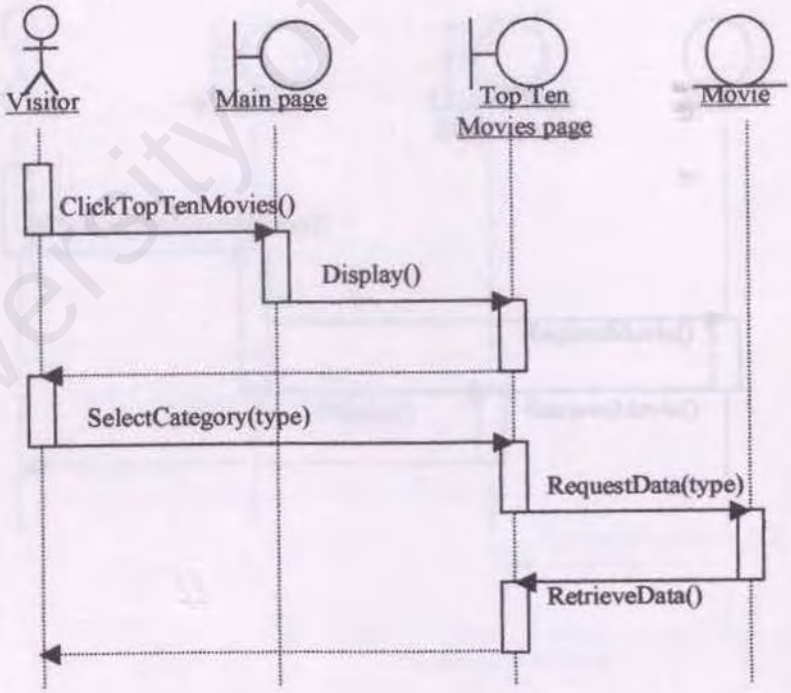
Visitor clicks Top Ten movies button on main page.

System displays the Top Ten Movies page.

Visitor select category of movie to be displayed.

System will request data to be displayed from movie table

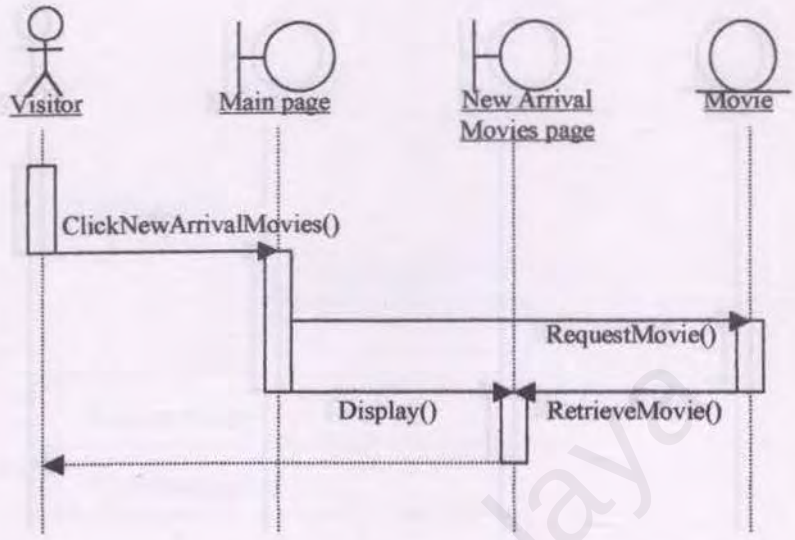
System returns movies list and display it on Top Ten Movies page.



View new arrival movies

Visitor clicks New Arrival movies button on main page.

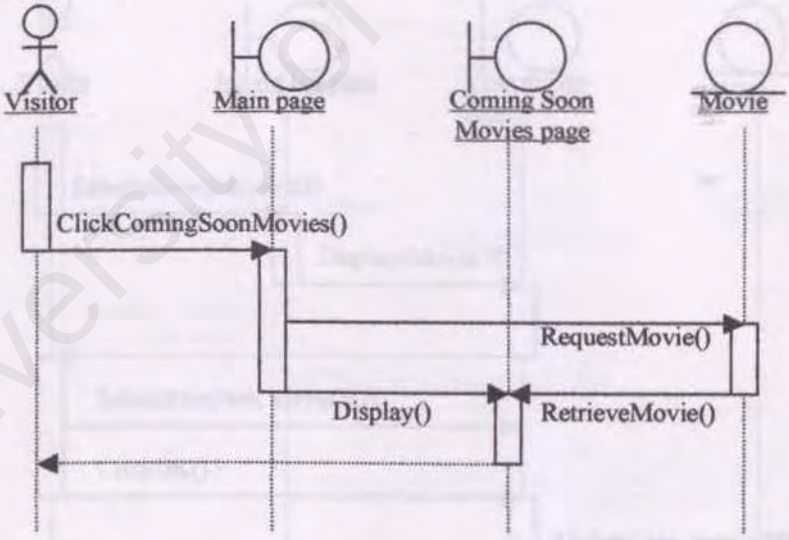
System requests new arrival movies from database and retrieves the movies on New Arrival Movie page.



View coming soon movies

Visitor clicks Coming Soon movies button on main page.

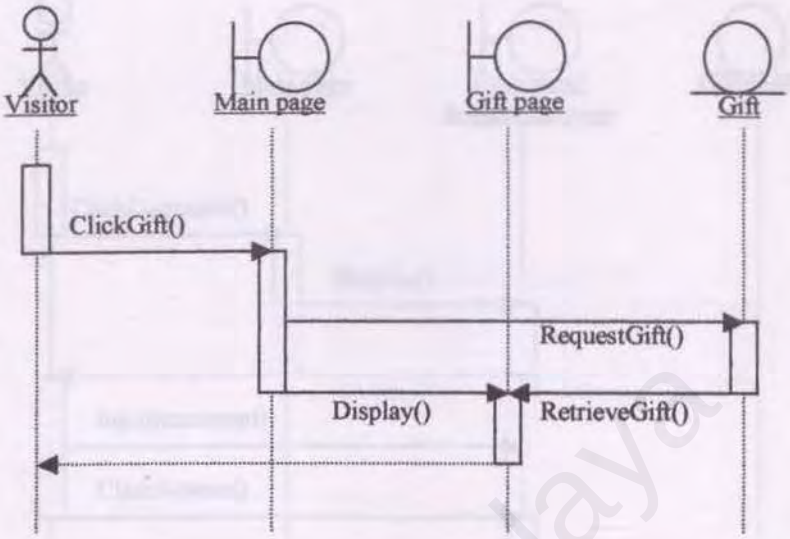
System requests coming soon movies from database and retrieves the movies on Coming Soon Movie page.



View Gift

Visitor clicks Gift button on main page.

System requests gift from database and retrieves gift on Gift page.



Vote movie

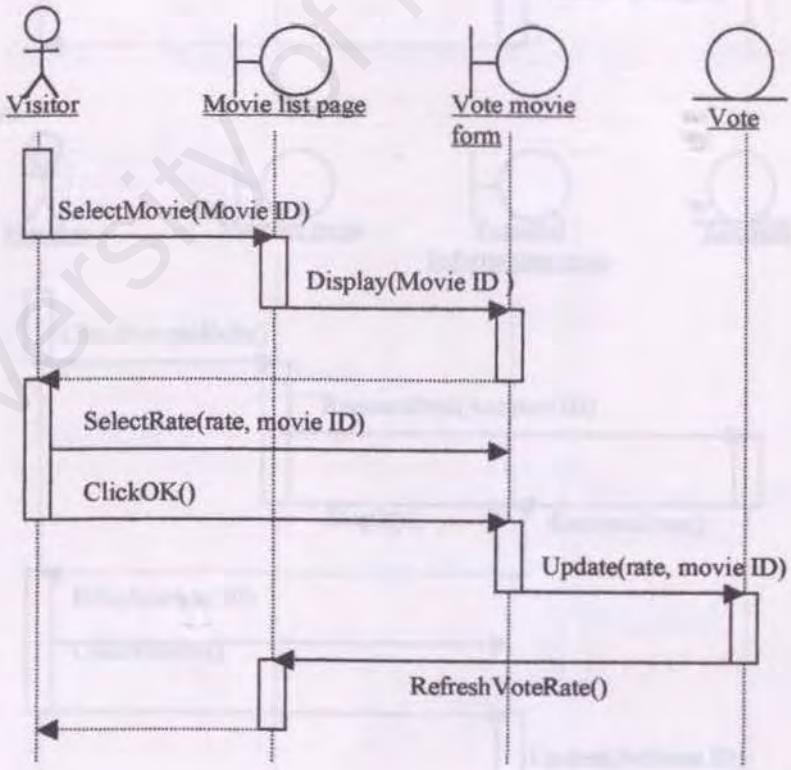
Visitor select movie to be vote on Movie List page.

System displays Vote Movie form for the selected movie.

Visitor select vote rate of the movie and click OK button.

System updates the selected movie rate in Vote table.

System then refreshes the Movie Listing page with the lattes movies' vote rate.



Comment / Suggestion

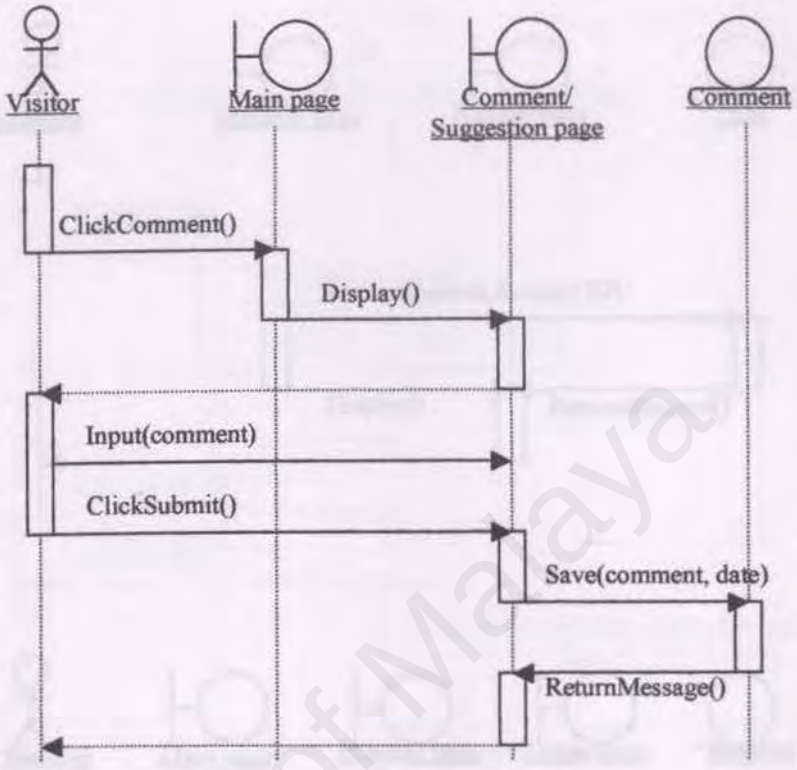
Visitor clicks Comment/ Suggest button on member page.

System displays the Comment/Suggestion page.

Visitor inputs comment/ suggestion, then click Submit button.

System saves the comment /suggestion into Comment table.

System returns message to visitor on Comment/ Suggestion page.



View personal information

Member clicks Personal Information button on member page.

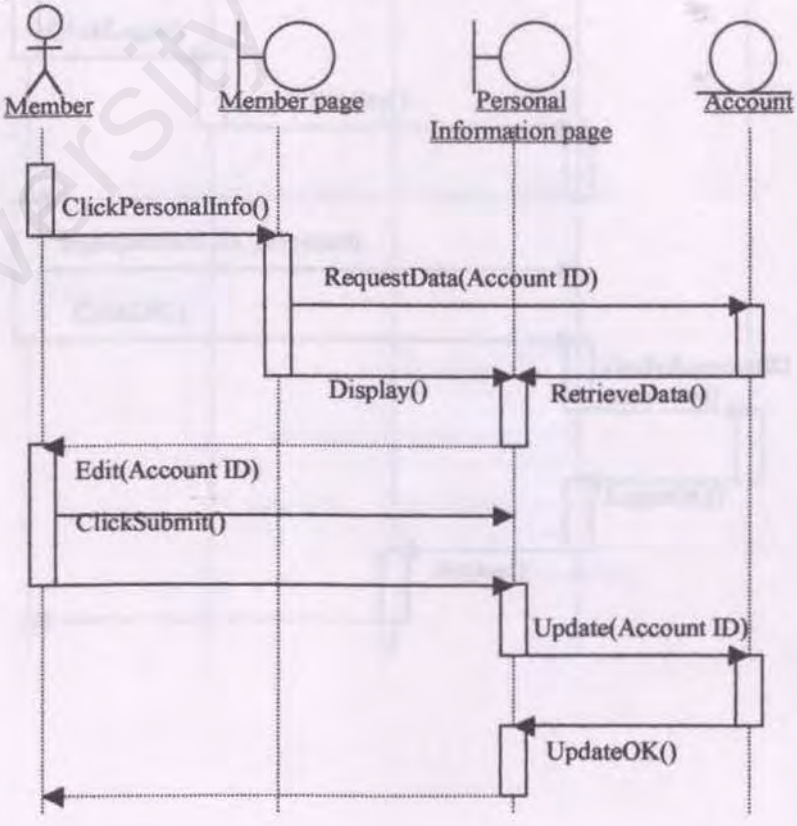
System requests data from Account table.

Personal details are retrieved and display on Personal Information page.

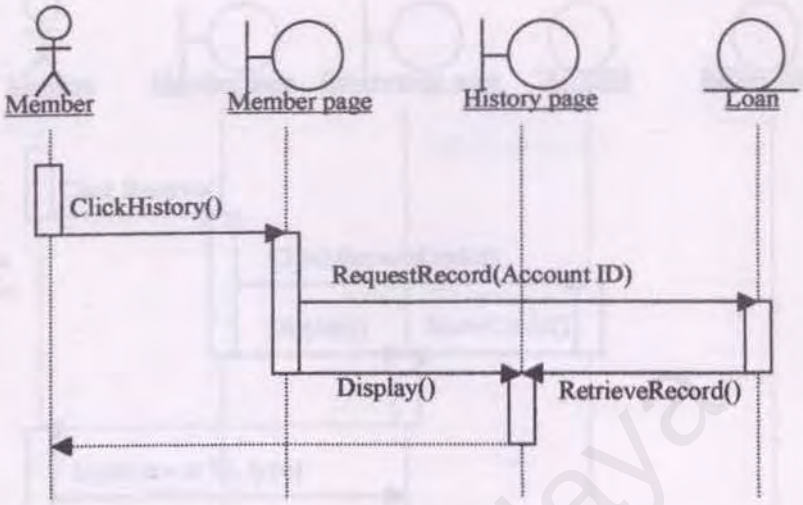
Member edits personal details, and then click Submit button.

System will update the account in the Account table.

When update is done, system returns to the Personal Information page.



Check history

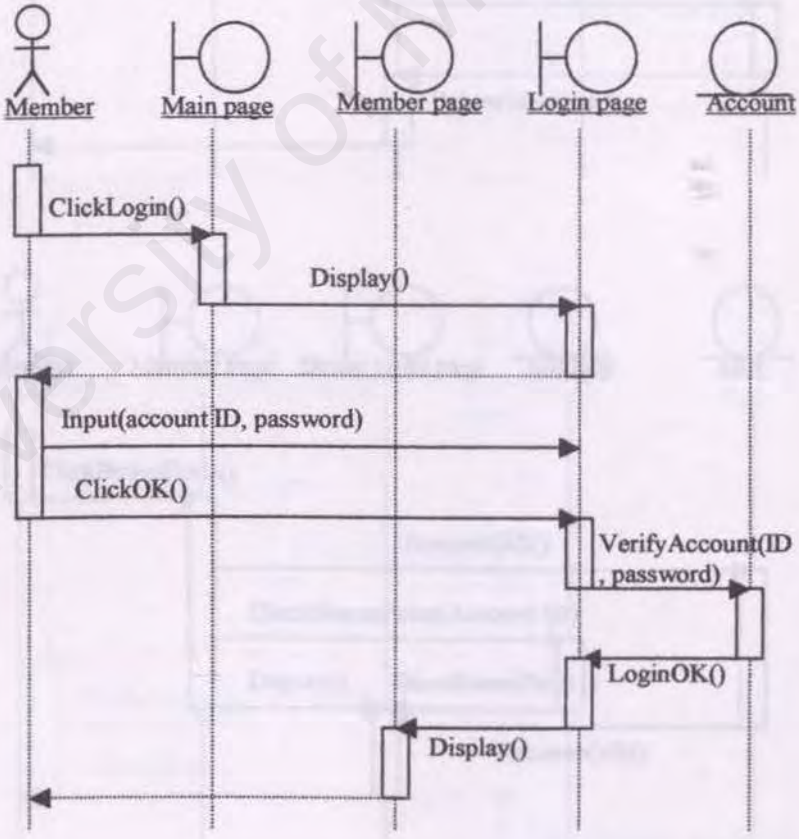


Member clicks History button on member page.

System requests history rental record to the Loan table.

History records are retrieved and display on History page.

Log in



Member clicks Login button on main page.

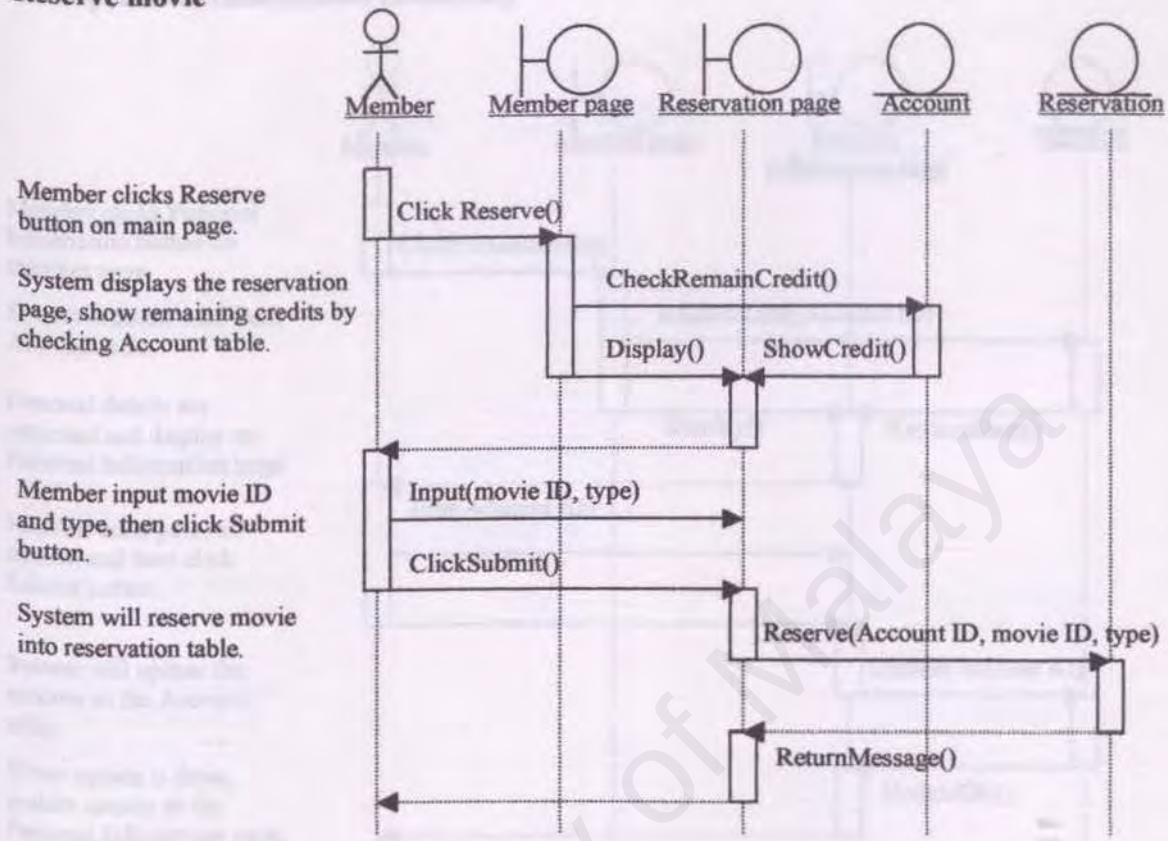
System displays the Login page.

Member inputs account and password, then click OK button.

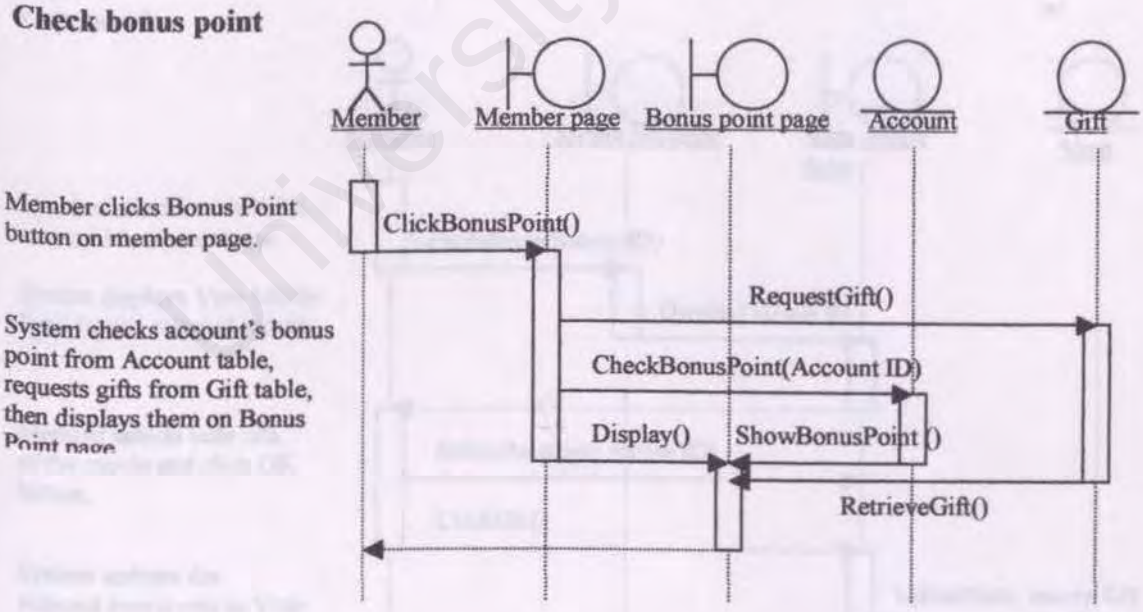
System will verify ID and password through account table.

If login OK, system will display Member page to the member.

Reserve movie



Check bonus point



View personal information (Editable)

Member clicks Personal Information button on member page.

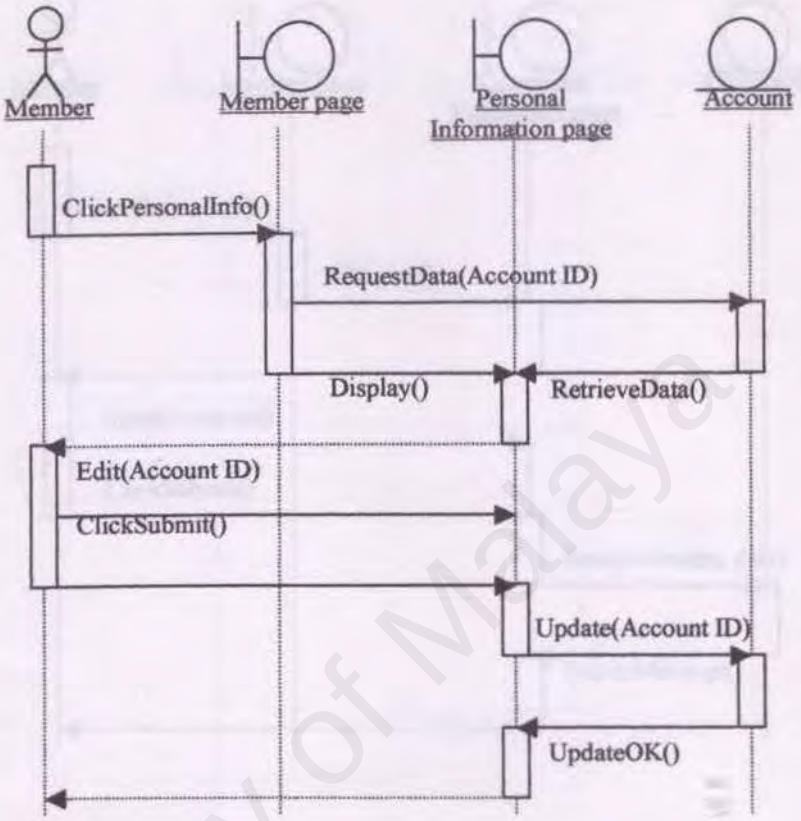
System requests data from Account table.

Personal details are retrieved and display on Personal Information page.

Member edits personal details, and then click Submit button.

System will update the account in the Account table.

When update is done, system returns to the Personal Information page.



Vote movie

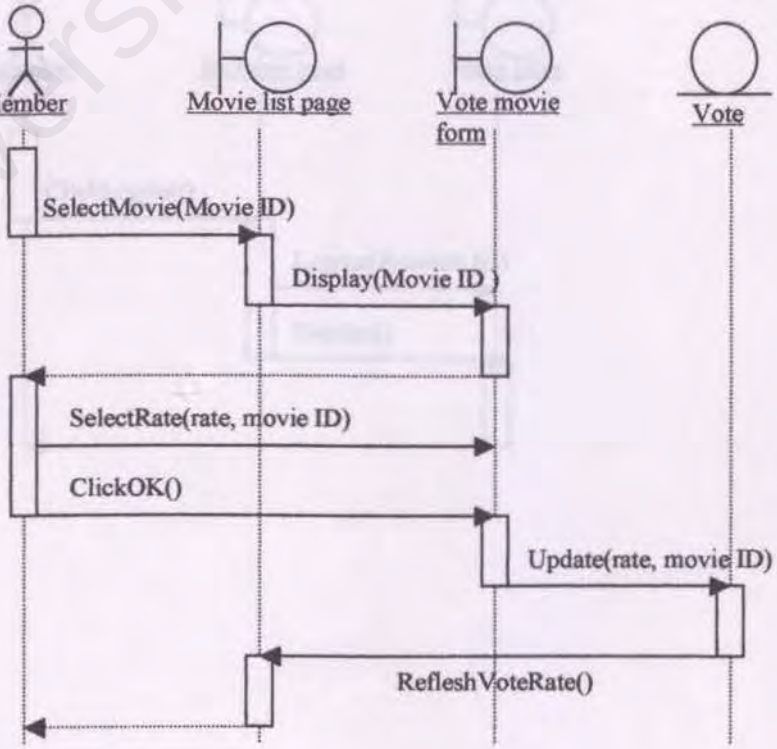
Member select movie to be vote on Movie List page.

System displays Vote Movie form for the selected movie.

Member selects vote rate of the movie and click OK button.

System updates the selected movie rate in Vote table.

System then refreshes the Movie Listing page with the lattes movies' vote rate.



Comment/Suggestion

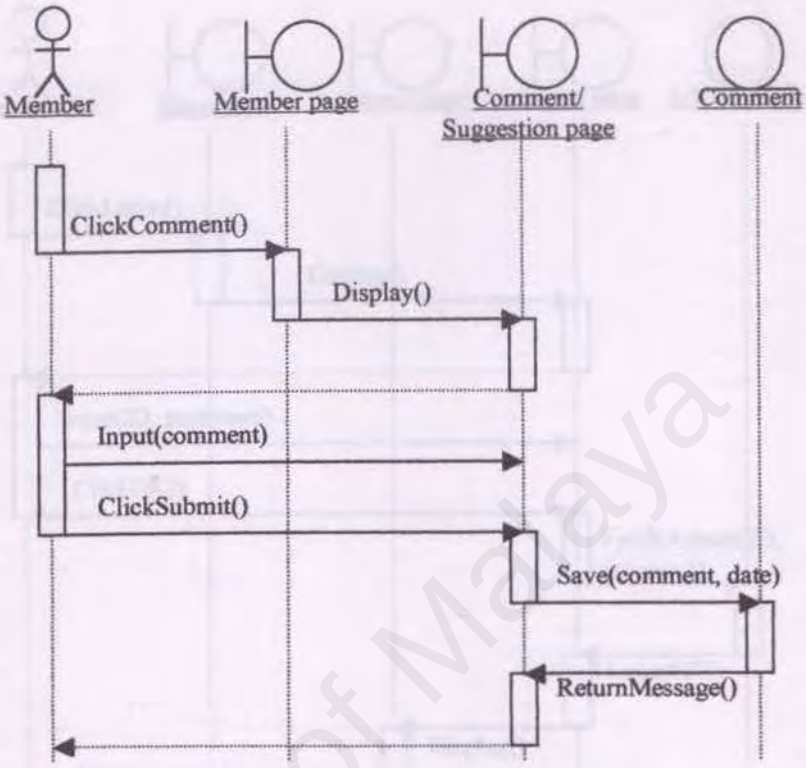
Member clicks Comment/ Suggest button on member page.

System displays the Comment/Suggestion page.

Member inputs comment/ suggestion, then click Submit button.

System saves the comment /suggestion into Comment table.

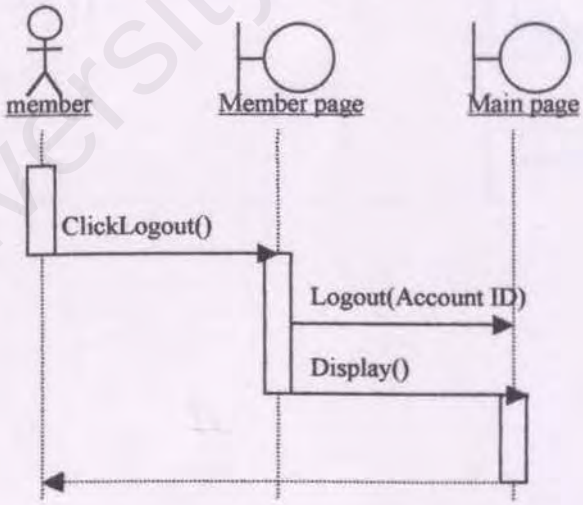
System returns message to member on Comment/ Suggestion page.



Log out

Member clicks Logout button on Member page.

System logs out the account and displays Main page.



Log in

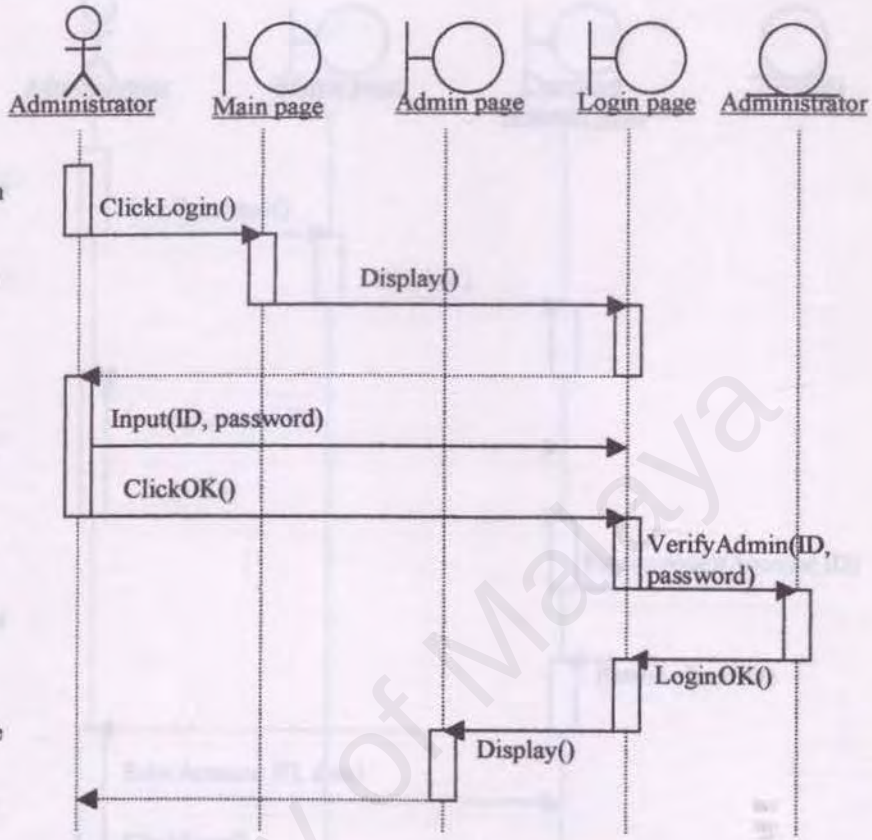
Administrator clicks Login button on main page.

System displays the Login page.

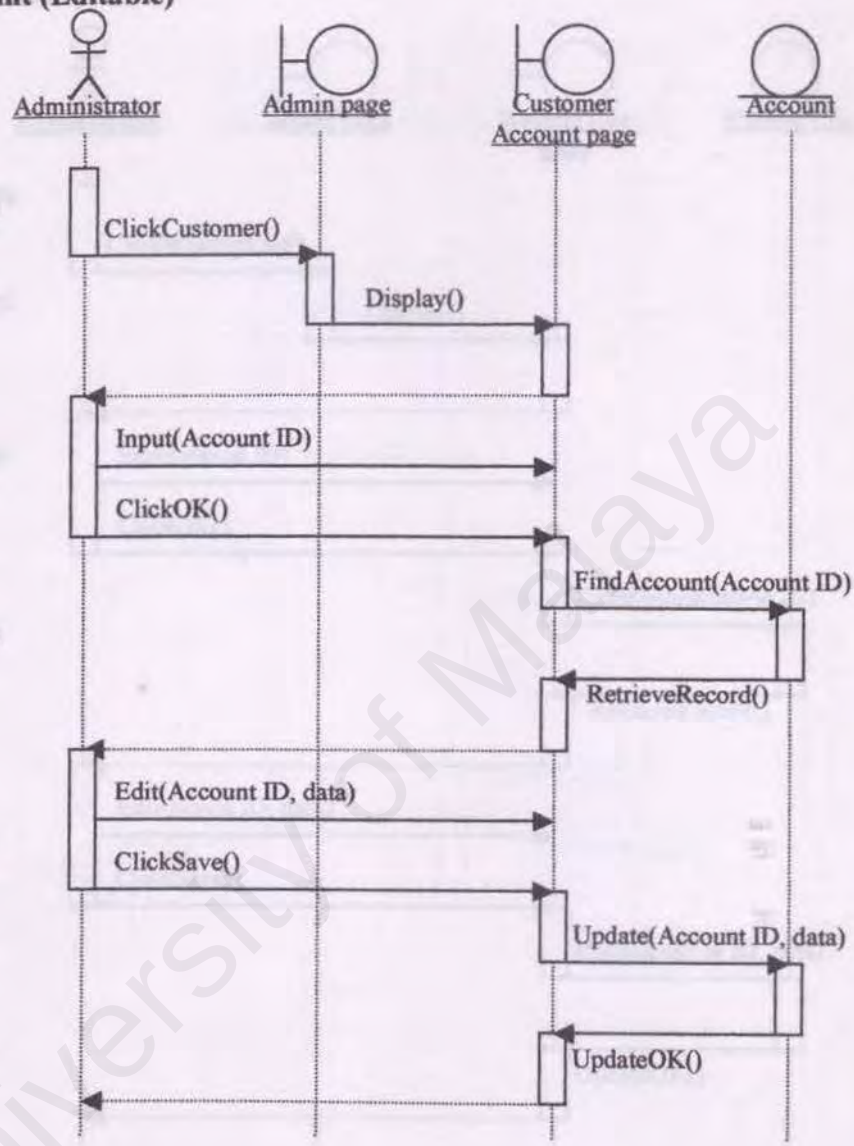
Administrator inputs ID, and password, then click OK button.

System will verify ID and password through Administrator table.

If login OK, system will display Administrator page to the administrator.



View customer account (Editable)



Administrator clicks Customer button on Admin page.

System displays the Customer Account page.

Administrator inputs account ID, then click OK button.

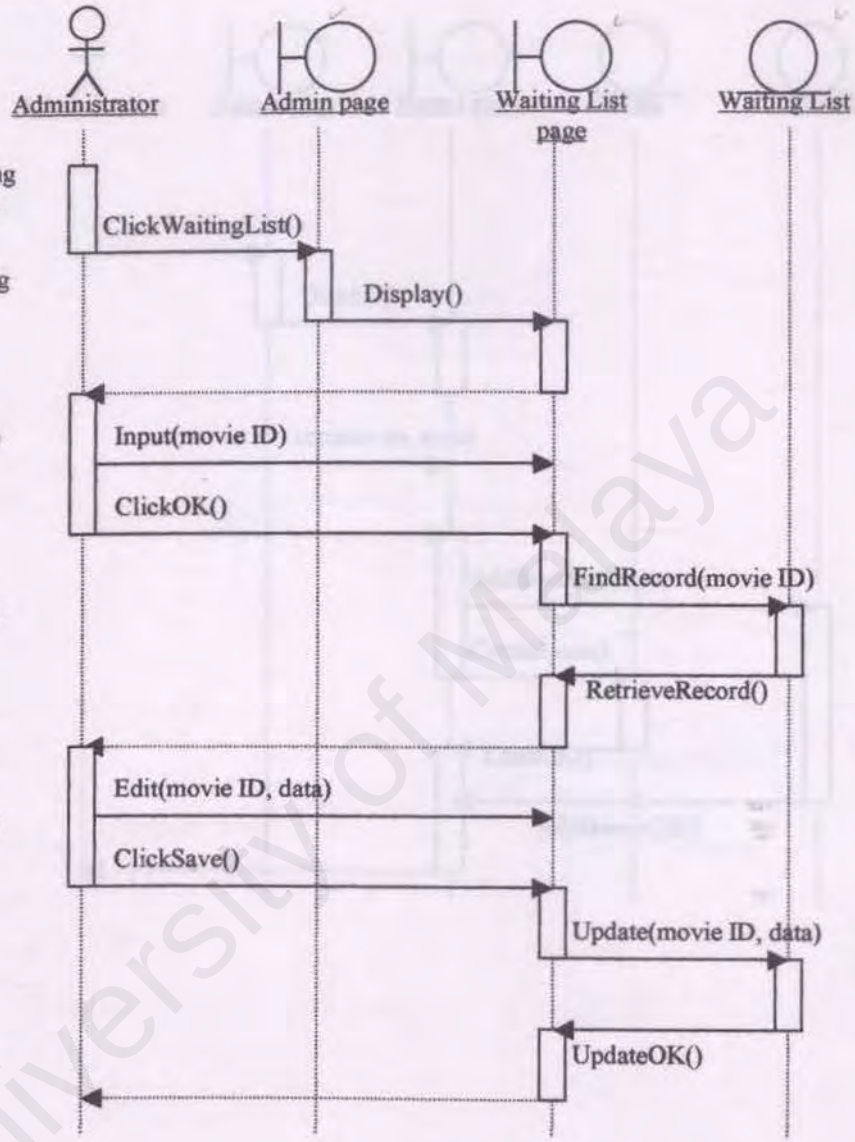
System finds the account from Account table, and then retrieves the record on Customer Account page.

Administrator edits the account's details, and then clicks Save button.

System will update the account into the Account table.

Finally, system will return to the Customer Account Page.

View waiting list (Editable)



Administrator clicks Waiting List button on Admin page.

System displays the Waiting List page.

Administrator inputs movie ID, and then clicks OK button.

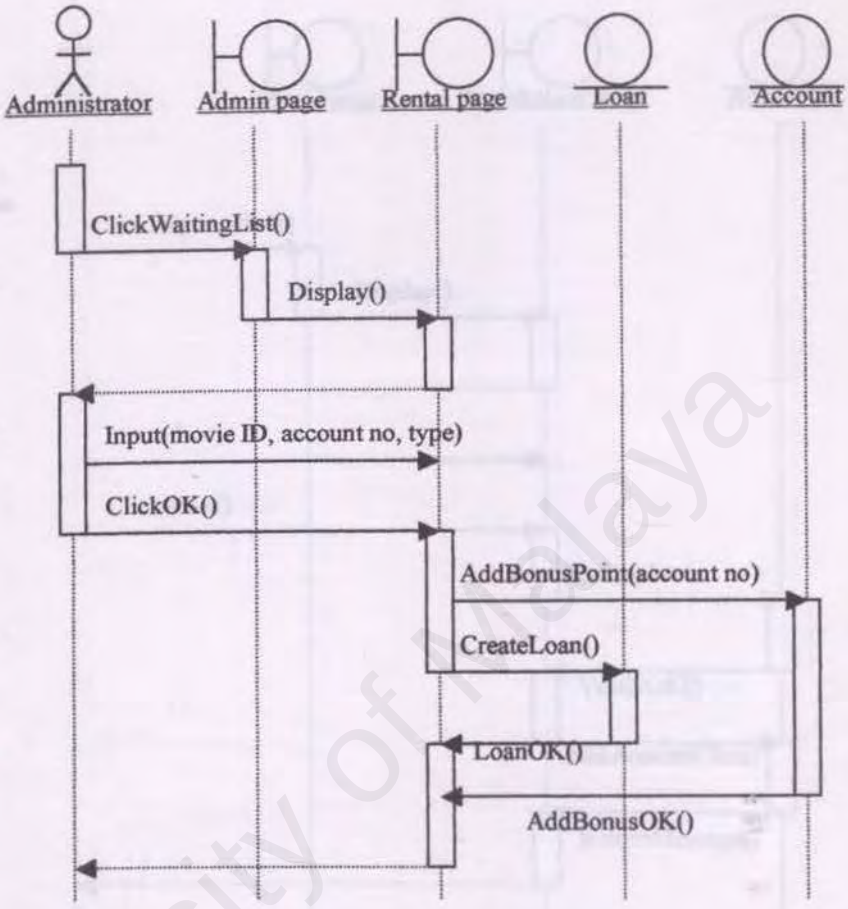
System finds the records for the movie from Waiting List table, and then retrieves the records on Waiting List page.

Administrator edits the waiting list, and then clicks Save button.

System will update the waiting list into the Waiting List table.

Finally, system will return to the Waiting List Page.

Manage rental



Administrator clicks Rental button on Admin page.

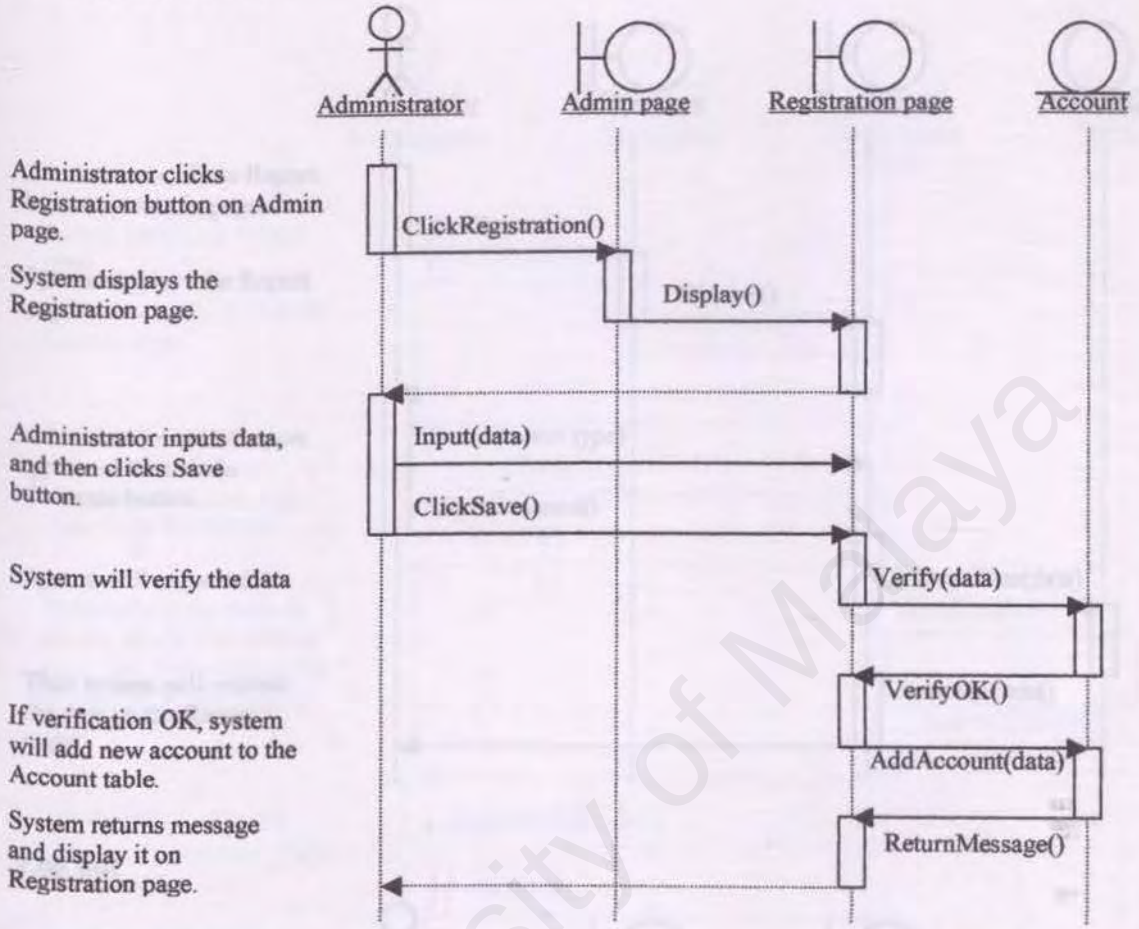
System displays the Rental page.

Administrator inputs movie ID, account no and type, then clicks OK button.

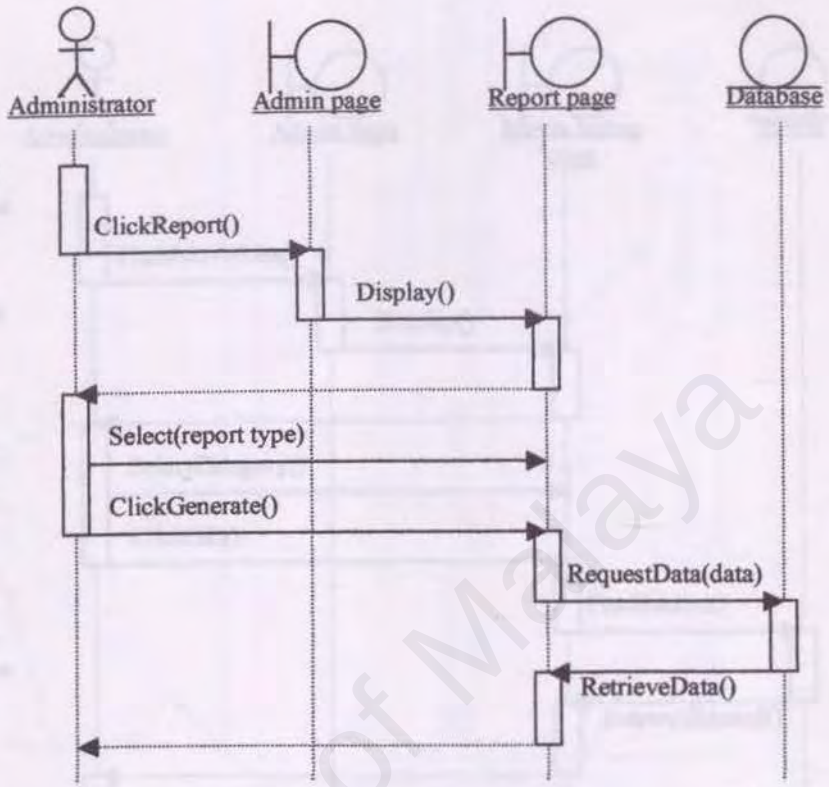
System will create a loan into Loan table, and add bonus point for the account in Account table.

Finally, system will return the loan status to the Administrator on Rental

Manage registration



Generate reports



Administrator clicks Report button on Admin page.

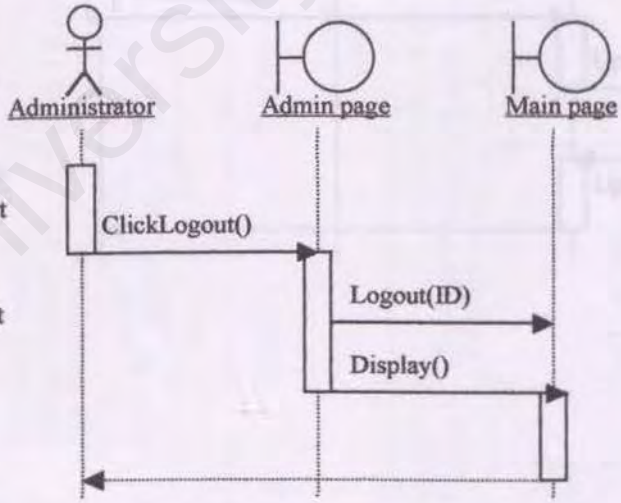
System displays the Report page.

Administrator select report type, and then clicks Generate button.

System will request data

Then system will retrieve the data on the Report page.

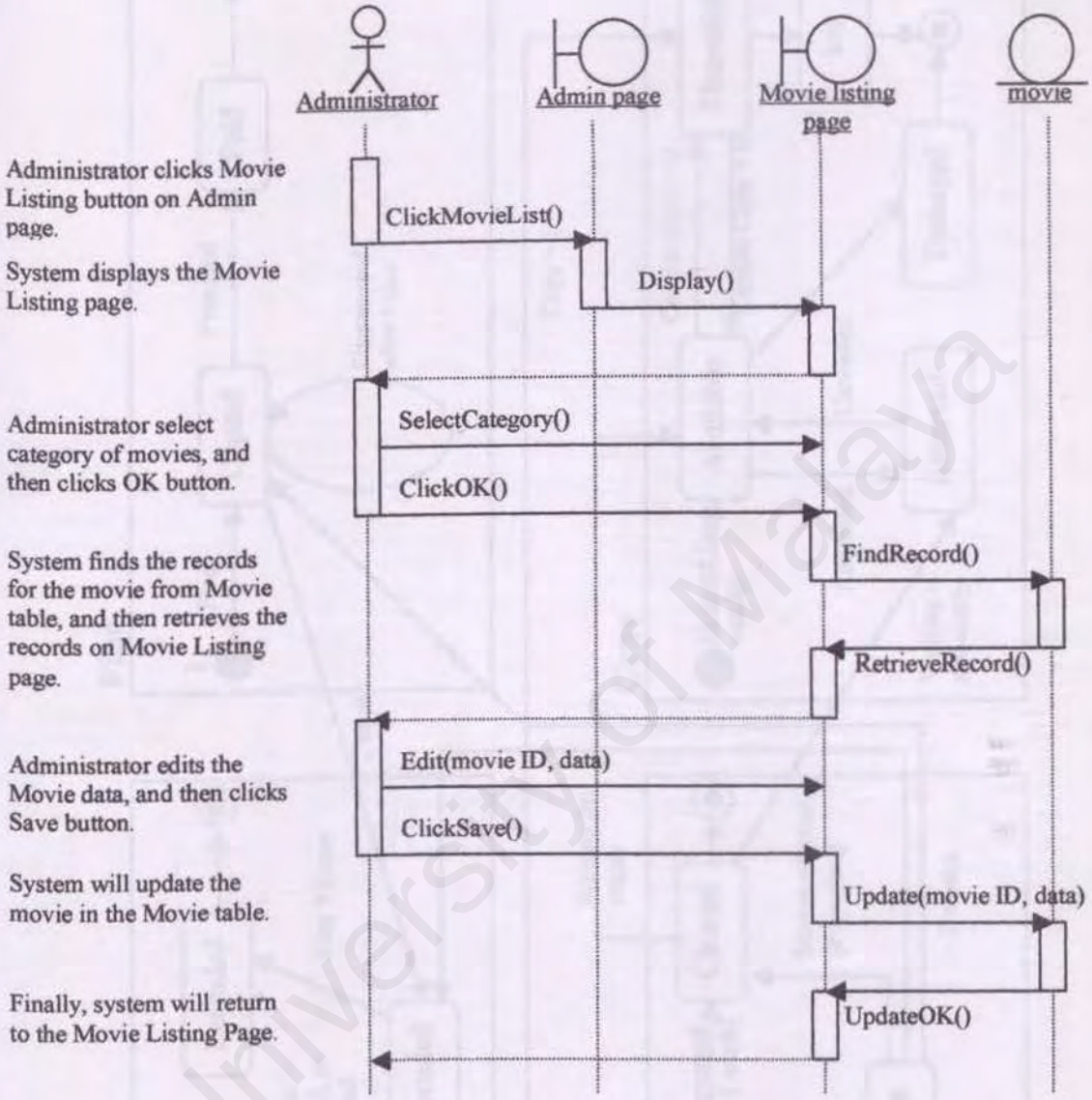
Log out



Administrator clicks Logout button on Admin page.

System logs out the account and displays Main page.

View Movie list



5.2.2 State diagram

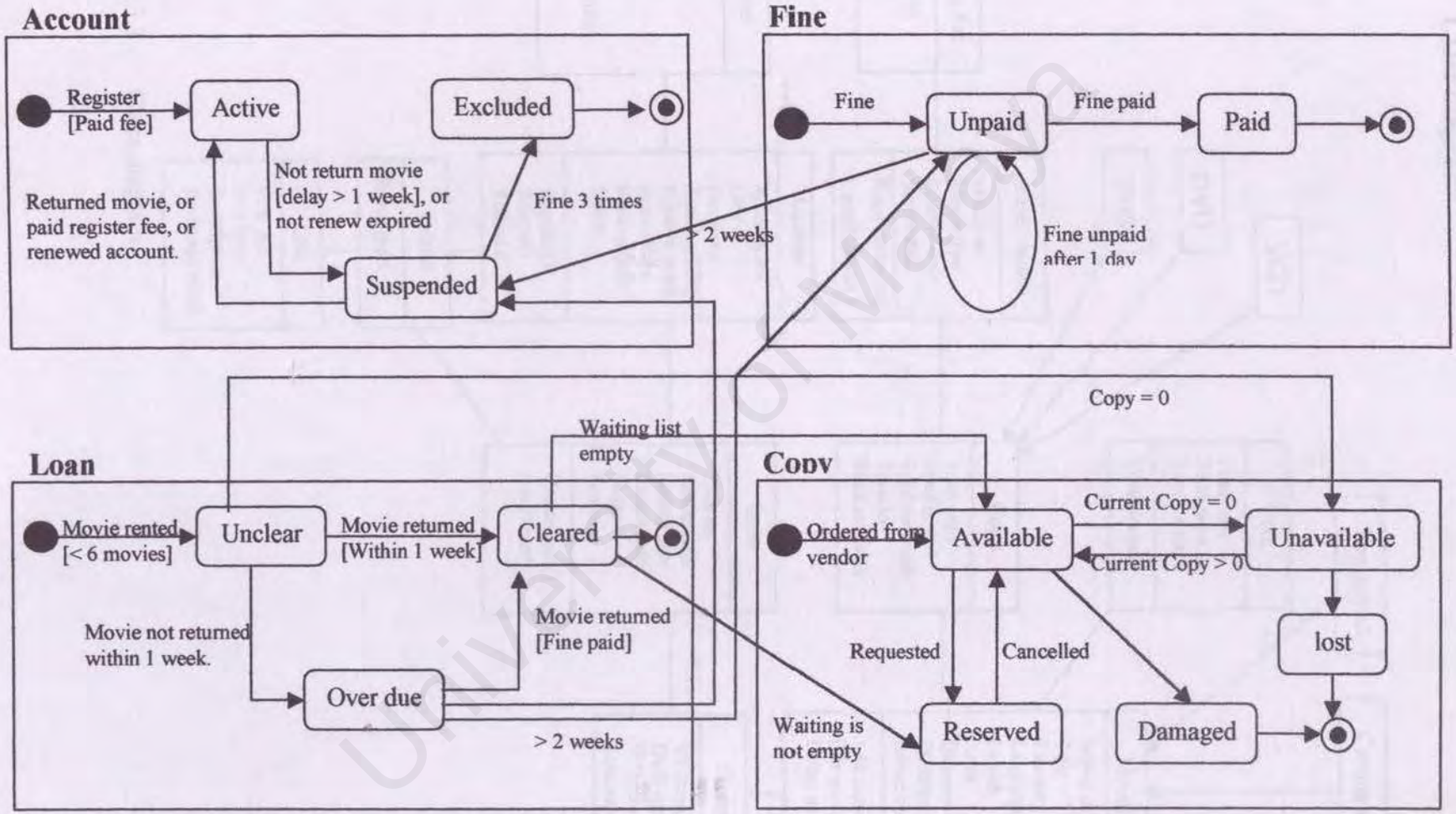


Figure 5.2 State diagram

5.2.3 Class diagram

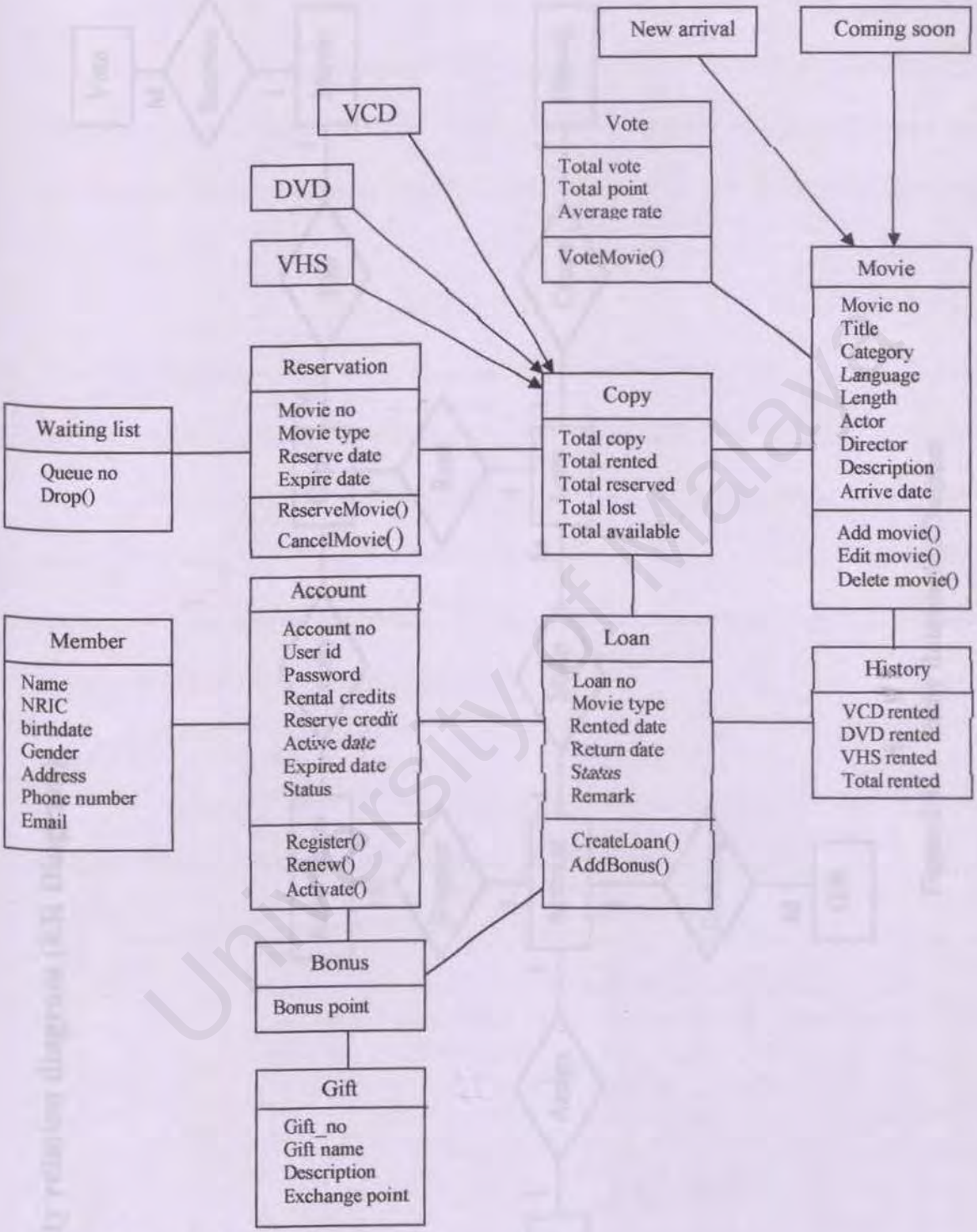


Figure 5.3 Class diagram

5.3 Entity relation diagram (ER Diagram)

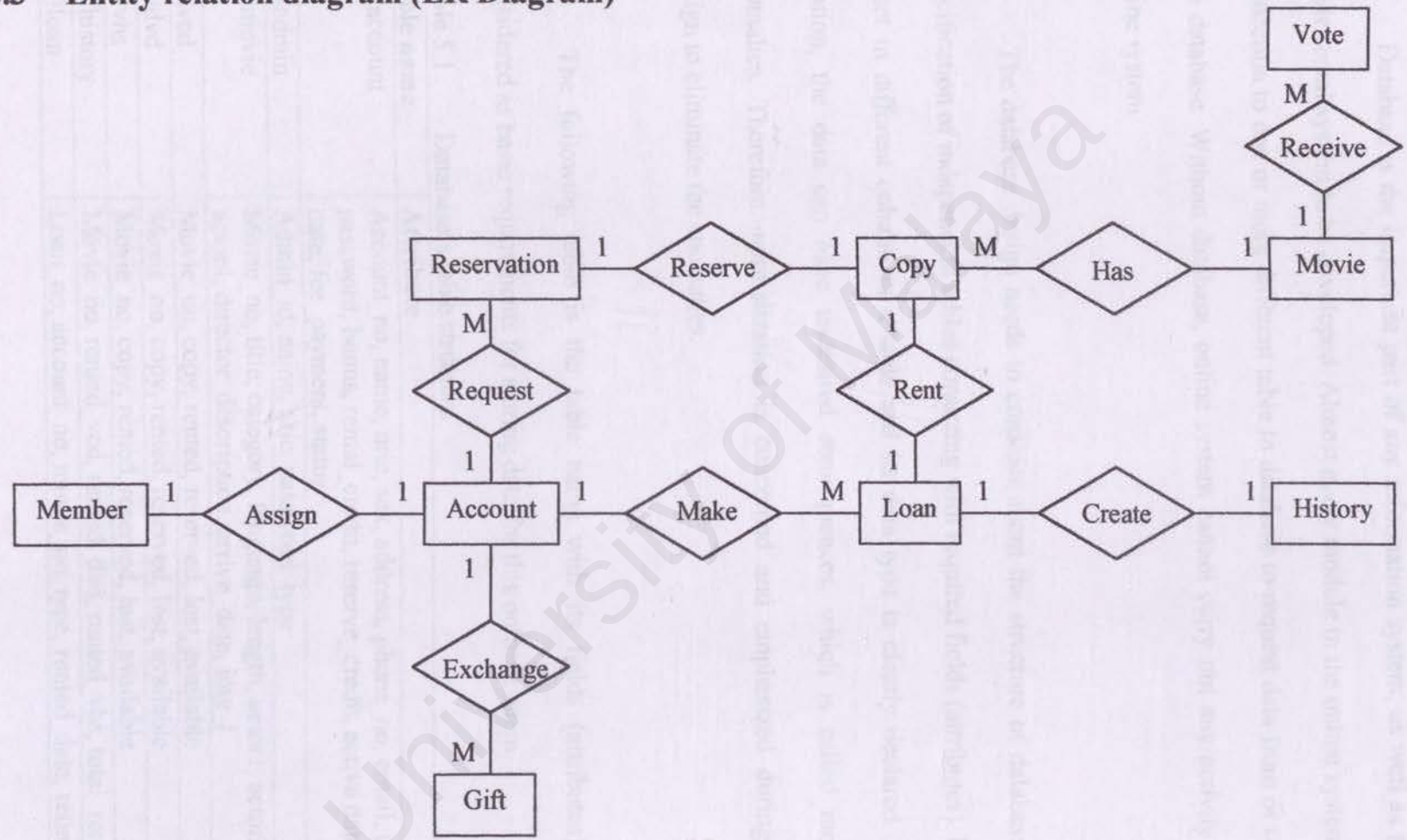


Figure 5.4 Entity Relationship Diagram

5.4 Database design

Database is the important part of any information system, as well as the online movie rental system to be developed. Almost every module in the online system requires connection to one or more different table in database to request data from or create data into database. Without database, online system cannot carry out any activity from the online system.

The database design needs to consider about the structure of database, and the specification of independent tables consisting with required fields (attributes). Each field is set in different column in a table and its data type is clearly declared. For some relation, the data can have undesired consequences, which is called modification anomalies. Therefore, normalization is concerned and emphasized during database design to eliminate the anomalies.

The following table is the table name with its fields (attributes) that are considered as basic requirements for storing data for this online system.

Table 5.1 Database's table structure

Table name	**Attribute**
Tblaccount	Account_no, name, nric, sex, address, phone_no, email, userid, password, bonus, rental_credit, reserve_credit, active date, expired date, fee_payment, status
Tbladmin	Admin_id, name, nric, password, type
Tblmovie	Movie_no, title, category, language, length, actor1, actor2, actor3, actor4, director, description, arrive_date, img_1
Tblvcd	Movie_no, copy, rented, reserved, lost, available
Tbldvd	Movie_no, copy, rented, reserved, lost, available
Tblvhs	Movie_no, copy, rented, reserved, lost, available
Tblhistory	Movie_no, rented_vcd, rented_dvd, rented_vhs, total_rented
Tblloan	Loan_no, account_no, movie_no, type, rented_date, return_date,

Table name	Attribute
	returned_date, status, remark
Tblreserve	Reserve_no, account_no, movie_no, type, reserve_date, expired_date, status
Tblwaiting	Movie_no, queue_no, account_no, movie_type
Tblvote	Movie_no, total_vote, total_point, rate
Tblcomment	Date, comment
Tblgift	Gift_no, gift_name, description, point, img_name

This section list down all the tables' structure of database design of he online movie rental system:

Table 5.2 Tblaccount table.

Tblaccount (key: Account_no)			
Field name	**Description**	**Type**	**MaxLen**
Account_no	Generated member's account number	Numeric	9
Name	Member's name	Varchar2	100
Nric	Member's NRIC number	Varchar2	20
Birthdate	Member's birthdate	Date	8
Sex	Male or Female	Varchar2	6
Address	Member's address	Varchar2	255
Phone_no	Member's telephone number	Number	12
Email	Member's e-mail	Varchar2	50
Userid	Member's login id	Varchar2	20
Password	Member's login password (unique key)	Varchar2	20
Bonus	Member's bonus point from rental	Numeric	9
Rental_credit	Remaining rental credit	Integer	4
Reserve_credit	Remaining reservation credit	Integer	4
Active_date	Active date for a member account	Date	8
Expired_date	Expired date for a member account	Date	8
Fee_payment	Payment of membership fee	Varchar2	3
Status	Account status	Varchar2	10

Table 5.3 Tbladmin table.

Tbladmin (key: Admin_id)			
Field name	**Description**	**Type**	**MaxLen**
Admin_id	Administrator's login ID	Varchar2	8
Name	Administrator name	Varchar2	100
Nric	Administrator NRIC number	Varchar2	20
Password	Administrator's login password	Varchar2	20
Type	A: Administrator, S: system Administrator	Char	1

Table 5.4 Tblmovie table.

Tblmovie (key: Movie_no)			
Field name	**Description**	**Type**	**MaxLen**
Movie_no	Generated movie's number	Numeric	8
Name	Movie name	Varchar2	100
Category	Movie category	Char	1
Language	Movie language, E: English, M: mandarin	Char	1
Length	Movie's length (in minutes)	Int	4
Actor1	Actor's name	Varchar2	50
Actor2	Actor's name	Varchar2	50
Actor3	Actor's name	Varchar2	50
Director	Director's name	Varchar2	50
Description	Movie's description	Varchar2	255
Arrive_date	Movie's arrive date	Date	8
Img_1	Movie's poster	Varchar2	100

Table 5.5 Tblvcd table.

Tblvcd (key: movie no)			
Field name	**Description**	**Type**	**MaxLen**
Movie_no	Movie's number	Numeric	8
Copy	Total copy of movie	Int	2
Rented	Total copy rented	Int	2
Reserved	Total copy reserved	Int	2
Lost	Total copy lost	Int	2
Available	Total copy available	Int	2

Table 5.6 Tbldvd table.

Tbldvd (key: movie_no)			
Field name	**Description**	**Type**	**MaxLen**
Movie_no	Movie's number	Numeric	8
Copy	Total copy of movie	Int	2
Rented	Total copy rented	Int	2
Reserved	Total copy reserved	Int	2
Lost	Total copy lost	Int	2
Available	Total copy available	Int	2

Table 5.7 Tblvhs table.

Tblvhs (key: movie_no)			
Field name	**Description**	**Type**	**MaxLen**
Movie_no	Movie's number	Numeric	8
Copy	Total copy of movie	Int	2
Rented	Total copy rented	Int	2

Tblvhs (key: movie_no)			
Field name	**Description**	**Type**	**MaxLen**
Reserved	Total copy reserved	Int	2
Lost	Total copy lost	Int	2
Available	Total copy available	Int	2

Table 5.8 Tblhistory table.

Tblhistory (key: movie_no)			
Field name	**Description**	**Type**	**MaxLen**
Movie_no	Movie's number	Numeric	9
Rented_vcd	Total copy of rented in VCD	Numeric	9
Rented_dvd	Total copy of rented in DVD	Numeric	9
Rented_vhs	Total copy of rented in VHS	Numeric	9
Total_rented	Total copy of movie rented	Numeric	9

Table 5.9 Tblloan table.

Tblloan (key: loan_no)			
Field name	**Description**	**Type**	**MaxLen**
Loan_no	Generated loan's record number	Numeric	9
Account_no	Member's Account ID	Numeric	9
Movie_no	Movie's number	Numeric	9
Type	Movie type	Varchar	4
Rent_date	Movie's rental date	Date	8
Return_date	Date movie should be returned	Date	8
Returned_date	Date movie is returned	Date	8
Status	RETURNED, ONHOLD	Varchar2	10
Remark	LATE, LOST	Varchar2	10

Table 5.10 Tblreserve table.

Tblreserve (key: Reserve_no)			
Field name	**Description**	**Type**	**MaxLen**
Reserve_no	Generated reservation number	Numeric	9
Account_no	Member's account number	Numeric	9
Movie_no	Movie's number	Numeric	9
Type	Movie type	Char	4
Reserve_date	Movie reserved date	Date	8
Expired_date	Expired date of reservation	Date	8
Status	PICKED, CANCELED	Varchar2	10

Table 5.11 Tblwaiting table.

Tblwaiting (key: account_no + movie_no + movie_type)			
Field name	**Description**	**Type**	**MaxLen**
Account_no	Member's Account ID	Numeric	9
Movie_no	Movie ID number	Numeric	9
Movie type	Movie type	Varchar2	4
Queue_no	Queue number in waiting list	Int	4

Table 5.12 Tblvote table.

Tblvote (key: movie_no)			
Field name	**Description**	**Type**	**MaxLen**
Movie_no	Movie ID number	Numeric	9
Total_vote	Total vote for movie	Numeric	9
Total_point	Total point of vote	Numeric	9
Average_rate	Average rate for movie	Float	8

Table 5.13 Tblvoteby

Tblvoteby (key: Movie_no + account_no)			
Field name	**Description**	**Type**	**MaxLen**
Movie_no	Movie ID number	Number	9
Account_no	Member's Account ID	Numeric	9
Rate	Rate of vote	Int	4

Table 5.14 Tblcomment table.

Tblcomment (key: comment_no)			
Field name	**Description**	**Type**	**MaxLen**
Comment	Comment / suggestion	Varchar2	1000
Date	Date of giving comment	Date	8

Table 5.15 Tblgift table.

Tblgift (key: gift_no)			
Field name	**Description**	**Type**	**MaxLen**
Gift_no	Gift's ID number	Numeric	9
Gift_name	Gift's name	Varchar2	50
Point	Point needed to exchange gift	Numeric	9
Description	Gift description	Varchar2	255
Gift_img	Filename of gift's poster	Varchar2	50

5.5 Interface design

5.5.1 Home page design

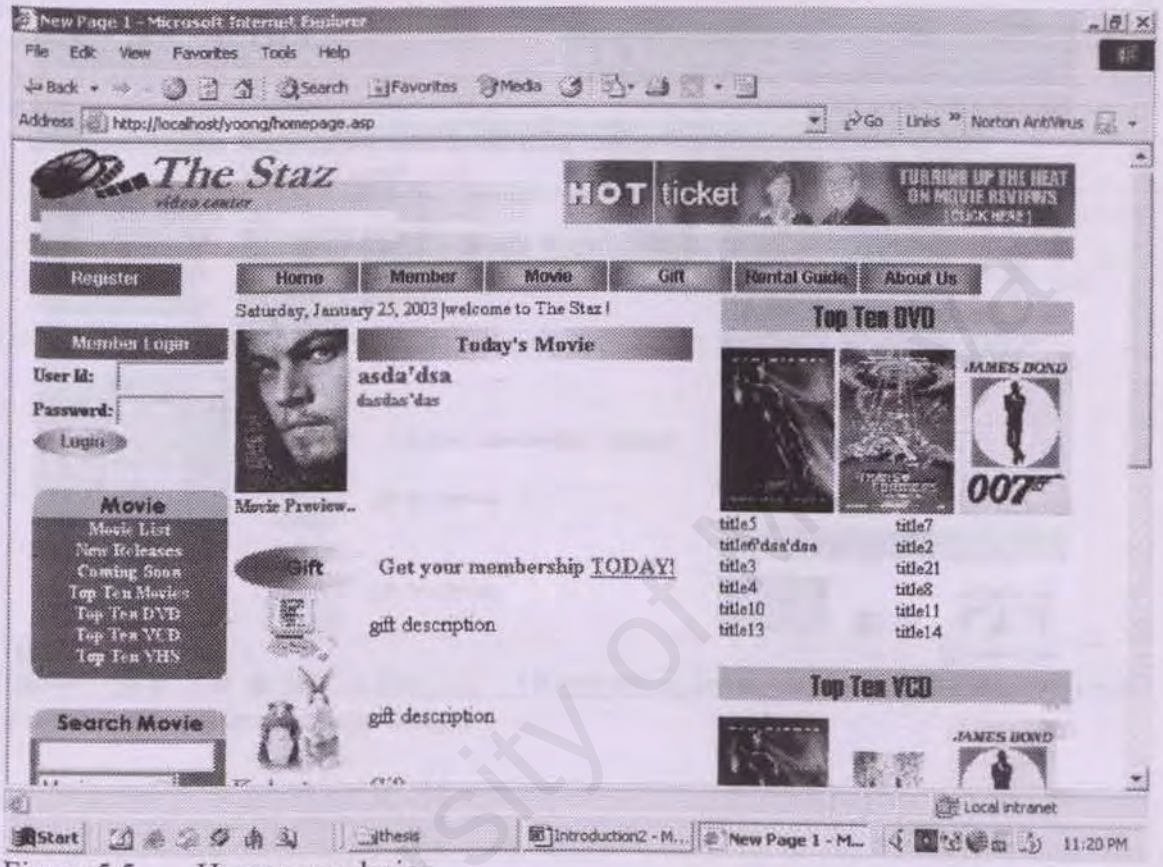


Figure 5.5 Home page design

5.5.2 Member page design

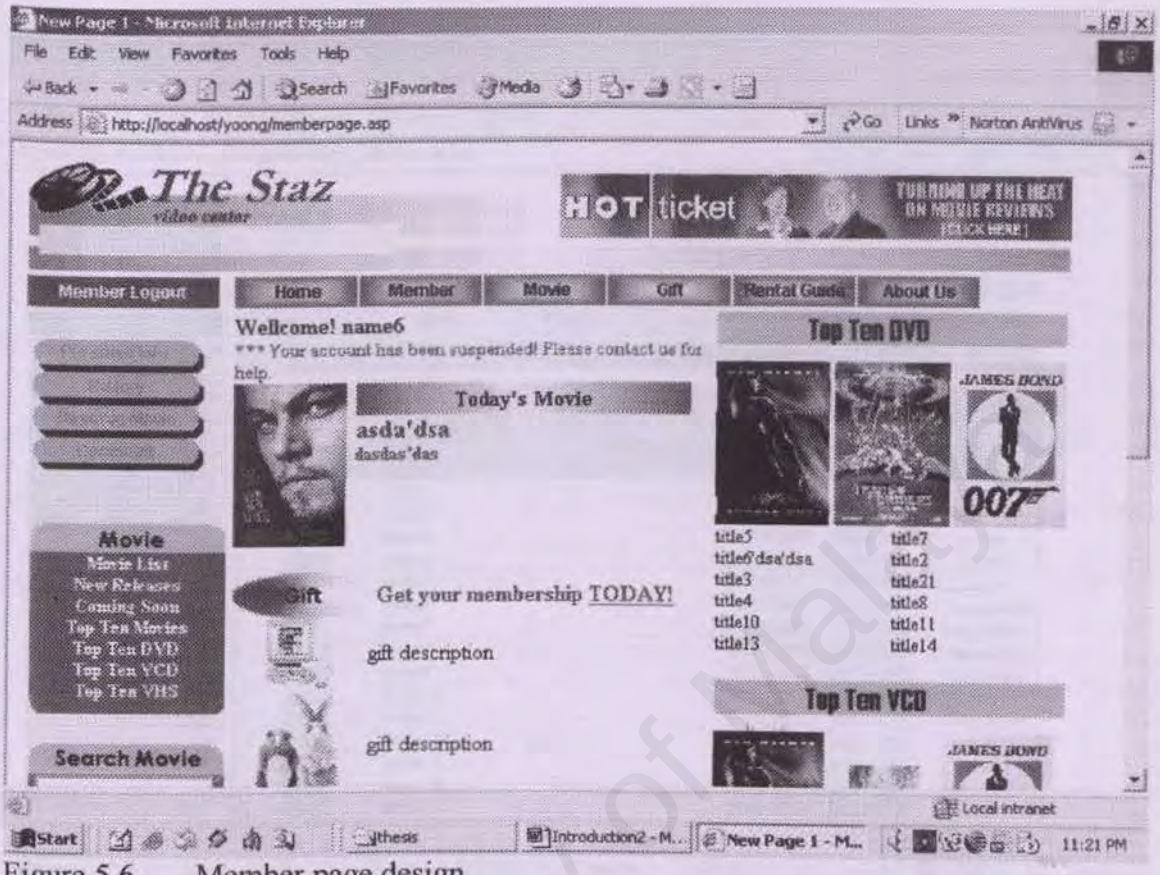


Figure 5.6 Member page design

5.5.3 Administration page design

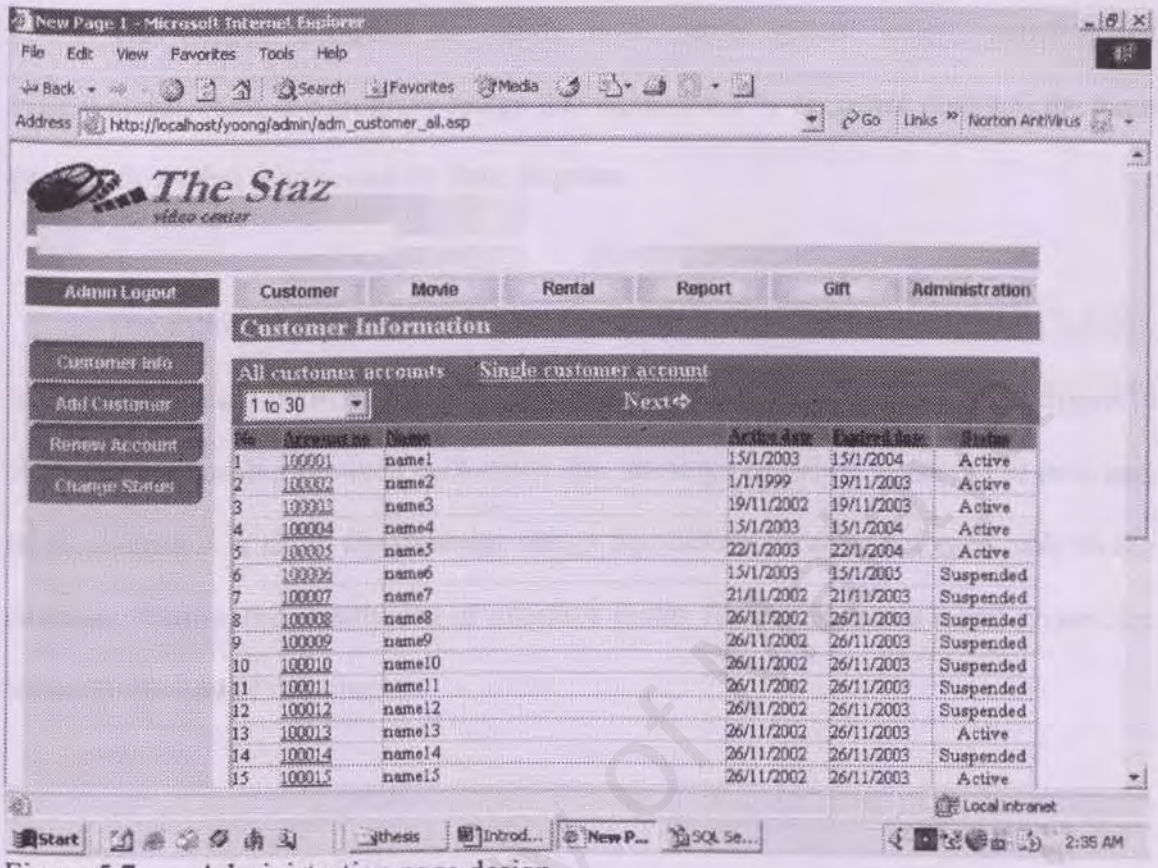


Figure 5.7 Administration page design

5.6 Summary

This chapter discusses the online movie rental system design, including the system architecture, the program design that represented by sequence diagram, the main process flows that represented by state diagram.

The followed discussion is about the classes of the object involved in system, and the association between classes. Next, the Entity Relationship Diagram is drawn to show the relationship between each entity that involved in online system. The next part of the chapter 5 is about the database design that defines structure of each table in the database. Finally, the prototyping of interface design for online movie rental system are shown in the end of this chapter.

Chapter 6 System implementation

6.1 Introduction

As mentioned in the earlier chapter, system implementation of this project is described by implementation workflow in UML approach. The primary activities of the implementation workflow are to build the implementation model, which describes how the elements of the design model are packaged into software components, such as source code file, dynamic link libraries (DLL), and Enterprice Java Beans (EJBs). The implementation model is represented by component diagrams and deployment diagram.

6.2 Component diagram

In UML, component is defined as the physical and replaceable part of a system that conforms to and realizes a set of interfaces. UML assigns components to one of three categories:

- Deployment component, an executable part of a system. There are two stereotypes for use of deployment components: <<executable>>, which indicates a binary (EXE) file; and <<library>>, which indicates a static or dynamic object library such as DLL.
- Work product component, a non-executable part of a system. There are three stereotypes for work product components: <<table>>, which indicates database table; <<file>>, which indicates a file that contains source code; and <<document>>.
- Execution component, which is created as a result of an executing system.

Component diagram shows a collection of related components. It can show the various kinds of relationships that components can have. The focus of the diagram will be on the interfaces that components expose and use, and the dependencies that exist among the various components.

The component diagrams below show the key components associated with the main functional modules in this online system:

6.2.1 Register new account

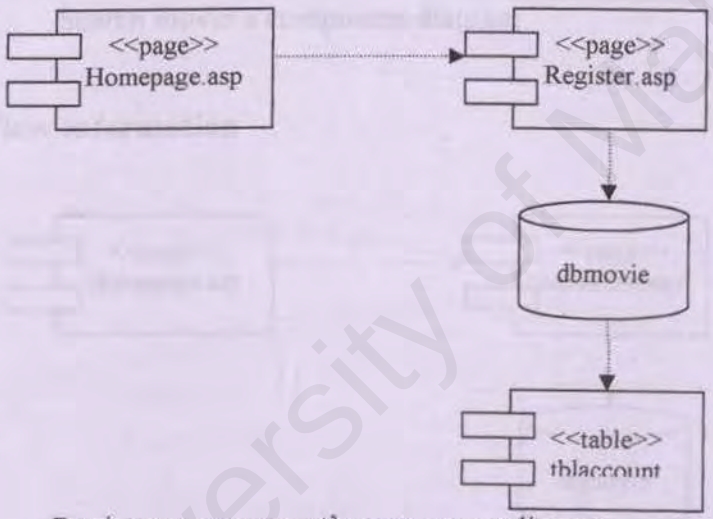


Figure 6.1 Register new account's component diagram

6.2.2 Search movie

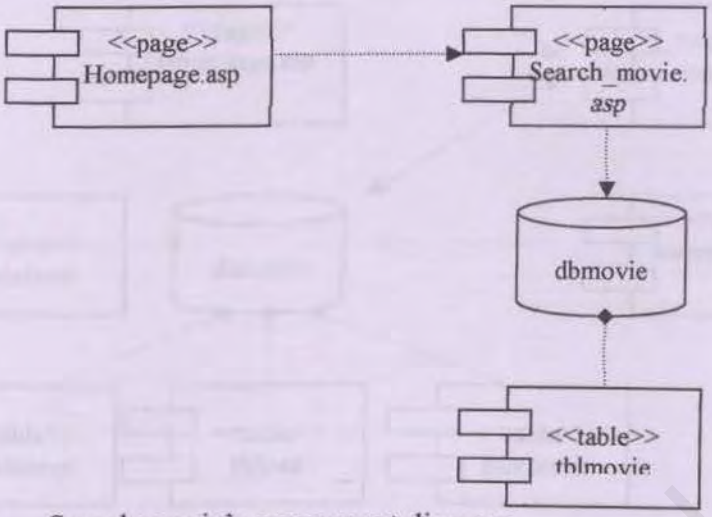


Figure 6.2 Search movie's component diagram

6.2.3 View information

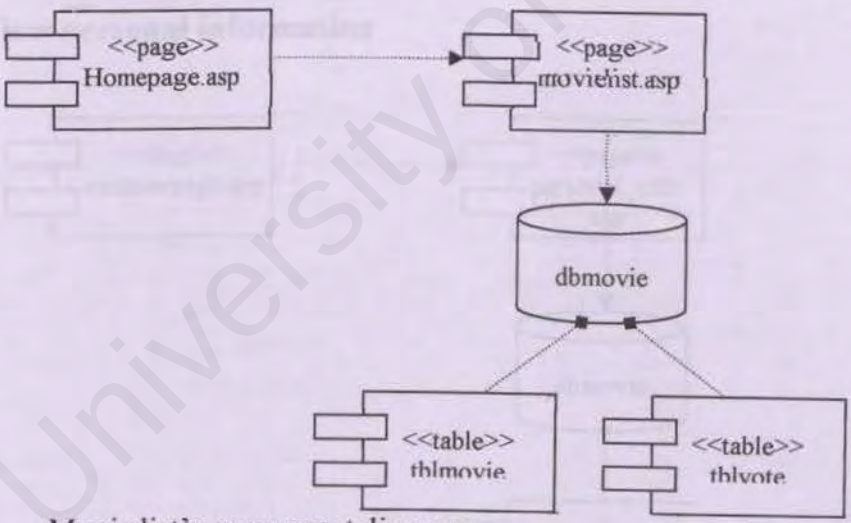


Figure 6.3 Movie list's component diagram

6.2.4 Member login

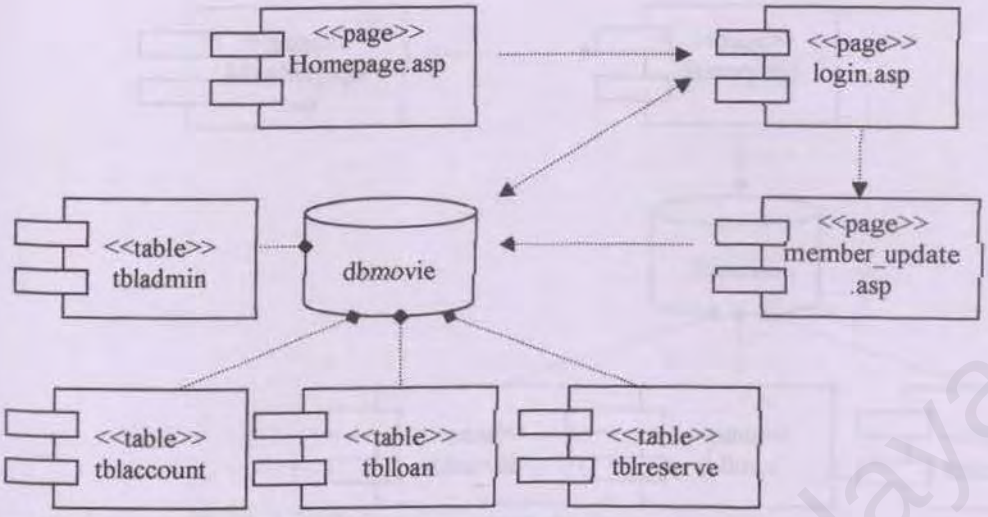


Figure 6.4 Member login's component diagram

6.2.5 View personal information

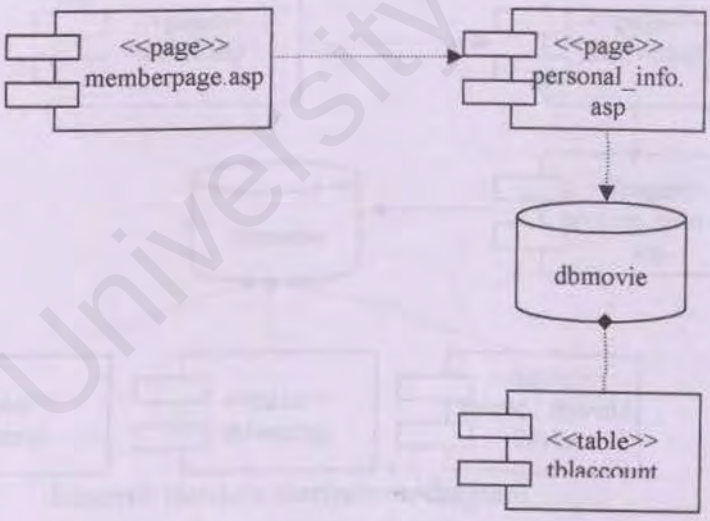


Figure 6.5 Personal account's component diagram

6.2.6 Check history

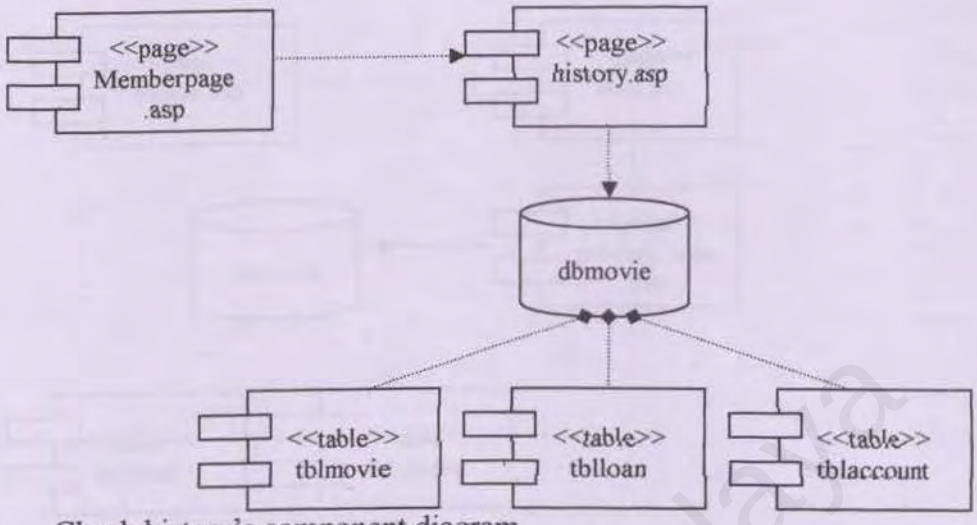


Figure 6.6 Check history's component diagram

6.2.7 Reserve movie

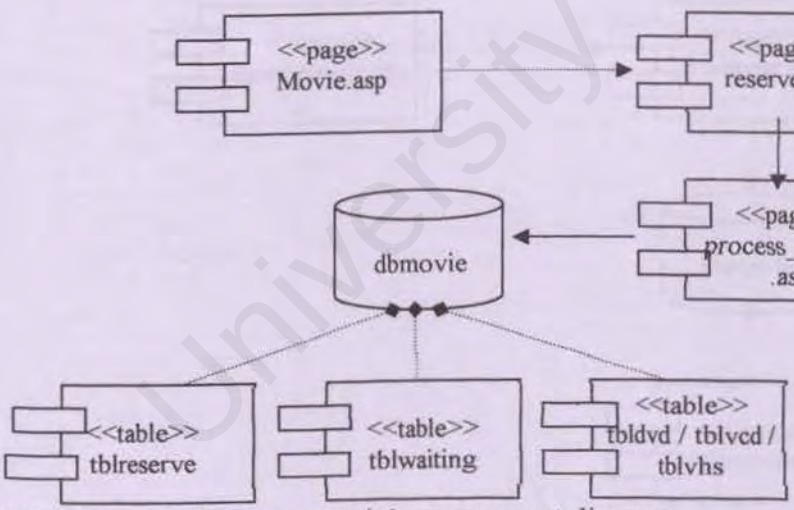


Figure 6.7 Reserve movie's component diagram

6.2.8 Vote movie

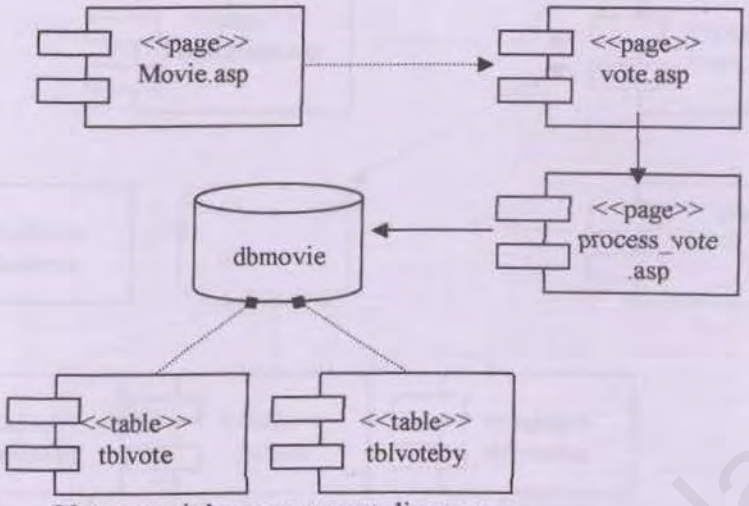


Figure 6.8 Vote movie's component diagram

6.2.9 Comment / suggestion

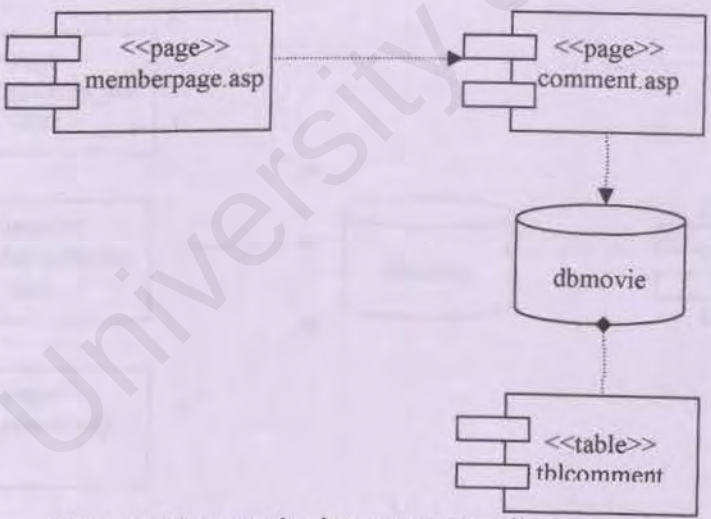


Figure 6.9 Comment/suggestion's component diagram

6.2.10 Administrator login

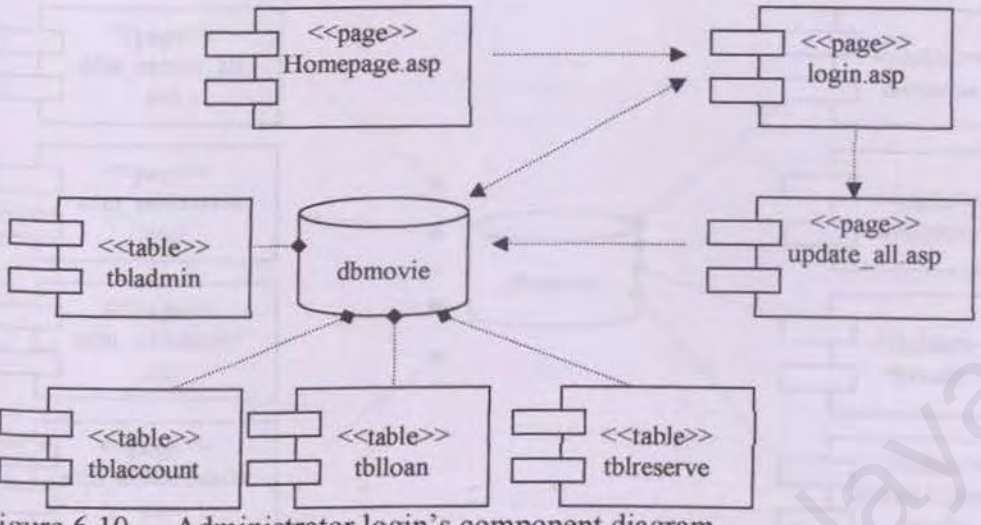


Figure 6.10 Administrator login's component diagram

6.2.11 Manage customer account

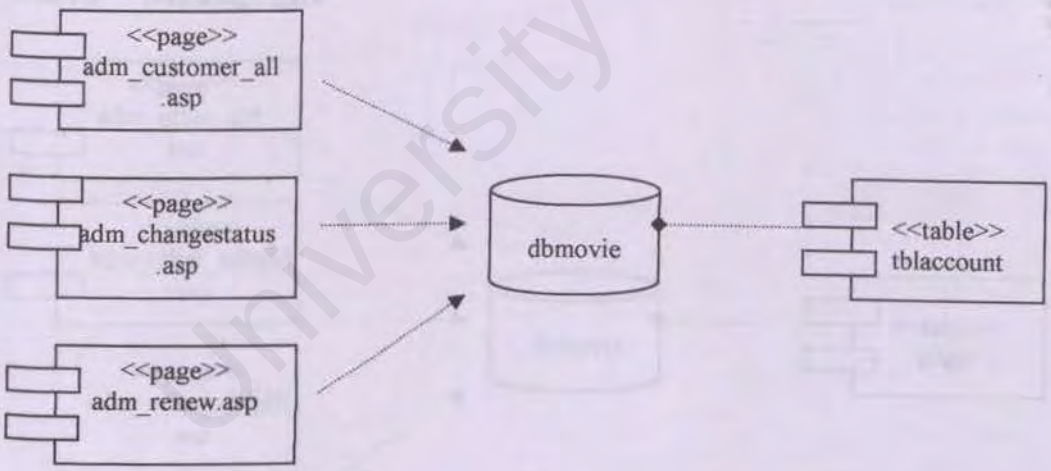


Figure 6.11 Manage customer account's component diagram

6.2.12 Manage movie

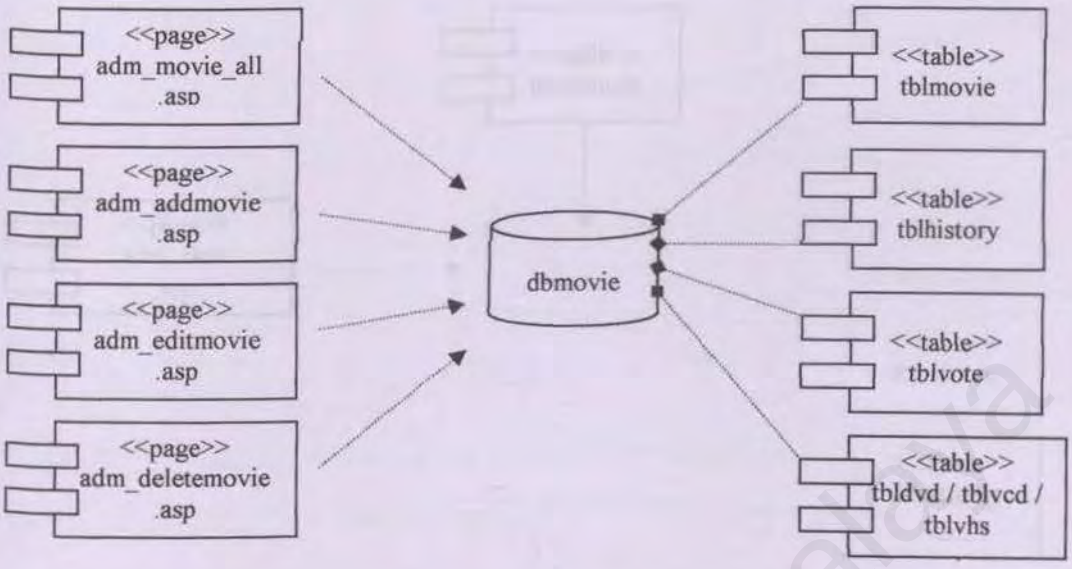


Figure 6.12 Manage movie's component diagram

6.2.13 Manage gift

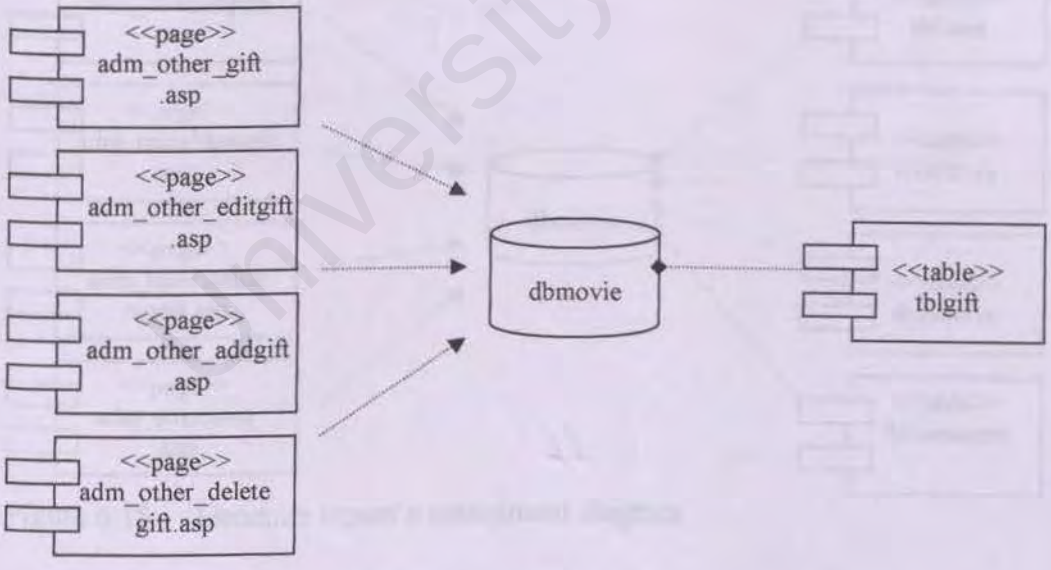


Figure 6.13 Manage gift's component diagram

6.2.14 Manage rental / reservation

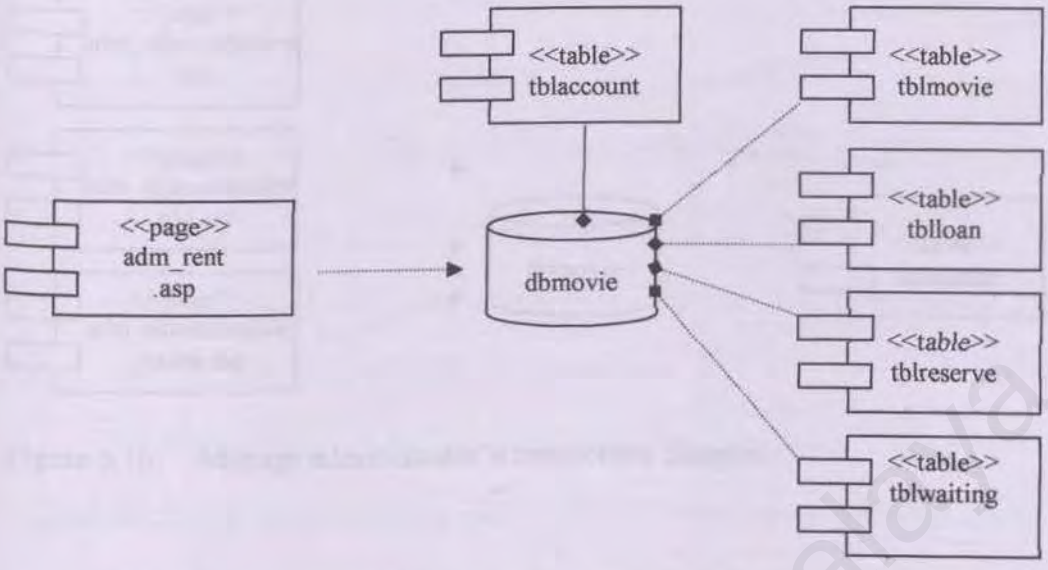


Figure 6.14 Manage rental / reservation's component diagram

6.2.15 Generate report

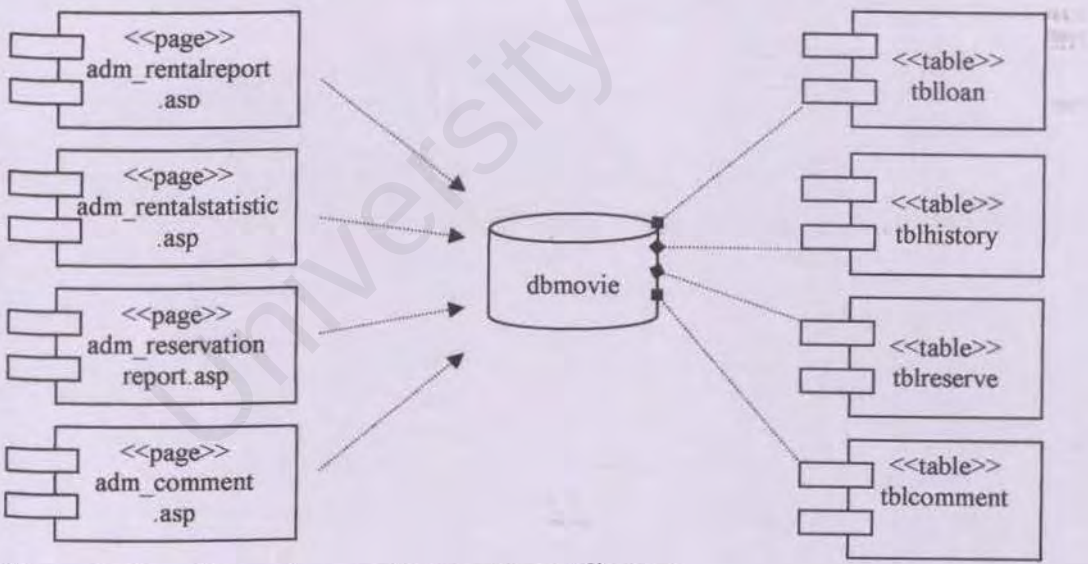


Figure 6.15 Generate report's component diagram

6.2.16 Manage administrator

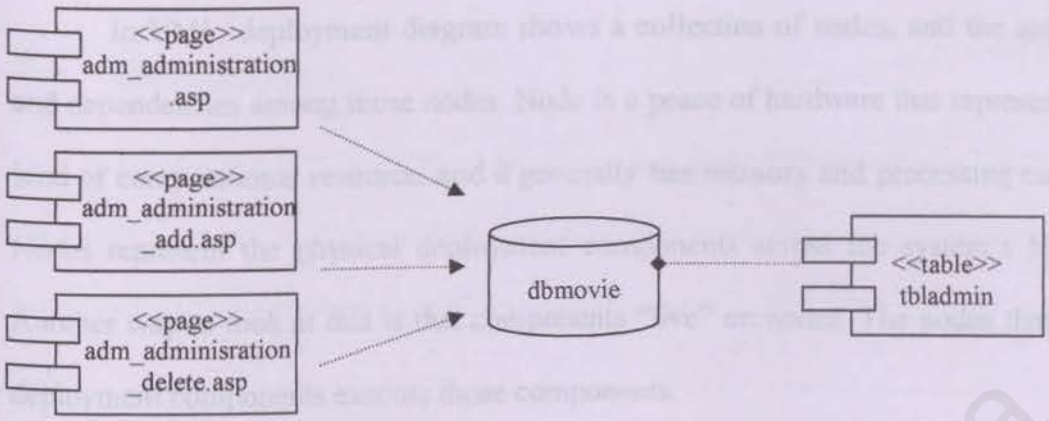


Figure 6.16 Manage administrator's component diagram

6.3 Deployment diagram

In UML, deployment diagram shows a collection of nodes, and the association and dependencies among those nodes. Node is a peace of hardware that represents some kind of computational resource, and it generally has memory and processing capability. Nodes represent the physical deployment components across the system's hardware. Another way to look at this is that components "live" on nodes. The nodes that contain deployment components execute those components.

On a deployment diagram, association between nodes represents a physical connection. The notation for node can be either a cube, which is UML defined, or user-defined icon, which is clearly add visual appeal and aid in understanding the diagram.

The deployment diagram for the online system is shown as below:

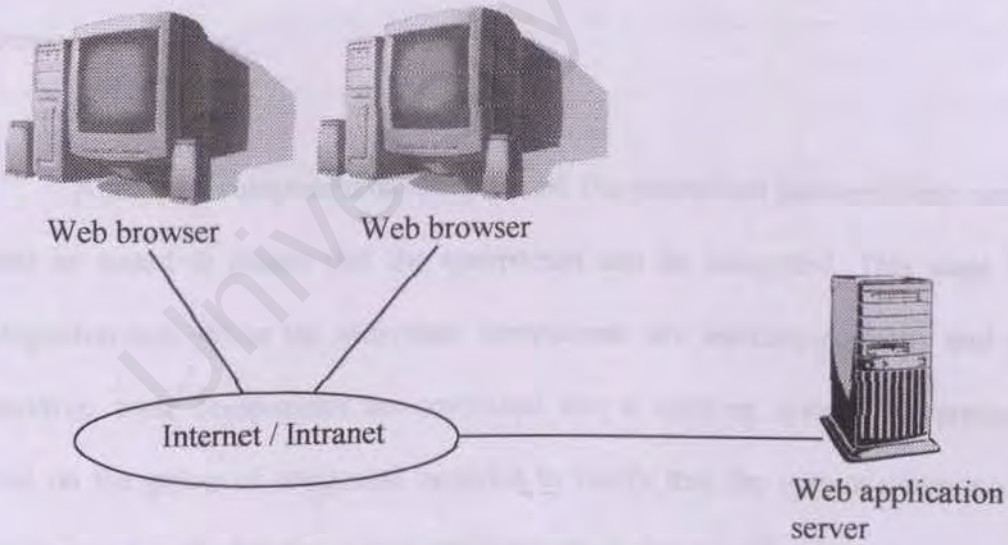


Figure 6.16 Deployment diagram

Chapter 7 System Testing

7.1 Introduction

Testing is a critical element in uncovering logical error and the test to system reliability. The goal is to design tests (test cases) that will uncover the greater number of errors with the minimum amount of time and effort.

Testing usually involves several stages: unit test, integration test and system test. During the unit test, each program component is tested on its own, isolated from other components in the system. The primary goal of unit test is to confirm that the particular, independent unit or component is correctly coded and perform function and algorithm properly as what developer expected. This stage of testing verifies that components functions properly with correct input and output expected from the studying to the component's design.

After each component has been tested, the interaction between these components must be tested to ensure that the component can be integrated. This stage is called integration test. When the individual components are working correctly and meet the objective, these components are combined into a working system. Integration test is done on the group of integrated modules to verify that the system components work together as described in the system and program design specifications.

System testing is the final testing procedure. System test is a series of different tests designed to fully exercise the system to uncover its limitations and measure its capabilities. The objective is to test an integrated system and verify that it meets specified requirements. System testing takes place at higher level, the testing focuses on behavior rather than function or functional structure.

7.1.1 Unit testing

This Online Movie Rental System applied the following types of testing:

7.1.1.1 Ad hoc testing

Ad hoc or ad lib testing means that the author simply play with the functioning unit, trying whatever comes to mind, in attempt to make it fail. One shortcoming of Ad hoc testing is that while the author usually found many errors, the author might be confused of what was or was not tested. Nevertheless, Ad hoc testing was a fast and efficient way of debugging code errors during the early development stage.

7.1.1.2 White box testing

White box testing involves looking at the structure of the code. It focuses on the idea of coverage. The main objective is to check for missing function.

White box testing includes the branch coverage of node testing for those IF…THEN…ELSE…END IF statements where every branch / decision is tested at lease once. Loop testing was done on data retrieving functions where there are extensive

usages of loop such as DO...WHILE...LOOP, FOR...TO...NEXT, and WHILE...WEND.

7.1.1.3 Black box testing

Black box testing focused on functionality of the code. The main objective is to uncover those wrong functions programmed correctly, by feeding input to the black box and take notes on what output is produced.

During black box testing, each unit in functional module is tested by inserting input to the module. The input includes the correct data to test whether the module works properly and produces correct output; and invalid data to make sure the error routines are working correctly. This test is done on the system user input form.

Boundary value analysis is also apart of black box testing. Since many errors tent to be occur on the boundaries of equivalence classes. The test includes test scenarios where the value set is inside, or outside the boundary.

7.1.2 Integration testing

After unit test was satisfied with that individual components are correctly and meet the objectives, the modules are integrated into a working system. For this online system, incremental approach was used, where the units are added one by one to the set of integrated units.

The objective of having integration test is to find out errors that occurred during the integration of component is being tested. In addition, the order in which components are tested affects the choice of test cases and tools. The integration test not only test for integration timing and order, but also the thoroughness of the testing.

During integration testing, two or more units in which either unit that use output data from or provide input data for another unit are tested in collection. These units have related characteristics to perform a common goal or function.

7.1.3 System test consideration

Because system testing take place at higher level, the testing focuses on behavior rather than function or functional structure, and this cannot be tested through code audits based on pattern matching. In system testing, not only does the behavior of the individual functions need to be tested; further functional tests should involve:

- The event list – all the possible triggers must be exercised and the expected results compared with the actual results. Every function should be tested by one or more events in the event list.
- Specific scenarios – the entire set of possible scenarios, or user profiles, should be specified for a given application. This can be done by defining the meaningful user profiles and restrict the testing to them.
- Testing transaction – a list of possible transactions, either extracted from the scenarios or from the event list, are tracked through the software system (or subsystem) to ascertain that they function correctly from input to output.

- Error message testing – every error message which can be generated by the system must be extracted from the code and placed in a table to test for appropriateness and understandability. Error message should be checked from a "national language" point of view to see that they have enough room to be translated both in the table and on the screen where they are displayed.
- Documentation testing – all examples used in user manual must be tested for correctness and for whether or not the manual give the exact answers users will obtain when they run the examples. All the functionality should be available through both parts of the manual and through an effective, accurate index. Further, all accessible terminology in the manual should be understood by user.

7.2 Test case

Test case describes how each test is to be conducted and input / output details. Developments of test cases assist in keeping track of what is tested, when it was tested, and the outcome of the test. A documented test case makes it easy for the developer to re-create the problem so that proper analysis can be done to fix it.

Test case should be designed for testing each function, with expected results. Test case should be repeatable and should give the same results each time.

Below are the examples of test cases defined for this online system, and each test is carried out to test its related module:

7.2.1 Login

Test description	Input	Expected output	Actual output
Login with valid member's user id and password	Valid user id and password	A user session is created and member page is opened	As expected
Test whether member's account is automatically updated after login	Valid user id and password	Member's account status, loan status, reservation status is updated.	As expected
Login with valid administrator's user id and password	Valid user id and password	A admin session is created and administration page is opened	As expected
Test whether all members' account is automatically updated after login	Valid user id and password	All member's account status, loan status, reservation status is updated.	As expected
Login with invalid member's user id and password	Invalid user id and password	Login failed and register page is redirected.	As expected

Table 7.1 Login test cases

7.2.2 Registration

Test description	Input	Expected output	Actual output
Whether error message is displayed if required field is blank.	No input	Error message is displayed, registration failed.	As expected
Whether error message is displayed if input length > maximum length	Input length > maximum length	Error message is displayed, registration failed.	As expected
Whether error message is displayed if Nric or user id same with other member	Same Nric or user id with other member.	Error message is displayed, registration failed.	As expected
Whether error message is displayed if password and confirmation password not same.	Password different with confirmation password.	Error message is displayed, registration failed.	As expected
Whether registration success when submit button is clicked and no error occurs.	Click submit button	Registration success	As expected

Table 7.2 Registration test cases

7.2.3 Search movie

Test description	Input	Expected output	Actual output
Insert valid movie title	Valid movie title	One or more movies found and listed	As expected
Insert invalid movie title	Invalid movie title	No movie found	As expected
Insert valid actor's / actress' name	Valid actor's / actress' name	One or more movies found and listed	As expected
Insert invalid actor's / actress' name	Invalid actor's / actress' name	No movie found	As expected
Insert valid director's name	Valid director's name	One or more movies found and listed	As expected
Insert invalid director's name	Invalid director's name	No movie found	As expected

Table 7.3 Search movie test cases

7.2.4 View movie list

Test description	Input	Expected output	Actual output
Whether movie list displayed according to selected list type.	Click on selected hyperlink	Movie list displayed according to selected list type.	As expected
Whether movie list can be correctly sorted	Click on selected sort type	Movie list is sorted according to selected sort type.	As expected
Whether movie's details is shown when its hyperlink is clicked	Click on movie details' hyperlink	Movie's details are displayed.	As expected
Whether reserve and vote buttons is hidden if user session doesn't exist.	No input	Reserve and vote buttons is hidden	As expected
Whether reserve and vote buttons appear if user session exists.	No input	Reserve and vote buttons appear	As expected

Table 7.4 Movie list test cases

7.2.5 Edit personal information

Test description	Input	Expected output	Actual output
Whether error message is displayed if required field is blank.	No input	Error message is displayed, edit failed.	As expected
Whether error message is displayed if input length > maximum length	Input length > maximum length	Error message is displayed, edit failed.	As expected
Whether error message is displayed if user id same with other member	Same user id with other member.	Error message is displayed, edit failed.	As expected
Whether error message is displayed if password and confirmation password not same.	Password different with confirmation password.	Error message is displayed, edit failed.	As expected
Whether system returns last updated value when refresh button is clicked	Click refresh button	System returns last updated values.	As expected
Whether edit success when submit button is clicked and no error occurs.	Click submit button	Edit success	As expected

Table 7.5 Edit personal information test cases

7.2.6 Check history

Test description	Input	Expected output	Actual output
Whether current rental is displayed if record exist.	No input	Current rental is listed	As expected
Whether previous rental displayed where previous loan date is in the selected date range.	Selected date range	Record found and displayed.	As expected
Whether previous rental displayed where loan date is out of the selected date range.	Selected date range	No record found	As expected

Table 7.6 Check history test cases

7.2.7 Check reservation

Test description	Input	Expected output	Actual output
Whether current reservation is displayed if record exist.	No input	Current reservation is listed	As expected
Whether waiting list is displayed if record exist.	No input	Request is displayed in waiting list	As expected
Whether current reservation is canceled when cancel button is clicked.	Click cancel button	Reservation is canceled	As expected
Whether request in waiting list is dropped when drop button is clicked.	Click drop button	Request is canceled	As expected

Table 7.7 Check reservation test cases

7.2.8 Comment / suggestion

Test description	Input	Expected output	Actual output
Whether error message is displayed if input length > maximum length	Input length > maximum length	Error message is displayed.	As expected
Whether comment is sent to database when submit button is clicked and no error occurs.	Click submit button	Comment is sent to database	As expected

Table 7.8 comment / suggestion test case

7.2.9 Vote movie

Test description	Input	Expected output	Actual output
Whether vote movie page display when vote button is clicked	Click vote button	Vote movie page display	As expected
Whether message displayed if member already voted the movie.	Click vote button	Message display, vote movie is not allowed.	As expected
Whether movie's vote rating updated after vote.	Select and click a rate	Movie's rating changed	As expected

Table 7.9 vote movie test cases

7.2.10 Reserve movie

Test description	Input	Expected output	Actual output
Whether reserve movie page display when reserve button is clicked	Click reserve button	reserve movie page display	As expected
Whether message displayed if member have no reservation credit.	Click reserve button	Message display, reserve movie is not allowed.	As expected
Whether message displayed if member's status is not active	Click reserve button	Message display, reserve movie is not allowed.	As expected
Whether message displayed if movie is not available	Select movie type, then click reserve button.	Message display, reservation is not allowed.	As expected
Whether request is added into waiting list if movie is not available	Select movie type, set checkbox to true, then click reserve button	Add request into waiting list	As expected

Table 7.10 Reserve movie test case

7.2.11 Manage customer account

Test description	Input	Expected output	Actual output
Whether customer list displayed according to selected page	Click on selected page	Customer list displayed according to selected page	As expected
Whether customer list can be correctly sorted	Click on selected sort type	Customer list is sorted according to selected sort type.	As expected
Whether customer's details is shown when its hyperlink is clicked	Click customer's account_no	Customer details are displayed.	As expected
Whether customer account is renewed when renew button is clicked	Click renew button	Account is renewed	As expected
Whether new customer is added when submit registration form	Fill form, then click submit button	New customer account is added	As expected
Whether customer account status change when changestatus button is clicked	Click changestatus button	Account status changed	As expected

Table 7.11 Manage customer account test cases

7.2.12 Manage movie

- **Movie list**

Test description	Input	Expected output	Actual output
Whether movie list displayed according to selected list type	Click on selected list type	Movie list displayed according to selected list type	As expected
Whether movie list displayed according to selected page	Click on selected page	Movie list displayed according to selected page	As expected
Whether movie list can be correctly sorted	Click on selected sort type	Movie list is sorted according to selected sort type.	As expected
Whether movie's details is shown when its hyperlink is clicked	Click movie's account_no	Movie details are displayed.	As expected

Table 7.12 movie list test cases

- **Edit movie**

Test description	Input	Expected output	Actual output
Whether movie's profile is displayed if record found	Insert movie no, then click search button	Movie's profile is displayed	As expected
Whether movie's profile is editable before clicking Edit hyperlink	No input	Movie's profile is not editable	As expected
Whether movie's profile is editable after clicking Edit hyperlink	Click Edit hyperlink	Movie's profile is editable	As expected
Whether movie's profile is updated after changes made and update button is clicked	Change movie's profile, then click update button	Movie's profile is updated	As expected

Table 7.13 Edit movie

- **Add movie**

Test description	Input	Expected output	Actual output
Whether error message is displayed if required field is blank.	No input	Error message is displayed, add movie failed.	As expected
Whether error message is displayed if input length > maximum length	Input length > maximum length	Error message is displayed, add movie failed.	As expected
Whether error message is displayed if data type is incorrect	Incorrect data type	Error message is displayed, add movie failed.	As expected
Whether movie's image is uploaded if image is selected.	Browse and select image, then submit form	Add movie success, image is uploaded	As expected
Whether image is displayed when image is selected	Browse and select image	Image preview is displayed	As expected

Table 7.14 add movie test cases

- **Delete movie**

Test description	Input	Expected output	Actual output
Whether movie's profile is displayed if record found	Insert movie no, then click search button	Movie's profile is displayed	As expected
Whether movie is deleted after clicking Delete button	Click Delete button	Movie is deleted	As expected

Table 7.15 Delete movie test cases

7.2.13 Manage gift

Test cases for manage gift is similar to test cases for manage movie. Test cases include:

- Edit gift
- Add gift
- Delete gift

7.2.14 Manage administrator

Test cases for manage administrator is similar to test cases for manage movie. Test cases include:

- Add administrator
- Delete administrator

7.2.15 Manage rental / reservation

Test description	Input	Expected output	Actual output
Whether error message is displayed if insert incorrect data type	Incorrect data type	Error message is displayed, no record is found	As expected
Whether error message is displayed if no record found	Insert invalid account no, Nric, or user id	Error message is displayed, no record is found	As expected
Whether account's detail is displayed if account record found	Valid account no, Nric, or user id	Account's detail is displayed	As expected
Whether account's current loan and current reservation are listed if account record found	Insert valid account no, Nric, or user id	Current loan and reservation is listed	As expected
Whether search movie button is disabled if no account found.	Insert invalid account no, Nric, or user id	Search movie button is disabled	As expected
Whether search movie button is enabled if account found.	Insert valid account no, Nric, or user id	Search movie button is enabled	As expected
Whether movie detail is displayed if movie found	Insert valid movie no	Movie detail is displayed	As expected
Whether rent button and reserve button is enabled if movie found	Insert valid movie no	Rent button and reserve button is enabled	As expected
Whether movie is rented /reserved if movie is available	Click rent / reserve button	Rental / reservation success	As expected
Whether message is displayed if movie is not available	Click rent / reserve button	Message displayed, rental / reservation failed	As expected
Whether movie is rented if Take button is clicked	Click Take button	Rental success	As expected
Whether movie is returned if Returned button is clicked	Click Return button	Movie is resturned	As expected

Table 7.16 Rent / reserve movie test cases

Chapter 8 System evaluation

8.1 Problems encountered and recommended solutions

There are many problems occurred during system development and so no exception for this project. Throughout this project, many problems have kelp unfolding one after another as development work progressed due to many reasons.

1. **Determining scope of the system during analysis phase**

   Since there was no prior experience in developing a system, it was hard to determine to which extent to define the scope of the system so that it can be completed within the given time frame. However, this was overcome by analyzing and studying all of the capabilities that Visual InterDev, Microsoft Front page 2000, SP technology can do before determining the scope of the system.

2. **Time constrain during design phase**

   There was not enough time to study and produce the best solution of design for the system, including the user interface design, coding design and database structure design. This was due to the lack of experience and knowledge in designing a system, especially a web based system. Therefore, the best way to overcome this problem is to read and analyze as many approaches used in previous year students' report documentation.

3. **Installation problems during implementation phase**

   There were a lot of problems on installing and configuring development environment, including the installation of Window server 2000, setting up the IIS, and other tools before system development can be started. Some software and tools were needed to be reinstalled or reconfigured in order to fix the errors occurred and assure those software and tools work properly. It is essential to know the sequence of product installation. This is to ensure smooth execution without system errors.

4. **Unanticipated appearance of web pages in different web browser during testing phase**

   The appearance of web pages on Internet Explorer and Netscape Navigator and Communicator is different, such as different positioning of graphics, text, and tables. There is nothing can be done with this problem since there is no knowledge and learning of those web browsers.

8.2 System strength

Although this online system does not have powerful features to some extent, it still have some strength when compared with some other web sites.

- **Auto updates account status, loan status, and reservation status**

  This system will automatically verify and update customer's account status each time member login or administrator login into this system. Further, the current loan

status, current reservation status, and waiting list status will be updated so that user can view lattes information.

- **Online editing account's information**

  Member is allowed to edit some of their personal information via this online system, such as email address, user id, and password.

- **User-friendly user interfaces**

  The user interfaces are design with brighter color and the appearance of information, text, images and tables is always contra with the background color. Users may have better sight and focuses on every text and graphics, therefore easier to read information and understand how this system works.

- **Fast response in retrieving data from server**

  Each web page is designed to be lightweight. All pages are loaded in a reasonable amount of time to ensure users not to wait too long to access the pages.

- **Simple search engine**

  This system provides a simple search function to allow users to search movies they wish to look at. This search function help users to directly get the movie's detail faster, instead of browsing page by page to find the movie in the list.

- **Error messaging**

  Each time user performs a wrong action in this system, an error message will be displayed to tell user what is going wrong, and guide user the right solution.

- **Transparent**

This system is transparent, as users do not need to know where the database resides, how the system is structured.

8.3 System limitations

There are some limitations in this online system, which cannot be researched and developed due to the time constrain and the lack of tools such as SQL mail and Microsoft English Query tool.

The limitations of the online movie rental system are:

- It does not incorporate with any online payment system as the system is configured to reserve movies through web. Customers are still required to get the movie including the payment at the video center.
- The system does not include the shipment of the products (movies). Customer must rent and get the movies from the video center.
- This online does not provide feature to sent email, since no tool such as SQL Mail is installed as one of the components of this system.
- Movie clip cannot be downloaded. It is designed for viewing only.
- Language selection is not available. Only English language is used as the system default.

8.4 Future enhancement

There are some future enhancement suggestions for the online movie rental system to make this system more powerful and useful.

- Allow member to rent movie directly from this online system, also set up the online payment system to enable payment to be done in the form such as credit cards.
- Allow member to purchase movies via this online system.
- Encryption and decryption of password. Password should be encrypted before stored in database and decrypted during password retrieval process.
- Enable system to sent email to member. This can be done with the help of tool like SQL Mail.
- Support other browsers. Besides Microsoft Internet Explorer 5.0, this system should be upgraded so that it is able to perform the same functions on other browsers.
- Advanced search engine. In future, this online system can be upgraded so that the search engine is able to recommend the nearest search results to users when keyword does not match data in database.

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