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Final Year Thesis Report
Session 2000/2001

Faculty of Computer Science & Information Technology

UMPJJ- WCS (Wages Claims System) Through Web

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Date	:	22th January 2001

This thesis report is summitted to

Faculty of Computer Science & Information Technology

University of Malaya, Kuala Lumpur, Malaysia.

Year 2000

Upon the complement degree of

Bachelor (Hons) of Information Technology (Management)

CONTENTS

Abstract

The final year thesis paper has divided into 2 major parts which are the WXET 3181 Latihan Ilmiah I and WXET 3182 Latihan Ilmiah II. The division of these 2 thesis paper is based on the 7 major stages in SDLC (System Development Life Cycle) context which WXET 3181 Latihan Ilmiah I covers 3 major stages in SDLC whereas WXET 3182 Latihan Ilmiah II covers the remaining 4 major stages in SDLC.

The WXET 3181 Latihan Ilmiah I is a special 4 credit hours thesis paper which does not involve any lecture or tutorial classes but to let the FSKTM final year students to involve themselves in their individual exclusive project of system development which has approved by the Dean Faculty of Computer Science and Information Technology of University of Malaya, Kuala Lumpur.

After completion of the WXET 3181 Latihan Ilmiah I , each of the students is required to prepare a thesis report and presentation on what have been done by them in the early stages of their system development from their research.

My thesis working paper is mainly focus on the web based application system development of wages claim system for PJJ(Distance Learning Center) University of Malaya. I call this system as UMPJJ-WCS.

UMPJJ-WCS enables UM PJJ (Distance Learning Center) in managing the wages claims for every lecturers in every semester effectively and efficiently. It is a web-based application system developed with the objectives of implementing the idea of information systems on the WWW. As a web-based application, the client terminals work in tandem with the server, operating over the internet during a request or response session. The server terminal contains all the related documents, data

storage, and business rules. There are 2 sections in a client terminal – the authorized users and administrator. The administrator has the full access to all databases and documents whereas the users access is somehow limited. Besides, the administrator is to do administrative task such as maintaining system contents, users list, and users personal particulars. A user will be able to browse through the web and making request for their wages claims through UMPJJ-WCS.

Acknowledgement

First and foremost, I would like to express my heartfelt gratitude to the kind and helpful people who have provided me guidance, assistances, helps, and enthusiasm throughout the development of this thesis project. I really gained and learnt many precious and valuable experiences and practical knowledge from my thesis project system development. My utmost gratitude is conveyed to my respected supervisor, Encik Omar Zakaria for his valuable supports, guidance, supervision and constructive comments and advices throughout the development of this project paper. His assistance in the development of this project is very highly appreciated. Furthermore, special thanks are also meant for my family members and my best friends especially LeeYeow Kuen, Tan Yean Bee, Lim Jit Cheng, and Jaffar@ Jotiu B.Parasin for their valuable supports and sharing of their much appreciated knowledge with me.

Nevertheless, I would like to extend my gratitude to the person listed below for their contribution to this system development project:-

- Dr. Syed Malek Fakar Duani, Deputy Dean of Academic of Faculty of Computer Science and Information Technology, University of Malaya.
- Puan Rodina Ahmad, Lecturer of Software Engineering, Faculty of Computer Science and Information Technology, University of Malaya.
- Encik Ibrahim Abu Bakar, Thesis Project Moderator, Faculty of Computer Science and Information Technology, University of Malaya.
- Encik Mohd.Nor Che Seman, Principal Assistant Registrar, Distance Learning Center of University of Malaya (UMPJJ).

- Cik Aishah, Administrative Officer, Distance Learning Center of University of Malaya (UMPJJ).
- Cik Nita, Accounts Officer, Distance Learning Center of University of Malaya (UMPJJ).
- Other project team members and staffs involved.

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Chapter 1

INTRODUCTION

Chapter 1 : INTRODUCTION

1.0 Project Definition and Introduction

The main purpose of UM PJJ LWCS is to automate the entire process of lecturers wages claims in the Accounts Department of UM PJJ(Distance Learning Center).

1.1 Motivation, Feasibility and Rationality of Project

The World Wide Web (WWW) is one of the most important and popular information gateway channel in Internet which allows people to access and share all kinds of information throughout the different computer networks world wide. The presentation of the information can be presented in plain text form, graphical form or multimedia form(audio or video). Nevertheless, the information can be manipulated in static, dynamic or interactively way in order to get the spontaneous reply from user. Corporations are implementing internal Webs and Web-based applications, known as intranets, to facilitate communications and sharing of information among employees.

Thus the development of lecturer wages claim system at University of Malaya Distance Learning Center through web has adopt the inherent characteristics of WWW in performing and executing the respective wages claims from the lecturers who teach the classes or program in University of Malaya Distance Learning Center. In fact, the efforts are taken to develop this system is mainly to convert the existing inefficient manual system to a systematic and efficient computerized system at

University of Malaya Distance Learning Center is managing the lecturers wages claims, eventually, these can eliminate all those unnecessary happenings.

1.2 Project Objectives

8 major objectives:-

1. To minimize the amount of paper work required.
2. To minimize the time span of any wages claim application.
3. To minimize the time span of wages payment issued to lecturers.
4. To provide a very convenient way through " web based " for lecturers to apply wages claim in any time at anywhere.
5. To provide a very convenient way through " web based " for UM PJJ staffs and officers to process lecturers' wages claim.
6. To provide an efficient searchable and checkable database of all lecturers wages claims and payments.
7. To generate accurate text-based and graphical illustration for consolidated documents and reports regarding the lecturers wages claims and payments for each semester.
8. To generate reference table for lecturers' wages claims entitlement.

1.3 Project Scopes

It is the range or extent of the project. Project scope helps to establish the bounding of the system request. Defining scope requires precise statements of the problems. The system will use the Microsoft Visual Basic 6 for programming and will be customized to meet the specific operating environment. Lecturers wages claim types consists of 2 major types such as academic wages claim and non-academic wages claim. This project scope only covered the UM PJJ lecturers wages claims and the project scopes were divided into the following categories:-

1.3.1 User Target Groups

(i) UM internal lecturers / tutors.

(ii) External lecturers / tutors.

(iii) UM PJJ staffs and officers.

(iv) UM Bursary management staffs and officers.

(v) 5 major Faculty and Academic Center:-

- Faculty of Computer Science and Information Technology.
- Faculty of Engineering.
- Faculty of Economics.
- Faculty of Business Administration and Accounting.
- Academic of Malay Studies.

1.3.2 System Contents Scopes

There are 2 major categories of the wages claims involved in UMPJJ-WCS:-

(A) Academic Wages Claims

- Lectures, tutorial, and laboratory class claims.
- Marking students examination scripts claims.
- Student project thesis claims.
- Student industrial training claims.

(B) Non-Academic Wages Claims

- Faculty coordinator allowance claims.
- Miscellaneous claims:-

  ~ Private Transportation(motorcycle, car, van) allowance claims.

  ~ Public Transportation(taxi, bus, train, ferry, airplane) allowance claims.

  ~ Accommodations allowance claims.

  ~ Food allowance claims.

  ~ Daily allowance claims.

  ~ Toll allowance claims.

  ~ Parking allowance claims.

  ~ Lodging allowance claims.

  ~ Dobby allowance claims.

  ~ Postage allowance claims.

  ~ Telephone, Telex, Fax allowance claims.

1.3.3 Language Version

UMPJJ-WCS is presented by using the English Language which is the very popular and important lingua franca being used throughout the world.

1.4 Importance of Project

The main objective in developing UMPJJ-WCS is to overcome the weaknesses and problems of the current manual WCS in UMPJJ office.

1.5 Project Expectation

Basically, for any project certain expectation of the outcomes are projected before the work getting started. A few factors have to be considered in making to these expectations. One of the important factor is the amount of time available to complete the project and also the technologies and resources available. The following are 4 major expectations of this project:-

1. System can perform some basic function and meet some criteria such as stability, consistency, user friendly, and reliability.
2. System is able to fulfill the requirements of UMPJJ and can perform the required functions efficiently and effectively.
3. The proposed system is quite a complete solution. However, it needs to be enhanced so that more functionality can be added.
4. The final implementation should allow for future enhancement as well as additional module to add functionality to the WCS that meet to the needs of UMPJJ.

1.6 Project Schedule

A Project schedule was planned carefully in order to achieve the system objectives. Time management must be used in order to accomplish the task within the allotted time frame. The following is the master schedule and deliverables planned for each stage of the project development lifecycle and their respective estimated and planned completion dates. The project will be started on 5 June 2000 until 25 Jan 2001.

Table 1.0 Project Timeline Scheduler Table

Task Name	Start Date	End Date
1.Concept of Definition	5 June 2000	30 June 2000
2.Requirement Specification & Analysis	15 June 2000	28 July 2000
3.System Design	15 July 2000	15 September 2000
4.Incremental Prototyping	15 August 2000	20 December 2000
5.Integration & Testing	20 December 2000	15 January 2001
6. Implementation	15 January 2001	25 January 2001

ID	Task Name	Start Date	End Date	Duration
1	Concept of Definition	6/5/00	6/30/00	20d
2	Requirement Specification & Analysis	6/15/00	7/28/00	32d
3	System Design	7/15/00	9/15/00	45d
4	Incremental Prototyping	8/15/00	12/20/00	92d
5	Integration & Testing	12/20/00	1/15/01	19d
6	Implementation	1/15/01	1/25/01	9d

1.7 Chapter Organization

This report is divided into 4 important chapters. The summary of every chapter is given as below:-

Chapter 1 : INTRODUCTION

This chapter will give the explanation about the introduction to the overall report that will be prepared. This chapter covered Project Definition and Introduction, Motivation, Feasibility and Rationality of Project, Project Objectives, Project Scopes, Importance of Project, Project Expectation, Project Schedule, and Chapter Organization.

Chapter 2 : LITERATURE REVIEW

This chapter covered the related information regarding the project topics and summarize all the researches that have been carried out throughout the system project development cycle.

Chapter 3 : METHODOLOGY

This chapter covered System Process Development Model, Context Diagram, and Proposed of Technology, Software and Hardware.

Chapter 4 : SYSTEM ANALYSIS AND DESIGN

This chapter covered the information that has been gathered and it is arranged in a systematic manner. It emphasized on the specification needed and explanation about the system analysis and design where the system is divided into different modules and components.

Chapter 2

LITERATURE REVIEW

Chapter 2 : LITERATURE REVIEW

2.0 Project Studies and Research

Before a project is being developed, it needs a lot of studies and analysis. It is because many processes involved in the wages claims system in UMPJJ which are not yet automated and the staffs always encounter a lot of problems everyday. After gathered some of the feedback, complaints, suggestions, and ideas, I decided to develop a system which enable to overcome the shortcomings and maximize the functionality of the administrative processing in UMPJJ especially in the wages claims application.

2.0.1 Current Manual System Processes Studies

All of the procedures and processes in current WCS are carried out or performed by the UMPJJ officers and each of the faculty coordinators manually. First and foremost, the faculty coordinator for each faculty will request the faculty lecturers or tutors to teach the subjects offered by UMPJJ to the students for each semester. Once the faculty coordinators received the confirmation of acceptance from the faculty lecturers or tutors, then the faculty coordinators will inform UMPJJ to issue the letter of offer to all of the respective lecturers and tutors upon teaching the UMPJJ classes for the particular semester. Then UMPJJ will make a record manually for each of the faculty lecturers and tutors classes and all of the regarded particulars. If there are no faculty lecturers or tutors who are free to teach in UMPJJ classes, UMPJJ will recruit the outsider lecturers or tutors to teach in the UMPJJ classes. Eventually, same procedures involved in this situation also as the outsider

lecturers or tutors. Normally, the lecturers or tutors are requested either to teach the classes in the UM campus itself or outside the UM campus through traveling to other places throughout Malaysia.

At the end of the semester, each of the lecturers or tutors must fill in several wages claims forms about all their classes total credit hours and other miscellaneous wages claims to UMPJJ in order to entitle their respective wages claims. The wages claims forms will first deliver to faculty coordinators to obtain the approval and validation from faculty coordinators and then the faculty coordinators will send the wages claims forms to UMPJJ office for final approval and validation from UMPJJ. The UMPJJ officers will check and validate manually all of the wages claims form together with the enclosed relevant documents and receipts from the lecturers and tutors.

After all, UMPJJ will generate a consolidated approved payment report of the lecturers and tutors wages claims. Then, UMPJJ will forward this approved payment report to UM Bursary for issuing the cheques payment to all of the lecturers and tutors in faculties. For outsider lecturers and tutors, cheques will be sent to the corresponding mailing address to them.

2.0.2 Weaknesses and Problems in Current Manual System

There are 10 major weaknesses: -

1. Time consuming because every procedures or processes are carried out manually.
2. Error prone because there are many manual procedures involved in checking, consolidating and calculating. It is easily prompt to errors if one of the steps having mistake.
3. Rigid in filing the wages claims forms. Lecturers and tutors easily make mistakes or forget to fill in some items.
4. Late payments to lecturers and tutors because processing works slow and take times. Required 2 weeks to process only 50 lecturers and tutors wages claims.
5. Inaccurate in payments because left off some claims or inaccurate in calculations.
6. Difficult to make a check request to the wages claims information data.
7. Take long time to generate a consolidated report.
8. There are too many paper works and file folders to keep the different data in different file folder in physical cabinet. Too many file folder may take more office spaces.
9. The possibility of losing or damaging the wages claims forms and report are very high and this incident happens frequently.

10. Difficult or rigid to make any modifications or amendments to the lecturers and tutors wages claims.

2.1 Development Tools and Technology Studies

2.1.1 Development Platform

2.1.1.1 Microsoft Windows NT 4 Server

- Microsoft NT 4 Server is one of the powerful OS (Operating System) for computing system. It is reliable, secure, multithreaded, symmetric processing, and support client server system.
- NT can control the access control of users in accessing certain file or application. It supports a wide range of networks protocol and remote access protocol as well. This make it easy for me to develop the distributed application.
- It is a complete platform available for building and hosting web-based application. It is the best platform to publish and share information securely over internet and intranet. It is so reliable that when an application have problem, it doesn't crash the whole program.
- It allows OLE(Object Linking & Embedding). It can combine the information from several applications into one compound document using the special OLE capabilities of windows based applications.
- It enables the capabilities of integrating applications on a single computer or even across multiple computers.

2.1.1.2 UNIX

- It is an increasingly popular OS. Traditionally used on minicomputers and workstations in the academic community, UNIX is now available on PC and the business community has started to choose UNIX for its openness.
- UNIX like other OS, it is a layer between the hardware and the applications that run on the computer. It has functions that manage the hardware and functions that manage the executing of applications.
- A standard UNIX system includes a set of libraries and a set of applications. It includes the file system and process control and a set of libraries.
- One of the greatest strength of UNIX is the consistent way in which it treats files. It is very easy for the users to work with files because users do not need to learn special commands for every new task.
- Besides, UNIX is now known only for its longevity and versatility as an OS, but also for the variety and number of utility programs that called tools.

2.1.1.3 Comparison between NT 4 Server and UNIX

1. There is a lot of supporting software for NT especially the free downloadable option packs.
2. UNIX is difficult to install compared to NT 4 Server. Sometimes it takes 2 weeks to install and configure UNIX machine but only 1 or 2 days to set up NT 4 Server.
3. NT 4 Server supports Microsoft Back Office Products but UNIX does not.

4. To use a UNIX OS, many commands needed to be entered. But for NT 4 Server provides user-friendly interface(GUI) that ease the job of users.

2.1.2 DBMS (Database Management System)

Database technology is used in a variety of applications. Some serve only a single user on a single computer while others are for multi users. There are a variety types of database such as Microsoft SQL Server 7.0, Oracle 8i, Sybase, Informix, Microsoft FoxPro 6 and Microsoft Access 2000.

In order to choose a reliable database, the database must be able to ensure the safety and security of data. The database is at the core of all mission-critical business applications. Choosing the wrong database can have drastic downstream results. The investment in software, implementation and development of a database system is substantial; it needs to be able to evolve with the changing requirements of a growing organization.

2.1.2.1 Microsoft Access 2000

A collection of data and objects related to a particular topic or purpose. A Microsoft Access database may contain tables, queries, forms, reports, macros, modules, and shortcuts to data access pages. The Microsoft Jet database engine manages data in tables that reside in the database. Data in linked tables may reside in another Access database, in an external data source such as dBASE or Microsoft Excel, or in an ODBC data source such as Microsoft SQL Server.

Microsoft Access 2000 provides many new features that make working with data and designing a database even easier.

- **Use record-level locking** A Microsoft Access database now supports record-level locking, in addition to page-level locking (which locks all records on a 4K page). You enable the locking level with the new database option, **Open databases using record level locking** (**Tools** menu, **Options** command, **Advanced** Tab). The actual level that is used depends on how the Access database is programmed.

- **Find and replace** You can now move freely between the **Find** and **Replace** dialog boxes and the data in the view or window.

- **View related data in a subdatasheet** Use a subdatasheet to view and edit related or joined data in a table, query, or form datasheet, or in a subform all from the same view. For example, in the Northwind sample database the Suppliers table has a one-to-many relationship with the Products table; so for each row of the Suppliers table in Datasheet view, you can view and edit the related rows of the Products table in a subdatasheet.

- **Automatically fix errors caused by renaming fields** Name AutoCorrect automatically corrects common side effects that occur when you rename forms, reports, tables, queries, fields, text boxes or other controls.

- **Take advantage of Unicode support** Use the characters of any language that Unicode supports in your data. Use Unicode compression to offset the effect of Unicode's increased storage space requirements. Take advantage of dual-font support — specify a substitute font that you can use in addition to your default font to properly display all of the characters in your data.

- **Work with the euro** To easily display euro amounts with other currencies, you can use the euro setting (#,###.##) of the **Format** property to indicate a euro amount. Alternatively, you can enter the euro symbol ( ) by pressing ALT+0128 on the numeric keypad with NUM LOCK on. When you paste or import data that contains the euro symbol ( ) from Microsoft Excel 2000 into Microsoft Access, Access stores the euro symbol regardless of the currency symbol defined in Regional Settings in Windows Control Panel. Finally, you can use the **EuroConvert** function to convert one currency to another by using the euro as an intermediary. More about working with the euro.

- **Print relationships** Print a report of the relationships in your Access database as they appear in the Relationships window.

- **Use the keyboard to manage relationships** Use the keyboard to create, edit, and delete relationships and joins.

- **Use Microsoft ActiveX Data Objects (ADO)** Use Microsoft ActiveX Data Objects (ADO) to access and manipulate data in a database server through any OLE DB provider.

Microsoft Access provides new features designed to help you easily use the Internet. You need a Web browser, such as Microsoft Internet Explorer, and a modem, intranet connection, or other network connection to access the Internet and take advantage of some of these new features.

- **Create data access pages** Create Web pages that you can use to add, edit, view, or manipulate current data in a Microsoft Access database or a Microsoft SQL Server database.

- **Collaborate over an intranet or the Internet** Use NetMeeting to collaborate with others on a Microsoft Access database or Microsoft Access project.

- **Assign a hyperlink to a toolbar button or menu command** Assign a hyperlink to a toolbar button or menu command for easy access to a location on your computer, a network, an intranet, or the Internet.

Microsoft Access 2000 provides new features for working with other products.

- **Work with Microsoft SQL Server** Create a Microsoft Access project that is easy to connect to a Microsoft SQL Server database, or use the Microsoft SQL Server Database Wizard to quickly create a SQL Server database and an Access project at the same time. Working with an Access project is similar to working with a Microsoft Access database — the process of creating forms, reports, data access pages, macros, and modules is the same. Once you connect to a SQL Server database, you can view, create, modify, and delete tables, views, stored procedures, and database diagrams using the Microsoft SQL Server Design Tools.

- **Create a new Access database from data in another file format** Just open a file that is in another file format — such as text, dBASE, Paradox, or spreadsheet format — in Access; Microsoft Access automatically creates an Access database and links the file for you.

- **Import or link data from Microsoft Outlook or Microsoft Exchange** Use the Exchange/Outlook Wizard to import or link data from Microsoft Outlook and Microsoft Exchange Server. For example, you might want to link to your Microsoft Outlook Contacts folder and then create form letters and mailing labels by merging the data with the Microsoft Word Mail Merge Wizard.

2.1.2.2 Microsoft Visual FoxPro 6

- Visual FoxPro 6.0, the object-oriented database management system that allows me to create state-of-the-art enterprise database solutions.Visual FoxPro leads me into the next generation by providing object and event models that help me create and modify applications faster than ever before.In Visual FoxPro, procedural and object-oriented programming work together so I can create powerful, flexible applications. At a structural level, programming in Visual FoxPro involves manipulating stored data. Client/server applications combine the functionality of Visual FoxPro on my local computer with the storage and security benefits provided by a remote server. I can prototype my application locally, then use the Upsizing Wizard to transform the application for a client/server environment.
- Visual FoxPro provides the tools to create powerful client/server applications. A Visual FoxPro client/server application combines the power, speed, graphical user interface and sophisticated querying, reporting, and processing of Visual FoxPro with the seamless multi-user access, massive data storage, built-in security, robust transaction processing, logging, and native server syntax of an ODBC data source or server. The synergy of Visual FoxPro and server strengths provides a powerful client/server solution.

- Access & Assign Methods

  These user-defined methods let me execute code when the value of a property is queried or when I attempt to change the property's value. Benefits are that I can create a public interface for a class or object that separates the interface from the implementation, I can easily implement property validation, and I can easily protect properties in sub class ActiveX controls.

- Active Documents

  An Active Document is a Windows-based, non-HTML application embedded in a browser, providing a way for the functionality of that application to be accessible from within the browser interface. Visual FoxPro Active Document applications are like any other Visual FoxPro applications in that I can run forms, reports, and labels, instantiate classes, run code, and manipulate data, but they have the added advantage of being host able in an Active Document container, such as Internet Explorer.

- Component Gallery

  The Component Gallery is a new tool that helps me to group and organize objects such as class libraries, forms, buttons, and so on, into object, project, application, or other groupings. These visual groupings are dynamically customisable so that I can use, duplicate, or rearrange components among several classifications within the Component Gallery.

- Coverage Profiler Application

  A coverage application writes information about which lines of code in a file were run. A profiler application provides information about which lines actually run, how many times a line is run, duration, and more. Coverage and profiling enable a developer to identify problem areas in an application, especially skipped code and performance bottlenecks. The Visual FoxPro Coverage Profiler provides a Coverage engine that I can use or customize, and a multi window application that I can use to analyse programs and projects.

- GIF & JPEG Support

  To further support Internet interoperability, Visual FoxPro has been enhanced to support the GIF (Graphics Interchange Format) and JPEG (Joint Photographic Electronic Group) graphic file formats.

- HTML Help

  HTML Help is the Microsoft solution for bringing Help content to the Internet world. Visual Studio comes with HTML Help Workshop so that I can create and distribute HTML Help files with my Visual FoxPro applications.

- Language Elements (new and enhanced)

  The Visual FoxPro language has been enhanced to simplify programming tasks. Also, many of the file name manipulation functions available in Foxtools.fll, a Visual FoxPro API library, have been added to Visual FoxPro.

- OLE Drag & Drop

  Visual FoxPro now supports OLE drag-and-drop, a powerful and useful tool that allows me to move data between other applications that support OLE drag-and-drop (such as Visual Basic, Windows Explorer, Microsoft Excel and Word). In a distributed Visual FoxPro application, I can move data between controls in the application, or between controls and other Window applications that support OLE drag-and-drop.

- Automation Server Improvements

  Visual FoxPro offers improved, more robust automation servers that work better with products and technologies such as the Microsoft Transaction Server, Microsoft Visual Basic, and Active Server Pages.

- Wizards and Builders (new and enhanced)

  Besides enhancements to several existing wizards, Visual FoxPro comes with new wizards and builders that help me to build applications, create databases, publish my data on the Web, perform object modelling, and create my own wizards.

2.1.2.3 Microsoft SQL Server 7

- SQL is a perfect example of an n-tier system. The user can manipulate the data directly from the client side. Most of the time, the data is validated first before it is updated into the database in server side. It is tightly integrated with the Microsoft BackOffice family product to enable organization to improve decision-making and streamline the system processes. It is the best database for Windows NT 4 Server.
- SQL is a significant tool in many regards. From data warehousing to applications that require not only a large amount of information, but also many different simultaneous users. SQL is a key component in answering data management requirement. It is a powerful and comprehensive database.
- It maintains referential integrity and security and ensures that operations can be recovered in the event of numerous types of failures. It can control the access for the type of information that can be retrieved by users.
- It supports internet database integration. It allows the user to automate the publishing of database information in HTML documents. It allows the me to build active web sites and let me conduct processes on the web. When combining with IIS and SQL Internet Connector, it gives users the complete Internet database publishing capabilities.
- It provides the function for transparent distributed transactions. This means that it provides automatic distributed update capability across 2 or more SQL transparent to the desktop application, making it a simple to use. It guarantees

the integrity of transaction of updating spanning multiple servers throughout the networks.

2.1.3 Microsoft Data Access Technology

Data assessment is very important for each application. In order to access, retrieve and share information efficiently throughout the office, I have chosen Microsoft Data Access Technology that provides me with a lot of functionality. It provides me with ease-to-use, programmatic access to all types of data throughout the enterprise. It is easy to integrate information from a variety of sources, which is relational and non-relational. These components can be used by the data driven client/server applications deployed over the web or LAN. There are many types of Microsoft Data Access Technologies such as VB SQL, ODBC, DAO, RDO, ADO, and OLE-DB.

2.1.3.1 ODBC (Open Database Connectivity)

It is one method that used by VB to communicate with client/server databases. It is a component of Microsoft's Windows Open System Architecture (WOSA). It provides a set of Application Program Interface (API) functions, which makes it easier for me to connect to a wide range of database formats, that is it supports SQL. I can access a number of PC database by using ODBC functions. ODBC is based on the X/Open Call-level Interface and uses SQL. During the run-time, ODBC driver will communicate with other drivers and through a standard interface called Service Provider Interface (SPI). It is a network independent technology because it employs replaceable network libraries. However, the biggest

downside to ODBC is that it must be able to support the capability to translate calls. This means that additional processing overhead can slow the data access a bit.

2.1.3.2 ADO (Active Data Object)

It is based on an object model that exposes the collections, methods, and properties necessary to access and work with the database. This object model is available from ASP code and works conjunction with the OLE-DB layers. It is a new technology for data access based on existing technologies and endowed with increased flexibility. It is an evolution of the both DAO and RDO into a single, simplified and extensible interface that will supersede all DB-Library, DAO and RDO functionality.

ADO focuses primarily on Internet deployment because it has the ability to maintain its current state in a connectionless environment. It includes implementation with full data manipulation capability and a downloadable, lightweight implementation available to internet clients at run-time. ADO base in ASP application, works by using the ODBC driver to connect SQL Server.

2.1.3.3 OLE-DB (Object Linking & Embedding Database)

It is Microsoft's new low-level database interface that provides access to much different kind of data. It is the extension of application capabilities beyond the limitations of ODBC. It is a COM-based API with features that provide access to both relational (SQL) and non-relational data sources. It provides an environment where database components can be replaceable.

2.1.4 Web Development Technology

Developing web-based applications rely on many network and application components working together to deliver information to the requesting clients. Only web browser extracted information from the web server. To transform the global network into reliable application, the original architecture of the web must be enhanced to meet the needs that we take for granted when developing traditional application.

2.1.4.1 IIS (Internet Information Server)

- It provides a transactional-based web server that is tightly integrated with the Microsoft Windows NT 4 Server. The advantages of IIS can be separated into 2 camps, which are the improvement in HTTP – related service areas and the additional functionality in managing and developing application functionality. The advancements in HTTP services area enable IIS to manage multiple web sites, tailor site or application specific settings. It enables HTTP 1.1 supports. The advancement for the application development side includes transactional- based applications. Process isolations, SSL supports, ActiveX Data Object(ADO) and new development tools.
- The benefits of IIS can be seen by the services it provided. IIS provides a high-speed, secure platform for publishing information on internal networks or internet. The server is specifically designed to provide the kind of performance that is necessary for handling an increased number of web users

and users who are connected with high-speed links such as ISDN and lease lines.

- The transactional ASP feature of IIS allows application with scripts and components to perform multiple actions. If a failure occurs during a particular transaction, IIS automatically backs up the server to the start of the transaction, allowing the user to recover from a failure without any loss of data.
- IIS provides configuration and management of properties such as access permissions and logon requirements for clients, home and virtual directories, and virtual servers.

2.1.4.2 Microsoft Personal Web Server 4

- Microsoft Personal Web Server 4.0 is a desktop Web server that makes it possible for me to publish my personal home page or web-based application and share documents on the corporate network right from the web server. Or, use PWS as a development staging platform before uploading your site to an Internet provider.
- Microsoft on the corporate intranet, Personal Web Server can be used to quickly share documents in their native format; or, convert documents to HTML, and then use PWS to share them across different operating systems. Because Personal Web Server supports Active Server Pages, it can be used as a development and testing platform for Web sites. PWS is a desktop Web server that makes Web site setup quick and simple. There are three situations

describing how PWS can be used as an intranet Web server or a development and staging platform. These scenarios are included:

(i) **Simple Document Sharing Solution**

(ii) **Custom Information Exchange Solution**

(iii) **Web Application Testing Solution**

- PWS can be installed on a computer running either Microsoft Windows 95 or later, or Microsoft Windows NT Workstation 4.0 or later operating system. Microsoft Internet Explorer 4.01 is also required.

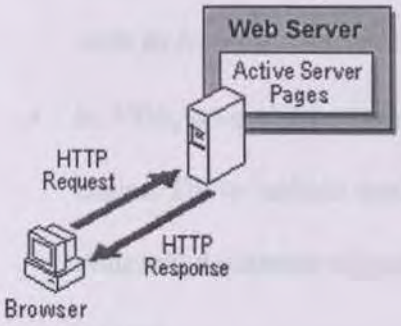
- Full support for Active Server Pages, including expanded functionality in the File System component, along with transaction processing for Web applications.

2.1.4.3 ASP (Active Server Page)

- Active Server Pages (ASP) is a server-side scripting environment that I can use to create dynamic Web pages or build powerful Web applications. ASP pages are files that contain HTML tags, text, and script commands. ASP pages can call ActiveX components to perform tasks, such as connecting to a database or performing a business calculation. With ASP, I can add interactive content to my Web pages or build entire Web applications that use HTML pages as the interface to the users.

- I can collect and analyze data from a form by using simple instructions that I embed directly into the HTML documents. I do not need to learn a full programming language or compile programs separately to create interactive pages.
- With ASP, I can easily use ActiveX components to perform complex tasks, such as connecting to a database to store and retrieve information.
- ASP pages I can use any scripting language for which I have installed a scripting engine that follows the ActiveX Scripting standard. ASP comes with scripting engines for Microsoft® Visual Basic® Scripting Edition (VBScript) and Microsoft® JScripts™ so that I can immediately begin writing scripts. ActiveX Scripting engines for PERL, REXX, and Python are available through third-party developers.
- Web computing with ASP translates into tangible benefits, enabling Web providers to provide interactive business applications rather than merely publishing content.
- The Active Server Pages Model -- An ASP script begins to run when a browser requests an .asp file from the Web server. The Web server then calls ASP, which reads through the requested file from top to bottom, executes any script commands, and sends a Web page to the browser.

Figure 2.0 Active Server Pages Model



- Because the scripts run on the server rather than on the client, the Web server does all the work involved in generating the Web pages that I wish to send to browsers. I need not worry whether a browser can process my scripts: Web server does all the script processing, transmitting standard HTML to the browser. Server-side scripts cannot be readily copied because only the result of the script is returned to the browser. The users cannot view the script commands that created the page they are viewing.

2.1.4.4 Visual Basic (VB) 6 Programming & Scripts

- VB is an extremely powerful, full-featured application development tool that exploits the key features of Microsoft Windows. It is easy to use through a graphical interface. Applications can be built in short time.
- It can be used to create several types of applications such as client applications, office applications, client-side applications, group ware applications, ASP web-based applications and server-side applications.

- Programmers only need to plan their program's logic and the design of the codes well without needed to know how to build the interface components, such as frames, command buttons, and so on.
- In VB6, several other wizards are included to make the development task easier. These include application wizard, ActiveX Control interface wizard, ActiveX document migration wizard, Data form wizard and Property page wizard.
- VB Scripting is a light-weight scripting language that provide programming functionality based on the VB programming language. It is natively executed on the Microsoft Internet Explorer and can be executed in the browser through plug-in technologies.
- It is the default scripting language for IIS. It lets the user interact with a web page rather than simply view it. It can take input from the user and check the data to make sure it is valid or meets certain criteria. Then, it can put a web server to work either by actually storing the data or causing some action to the place on the server based on the information given.
- It also plays an important role in many ways such as validating data, pricing, providing impressive multimedia feedback and initiating data storage. The user can use VBScript to sequence the questions based on responses. VB Script can perform calculations on data, such as computing the cost of an item after taking into account the sales tax.

- It lets me to use the intrinsic DHTML form controls and ActiveX controls with VB Script to give web pages an attractive look and feel. Intrinsic DHTML form controls, a timer control that enables me to time events on web pages and a pre-load control that lets me load bitmaps can be created. The users can create 3-D animation effects, making the web page come alive with moving objects in response to certain events.

2.1.4.5 DHTML (Dynamic Hyper Text Markup Language)

- Dynamic HTML is a set of innovative features in Microsoft® Internet Explorer 4.0. By enabling authors to dynamically change the rendering and content of a document, Dynamic HTML gives authors the ability to create visually outstanding HTML documents that interact with the user without the burden of relying on server-side programs or complicated sets of HTML pages to achieve special effects.

- Typically, Dynamic HTML documents are self-contained, using styles and a little script to process user input and directly manipulate the HTML tags, attributes, styles, and text in the document. The HTML elements, attributes, and styles in Dynamic HTML are based on existing HTML and cascading style sheet (CSS) specifications. Users can view my documents whether they use Internet Explorer version 4.0 or some other browser.

- Dynamic HTML works well with applications, ActiveX™ Controls, and other embedded objects. I can use existing applications and controls, or I can create new ones that specifically take advantage of the features of Dynamic HTML. Applications and controls work best when I rely on them to do computationally difficult tasks, and use Dynamic HTML to display output and process user input.

- The data source object retrieves and sets data in a database, and Dynamic HTML does the rest: processing user queries, displaying the data, and carrying out the necessary interaction with the object.

- Dynamic HTML eliminates the shortcomings of previous browser technologies. I can create innovative Web sites, whether on the Internet or an intranet, without having to sacrifice performance for interactivity and special effects. Not only does Dynamic HTML enhance the user's perception of your documents, it also improves server performance by reducing requests to the server and subsequently server load.

2.1.4.6 Microsoft Visual InterDev 6

Microsoft® Visual InterDev™ 6.0, the Web development system that provides all the tools for creating dynamic Internet and intranet Web applications. Microsoft® Visual InterDev™ version 6.0 gives developers: -

1. **Data Environment**

   Creating and modifying data-related objects is performed in one place: the graphical data environment. In the data environment, I can drag and drop objects onto Active Server Pages (ASP) to automatically create data-bound design-time controls. In this version of Visual InterDev, the data environment also supports Oracle.

2. **Data-Bound Design-Time Controls**

   Design-time controls offer me a richer, more visual editing interface for creating data-enriched pages. Data-bound controls make it simple to incorporate script in my ASP or HTML pages to interact with a database. The controls included with this version of Visual InterDev allow me to target a wide range of browsers, or to narrow my focus to the rich dynamic HTML available in Microsoft® Internet Explorer 4.0.

3. **Scripting Object Model**

   The scripting object model simplifies Web application development by providing a model for object-oriented scripting. Script objects simplify Web

application development and also greatly reduce the complexity and quantity of scripting required writing applications that span the client (browser) and server. To make it easier to write against the scripting object model, Visual InterDev offers me design-time controls that create script objects for me.

4. **Site Designer**

   To quickly prototype and build Web sites, use the graphical Site Designer. In the Site Designer, I use site diagrams to create pages, links, navigation, hierarchy, and more – all with an easy-to-use drag and drop interface.

5. **Cascading Style Sheets Editor**

   I can edit style sheets easily in the CSS editor. I can create or modify style sheets for a set of Web pages and preview how my pages, or any page in the Web application would look, if the current style sheet were applied.

6. **WYSIWYG Page Editor**

   The new Visual InterDev editor has a Design view that lets me edit and create content in a WYSIWYG workspace. In addition to the Design view, I can write script in Source view, which offers statement completion and color-coding of script elements. In addition, instead of viewing my file in an external browser, I can easily preview my file in Quick view.

7. **IntelliSense Statement Completion**

   IntelliSense® helps me create error-free script statements by presenting me with the names of methods and properties as soon as I've typed in the name of an object.

8. **Dynamic HTML**

   Visual InterDev supports dynamic HTML (DHTML) in Microsoft Internet Explorer 4.0. The Visual InterDev editor helps me create script for DHTML objects and events by presenting statement completion options for the object model and by displaying the object model hierarchy in the Script Outline window in Source view. As well as scripting directly to the Internet Explorer 4.0 object model, I can choose to have my design-time controls create client-side data binding script.

9. **Developer Isolation**

   I can work on local versions of project files, giving me the ability to test and debug my files before updating the master server. I can also work in master mode, where files are automatically saved both locally and to the master server.

10. **Debugging Tools**

    Visual InterDev comes with a debugger that helps me test and debug script and Java components. I can use the debugger with Microsoft® Visual Basic®, Scripting Edition (VBScript) and Microsoft® JScript™, as well as applications written in Sun Microsystems Java and run using the Microsoft Java Virtual Machine.

11. **Deployment**

    This version includes deployment features for middle-tier COM server components. New features make it easier to build and deploy component-

based Web applications, including integration with the Microsoft® Transaction Server for building scaleable and robust enterprise Web applications. Copying my Web application to a production server is only a click away with this version of Visual InterDev.

2.1.5 Others

2.1.5.1 Active X

It is the set of technology developer uses to write software components that interoperate, regardless of the language used to create them. These ActiveX applications cab be written using C++, Java, VB, and Delphi. The real power of ActiveX comes from its consistent and comprehensive implementation. This implied that with the same component-based approach, a developer can:-

(i) Script objects inside an HTML page.

(ii) Assemble interface for Windows application.

(iii) Communicate between client and server components.

(iv) Script business rules or web server application.

3 main reasons why ActiveX is being considered in this project: -

(i) It is reusable in other application.

(ii) It is created specifically for web-based application development.

(iii) It provides different types of ActiveX components that could be used in different project types: -

- ❖ Classes, which enables reusable, systematic and organized coding.

- ActiveX DLL's (in process), which offers sharing capability amongst the applications.
- ActiveX EXE (out process), which can be created and used both by client and server applications.
- ActiveX Controls, which are compatible with many containers, including Microsoft Office Applications and Microsoft Internet Explorer.
- ActiveX Document (Doc Objects), which associates data in a document file with a user interface object. Therefore, this allows distributions of arbitrarily complex data across the internet and intranet.

2.2.5.2 Active X DLL (Dynamic Link Library)

It is used to add functionality to an HTML page on either the client or server. Code Components on the client can offer an increase in speeds, since users' commands do not need to be routed back to the server. Server components also have the benefits of being able to show user interface elements. Active X DLL files can be made to become an ASP components that can be run in the web server. The Active DLL is used when the functionality of the VB is not available for the VB scripting in ASP.

2.2 Synthesis

2.2.1 New Proposed UMPJJ Wages Claims System

UMPJJ-WCS has been developed and proposed to UMPJJ is a web-based software application system, designed as a comprehensive solution to an organization's wages claims. The system generates timely, accurate and relevant information necessary to effectively monitor and manage the UMPJJ wages claims. Besides, as a single specialized component that may be integrated into a complete Human Resources Information System (HRIS).

2.2.2 Strengths and Advantages in New Proposed System

8 major advantages: -

1. To minimize the amount of paper work required.
2. To minimize the time span of any wages claim application.
3. To minimize the time span of wages payment issued to lecturers.
4. To provide a very convenient way through " web based " for lecturers to apply wages claim in any time at anywhere.
5. To provide a very convenient way through " web based " for UM PJJ staffs and officers to process lecturers' wages claim.
6. To provide an efficient searchable and checkable database of all lecturers wages claims and payments.
7. To generate accurate text-based and graphical illustration for consolidated documents and reports regarding the lecturers wages claims and payments for each semester.

8. To generate reference table for lecturers' wages claims entitlement.

Some of the benefits of applications development using this technology from both the user and developer's perspective.

2.2.2.1 The Users Perspective

End-users are the primary reason why applications are developed. Web applications provide many benefits to end-users that aren't as readily achievable by using traditional systems-development tools. Here are just a few of the benefits:

- Graphical user interfaces

  The GUI used by Web applications is the Web browser. These GUIs make life easier for end-users by enabling them to point and click to navigate applications. This makes selecting from lists, scrolling pages of information, viewing graphics, and entering inputs far easier than non- graphical systems. Standard HTML documents read by a variety of Web browsers are rendered in a common way regardless of the browser used. This enables people to use the same application regardless of the platform they are on.

- Abstraction of applications and query languages using forms
  HTML forms and hypertext links provide mechanisms by which the details of an application can be abstracted for the user. Users no longer are required to have detailed knowledge of the application or its input parameters and valid values to use it. Instead, they're presented with forms complete with text-entry boxes, selection lists, scrollable menus, radio buttons, and checkboxes.

These user-input objects guide the user to enter the information needed to execute an application or query a database. And users don't need to know the structure or table relations of the databases they access. In fact, they might be totally unaware that a database is integrated with the application. Form-input objects are used to collect the information necessary for a database query to be constructed by the application on behalf of users. Users just need to concentrate on how they can use the results of the application to their benefit.

- Browser customization
  The current generation of graphical Web browsers enables users to customize many attributes to suit their tastes and preferences. Here are some of the attributes that are user-configurable:

  ~ General appearance
  ~ Font style
  ~ Text, background, and link colors
  ~ Image-rendering characteristics
  ~ Plug-ins and helper applications definitions
  ~ Language
  ~ Newsgroup access
  ~ Quick and easy access to information, databases, and applications

Web interfaces provide users with access to a variety of information sources previously unavailable. Not only is the information being made available, but Web

database applications are being developed that enable users to perform complex searches of the information by just clicking the mouse a few times.

2.2.2.2 The Developers Perspective

Web technologies provide developers with a number of advantages over traditional development tools:

- Standard technologies
  Web applications are built on standardized protocols such as TCP/IP and HTTP, and on technologies such as HTML and CGI. Using a common network protocol (TCP/IP) as well as a browser/server communications protocol (HTTP) makes life easier for developers, because they don't need to worry about the implementation details. Web servers, browsers, and the computers on which they reside already have this built-in support. Developers can concentrate on the application instead of the communications details. HTML is not a programming language in that it does not provide typical procedural language constructs for loops, conditions, calculations, storage, and so on. You can use it, however, to present applications, render images, and provide access to underlying programs (on the server) by using CGI and Web server APIs. HTML has the advantage that it is a (relatively) standard text-based markup language that requires no compiler. Additionally, client-side scripting (using VBScript, for example) and ActiveX controls provide the capability to greatly extend and improve the interactive ness of HTML forms. Applications can be developed using any simple text editor or word

processor on any computer platform. The HTML code then can be installed on any Web server from which you want it to run.

- Short learning curves

  Unlike traditional programming languages, HTML is relatively easy to master quickly. In fact, several development tools, such as Microsoft's FrontPage, provide even novice HTML developers with development tools that are as easy to use as most word processors. This means that non-programmers--even end users--can participate in developing GUI front ends to applications. This capability enables programmers to concentrate more on developing the underlying applications to be run on the server.

- Cross-platform compatibility

  Browsers are available for nearly any make or model of computer. Furthermore, by using standard HTML, you can develop applications interfaces that will run on most graphical browsers on almost any machine. Graphical user interfaces do not need to be specifically coded for the platform on which they will run. Web applications also leverage benefits of the client/server model of computing. Because applications reside on the Web server host (or other computers it subsequently accesses), the application is developed for a single runtime environment. This means that any computer running a browser--whether it's a PC running Windows, a Macintosh, or a UNIX workstation--can access the same applications.

- Ease of integration

  Because HTML provides the capability to easily invoke server-side programs. Rapid GUI development. Using HTML (as well as ActiveX controls and VBScript) as a GUI development environment which browser-based interfaces can be developed in a matter of minutes or days rather than days or weeks, which enables developers to concentrate on the development of the underlying application. The result is shorter development cycles, allowing applications to reach end users more quickly. Also, modifications and enhancements to HTML and VBScript code typically are much faster than traditional development environments.

Chapter 3

METHODOLOGY

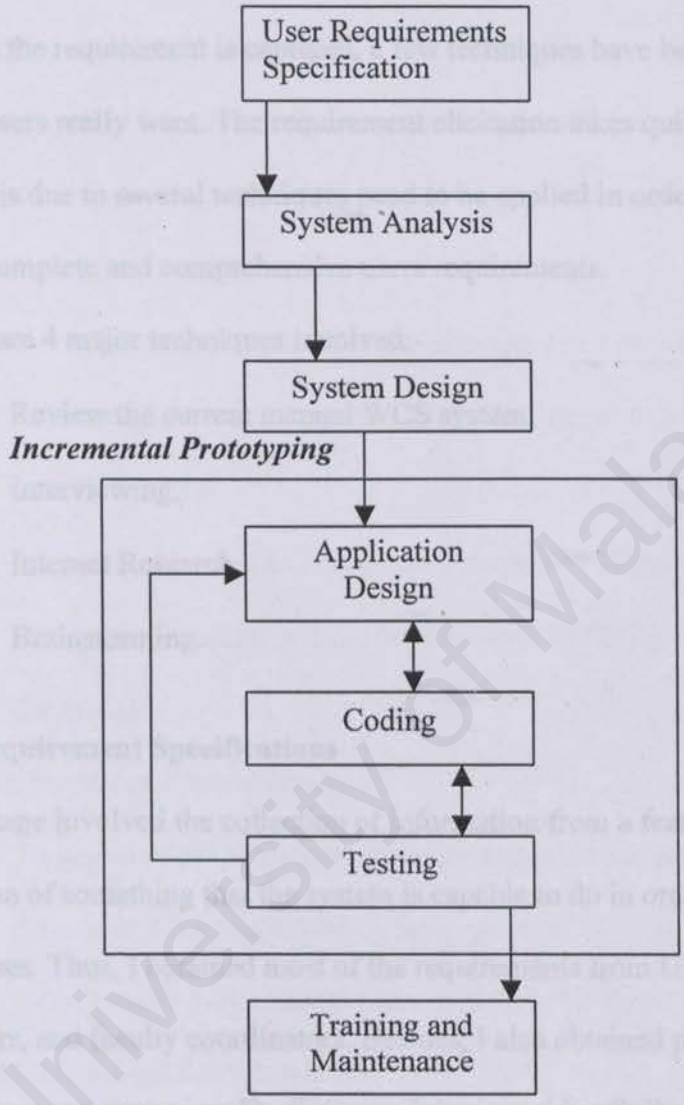
Chapter 3: METHODOLOGY

3.0 System Process Development Model

System process development model is very important during the development of software system. It can form a common understanding of the activities, resources and constraints involved in software development. When a process model is created, it can help me to find the inconsistencies, redundancies, and omissions in the process. There are many types of process models such as Waterfall model, Prototyping model, Transformational model, Spiral model and others.

Before a process model is chosen, it should reflect the goals of the development. Therefore, the process model for this thesis project is actually a mixture of the Waterfall model and Prototyping Incremental development model. The Waterfall model presents a very high-level view of what happening during the development and it suggests to me the sequence of the events, which would encounter. It helps me to plan what I need to do throughout the development process all the way.

Diagram 3.0 UMPJJ-WCS System Process Development Model



Legend:

Process Stage

Process Flow

3.0.1 User Requirements Elicitation

Before the requirement is captured, a few techniques have been used to find out what the users really want. The requirement elicitation takes quite a long time to conduct. This is due to several techniques need to be applied in order to determine and obtain a complete and comprehensive users requirements.

There are 4 major techniques involved:-

- Review the current manual WCS system.
- Interviewing.
- Internet Research.
- Brainstorming.

3.0.2 User Requirement Specifications

This stage involved the collection of information from a feature of the system or a description of something that the system is capable to do in order to fulfill the system purposes. Thus, I obtained most of the requirements from UMPJJ officers, lecturers, tutors, and faculty coordinators. Besides, I also obtained precious ideas and information from my supervisor Encik Omar Zakaria and Encik Ibrahim. After I have collected the information, it has to be rewritten so that it can be transferred into a good system design in order to implement the working and operational system.

3.0.2.1 Functional User Requirements

1. User Authentication Module
    - To assign the users authentication assessments level: read, write, modify, delete, print, approve, cancel, and add.
2. Lecturers/Tutors Registration Module
    - To register the particulars of the lecturers and tutors and the classes. Add user, delete user, modify user, save user, and print users list.
3. User Password Module
    - To enable the users to change their respective password frequently and flexibly in order to give high security to the assessment of users to the system.
4. Wages Claims Application Module
    - To key in relevant particulars in the wages claims form. Then users can summit the wages claims form, print form, clear form, retrieve form, modify form, cancel form, and approve form.
5. Wages Claims Calculator Module
    - To calculate wages claims based on rules and entitlements.
6. Wages Claims Enquiry Module
    - To provide a volatile enquiry for users wages claims which consists of 3 major sub-modules as follows:-

        (i) Wages claims approval sub-module

(ii) Wages claims payments sub-module

(iii) Wages claims archives sub-module

7. Claims Entitlement Table Module
    - To provide and display the regulations entitlement reference table for users knowledge and references.
8. Wages Claims Report Generator Module
    - To generate text-based or graphical illustration consolidated report, print report, view on screen report.
9. User Help Module
    - To provide help steps and further information about certain procedures and processes to users if users encounter any difficulties and not sure what they should do in a particular situation.
10. Public Message Board Module
    - To display the important notices and messages about the wages claims. Users can create/add, delete, modify, print new notices or messages.
11. Error Messages Display Module
    - To control and manipulate any invalid input or processes encountered and display the error messages to illustrate the errors.

3.0.2.2 Non-Functional User Requirements

Non-functional requirements are essential definition of system properties and constraints under which a system must operate. Although these non-functional requirements are very subjective, they are very much as important as the functional requirements. Basically, there are 8 major non-functional requirements specifications which have taken into consideration for this system:-

(I) **Reliability**

The system does not produce dangerous or costly failures when it is used in a reasonable manner.

(II) **Robustness**

The quality that causes a system to be able to handle or at least avoid disaster in the face of unexpected data. When such an error is detected, an error message will be prompted for re-entry before any further processing is carried out. This error message will explain the type of error and the necessary corrections to be made, so that this similar mistake would not be repeated.

(III) **Accuracy**

Refers to the precision of computations and control. Maintain an accurate database.

(IV) **Modularity**

A key in good program design. The working of the system was divided into modules so that distinct functions of objects could be isolated from one another. This characteristics makes testing and maintenance much easier. The modular in design approach means other shell modules may also be easily combined or joined at a later time.

(V) **Reusability**

The extent to which a program or parts of a program can be reused in other applications – related to the packaging and scope of the functions that the program performs.

(VI) **User Friendliness**

A hypertext document where the users can perform various tasks by clicking a mouse-type instrument on the hypertext or image. Prompts and messages are displayed to guide the user along the operation of system. The GUI(Graphical User Interface) provides better visual meanings to the user. The usage of suitable and meaningful icons will help ensure that users use the system with more confidence. Related functions are grouped together. The use of toolbars, status bar and windows gives the user substantial information when using the system. An effective error-handling and validation procedure will also help the user to use the system. The system will display an error message if an error occurs, such as invalid data input, password, and operation.

(VII) **Maintainability & Expandability**

The ease of software can be understood, corrected, adapted, and enhanced. It is the degree to which architectural, data or procedural design can be easily extended in future.

(VIII) **Security**

To prevent unauthorized access into the system. Users must log in with correct user name and password. Authorized users can change their password when desired. Each user are assigned different access level according to the authentication list.

3.0.3 System Analysis

I have to study the existing system that is available and do the planning for the new system. After finished this stage, it comes to the system design.

3.0.4 System Design

An alternatives solution will be set. All the application or modules design at the next stage will strictly follow this solution.

3.0.5 Application Design

The incremental prototyping method will be used during this stage and the following stage. The prototype will be created based on each module that is specified in the project. Then, it is followed by the coding stage.

3.0.6 Coding

A variety of tools and techniques will be used to write the program based on the prototype. If there is any problem, it will refer back to the application design.

3.0.7 Testing

After coding the program components, testing is needed to examine the program code to spot faults and eliminate the errors. It is necessary to ensure that the application program written in isolation work properly when they are integrated into the total system. Any problems encountered in this stage will refer back to the coding stage or the application design stage.

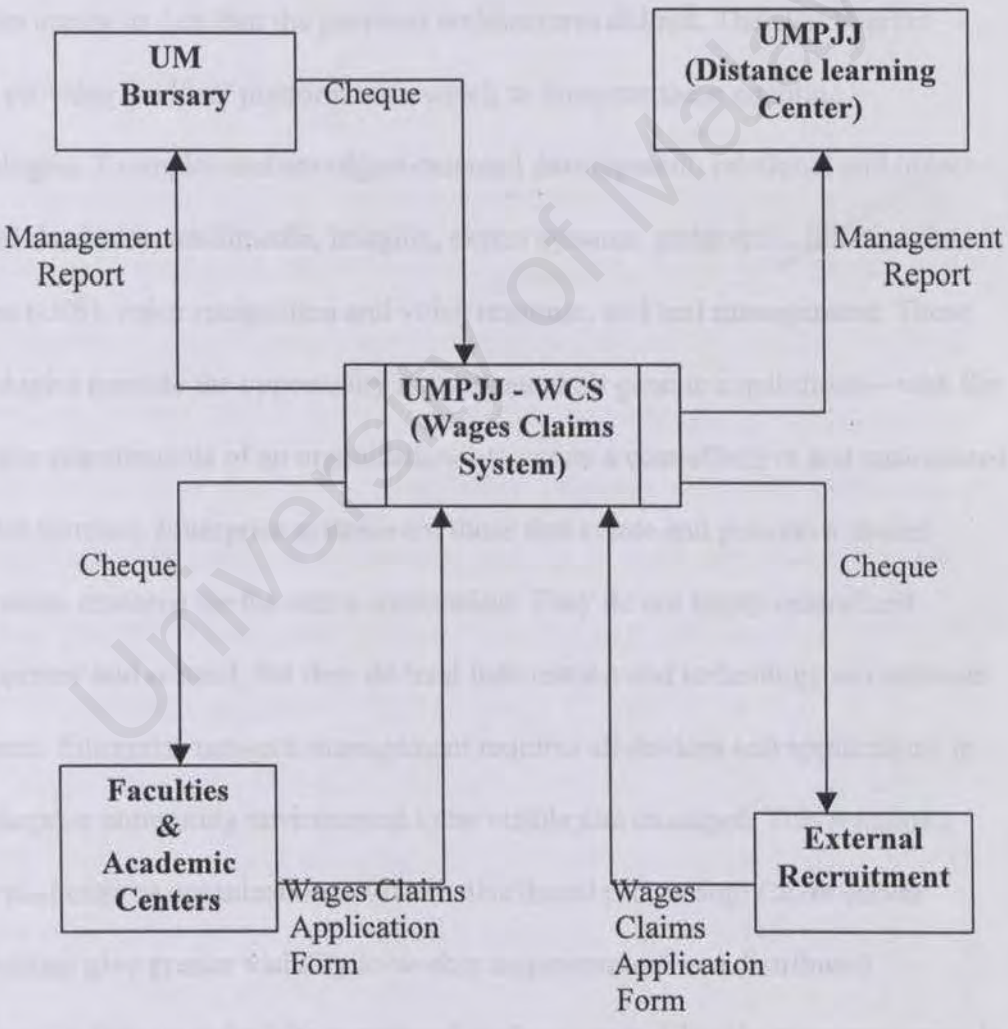
3.0.8 Training and Maintenance

The very last stage that serve the purpose of helping users to understand and feel comfortable of the new WCS. This stage will give guidance to the users about the usage of the new system and how the users can use the system effectively to do their works and jobs especially in wages claims in UMPJJ office.

3.1 System Context Diagram

This is an overview of an organizational system that shows the system boundary, external entities that interact with the system and the major information flows between the entities and the system.

Diagram 3.1 System Context Diagram for UMPJJ –WCS



3.2 Proposed of Technology Architecture, Software and Hardware

3.2.1 Technology Architecture

Web-based Client Server Architecture

The client/server model provides power to the desktop, with information available to *support* the decision-making process and *enable* decision-making authority. The client/server model makes the enterprise available at the desk. It provides access to data that the previous architectures did not. The client/server model provides the ideal platform with which to integrate these enabling technologies. Examples include object-oriented development, relational and object-oriented databases, multimedia, imaging, expert systems, geographic information systems (GIS), voice recognition and voice response, and text management. These technologies provide the opportunity to integrate their generic capabilities—with the particular requirements of an organization—to create a cost-effective and customized business solution. Enterprise systems are those that create and provide a shared information resource for the entire corporation. They do not imply centralized development and control, but they do treat information and technology as corporate resources. Enterprise network management requires all devices and applications in the enterprise computing environment to be visible and managed. This remains a major challenge as organizations move to distributed processing. Client/server applications give greater viability to worker empowerment in a distributed organization than do today's host-centered environments. Client/server computing is

the most effective source for the tools that empower employees with authority and responsibility.

- ***Client:*** A client is a single-user workstation that provides presentation services and the appropriate computing, connectivity, and database services and interfaces relevant to the business need.

- ***Server:*** A server is one or more multiuser processors with shared memory providing computing, connectivity, and database services and interfaces relevant to the business need.

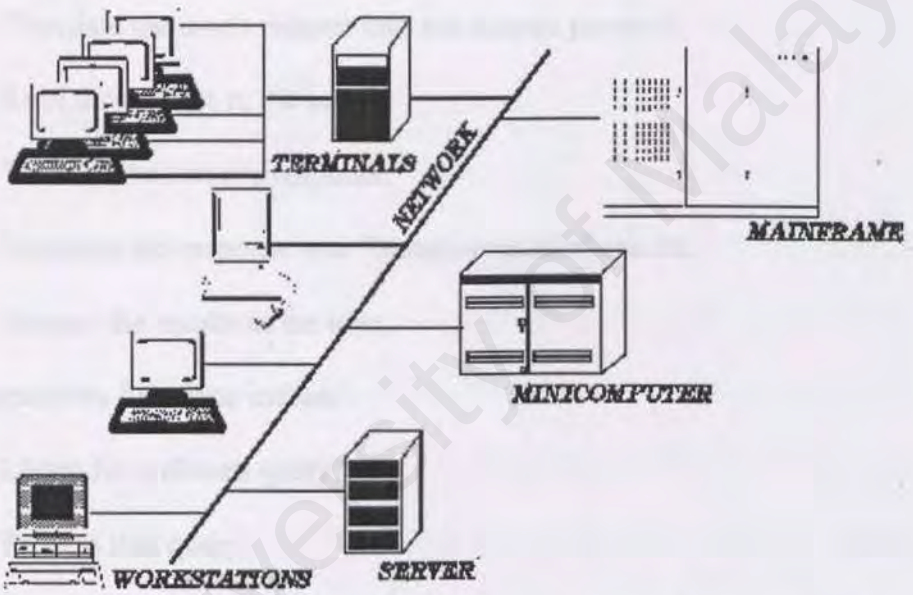
Client/server computing is an environment that allocating the application processing between the client and the server processors. The client requests services from the server; the server processes the request and returns the result to the client. The communications mechanism is a message passing interprocess communication (IPC) that enables (but does not require) distributed placement of the client and server processes. Client/server is a software model of computing, not a hardware definition. This definition makes client/server a rather generic model and fits what is known in the industry as "cooperative processing" or "peer-to-peer."

Because the client/server environment is typically heterogeneous, the hardware platform and operating system of the client and server are not usually the same. In such cases, the communications mechanism may be further extended

through a well-defined set of standard application program interfaces (APIs) and remote procedure calls (RPCs).

Effective client/server computing will be fundamentally platform-independent. Changes in platform and underlying technology should be transparent to the user.

Figure 3.0 A modern client/server architecture.



Client/server computing provides the capability to use the most cost-effective user interface, data storage, connectivity, and application services. Client/server computing in its best implementations moves the data-capture and information-processing functions directly to the knowledgeable worker—that is, the worker with the ability to respond to errors in the data, and the worker with the ability to use the information made available. Client/server applications integrate the front and back

office processes because data capture and usage become an integral part of the business rather than an after-the-fact administrative process.

The client/server model is a form of distributed computing where one program (the client) communicates with another program (the server) for the purpose of exchanging information.

The client's responsibility is usually to:

Handle the user interface.

Translate the user's request into the desired protocol.

Send the request to the server.

Wait for the server's response.

Translate the response into "human-readable" results.

Present the results to the user.

The server's functions include:

Listen for a client's query.

Process that query.

Return the results back to the client.

A typical client/server interaction goes like this:

The user runs client software to create a query.

The client connects to the server.

The client sends the query to the server.

The server analyzes the query.

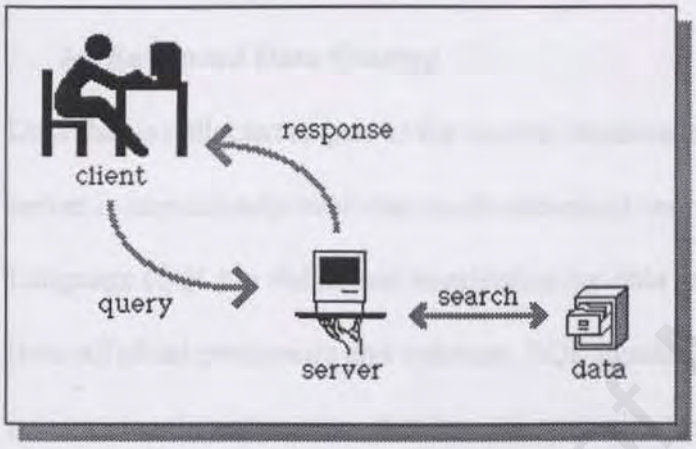
The server computes the results of the query.

The server sends the results to the client.

The client presents the results to the user.

Repeat as necessary.

Figure 3.1 Client Server Model



Flexible user interface development is the most obvious advantage of client/server computing. This allows information to be stored in a central server and disseminated to different types of remote computers. Since the user interface is the responsibility of the client, the server has more computing resources to spend on analyzing queries and disseminating information. This is another major advantage of client/server computing; it tends to use the strengths of divergent computing platforms to create more powerful applications. In short, client/server computing provides a mechanism for disparate computers to cooperate on a single computing task.

The Advantages of Client/Server Computing

The client/server computing model provides the means to integrate personal productivity applications for an individual employee or manager with specific business data processing needs to satisfy total information processing requirements for the entire enterprise.

- **Enhanced Data Sharing**

Data that is collected as part of the normal business process and maintained on a server is immediately available to all authorized users. The use of Structured Query Language (SQL) to define and manipulate the data provides support for open access from all client processors and software. SQL grants all authorized users access to the information through a view that is consistent with their business need. Transparent network services ensure that the same data is available with the same currency to all designated users.

- **Integrated Services**

In the client/server model, all information that the client (user) is entitled to use is available at the desktop. There is no need to change into terminal mode or log into another processor to access information. All authorized information and processes are directly available from the desktop interface. The desktop tools—e-mail, spreadsheet, presentation graphics, and word processing—are available and can be used to deal with information provided by application and database servers resident on the network. Desktop users can use their desktop tools in conjunction with

information made available from the corporate systems to produce new and useful information.

- **Sharing Resources Among Diverse Platforms**

The client/server computing model provides opportunities to achieve true open system computing. Applications may be created and implemented without regard to the hardware platforms or the technical characteristics of the software. Thus, users may obtain client services and transparent access to the services provided by database, communications, and applications servers. Operating systems software and platform hardware are independent of the application and masked by the development tools used to build the application. Client/server applications operate in one of two ways. They can function as the front end to an existing application or they can provide data entry, storage, and reporting by using a distributed set of clients and servers.

- **Data Interchangeability and Interoperability**

SQL is an industry-standard data definition and access language. This standard definition has enabled many vendors to develop production-class database engines to manage data as SQL tables. Almost all the development tools used for client/server development expect to reference a back-end database server accessed through SQL. Network services provide transparent connectivity between the client and local or remote servers. The client/server model provides the capability to make ad hoc requests for information. As a result, optimization of dynamic SQL and support for distributed databases are crucial for the success of the second generation of a

client/server application. The first generation implements the operational aspects of the business process. The second generation is the introduction of ad hoc requests generated by the knowledgeable user looking to gain additional insight from the information available.

- **Masked Physical Data Access**

When SQL is used for data access, users can access information from databases anywhere in the network. From the local PC, local server, or wide area network (WAN) server, data access is supported with the developer and user using the same data request. The only noticeable difference may be performance degradation if the network bandwidth is inadequate. Data may be accessed from dynamic random-access memory (D-RAM), from magnetic disk, or from optical disk, with the same SQL statements. Logical tables can be accessed—without any knowledge of the ordering of columns or awareness of extraneous columns—by selecting a subset of the columns in a table. Several tables may be joined into a view that creates a new logical table for application program manipulation, without regard to its physical storage format. The use of new data types, such as binary large objects (BLOBs), enables other types of information such as images, video, and audio to be stored and accessed using the same SQL statements for data access. RPCs frequently include data conversion facilities to translate the stored data of one processor into an acceptable format for another.

- **Location Independence of Data and Processing**

We are moving from the machine-centered computing era of the 1970s and 1980s to a new era in which PC-familiar users demand systems that are user-centered. Previously, a user logged into a mainframe, mini-, or micro application. The syntax of access was unique in each platform. Function keys, error messages, navigation methods, security, performance, and editing were all very visible. Today's users expect a standard "look and feel." Users log into an application from the desktop with no concern for the location or technology of the processors involved.

Data is accessed through SQL without regard to the hardware, operating system, or location providing the data. Consistent network access methods envelop the application and SQL requests within an RPC. The network may be based in Open Systems Interconnect (OSI), Transmission Control Protocol/Internet Protocol (TCP/IP), or Systems Network Architecture (SNA), but no changes are required in the business logic coding. The developer of business logic deals with a standard process logic syntax without considering the physical platform.

- **Centralized Management**

As processing steers away from the central data center to the remote office and plant, workstation server, and local area network (LAN) reliability must approach that provided today by the centrally located mini- and mainframe computers. The most effective way to ensure this is through the provision of monitoring and support from these same central locations. A combination of technologies that can "see" the

operation of hardware and software on the LAN—monitored by experienced support personnel—provides the best opportunity to achieve the level of reliability required.

Transition of Client Server System to Web-based System

A new era was born in computing system and architecture with the introduction and creation of Internet. A process of reengineering was done by many businesses to take full advantage of it.

The latest technology was be the client server together with web-based architecture. The main differences would be their evolution in the current flow of computing technology and their adoption in the dynamic computing technology.

Differences of web server development compare to the traditional client server computing:-

(A) Adaptability – traditional client-server system have difficulty in adapting to new technologies, such as network computers, intranets and Java. Web-based represent a retreat toward centralized computing, away from the empowering effects of desktop computing.

(B) Much Thinner Client – traditional client-server application results a fat-client whereas web application results a much thinner client because using only HTML on application. Fat-client software are more complex because it handles more processing jobs. It is more error prone while a web server

client(web browser) fails less often and is much more reliable.

(C) Maintainability – The only necessity is the web browser and this has decreased the number of software to be installed. It has increase in mobility, where users worldwide can access the application by using any web browser. User transparency exist because the applications can be upgraded without user's knowledge. This is contrast to client-server system where client installation and upgrades can take considerable time and expenses.

(D) Simple Network Component – TCP/IP network layer and the HTTP protocol for network transport and communication are utilized in the web-based system. Selection of protocols and appropriate standards is a vital decisions in traditional client-server computing system.

3.2.2 Software

Minimal Software Requirements:-

(A) User Client Workstation Terminal

- Operating System : Microsoft Windows 95/ 98/ 2000 Professional / NT4 Workstation.
- Web Browser : Microsoft Internet Explorer 5 or Netscape Navigator 4.97.
- Office Application : Microsoft Office 97 / 2000. (Optional)
- Microsoft Personal Web Server.

(B) Server Terminal

- Operating System : Microsoft Windows NT4 Server / 2000 Advanced Server.
- Web Browser : Microsoft Internet Explorer 5 or Netscape Navigator 4.97.
- Office Application : Microsoft Office 97 / 2000.
- System Development Tools : Microsoft Visual Studio 97 / 98 / 2000
  - ~ Development Editor – Microsoft Visual Interdev.
  - ~ Database – Microsoft FoxPro.
  - ~ Programming Language – Microsoft Visual Basic.
- Graphics Editor : Adobe Photoshop 5.5.

3.2.3 Hardware

Minimal Hardware Requirements:-

(A) User Client Workstation Terminal

IBM PC or compatibles with the following configurations:-

- Cyrix MI /AMD K5 / Intel Pentium MMX 166 Mhz microprocessor.
- 64MB EDO RAM.
- 1.0GB Hard Disk space.
- 3.5" Floppy Disk Drive.
- Compatible mouse device.
- 104 keys standard keyboard.
- 16 Speeds CD-ROM Drive.
- 15" SVGA Monitor.

(B) Server Terminal

IBM PC or compatibles with the following configurations: -

- Cyrix MII /AMD K6 / Intel Pentium II 350 Mhz microprocessor.
- 128MB EDO RAM.
- 3.5GB Hard Disk space.
- 3.5" Floppy Disk Drive.
- Compatible mouse device.

- 104 keys standard keyboard.
- 16 Speeds CD-ROM Drive.
- 15" SVGA Monitor.

Chapter 4

SYSTEM ANALYSIS AND DESIGN

Chapter 4

SYSTEM ANALYSIS AND DESIGN

Chapter 4 : SYSTEM ANALYSIS AND DESIGN

4.1 System Design

System design is the essential nucleus of the software development process and is applied regardless of the development model or standard that is used. The common steps involved including analyzing, designing, coding, and testing the system to ensure that it conforms to the software specifications and requirements. Each activity transforms information in a manner that ultimately results in validated computer software. I described the detail of how the system would meet the requirements identified during system analysis phase. I transformed the user requirements into a working model that can be used as guidance before developing the complete system.

There are 4 major system design that I wished to derive as follows for illustrating different exclusive purposes:-

I. System Functionality Design.

II. Network Design.

III. Database Design.

IV. GUI (Graphical User Interface) Design.

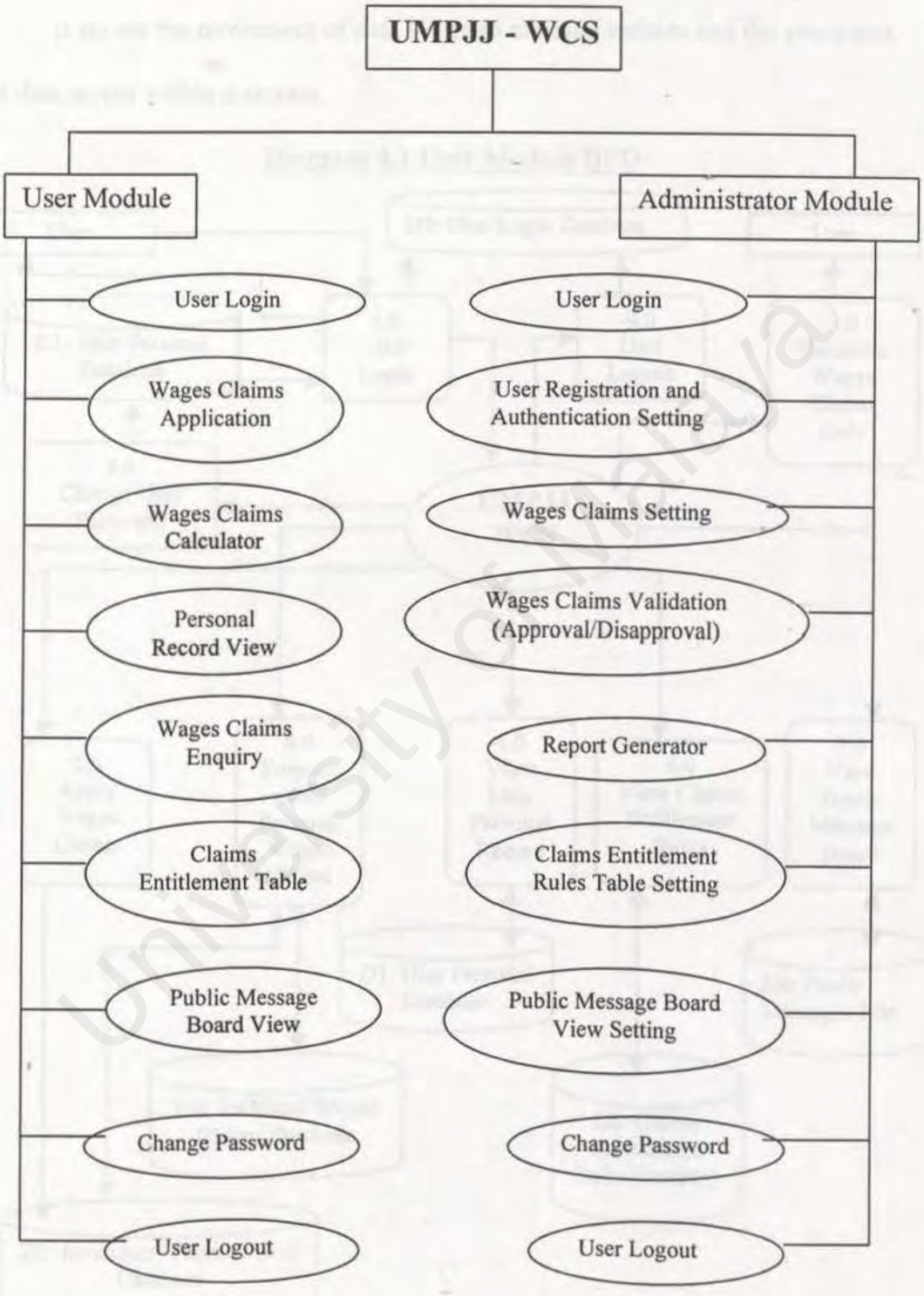
4.2 System Functionality Design

4.2.1 System Architecture Design

The primary objective of system architecture design is to develop a modular software program structure and represent the control relationships between modules. System architecture design associates the system capabilities identified in the requirements specifications with the system components. Components are usually modules and the system architecture design also describes the interconnection among them. In addition, the system architecture design defines operations that create system from subsystems.

UMPJJ-WCS system architecture design is divided into 2 major system modules such as the User System Module and the Administrator System Module.

Diagram 4.0 UMPJJ-WCS System Architecture Design



4.2.2 Data Flow Diagram (DFD)

It shows the movement of data between external entities and the processes and data stores within a system.

Diagram 4.1 User Module DFD

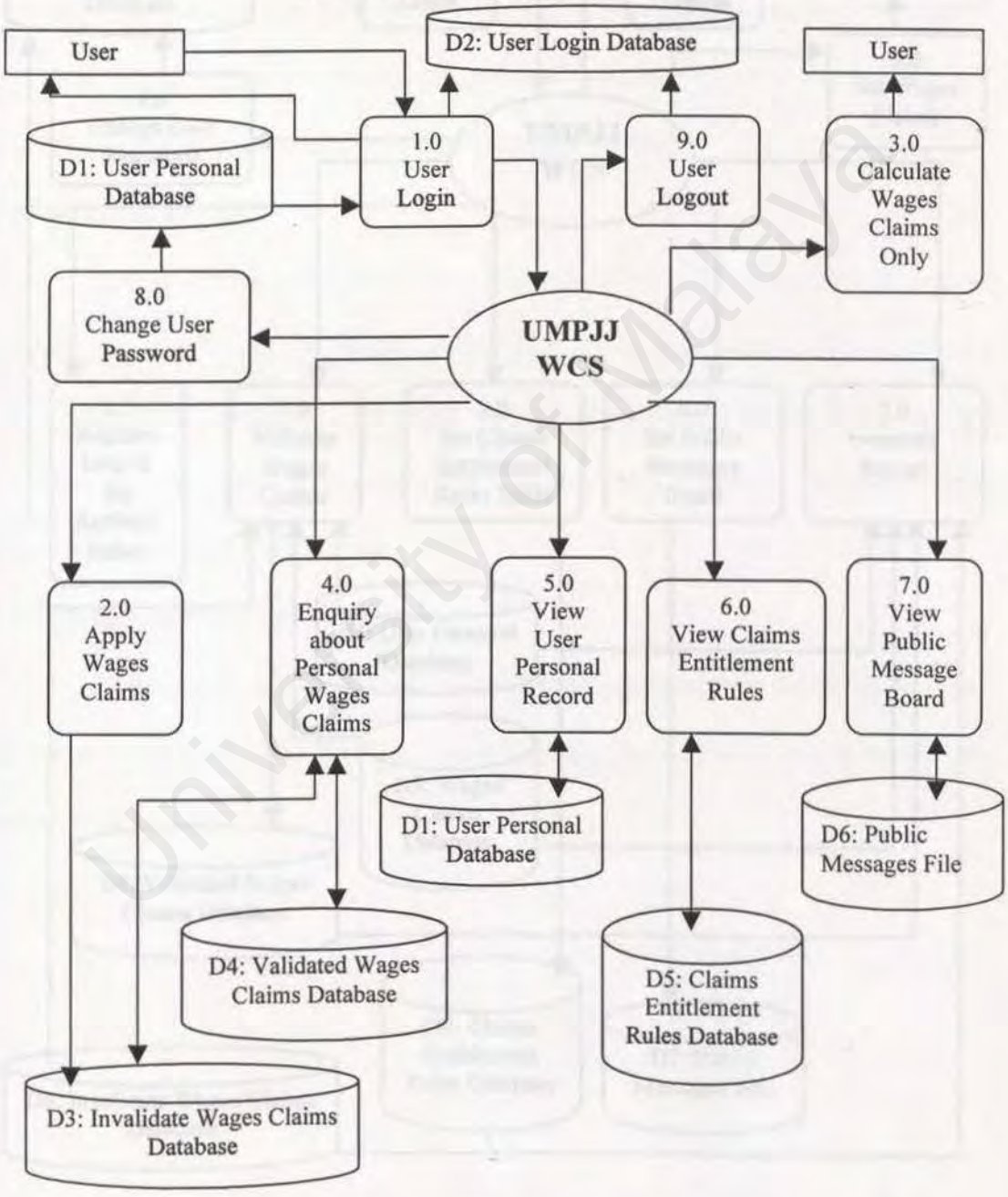
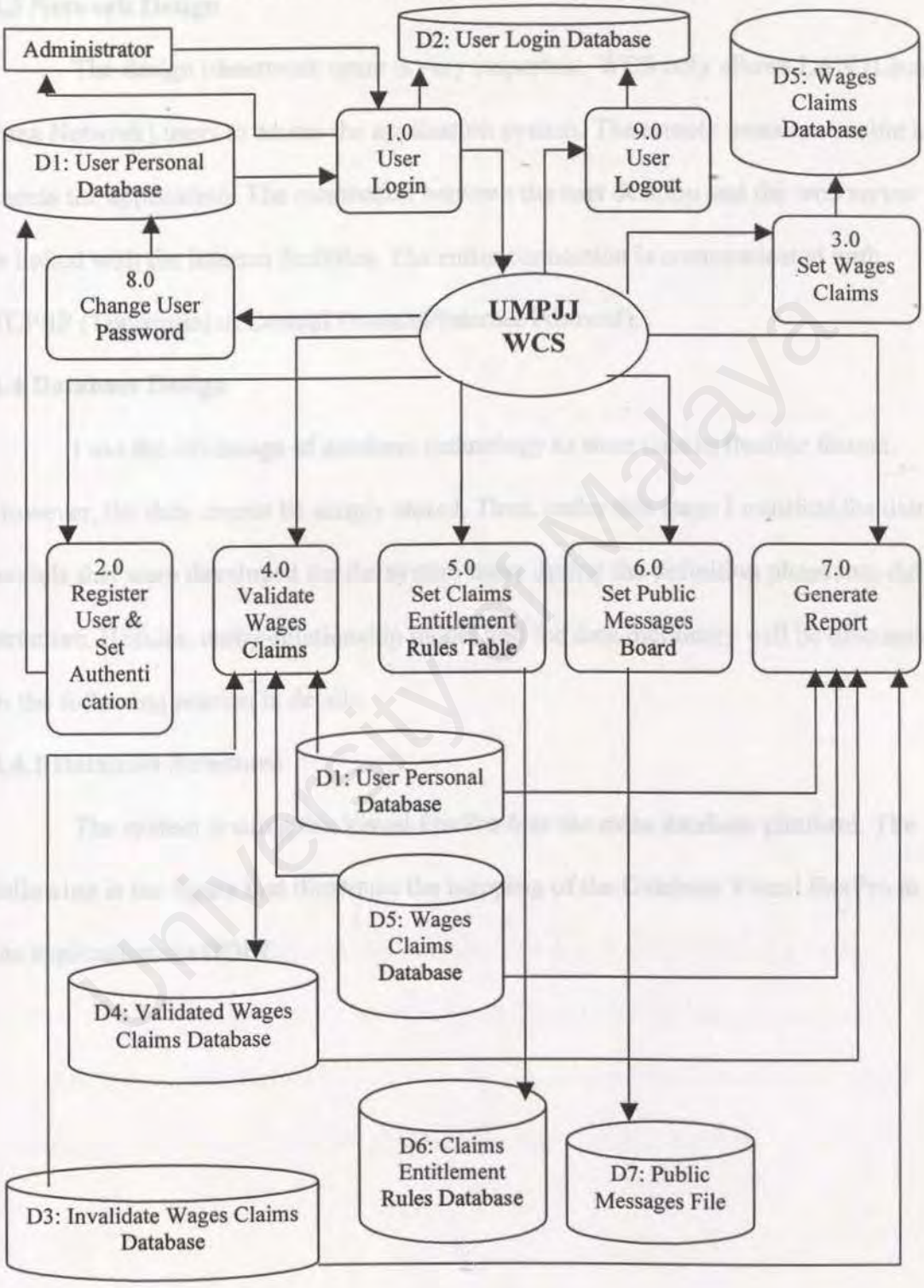


Diagram 4.2 Administrator Module DFD



4.3 Network Design

The design of network setup is very important. WCS only allows LAN (Local Area Network) users to access the application system. The remote users are unable to access the application. The connection between the user desktop and the web server is linked with the internet facilities. The entire connection is communicated with TCP/IP (Transmission Control Protocol/Internet Protocol).

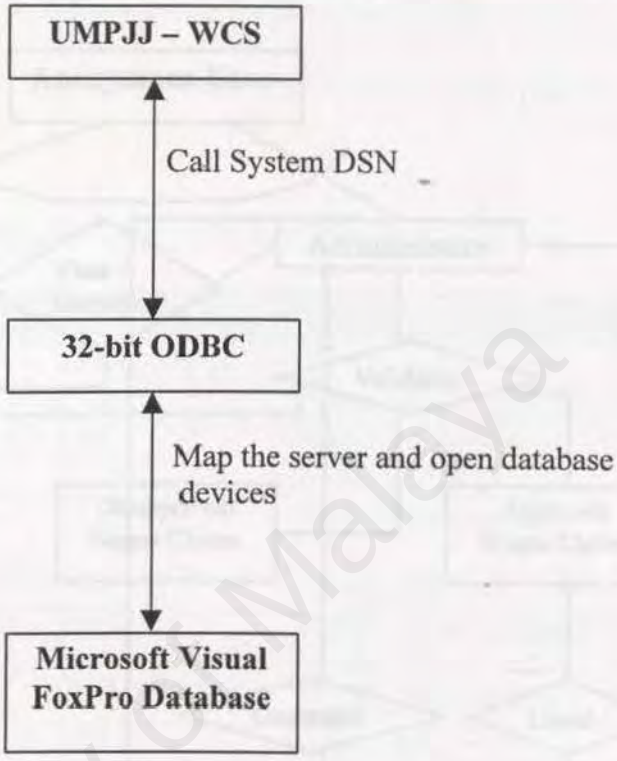
4.4 Database Design

I use the advantage of database technology to store data in flexible format. However, the data cannot be simply stored. Thus, under this stage I translate the data models that were developed for the system users during the definition phase into data structure. Besides, entity-relationship model and the data dictionary will be discussed in the following session in details.

4.4.1 Database Structure

The system is using the Visual FoxPro 6 as the main database platform. The following is the figure that illustrates the mapping of the Database Visual FoxPro to the application via ODBC.

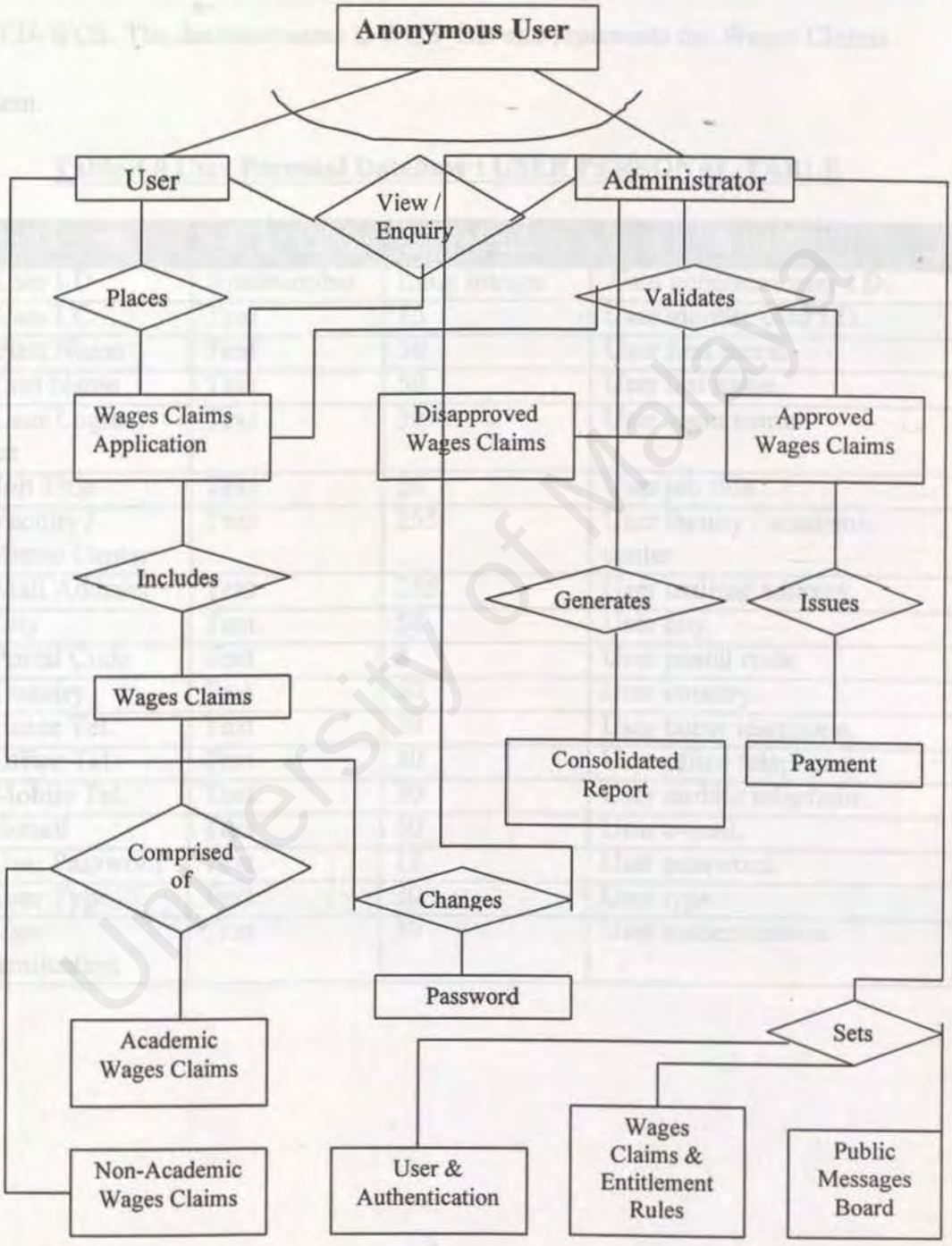
Diagram 4.3 The mapping of database to UMPJJ-WCS Application



4.4.2 Entity Relational (E-R) Diagram

An E-R diagram is a detailed, logical representation of the data for an organization or for a business area. The E-R diagram is expressed in terms of entities in the organization environment, the relationships or associations among those entities, and the attributes or properties of both the entities and their relationships. The purpose of E-R Diagram is to capture the richest possible understanding of the meaning of data necessary for an information system or organization.

Diagram 4.4 E-R Diagram for UMPJJ-WCS



4.4.3 Database Dictionary

It illustrates the attributes and fields of the database that is used in the UMPJJ-WCS. The database name is WCS_DB and represents the Wages Claims System.

Table 4.0 User Personal Database : USER PERSONAL TABLE

Field Name	Data Type	Data Length	Description
*1. User I.D	AutoNumber	Long integer	Auto generated user I.D.
*2. User I.C	Text	15	User identity card I.D.
3. First Name	Text	50	User first name.
4. Last Name	Text	50	User last name.
5. User Login Name	Text	30	User login name.
6. Job Title	Text	50	User job title.
7. Faculty / Academic Center	Text	255	User faculty / academic center
8. Mail Address	Text	255	User mailing address.
9. City	Text	50	User city.
10. Postal Code	Text	8	User postal code.
11. Country	Text	50	User country.
12. Home Tel.	Text	30	User home telephone.
13. Office Tel.	Text	30	User office telephone.
14. Mobile Tel.	Text	30	User mobile telephone.
15. E-mail	Text	50	User e-mail.
16. User Password	Text	12	User password.
17. User Type	Text	30	User type.
18. User Authentication	Text	30	User authentication.

Table 4.1 User Login Database : USER LOGIN TABLE

Field Name	Data Type	Data Length	Description
*1. User I.C	Text	15	User identity card I.D.
2. User Login Name	Text	30	User login name.
3. User Password	Text	12	User password.
4. Login Status	Boolean	In/Out	User login status.

Table 4.2 Wages Claims Database : WAGES CLAIMS TABLE

Field Name	Data Type	Data Length	Description
*1. Wages Claims I.D.	Auto Number	Long Integer	Wages claims I.D..
2. Wages Claims Name	Text	50	Wages claims name.
3. Wages Claims Category	Text	15	Wages claims category.
4. Wages Claims Date	Date	DD/MM/YYYY	Wages claims date.
5. Wages Claims Amount	Numeric	Integer	Wages claims amount.

Table 4.3 Wages Claims Application Database : WAGES CLAIMS APPLICATION TABLE

Field Name	Data Type	Data Length	Description
*1. Wages Claims Application I.D.	Auto Number	Long Integer	Wages claims application I.D..
*2. User I.C	Text	15	User identity card I.D.
3. First Name	Text	50	User first name.
4. Last Name	Text	50	User last name.
5. Job Title	Text	50	User job title.
6. Faculty / Academic Center	Text	255	User faculty / academic center
7. Mail Address	Text	255	User mailing address.
8. City	Text	50	User city.
9. Postal Code	Text	8	User postal code.

10. Country	Text	50	User country.
11. Home Tel.	Text	30	User home telephone.
12. Office Tel.	Text	30	User office telephone.
13. Mobile Tel.	Text	30	User mobile telephone.
14. E-mail	Text	50	User e-mail.
15. Wages Claims Item	Text	100	Wages claims items.
16. Wages Claims Item Amount	Numeric	8	Wages claims item amount.
17. Wages Claims Total Amount	Numeric	16	Wages claims total amount.
18. Application Status	Boolean	Approve/Disapprove	Wages claims application status.

4.5 GUI (Graphical User Interface) Design

The designer of the user interface to a computer is faced with 2 key issues. How can information from the user to be provided to the computer system and how can the information from computer system to be presented to the users? I design the interface to improve the efficiency and effectiveness of the user when using the entire system. Thus, the interface design for UMPJJ-WCS is easy to understand and easy to use. Basically, the user interface could be textual or form based. The users need not to remember any command syntax and what he or she needs to do is just doing some mouse clicking. I have created the interface design as friendly as possible. The design is able to prevent failures and improper procedures. Form-based user interface for UMPJJ-WCS is provided and including GUI which support high resolution color screens and interaction using a mouse as well as a keyboard.

3 major advantages of GUI's are:-

- They are relatively easy to learn and use. Users with no computing experiences can learn to use the interface after a brief training session.
- The user has multiple screens(windows) for system interaction.
- Fast, full screen interaction is possible with immediate access to anywhere on the screen.

Design Principles

The following are general principles, which were applied in the design of UMPJJ-WCS graphical user interface(GUI):-

(i) User Familiarity – Users should not be forced to adapt to an interface because it is convenient to implement. For example: a system is designed by using familiar words such as "edit", "add", etc.

(ii) Consistency – System commands and menus should have the same format. Parameters should be passed to all commands in the same way and command punctuation should be similar.

(iii) Meaningful Error Messages – The error messages should describe the problems in a language that the user understands.

(iv) Confirmation – If a user specifies an action, which is potentially destructive, he or she should be asked to confirm that it is really what is intended before any information in administrator section will be asked to confirm the deletion.

(v) Robustness – The system should be able to protect itself from user errors that might cause it to fail. For example: WCS is able to recover and

display an error message when the user specifies a non-numeric value for the numeric input field.

Characteristics of User Interface: -

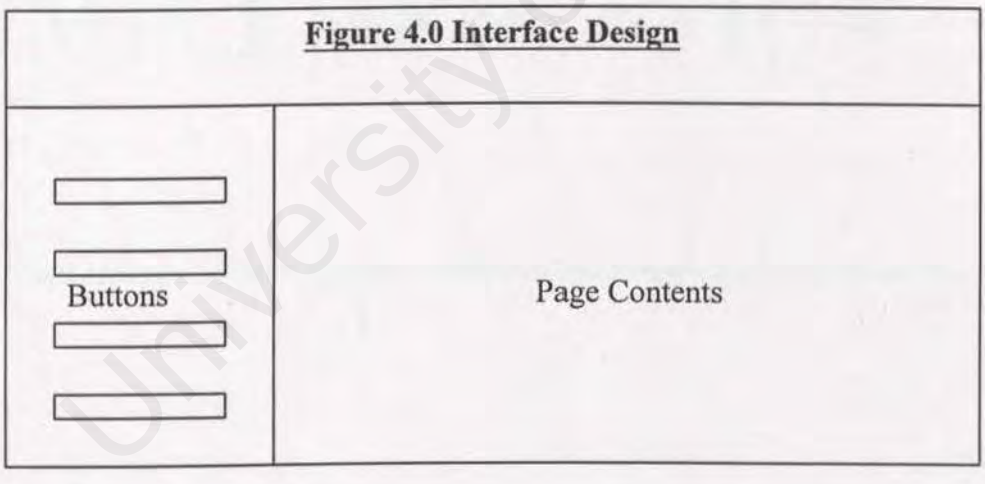
(i) Buttons – Picking a button causes a single action to be initiated.

(ii) Text Field – Ask the user for a specific piece of information within a form.

(iii) Radio Button – Appears as a small circle the user can select or deselect by clicking on the mouse device. Only one choice can be selected at one time.

(iv) Menu List – Users select one of a number of possibilities to issue a command.

Figure 4.0 Interface Design



4.5.1 Screen Design

The design of GUI for WCS is divided into the administrator and users screen. To use the functions of the system, the users just need to click on the selected task or button. The GUI design for the system is normally divided into 2 frames. The left frame contains the menu control while the right frame contains the task or the function display for the selected control.

4.5.2 Output Design

The output design serves the purpose of providing the information that the users needs, based on the criteria selected by the users. WCS provides the functions of generating daily or monthly report and semester summary listing for the records. The report is design in such a way that it can be printed out according to the format required by the UMPJJ officers.

Chapter 5

SYSTEM IMPLEMENTATION

Chapter 5: SYSTEM IMPLEMENTATION

Under this stage, I transformed the design model of WCS into a workable product. The system implementation of WCS is divided into 2 compartments which are the platform development and the modules implementation.

5.1 Platform Development

The platform development will include setting up the Windows 98, Microsoft Access 2000 & Personal Web Server.

5.1.1 Setting Windows 98

Before the system is being developed, it needs to run under Windows 98. Steps of installation:-

- Partitioned the blank hard disk into either one master partition or several partitions as well by using FDISK.EXE from the MS-DOS or Windows DOS platform.
- Formatted the hard disk in either FAT 16 or FAT 32 file system format by using FORMAT.COM from the MS-DOS or Windows DOS platform.
- Now, the hard disk is ready to be installed the Operating System of Microsoft Windows 98. Insert the Windows 98 Bootable CD into the CD-ROM drive and restart the computer and reboot from the CD-ROM.
- The bootable Windows 98 will be booted up and it detects the necessary computer peripherals and hard disk in order to start installing the OS into the hard disk.

- It takes approximately 45 to 60 minutes to be completely installed the Windows 98.

5.1.2 Setting Access 2000

The Access 2000 is installed in another server. This database will become the database storage for the system. The tables are created for keeping the data used in all modules of the WCS.

In order to map the database to the web server, a system Data Source Name(DSN) was created. The system DSN named **wcsdb_conn** was registered through the ODBC in the web server machine. The ODBC could map to the storage even it is in the different machines. Likewise, the web server could open the database storage by just calling the system DSN.

5.1.3 Configure Personal Web Server (PWS)

After installing the PWS, the virtual directory is created in order to enable the user to access the application. Besides, the virtual directory is configured that it only grants access to the LAN users. The users can access the application through the following URL address as **http://omt/Login.htm** . Personal Web Server is a web server that uses TCP/IP to host a Web site on the corporate intranet.

On Windows 98, PWS offers the following three installation options:

- Minimum install The minimum necessary components to operate PWS.
- Typical install Minimum options plus additional functionality and documentation.

- Custom install Presents all possible components as options, with all options included in the minimum and typical installations pre-selected.

The Personal Web Server package makes it easy to install any of the following new features:

Microsoft Personal Web Server

A desktop Web server that can be used to host a Web site on the corporate intranet, or to develop and test a Web site before hosting the site on an internet service provider (ISP).

FrontPage Server Extensions

Supports the use of Microsoft FrontPage to manage your Web site, as well as create the site content.

Microsoft Data Access Components

Easy use of databases with support for ActiveX Data Objects and the Microsoft Access driver.

Microsoft Message Queue Server 1.0

Makes it easy for application programs to communicate with other application programs quickly, reliably, and asynchronously by sending and receiving messages. The key features of Message Queue Server (MSMQ), such as ActiveX support, comprehensive security controls, powerful administration tools, extensive feature set, and integration with strategic Microsoft products such as Internet Information Server and MTS, make MSMQ the message queuing product of choice for applications

running on Windows 95, Windows 98, and Windows NT. The Personal Web Server package includes the MSMQ Dependent and Independent Clients.

Microsoft Transaction Server

Supports creation of Microsoft® Transaction Server (MTS) applications. A transaction is a server operation that succeeds or fails as a whole, even if the operation involves many steps. MTS also supports process isolation of applications.

Visual InterDev RAD Remote Deployment Support

Enables the remote deployment of applications on your Web server.

About System Requirements

For you to install and run PWS, your computer must meet certain hardware and software requirements. This topic details the requirements, and includes an easy-to-follow table you can use to review your system.

Hardware Requirements

If you intend to publish documents on your intranet, you must have a network connection. If you plan to use PWS as a development and staging platform only, and then upload your site to a corporate server or an Internet service provider, a network connection is not required. In addition, your hardware must meet the following specifications.

Hardware Requirements and Recommendations		
Hardware Component	**Minimum**	**Recommendation**
Processor	33 MHz 486	90 MHz Pentium®
RAM	16 MB	32 to 64 MB
Free hard disk space	20 MB (minimum install)	100 MB
Monitor	VGA	Super VGA

Tip If you have a name resolution system installed on your network, users can use "friendly" text names instead of IP addresses when connecting to your server.

Software Requirements

PWS can be installed on a computer running either Microsoft® Windows® 95 or later, or Microsoft® Windows NT® Workstation 4.0 or later operating system. Microsoft Internet Explorer 4.01 is also required.

Other Known Problems and Limitations

The following list contains problems and limitations that are known to exist in this release:

- Personal Web Server does not support FTP services.

- If you are upgrading from a previous version of PWS and you have trouble viewing Default.asp, then you probably have an older version of this file. In order to install the newer PWS 4.0 version of this file, you must manually remove the older version of Default.asp. The location is C:\InetPub\Wwwroot.

- In some cases, files left behind from an earlier installation of the FrontPage Server Extensions may prevent newer versions of this component from installing correctly. If PWS Setup reports errors during the installation of FrontPage Server Extensions, or if PWS, Microsoft FrontPage, or Microsoft Visual InterDev fail when connecting to a FrontPage Web, use the following procedure to correct the problem:

  1. Run PWS Setup, choose **Add/Remove** and uninstall the **FrontPage Server Extensions**.

  2. In the \Windows\System\ directory, delete the following files: Fp30txt.dll, Fp30utl.dll and Fp30wel.dll.

  3. Delete the \Program Files\Microsoft FrontPage\version3.0 directory including all files and sub-directories.

  4. Run IIS Setup and reinstall the **FrontPage Server Extensions**.

5.2 Modules Implementation

The WCS is divided into 2 main modules, which are the user and administrator module. Each module is developed using 2 types of languages such as the VbScript and ASP (Active Server Page).

5.2.1 User Modules

This user module consists of several sub-modules, which are Authenticate User Login Module, Change User Login Password Module, Change User Personal Particulars Module, Apply Wages Claims Module, View Wages Claims Approval Module, Wages Claims Rates, Rules and Regulations Module.

These modules are developed using the VbScript and DHTML language. The entire module is implemented individually before there are integrated together.

5.2.2 Administrator Modules

It consists of several sub-modules, which are Authenticate Administrator Login Module, Change Administrator Login Password Module, Change Administrator Personal Particulars Module, WCS System Setup Module, Validate Wages Claims Application Module, Generate Report Module, Apply Wages Claims Module, View Wages Claims Approval Module, Wages Claims Rates, Rules and Regulations Module. These modules are developed using VbScript and DHTML language. The entire module is implemented individually before there are integrated together. All of the record updating is using the similar code that is using the recordset to update the database.

Chapter 6

SYSTEM TESTING

Chapter 6: System Testing

Under this stage, I perform many types of testing to ensure that the final system perform as what it should be before the system is released and to make sure the system is developed according to its specification and every functions implemented in a program works correctly.

4 types of testing are being used for WCS and there are :-

1. Unit Testing.
2. Module Testing.
3. Integration Testing.
4. System Testing.

6.1 Unit Testing

After one new module is developed, I usually test it immediately in order to assure their accuracy and to find faults in the modules. There are 3 types of testing strategy carried out for unit testing:-

(a.)Code Reviewing.

(b.)Test Cases.

(c.)Other Users.

6.1.1 Code Reviewing

The codes are examined line by line in order to make sure that many uncovered semantic errors during implementation could be revealed. In reviewing the code, the correctness of coding was identified by comparing it to the original design of the program flow. When the logic and flow of the program were identified, the code was commented so that it can be traced easily in future.

The code was also examined and debugged in order to identify any fault coding. It is easier to debug the error using VB if compared to ASP coding. I can trace the VB code line by line using the debugger available. However, debugging using ASP was difficult because there were no proper ASP debugger and tester used in the project. The "Response.Write" command is inserted into the code to examine the value of the variables.Thus, it was used as the 'Watch' value of the variables.

Ex:-

```
<%   count= Request.form("txttime")
Response.Write count & "value" //print out the value of variable count.
    If count >10 then
        Response.Write"Run" //print out if the statement runs.
        Updatedata()
    End if
%>
```

6.1.2 Test Cases

I use some test cases to test the system. This approach is used as some set of structural input is given and output is observed. This strategy is needed to identity the variance between the prototype and the requirement.

Ex: input different login ID and password to test the authenticate logon module. With this, the reaction of the program to the input data could be tested. This could identify the program's faults, which probably happen in normal condition.

6.1.3 Other Users

I launch the beta version of the system to other users for testing purposes. This is to identity the fault that way incur in any other unexpected condition. The testing involved with random data in random situation. From the testing, I get some feedback from the users. This feedback provides some important information about the usability and reliability of the application.

6.2 Module Testing

I perform the module testing which include the user module testing and the administrator module testing. I created 1 administrator and some users data in performing the testing. The testing was carried out to ensure that the codes under the module function according when all units of code are integrated. If the errors are presented from a particular module, the part of the module that goes wrong is identify and unit testing is used to identify the errors.

6.3 Integration Testing

The testing was carried out in order to identify the fault and failure caused by the integration as well as review and rectify the correct path of the system flow. During the integration, all the module prototypes were combined and tested in a testing environment. The testing environment was consistent for all the modules in terms of interface, user authentication and function calling procedures. The program flow and the testing needs for each of the modules were reviewed and identified. Then, the program flow for the entire system were reviewed and tested. After that, the entire system was tested with some test cases. Finally, the system is published to let the other users to test it.

6.4 System Testing

Finally, I perform the system testing to ensure that the entire application, of which the modified program was a part, still works. It is used to test the integrated system and verify whether it meets the specified requirements.

Chapter 7

PROJECT FINDINGS AND CONCLUSION

Chapter 7: Project Findings and Conclusion

7.1 System Evaluation

After the system implementation of WCS, the end product of the project is brought up for evaluation. There are many ways to evaluate the final system from different perspective.

7.1.1 System Strength

Web Enabled

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

Simplicity of GUI(Graphical User Interface)

The graphical interface design of the system is quite similar to the GUI of the windows environment. The GUI ensures user friendliness. Thus, the users should find it easy to use.

Scalability

Hardware and applications could be easily added to the existing system without influence the existing applications because the system is not hardware dependency.

7.1.2 System Limitation

Browser Limitation

The system is only supported by IE 4.0 or above. This is due to most of the scripts are written in VbScript, which is not supported by other browser such as Netscape Communicator and Navigator.

7.1.3 Future Enhancement

Some functionality of the system can be enhanced in order to improve the quality of the system.

Maintenance of user interface

The users can change the system interface of the system according to his/her preferences.

Distributed Server Architecture

Using of IIS(Internet Information Server) resides in one server and SQL server resides in another one server. This architecture allowed added flexibility server implementation and lessened dependency on individual machines and future backup capabilities.

Adding More Functional User Requirements

Due to the time and resource constraints, the UMPJJ WCS only covered the Academic Wages Claims only. In future, we can add in more functions which cover the Non-Academic Wages Claims as well such as Transportation(Public and Private)

Claims, Accommodation & Lodging Claims, Food & Daily Claims, and Other Miscellaneous Claims.

7.2 Problems Encountered

During the entire development of WCS, many and various problems were encountered. Some of them could be rectified and solved through certain solution and some of them were not. Generally, there are typical problems that arises during the development process as below:-

7.2.1 Set Up and Configuration

The set up of the server are critical for the operation of the application developed. However, the setup processes can take a long time because lack of pratical experiences. Besides, the repeated failure of the the server required re-installation of the server as a remedy and this consumed time and effort.

I encountered problems during making the database connection to Microsoft Access Database and manipulating the databases.

The installation of Microsoft Windows 98 is very troublesome. This is because we need to restart the server each time when we upgraded the Service Pack and configured the network setting.

7.2.2 User Requirements changed frequently

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

7.3 Knowledge gained

During the entire development of the WCS, I've gained many kinds of knowledge as follows:-

- Setting up different kind of server

  During the process of development, I have the opportunities to set up the Microsoft Windows 98, and Windows NT 4 Server. Several discussions presentation were held to share our knowledge and solving problems.

- Additional software tools

  I have gained knowledge on writing 2 new programming languages, which are VBScript and ASP(Active Server Page).

7.4 Reviews on goals

At the final stage of the project, there were certain expectations on what should be achieved.

7.4.1 Expectation achieved

In overall, the system has fulfilled the expectation stated by the project. The basic foundation of the system is designed and implemented. The system is able to provide the functions required by the UMPJJ. It is eligible for future growth and implementation. The WCS meet the criteria such as reliabilities, users friendliness, open system and wide accessible.

7.4.2 Objectives achieved

The project has successfully created a system that supports the wages claims process in UMPJJ. This system are now provide users with certain functional likes all academic wages claims such as Subjects, Classes, Exam Scripts, Thesis, and Industrial Training Claims and for the Coordinator Wages Claims.

This project has proven that organization can already implement the concept of web-based claims system application. Finally, it could be concluded that the objectives to establish the WCS has been achieved.

7.5 Overall Conclusion

WCS is an web-based software application system, designed as a comprehensive solution to an organization's staff wages claims. The system generates timely, accurate and relevant information necessary to monitor and manage the claims processes. The feasibilities of the system depends on how much the organization will benefit from its implementation.

The entire system was carried out accordingly to the specified system requirements. The system not only provide a secure, faster, and easier way for user to apply claims but also simplifies the paper work which has to be performed by the management officers of UMPJJ center.

However, there is also some limitations in this system. It needs to be enhanced in order to transform it to a more complete system. Despite the limitations, the project has reasonably achieved all of its major objectives.

Chapter 8

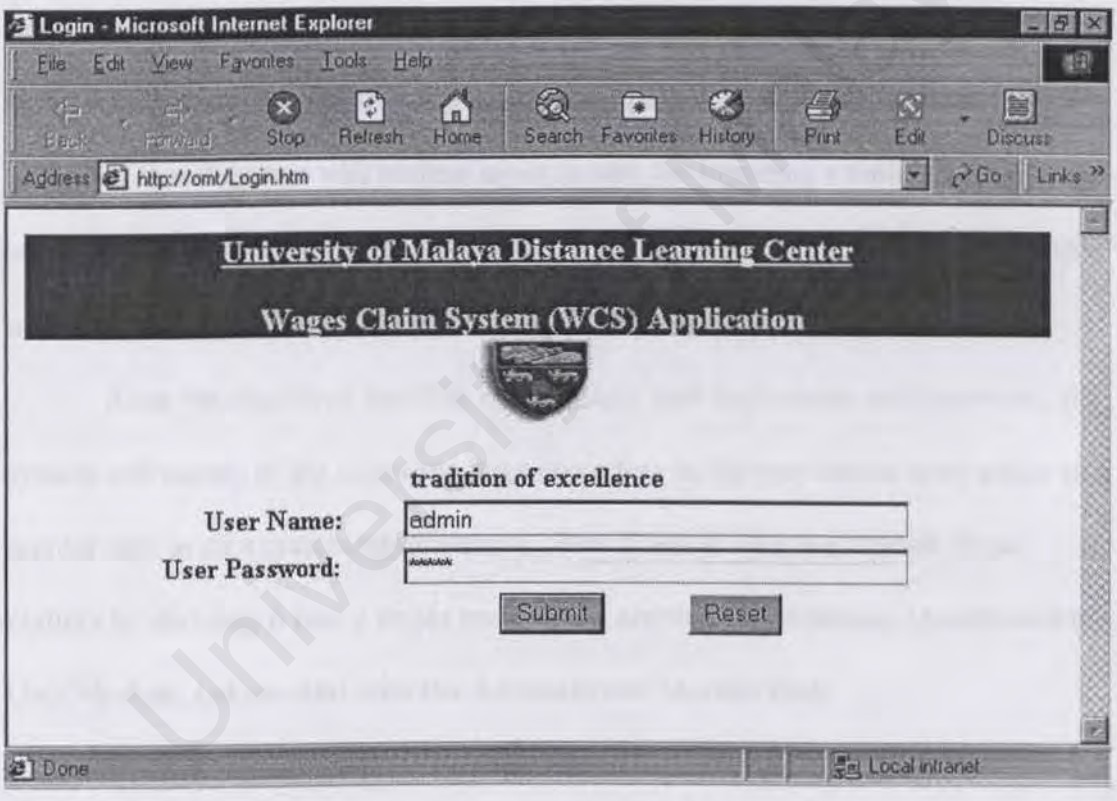
USER MANUAL GUIDES

Chapter 8: USER MANUAL GUIDES

Initially, WCS consists of 2 major Modules, which are the User Module, and the Administrator Module. Eventually, the subsequent functional modules are being developed according to the user and administrator scope of functionalities.

Users needed to enter the URL of http://omt/Login.htm in order to access and login into the UMPJJ WCS(Wages Claims System) locally.

8.1 WCS First Page : User Login Page



User is required to enter the respective individual user login name and the user login password in order to access to the UMPJJ WCS. However, user is required to register himself or herself first to the UMPJJ office before they can have access to the WCS system. The administrator in UMPJJ will have to register and enter the

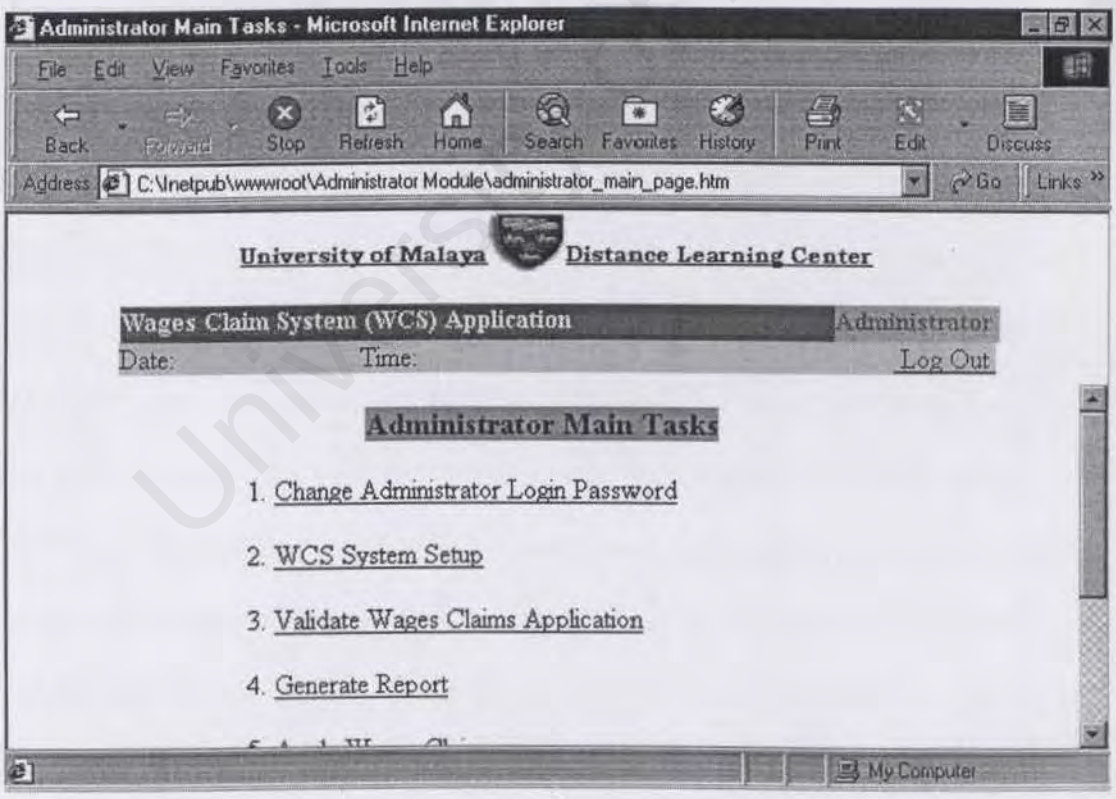
users particulars into the WCS System through User Setup. Users must provide their all required personal particulars, user login name and user login password first to administrator in order to register them in the WCS. The UMPJJ administrator will assign a respective user access level according to the user scope of functionalities of using this WCS system. User can only be assigned either as a regular user or the system administrator. Once the user is registered, user can change their respective personal particulars including their user login password as well in order to prohibit unnecessary intruder to use their login password to access to the WCS without their acknowledgement. Invalid user login name and password will prohibit user to access to the WCS and system will request again to user for inputting a valid and registered user login name and password. Otherwise, WCS is not accessible to the unregistered user.

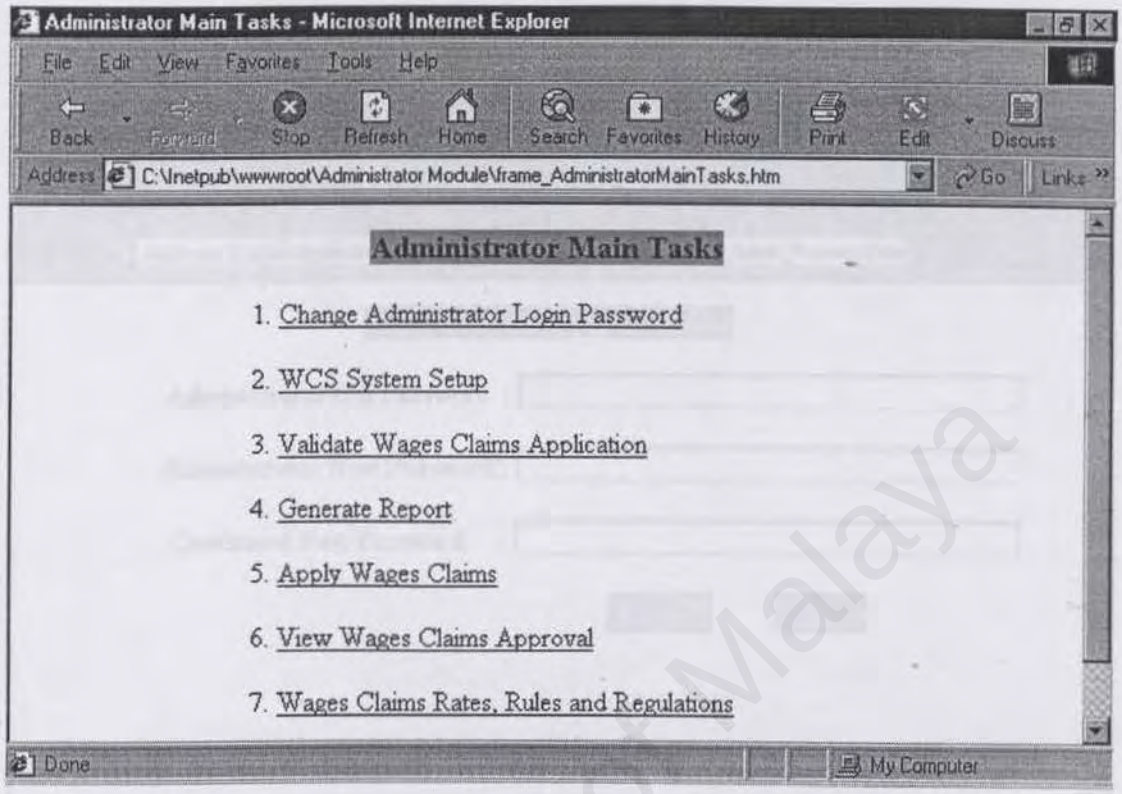
After the registered user had entered their user login name and password, the system will access to the following page according to the user access level either as a regular user or as a system administrator. Here, I would like to elaborate these matters by dividing it into 2 major parts which are the Administrator Module and the User Module. Let me start with the Administrator Module first.

8.2 Administrator Page : Administrator Module

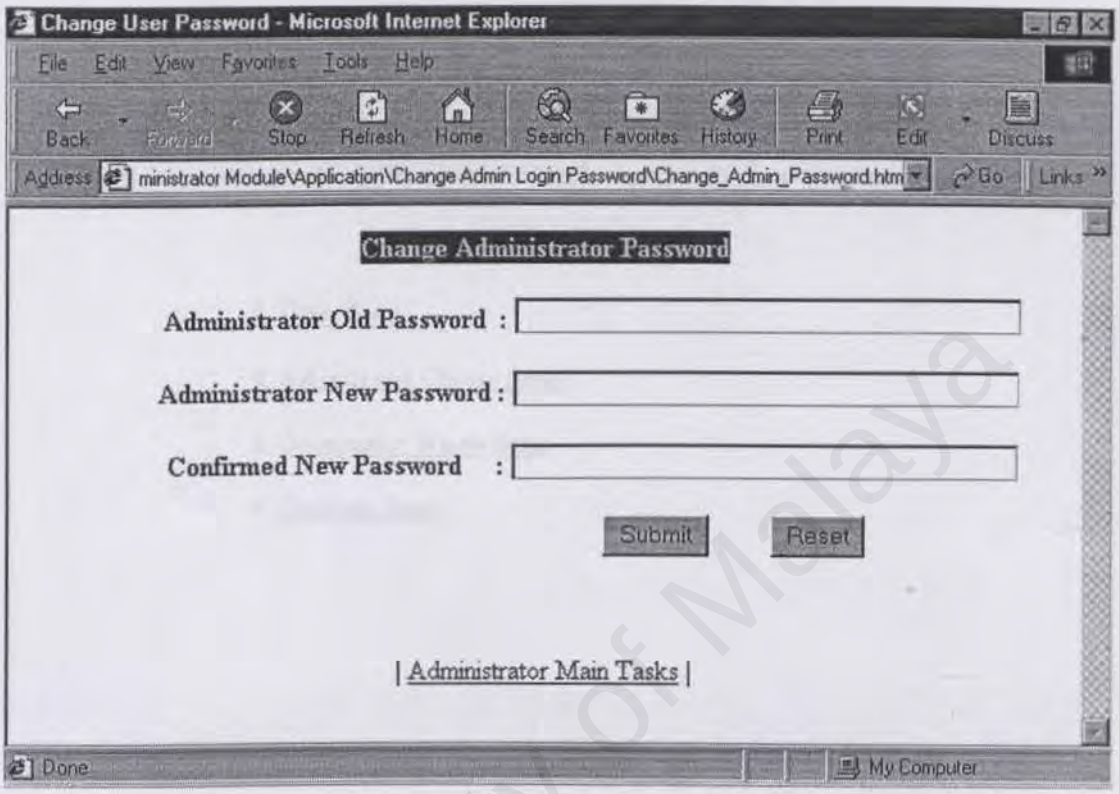
There are only 7 main function sub-modules in Administrator Module such as below:-

1. Change Administrator Login Password
2. WCS System Setup
3. Validate Wages Claims Application
4. Generate Report
5. Apply Wages Claims
6. View Wages Claims Approval
7. Wages Claims Rates, Rules and Regulations



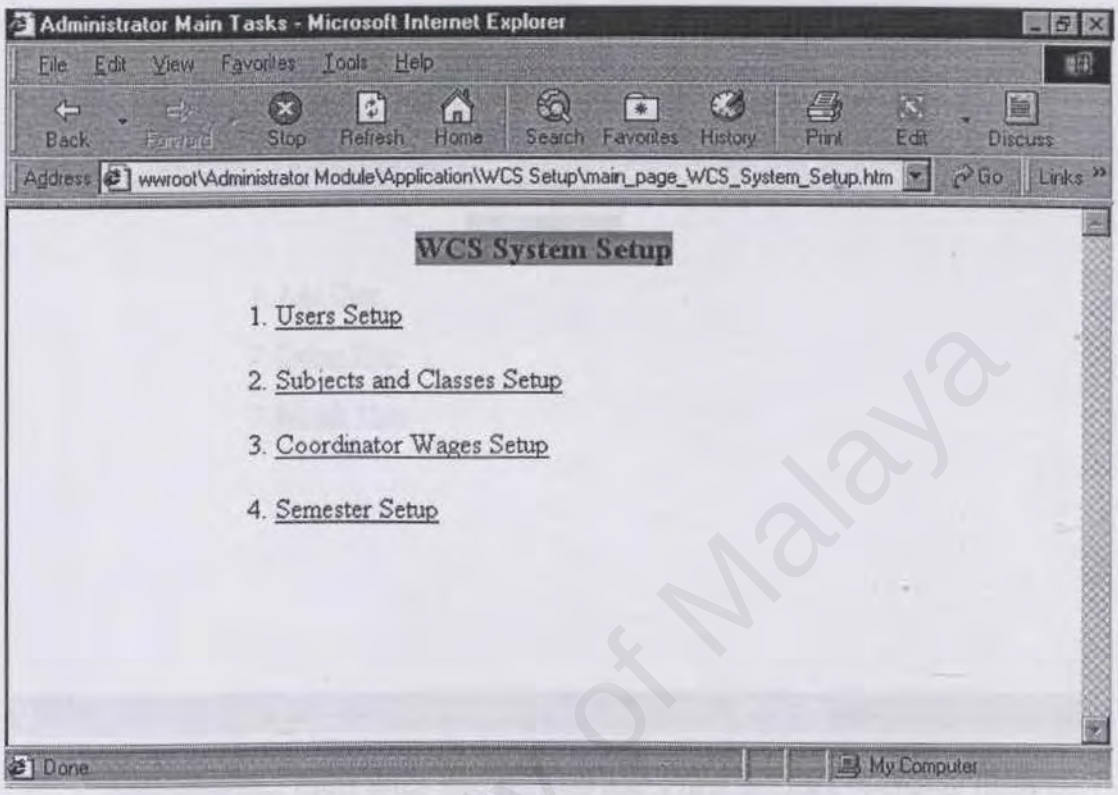


8.2.1 Change Administrator Login Password



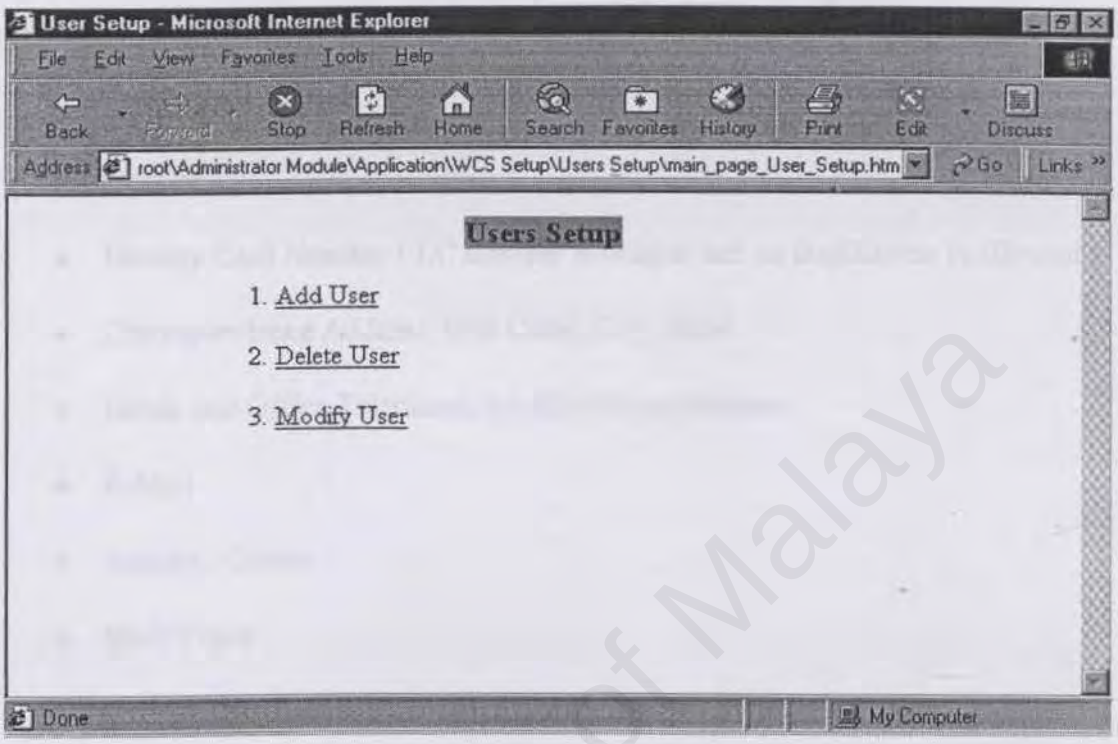
Administrator can use this function sub-module to change their login password. Administrator is required to enter their old password, new password and again confirmed new password in order to successfully change their respective password. Any differences between the new password and the confirmed new password will prohibit administrator to change their password. In other words, administrator must give exactly the same for these both passwords. Entering the old password is a must to protect the administrator's password from others of having simply change others administrator password. There is no restriction on entering any characters for password. But the password can only take the maximum of 40 characters.

8.2.2 WCS System Setup

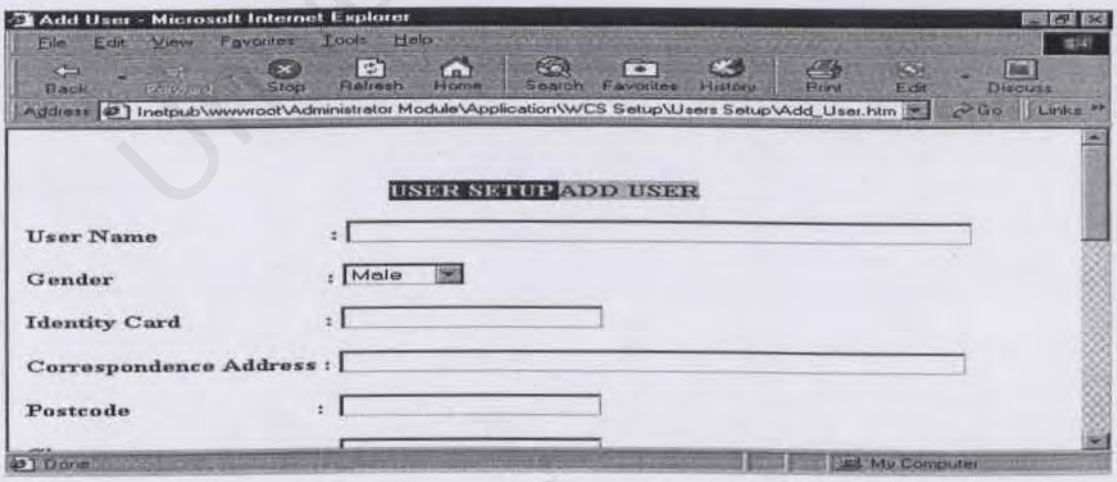


Generally, there are 4 sub-setup in WCS System Setup which are Users Setup, Subjects and Classes Setup, Coordinator Wages Setup, and Semester Setup.

8.2.2.1 Users Setup



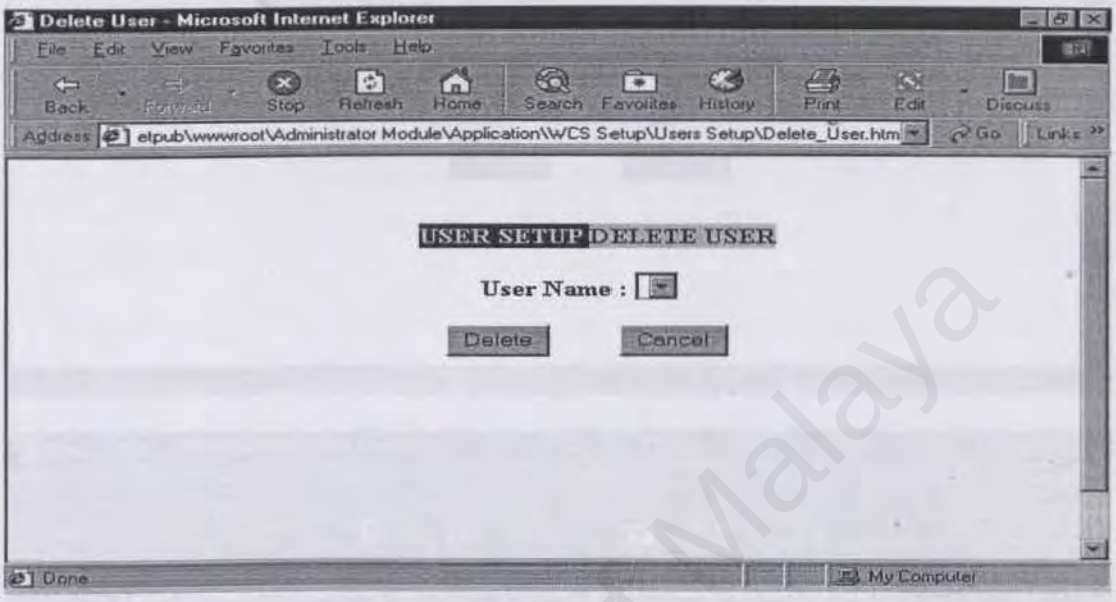
Administrator must setup and register users first in order to enable them to access to WCS system. To setup and register users, administrator must select the "Add User" to perform this task.



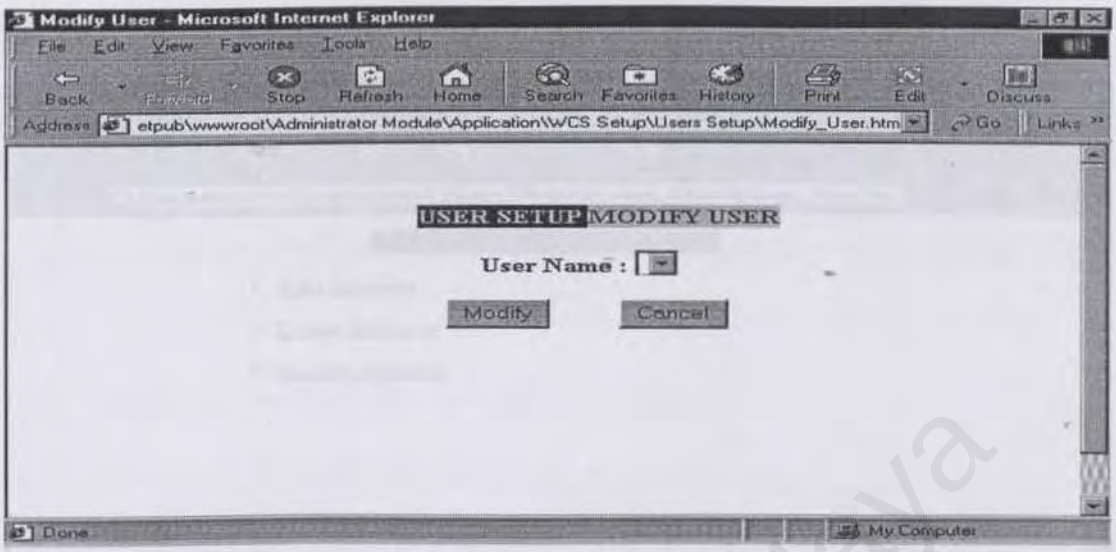
There are several essential data or information that is required from the users in order to register as valid user for WCS system. The data is required such as:-

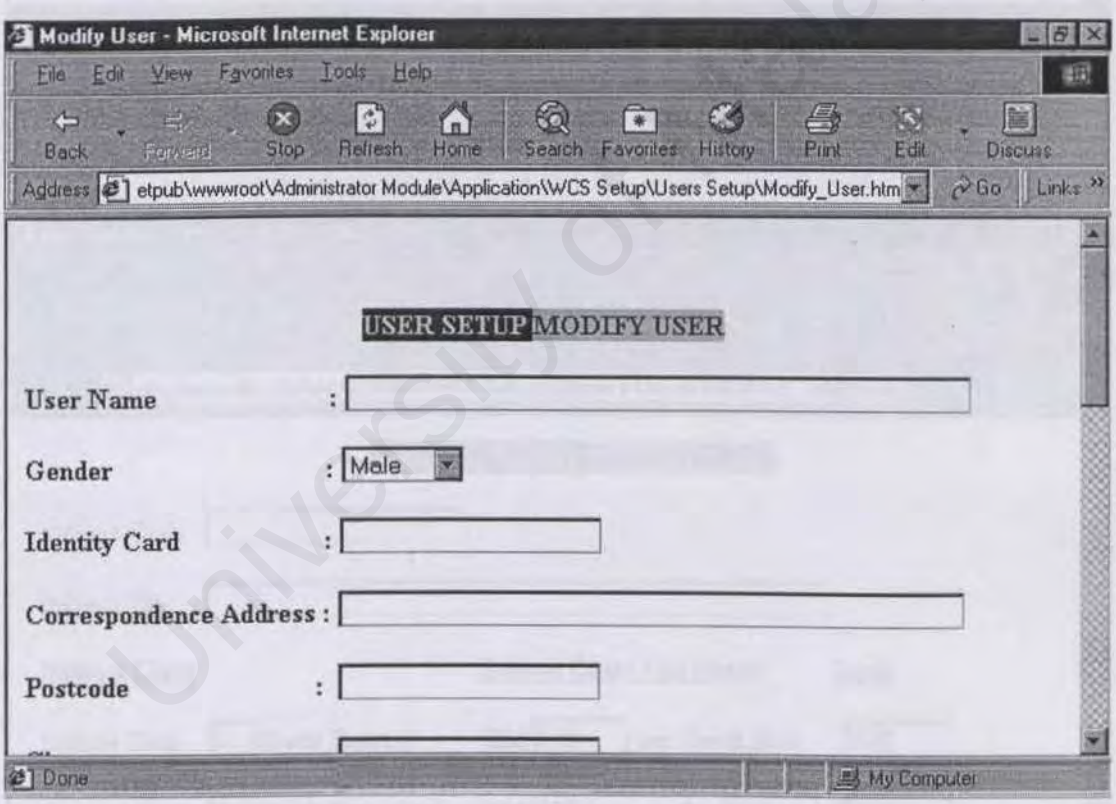
- User Name
- Gender
- Identity Card Number (I.C number is unique and no duplication is allowed)
- Correspondence Address, Post Code, City, State
- Home and Office Telephone, Mobile Phone Number
- E-Mail
- Faculty / Center
- Staff Types
- User Access Level

Administrator can select "Delete User" to delete the respective user permanently from the system to prohibit the user of accessing the WCS.

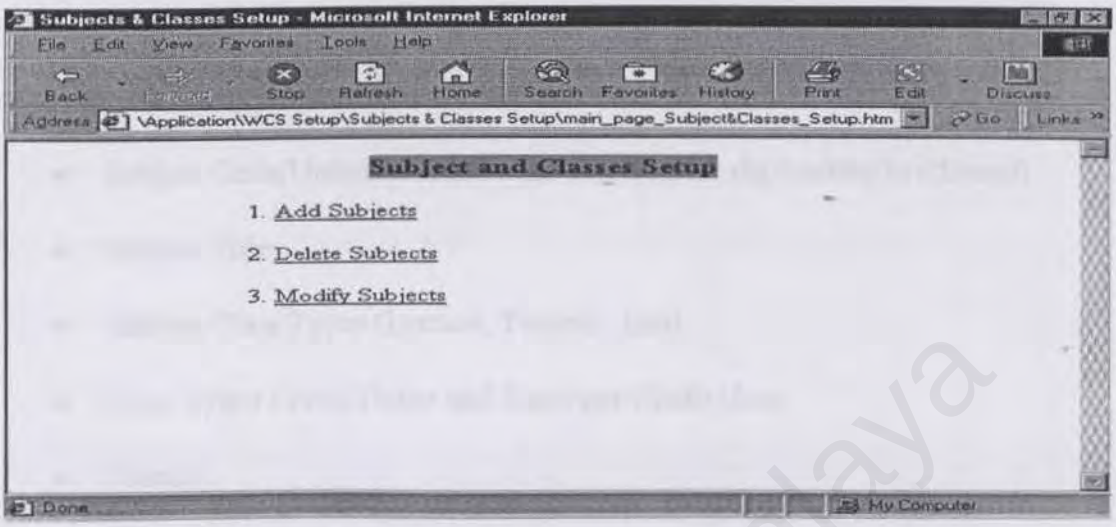


If there are any modifications or amendments on user data and information, administrator can select the "Modify User" to select which user they like to amend and modify the particulars of a user then the respective user's particulars will be shown out exactly from the original user registration form as in "Add User". Administrator can amend the required field in the user form and then save the data and information back to the database to always keep the latest updated user information.

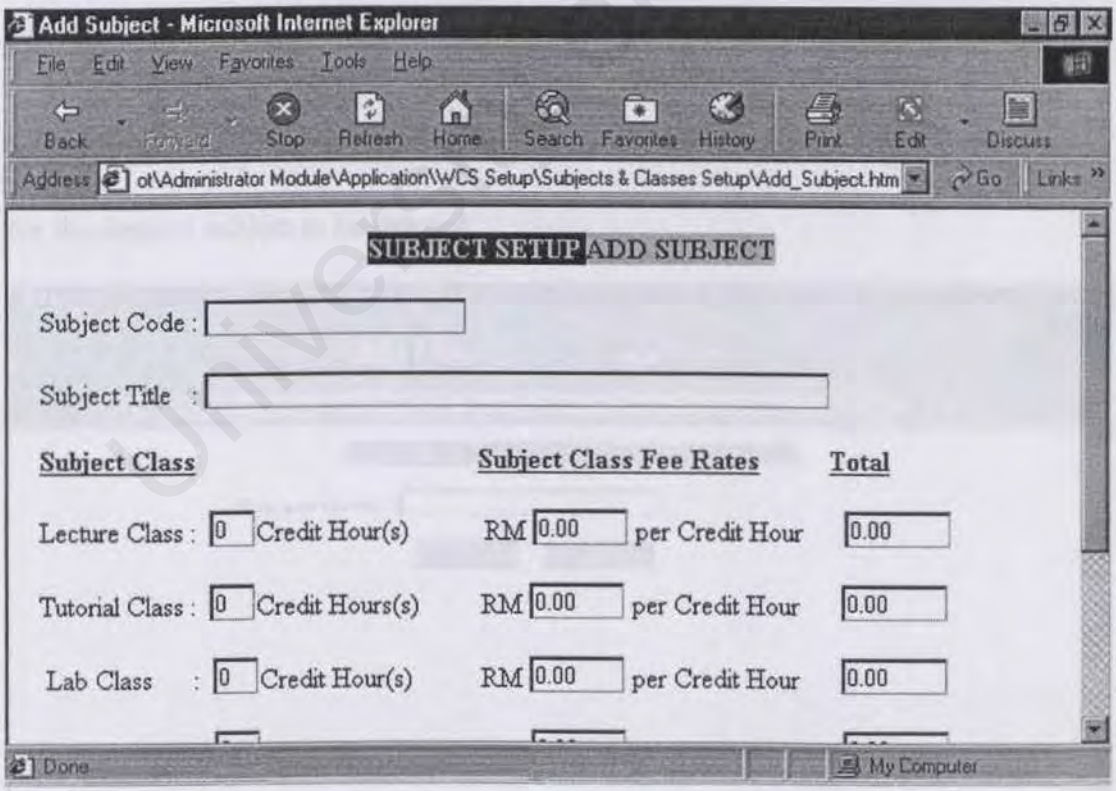




8.2.2.2 Subjects and Classes Setup



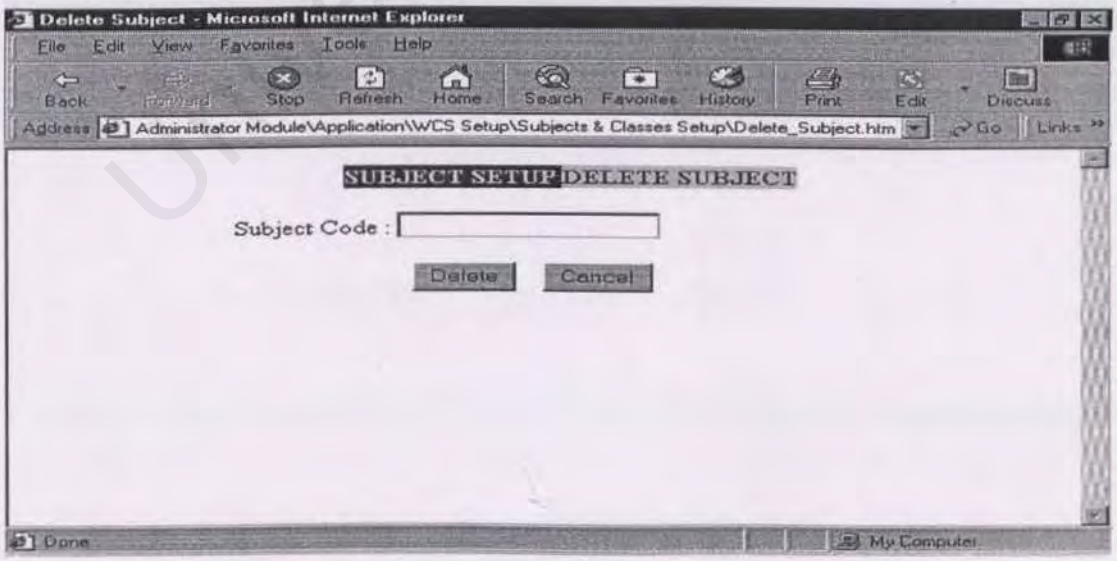
Administrator can select "Add Subject" to add the respective subject into the database of WCS.



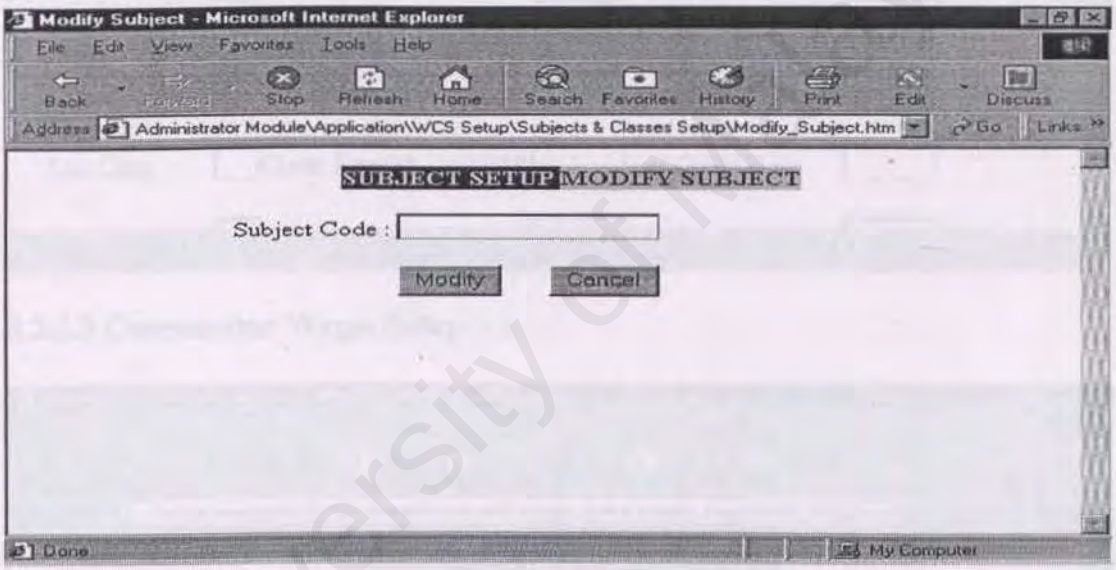
Administrator must enter sufficient data in order to register and add a subject into the database. The data required are such as :-

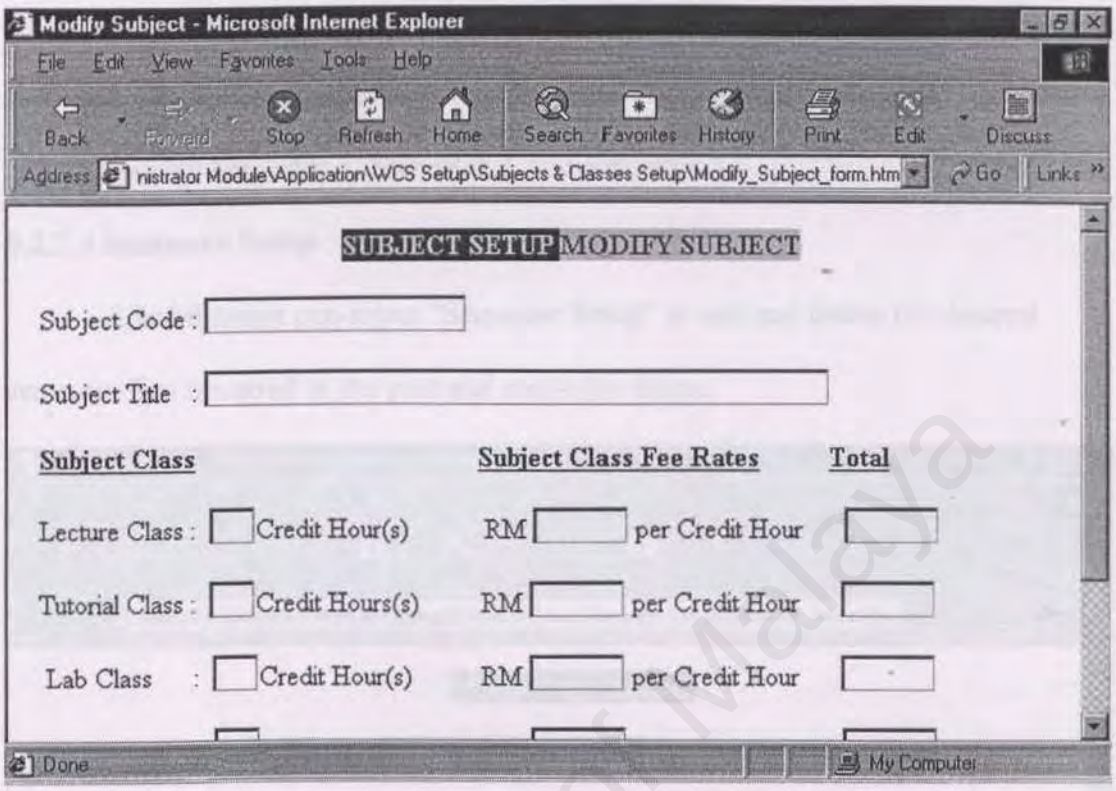
- Subject Code(Unique number code and no code duplication is allowed)
- Subject Title
- Subject Class Types (Lecture, Tutorial, Lab)
- Class Types Credit Hours and Rates per Credit Hour
- Thesis
- Industrial Training
- Rates of Marking Exam Scripts per Student

Administrator can select " Delete Subject" to delete one subject from the database in WCS permanently. Administrator needed to enter the exact subject code for the desired subject to be deleted.

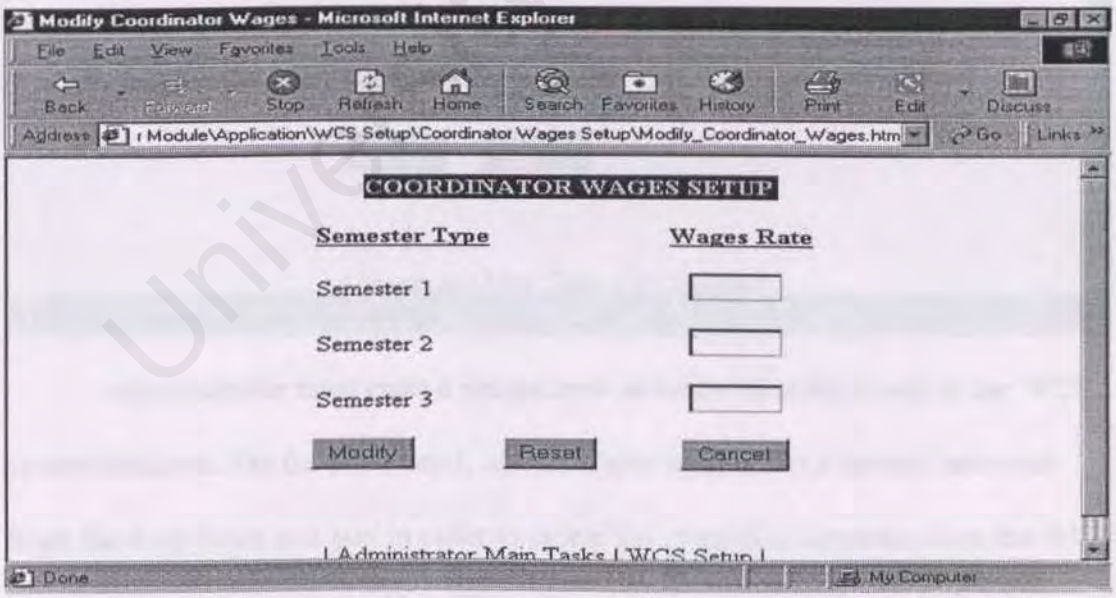


If there are any modifications or amendments on subject data and information, administrator can select the "Modify Subject" to enter the required subject code which they like to amend and modify the particulars of that subject then the respective subject's particulars will be shown out exactly from the original subject registration form as in "Add Subject". Administrator can amend the required field in the subject form and then save the data and information back to the database to always keep the latest updated subject information.





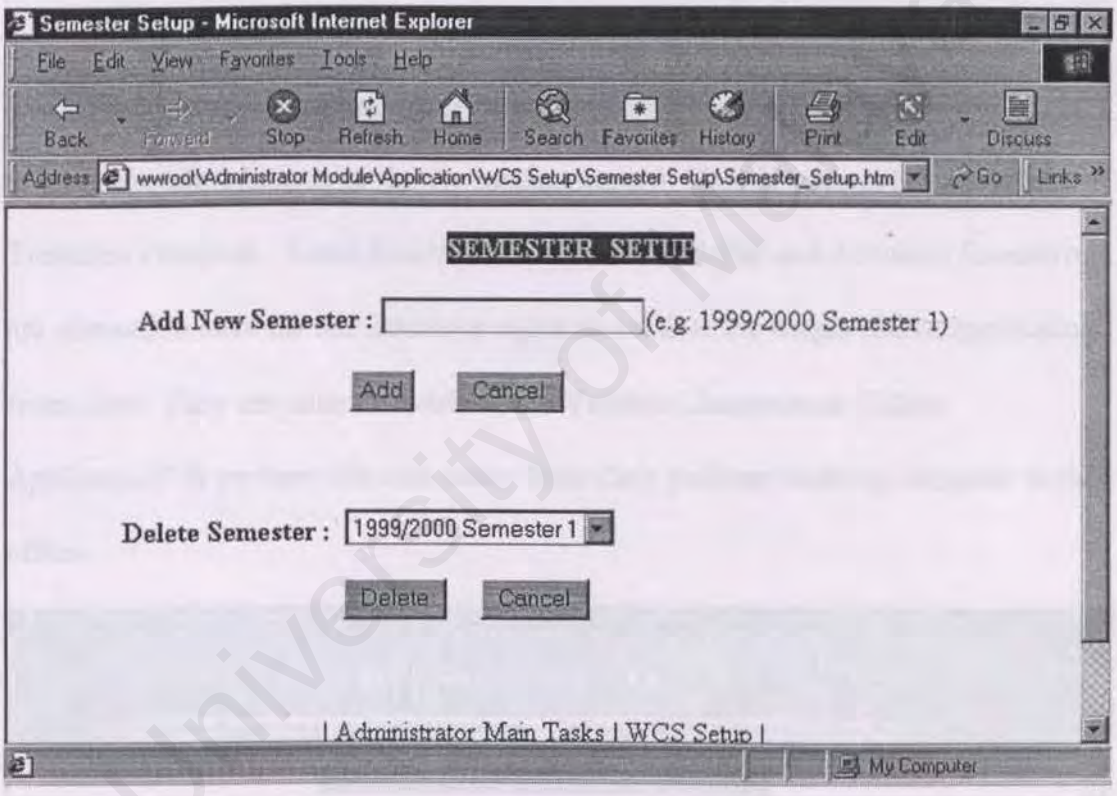
8.2.2.3 Coordinator Wages Setup



Administrator can select the " Coordinator Wages Setup" to setup and update the latest rate for the coordinator wages claims. The required data are the coordinator wages rates for Semester 1, Semester 2, and Semester 3.

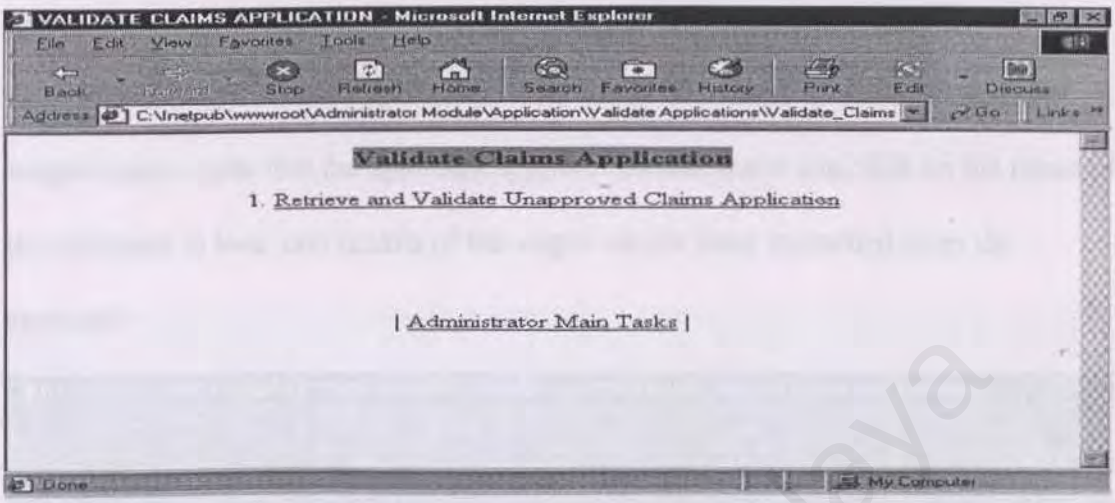
8.2.2.4 Semester Setup

Administrator can select "Semester Setup" to add and delete the desired semester that occurred in the past and create for future.

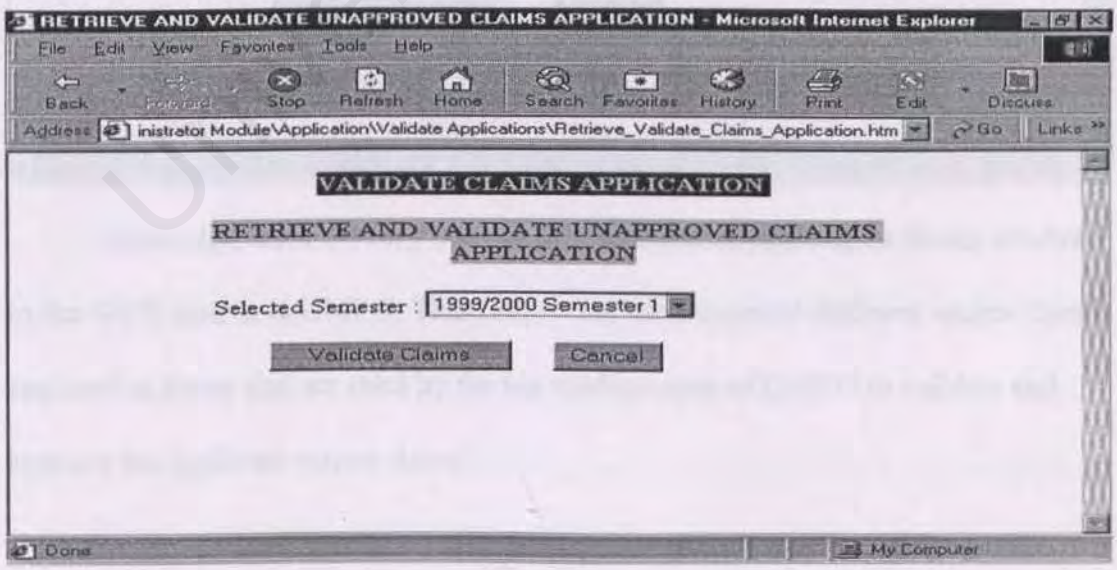


Administrator must enter a unique new semester in order to add to the WCS system database. On the other hand, administrator must select a desired semester from the drop down text box in order to delete the respective semester from the WCS system. Generally, UMPJJ office will maintain 2 years back semester in the system.

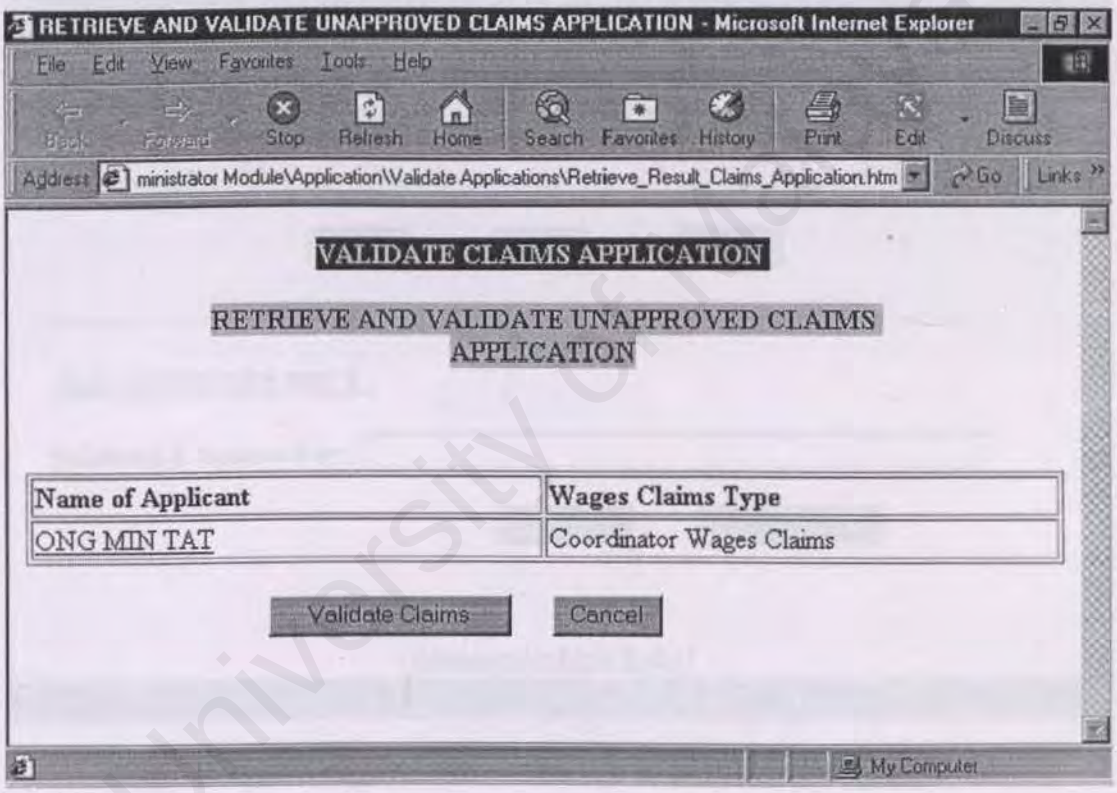
8.2.3 Validate Wages Claims Application



The administrator or the top management of UMPJJ such as the Pengarah, Timbalan Pengarah , Ketua Pendaftar, Timbalan Pendaftar and Accounts Executives are allowed to have the administrator rights to validate the wages claims application from users. They can select " Retrieve and Validate Unapproved Claims Application" to perform this task easily from their personal desktop computer in their office.



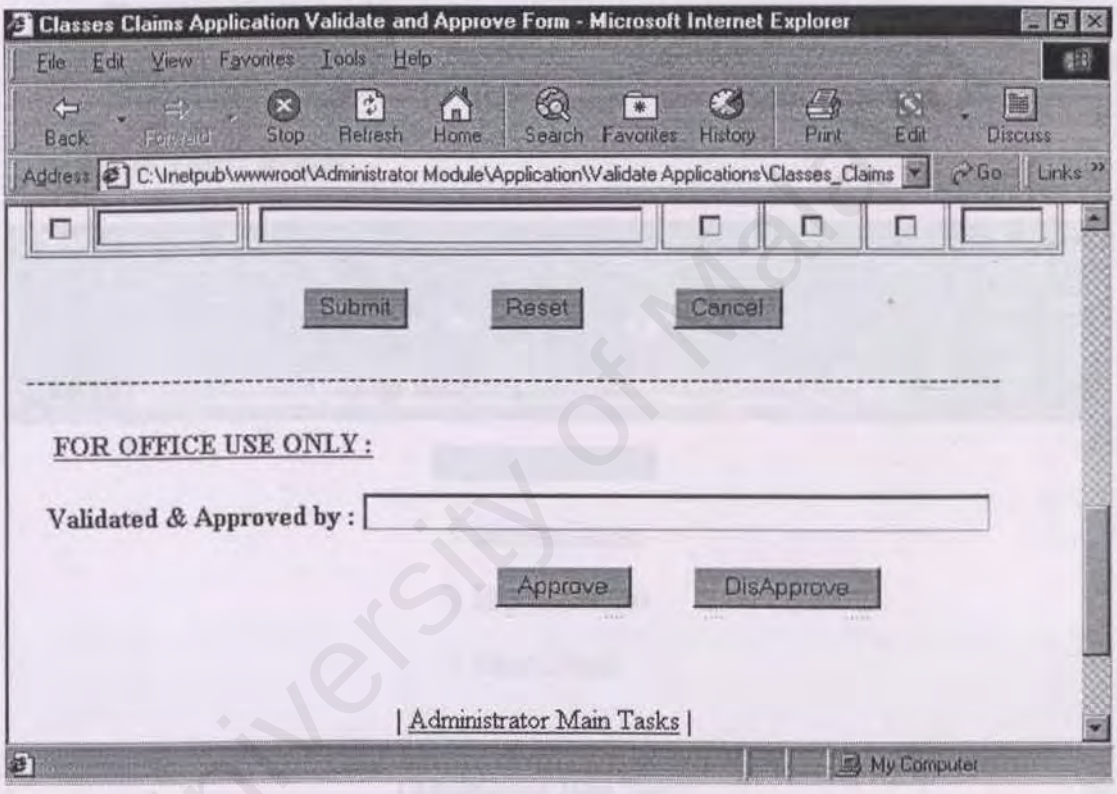
Administrator is required to select which semester in which year term they prefer to look and validate on the wages claims applications. Below is a list of unapproved wages claims application. It shows out the name of applicant and the wages claims types that the applicant applied. Administrator can click on the name of the applicant to look into details of the wages claims form submitted from the applicant.



Generally, there are only 3 types of wages claims application forms involved in the WCS system in UMPJJ. Thus, below are the 3 types of different wages claims application forms that are used by the top management of UMPJJ to validate and approve the applicant wages claims.

- **Subject, Classes, Exam Scripts Claims**
- **Thesis and Industrial Training Claims**
- **Coordinator Claims**

However, these 3 forms are having the same portion of validate and approve statements added at the very bottom of each type of application form like below:-



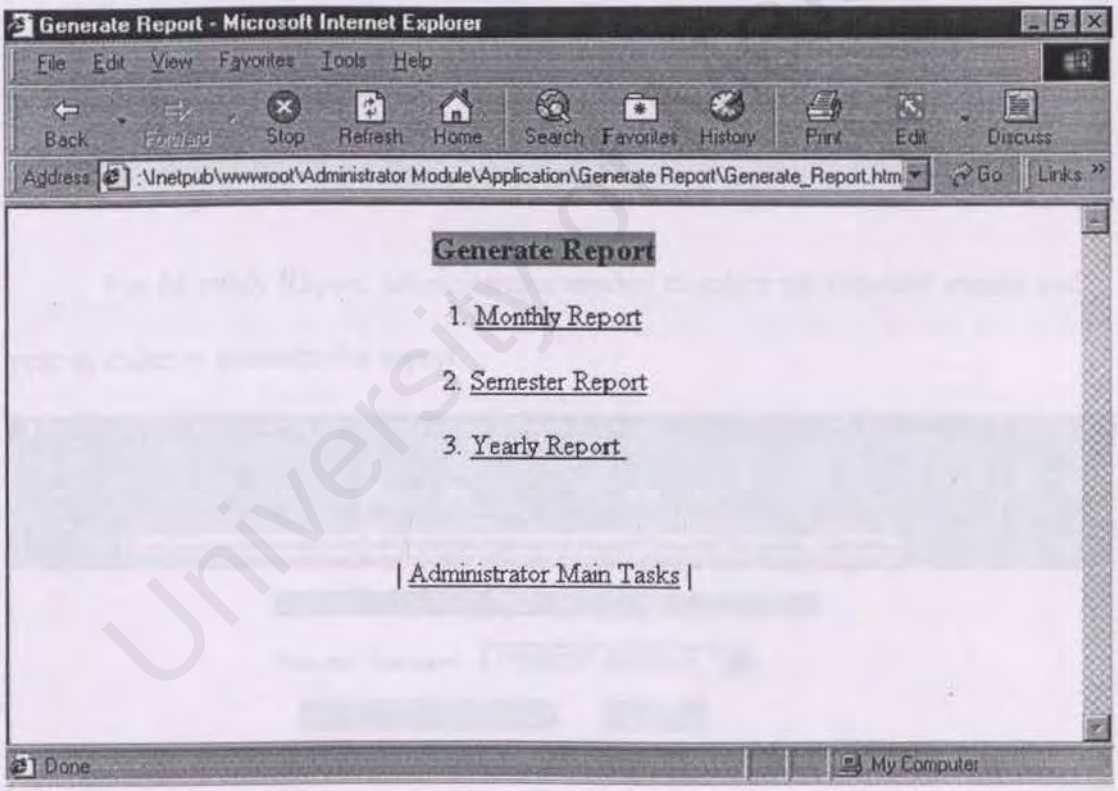
After the top management have checked and validated wages claims application through the documents and receipts from applicant, if everything is in the correct order and the people in charged has to enter their name as he or she is the one who validate and finally give the approval to this application. Otherwise, the people in charged also needed to enter their name to give the disapproval to the application.

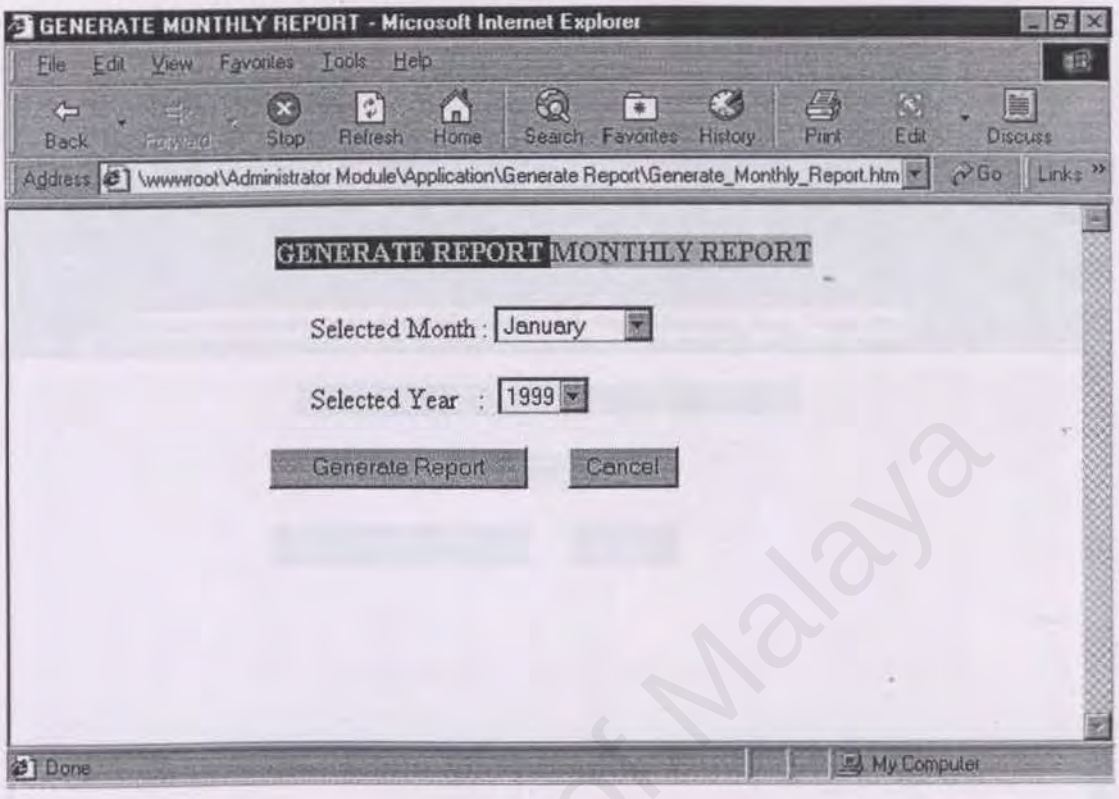
Then the submitted approved and disapproved application would update to the respective database and applicant can view the final results from the WCS system.

8.2.4 Generate Report

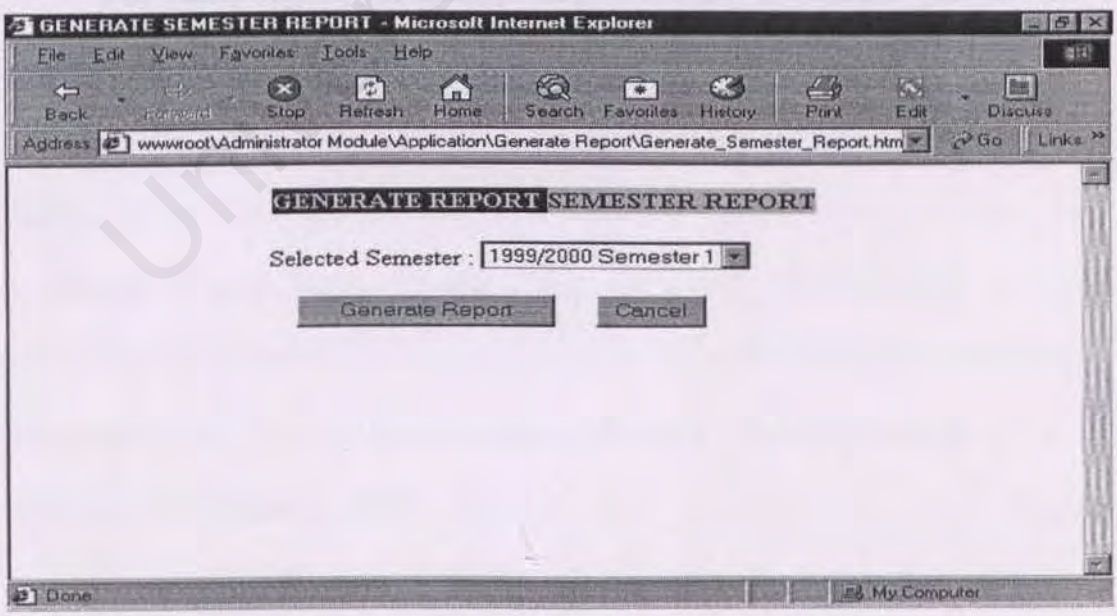
Top management of UMPJJ can generate 3 major types of report from WCS such as :-

- The Monthly Report
- The Semester Report
- The Yearly Report

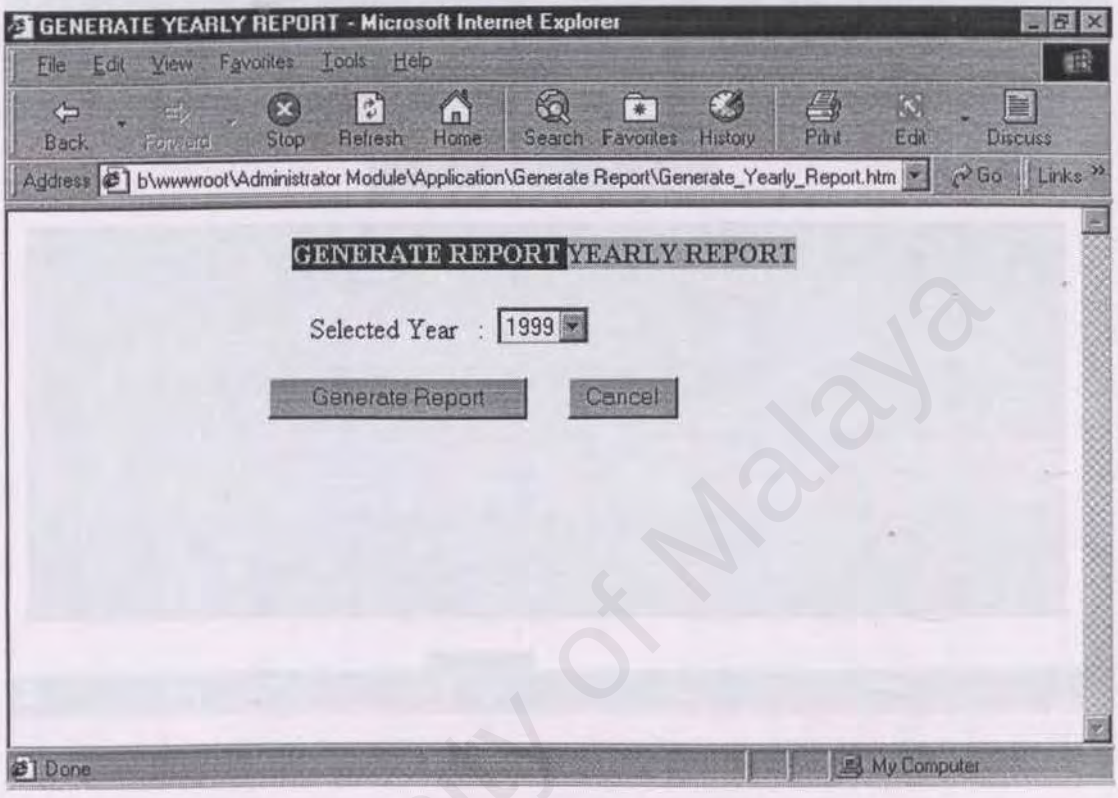




For Monthly Report, administrator needed to select the required month and year in order to generate the report.

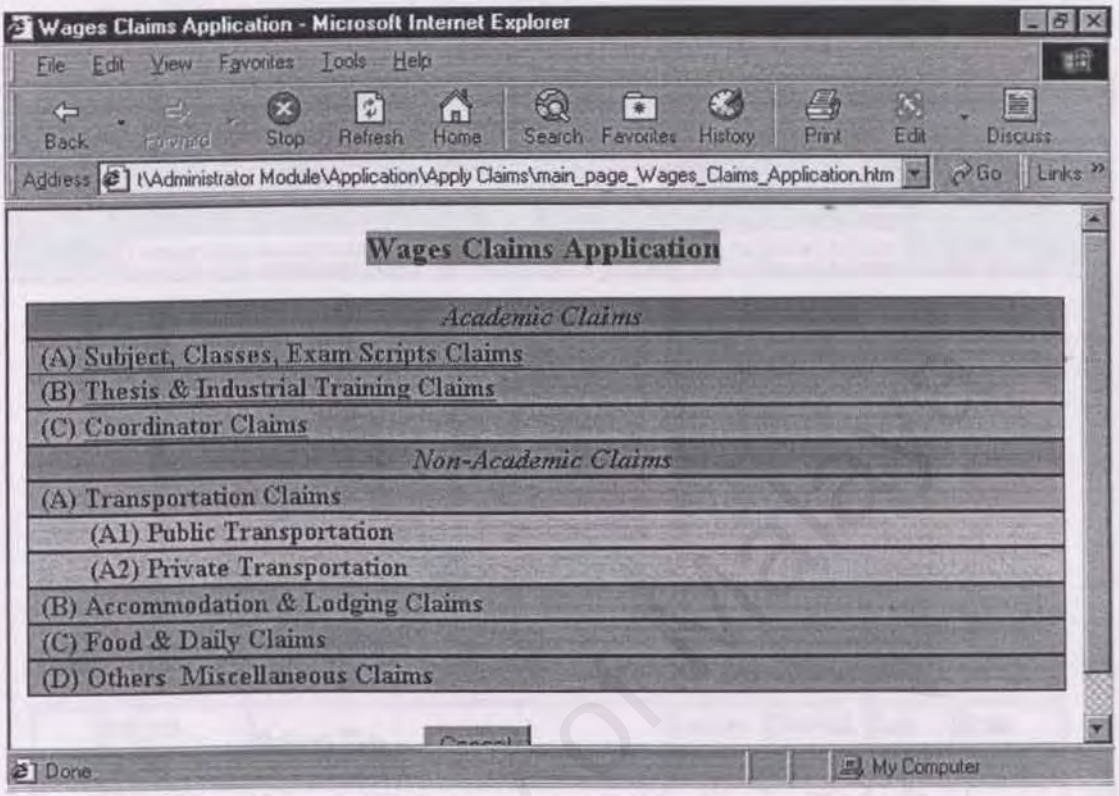


For Semester Report, administrator needed to select the required semester in order to generate the report.



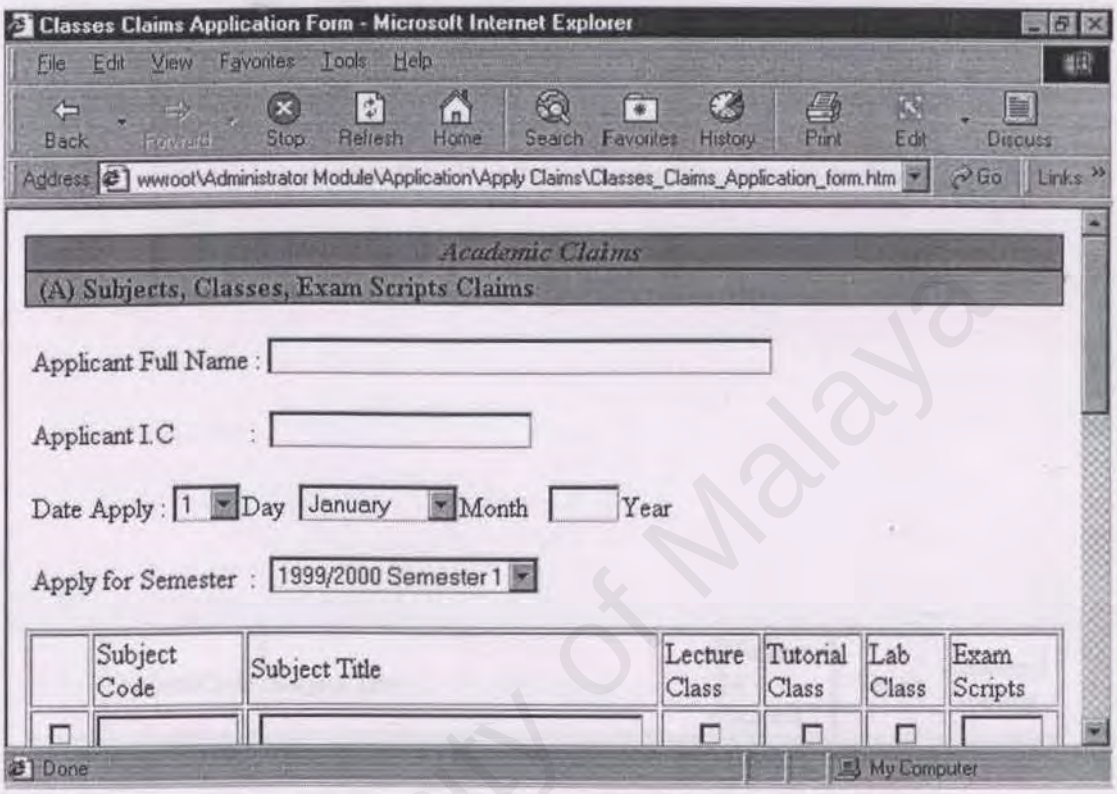
For Yearly Report, administrator needed to select the required year in order to generate the report

8.2.5 Apply Wages Claims



Initially, UMPJJ WCS covered 2 major categories of wages claims application as in the above figure such as the Academic Claims and Non-Academic Claims. However, due to the time and resources constraint in this thesis, I only managed to cover only the Academic Claims Application such as the Subjects, Classes, Exam Scripts Claims, Thesis and Industrial Training Claims, and the Coordinator Wages Claims. In future, I hope and wish this thesis can still carry on to cover the Non-Academic Claims such as Transportation (Public and Private) Claims, Accommodations and Lodging Claims, Food and Daily Claims, and Other Miscellaneous Claims as well.

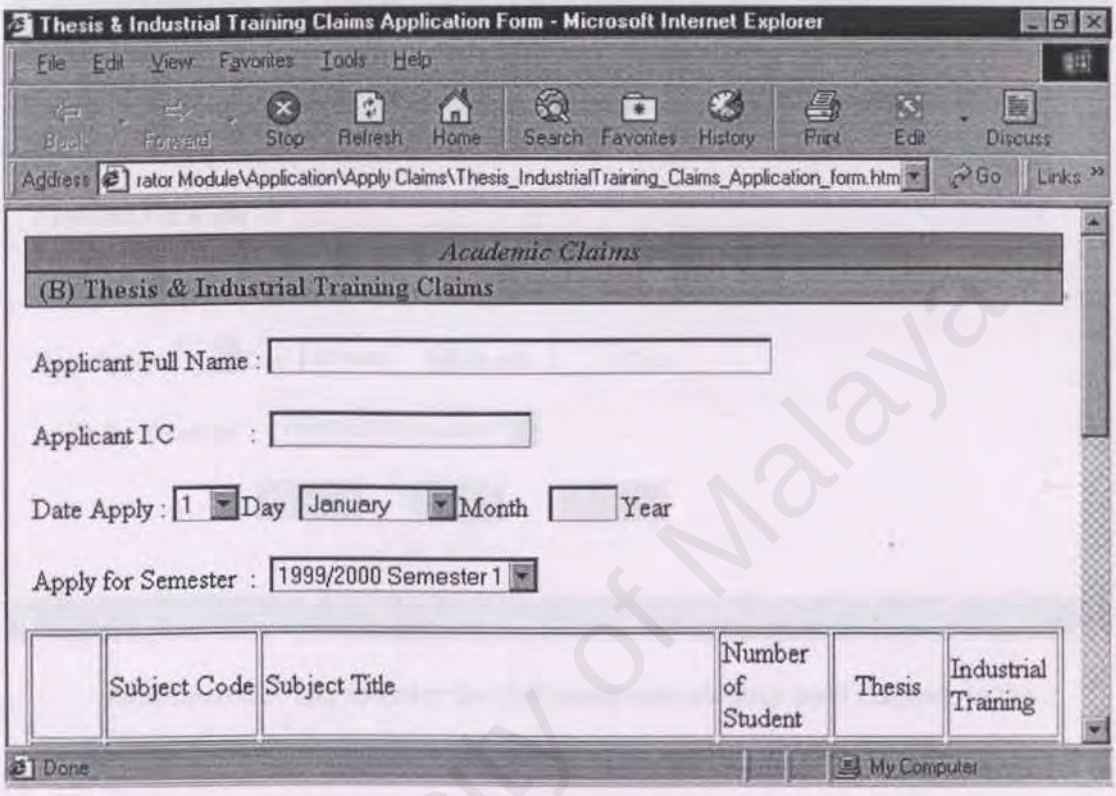
Administrator also can make the applications to these 3 types of claims as well.



Administrator has to enter the full name and identity card number in the application form. Then, select the respective date and semester for this application to be taken place. There is a table which applicant must enter the correct subject code and subject title in the table. Besides, applicant must determine the regarded subject class types (Lecture, Tutorial, Lab) and the amount of exam scripts that the applicant has been involved in for the respective semester final exam in UM campus.

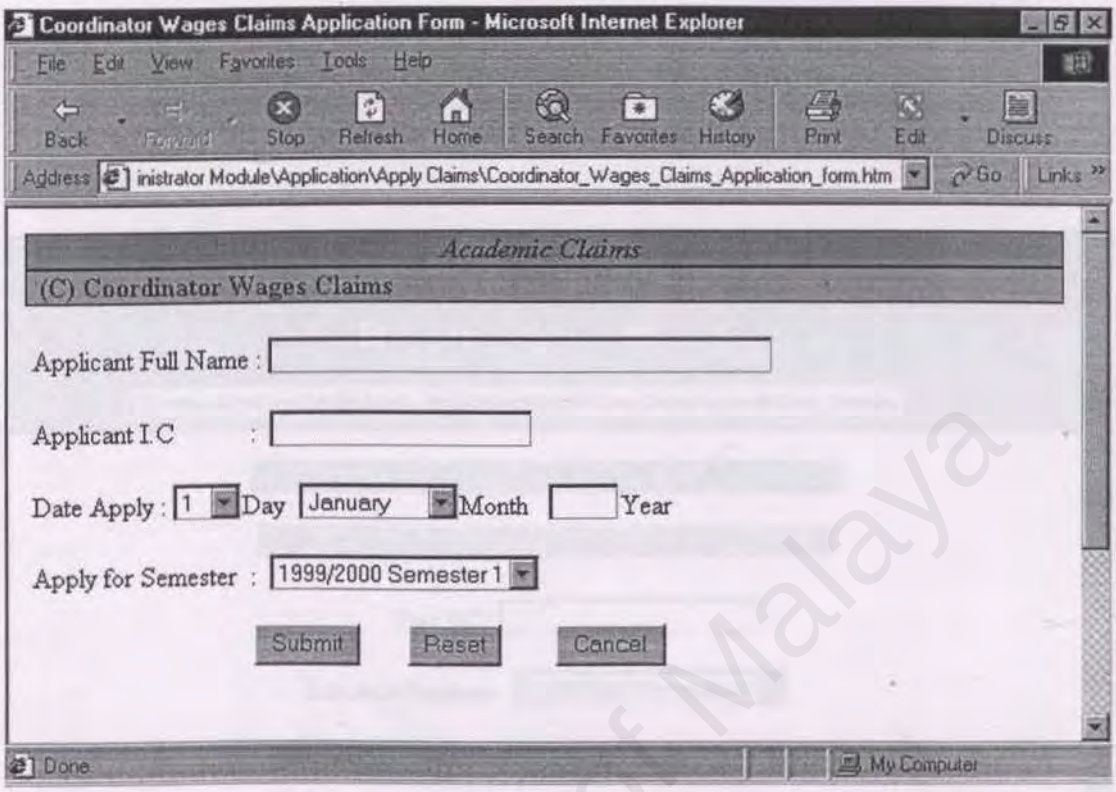
Before the application form is submitted, please make sure that the subject "checked box" is checked for the particular subject otherwise the entered data is not

submitted completely or correctly as applicant desired. Please double check the "Checked Box" again before submit the application form.



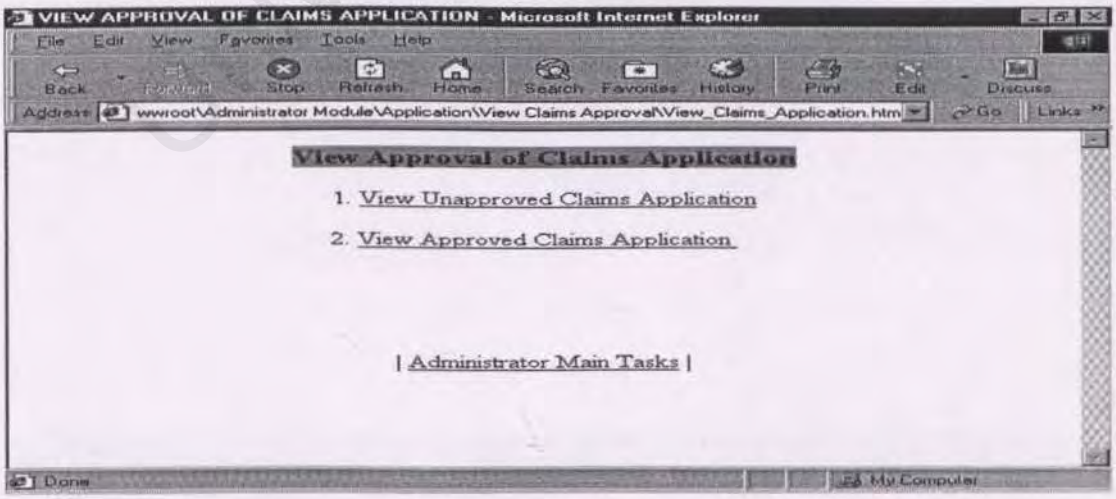
Administrator has to enter the full name and identity card number in the application form. Then, select the respective date and semester for this application to be taken place. There is a table which applicant must enter the correct subject code and subject title in the table. Besides, applicant must determine the regarded subject types (Thesis or Industrial Training).

Before the application form is submitted, please make sure that the subject "checked box" is checked for the particular subject otherwise the entered data is not submitted completely or correctly as applicant desired. Please double check the "Checked Box" again before submit the application form.

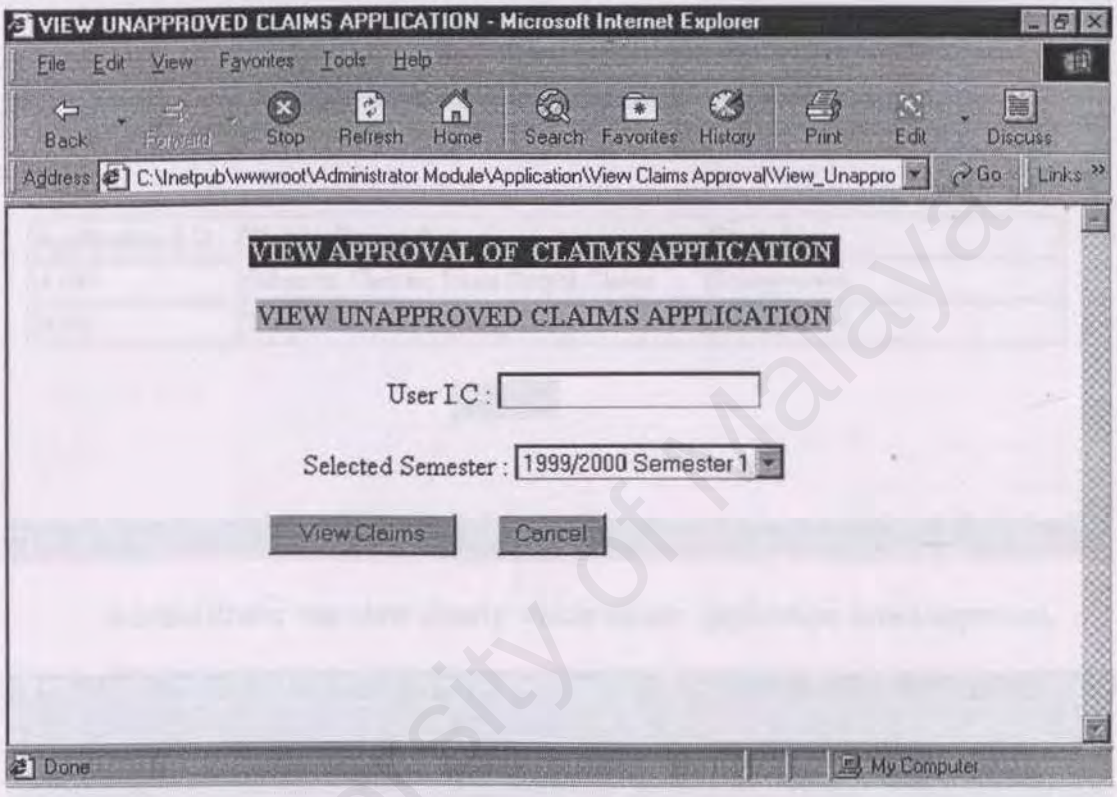


Administrator has to enter the full name and identity card number in the application form. Then, select the respective date and semester for this application to be taken place.

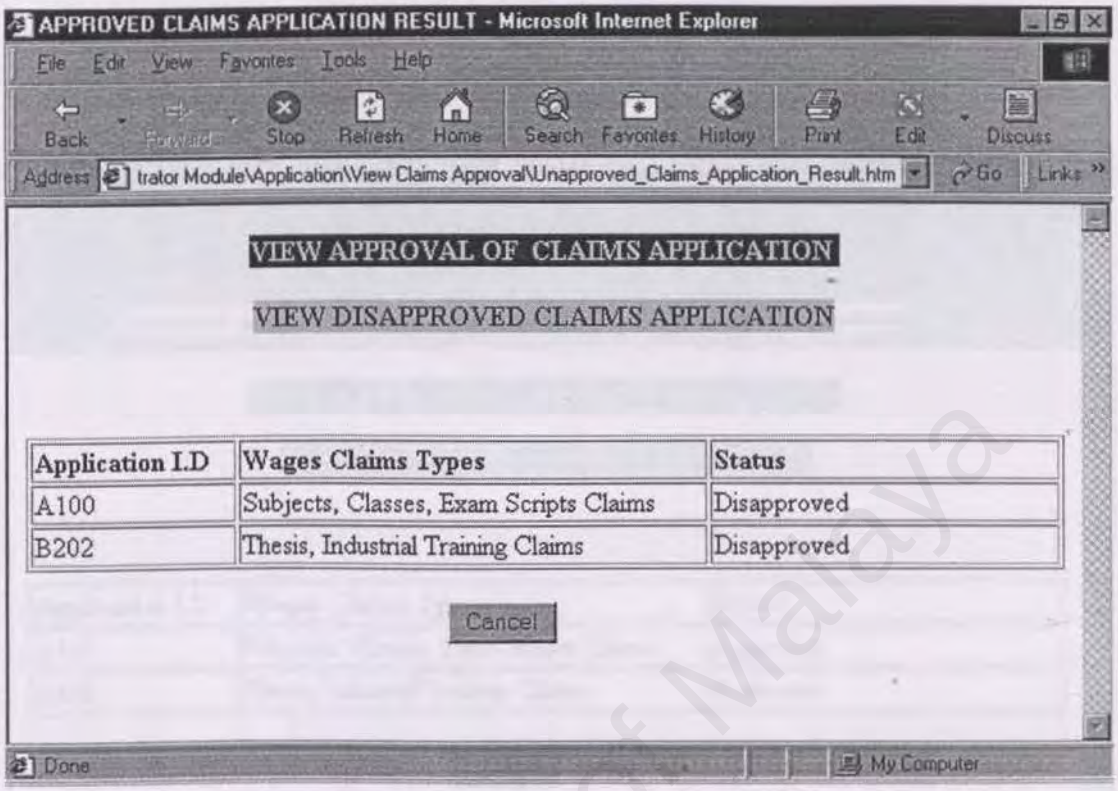
8.2.6 View Wages Claims Approval



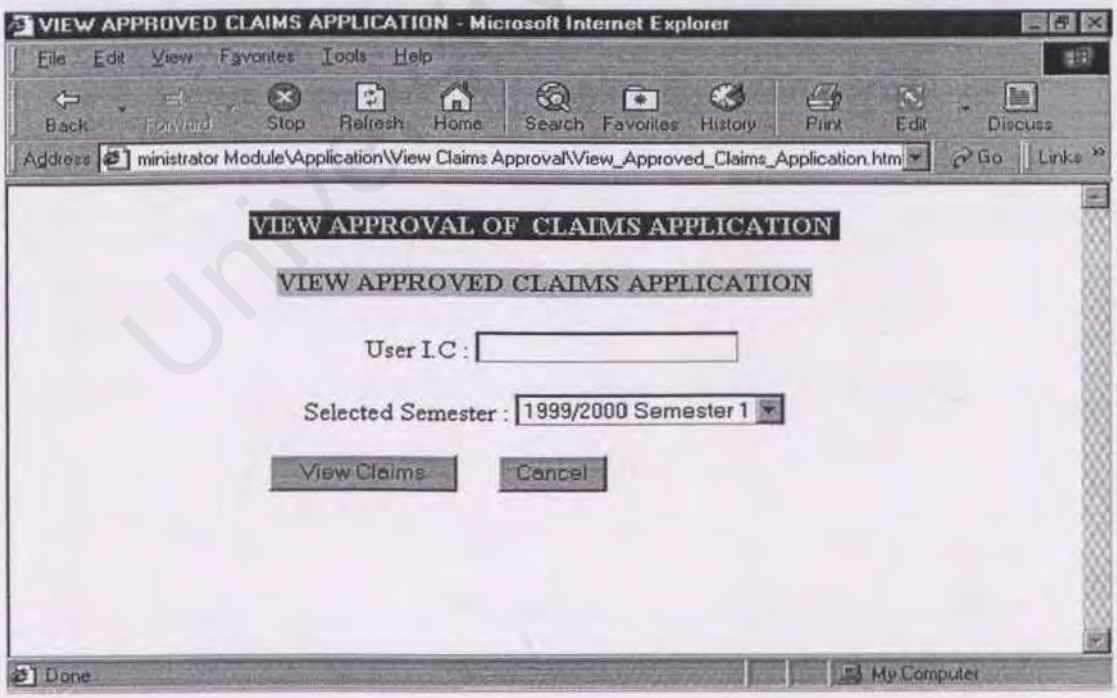
Administrator has 2 options in viewing the results of their claims applications such as viewing the disapproved claims application and the approved claims applications.



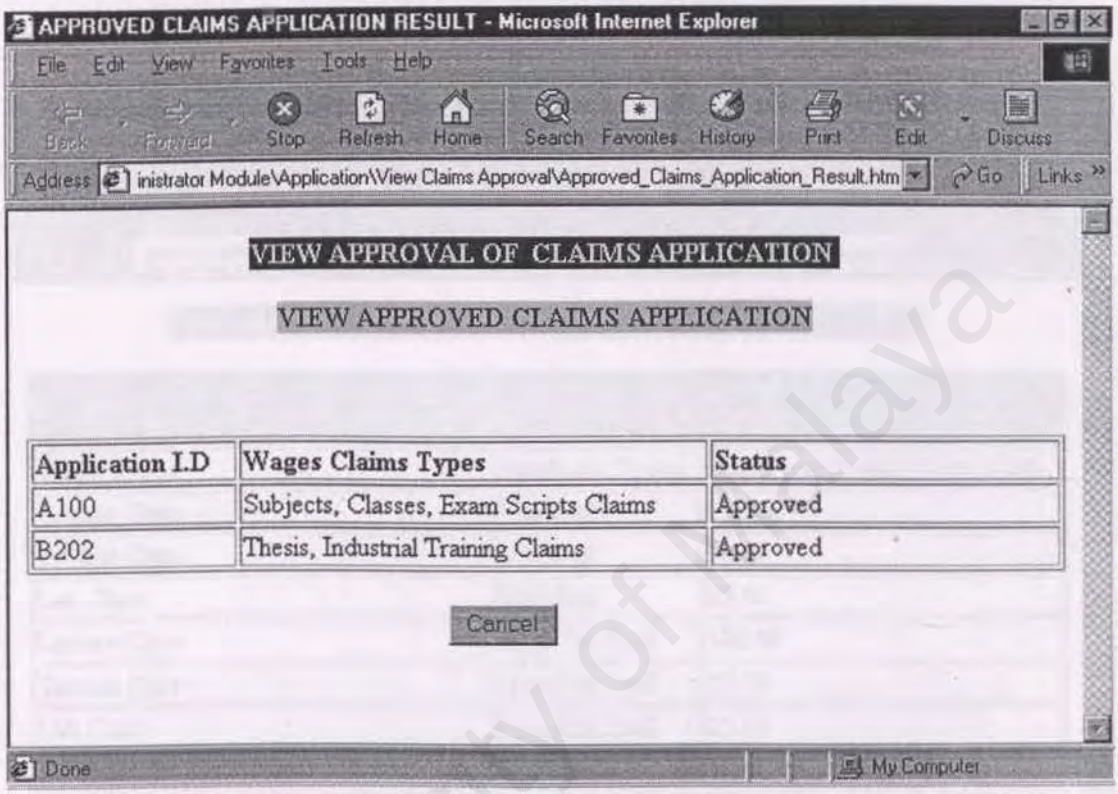
Administrator must enter individual identity card number and select the respective semester of their claims applications took place during their submission.



Administrator can view clearly which claims application is not approved.



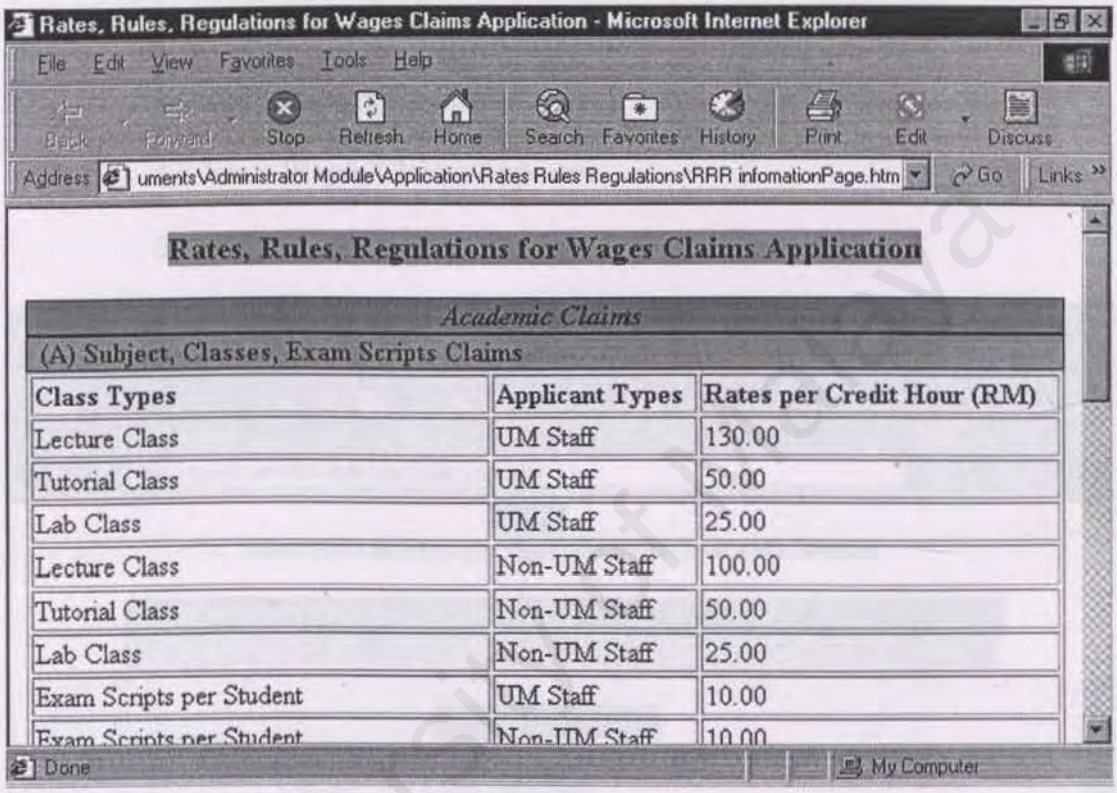
Administrator must enter individual identity card number and select the respective semester of their claims applications took place during their submission.



Administrator can view clearly which claims application is approved.

8.2.7 Wages Claims Rates, Rules, Regulations

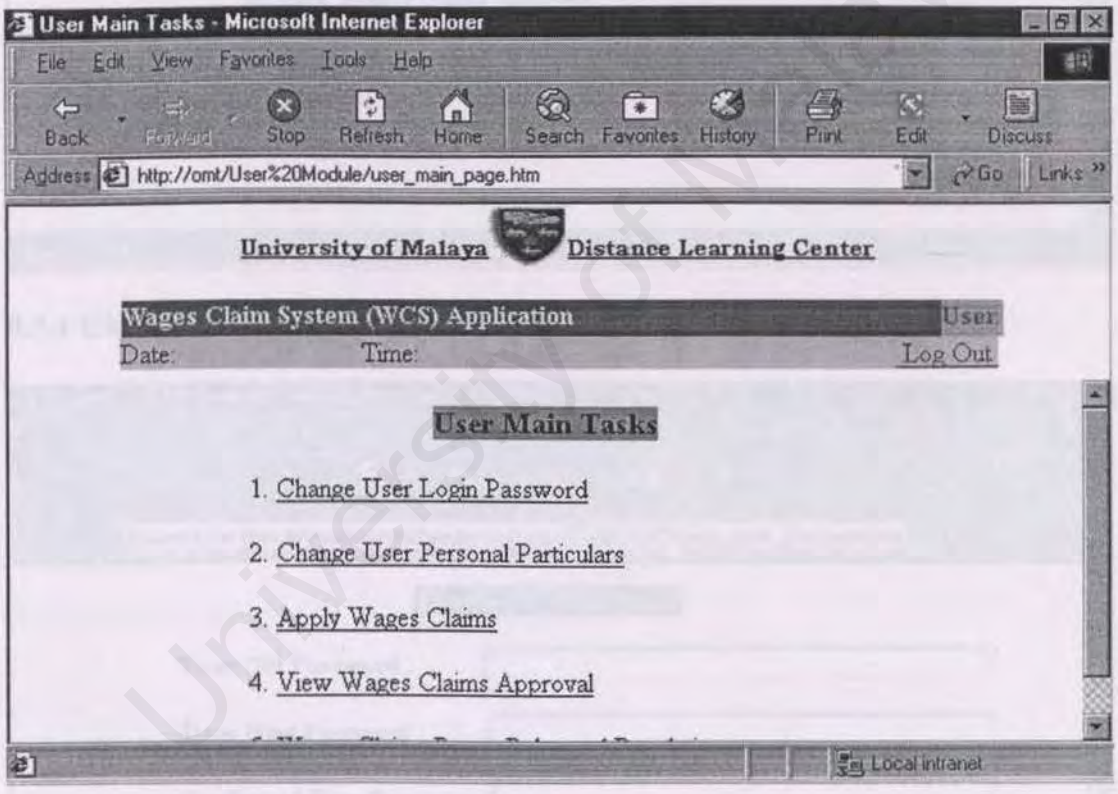
Administrator can view the current rates, rules, and regulations regarding the wages claims application in UMPJJ.

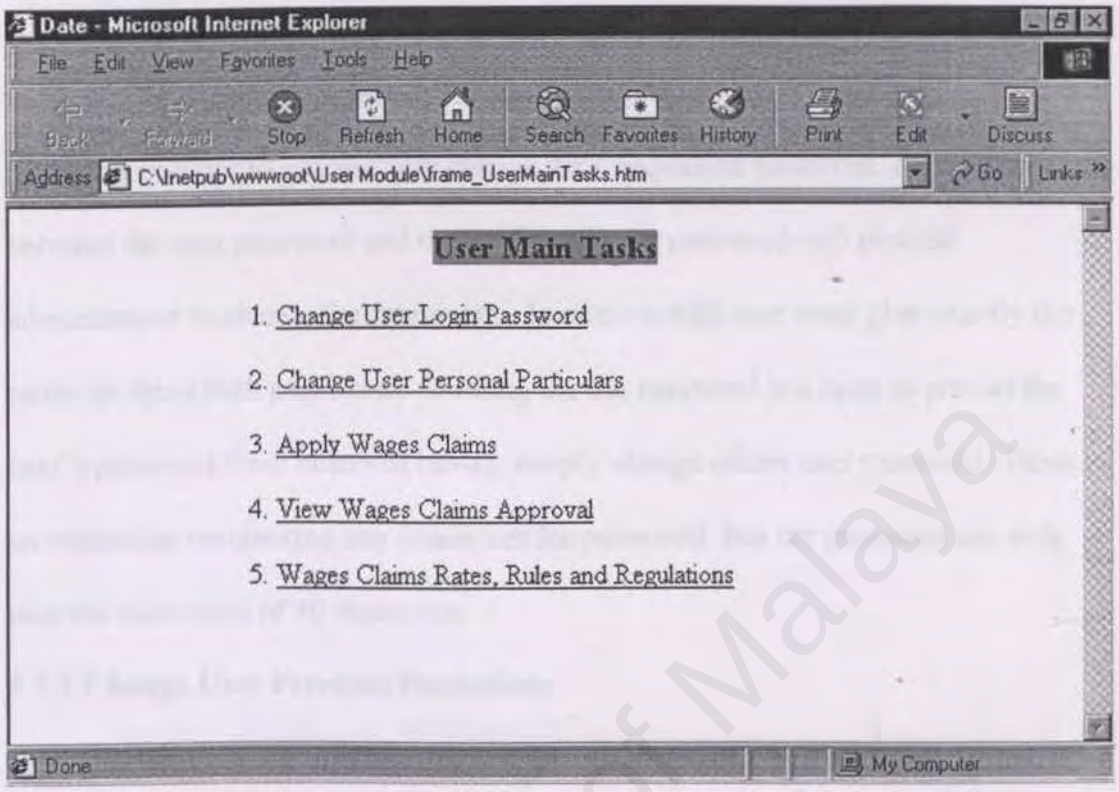


8.3 User Page : User Module

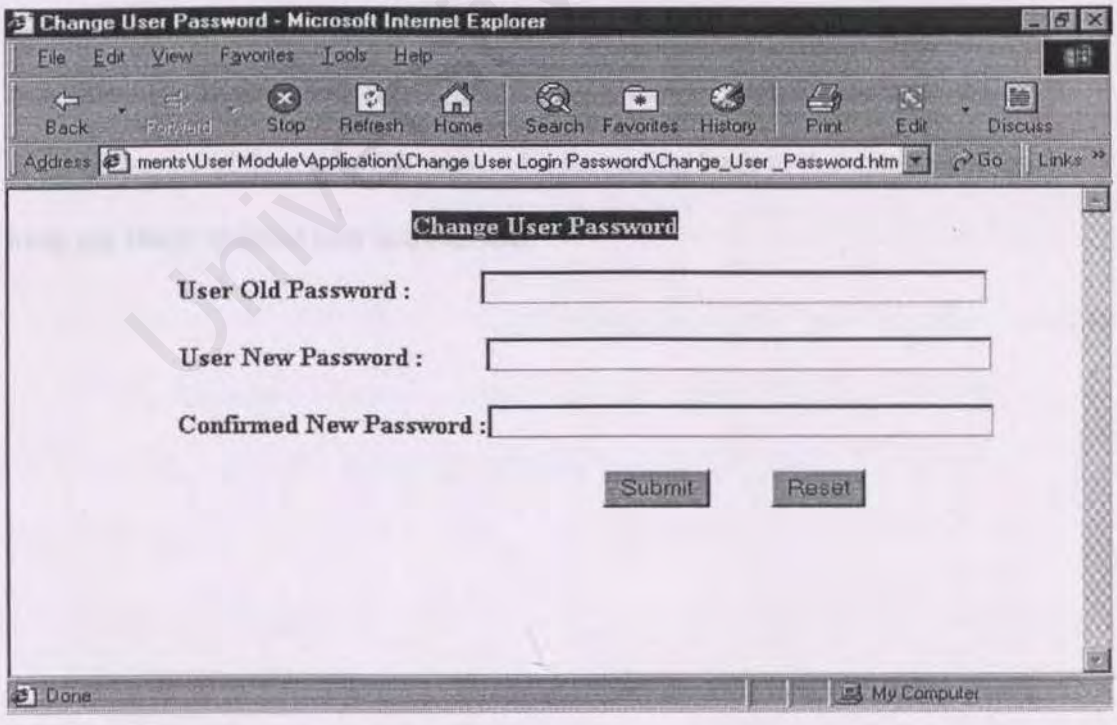
There are only 5 main function sub-modules in User Module such as below:-

1. Change User Login Password
2. Change User Personal Particulars
3. Apply Wages Claims
4. View Wages Claims Approval
5. Wages Claims Rates, Rules and Regulations





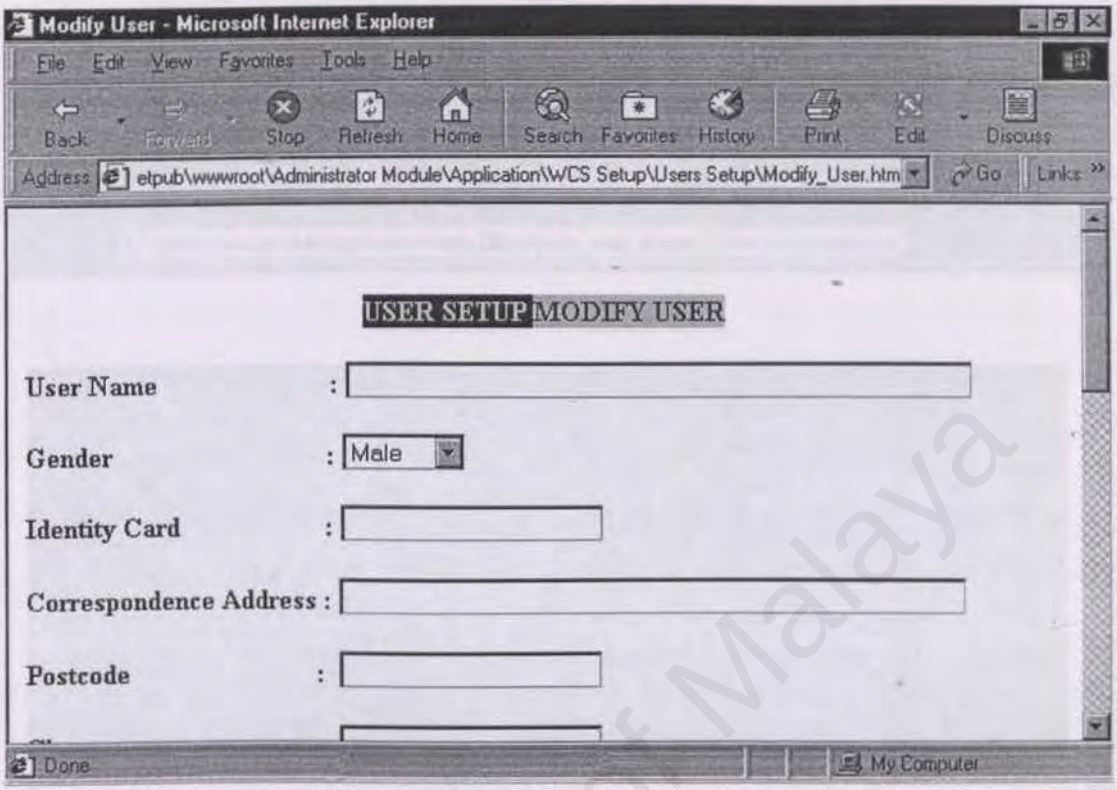
8.3.1 Change User Login Password



User can use this function sub-module to change their login password. User is required to enter their old password, new password and again confirmed new password in order to successfully change their respective password. Any differences between the new password and the confirmed new password will prohibit administrator to change their password. In other words, user must give exactly the same for these both passwords. Entering the old password is a must to protect the user's password from others of having simply change others user password. There is no restriction on entering any characters for password. But the password can only take the maximum of 40 characters.

8.3.2 Change User Personal Particulars

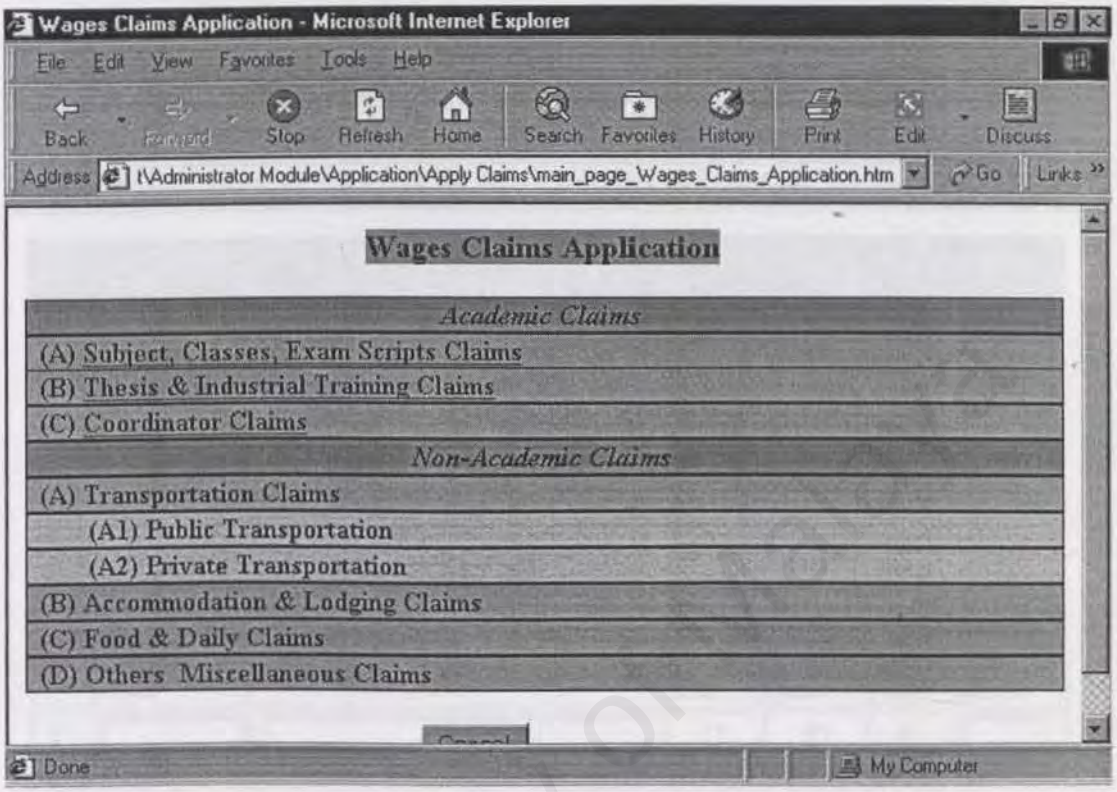
If there are any modifications or amendments on user data and information, user can select the "Change User Personal Particulars" to amend and modify the respective user's particulars will be shown out exactly from the original user registration form as in user registration form. User can amend the required field in the user form and then save the data and information back to the database to always keep the latest updated user information.



There are several essential data or information that is required from the users in order to amend or modify as valid user for WCS system. The data is required such as:-

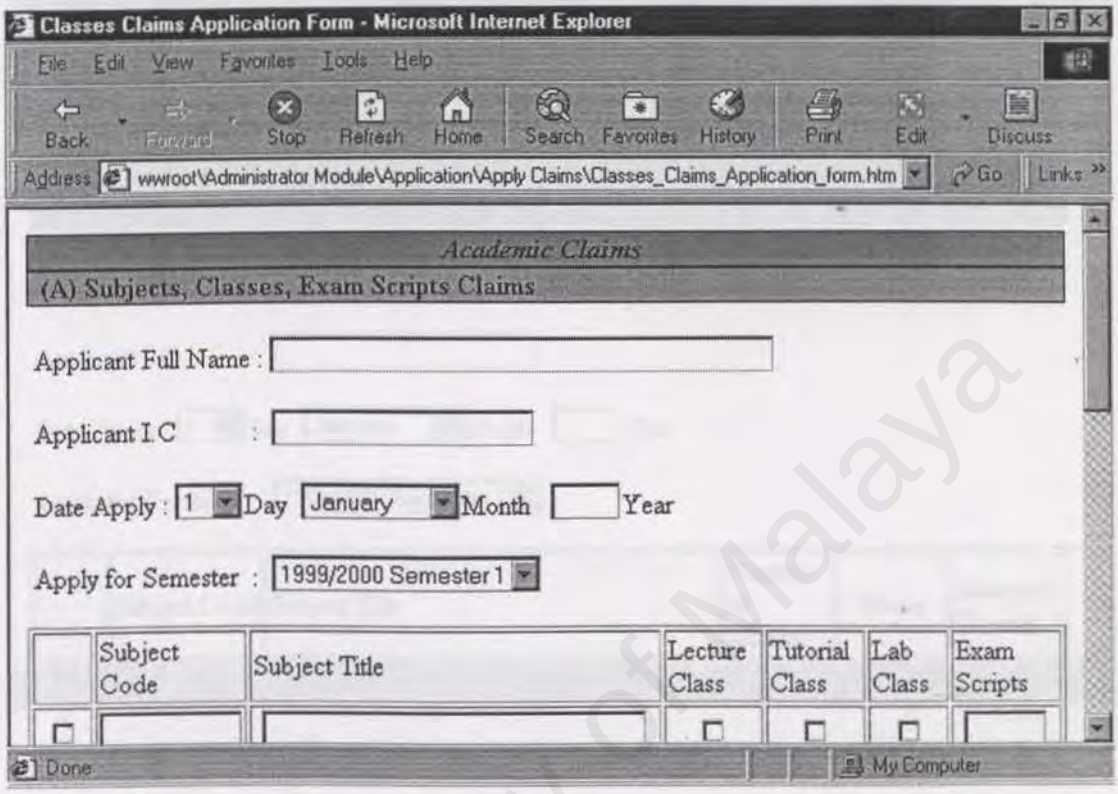
- User Name
- Gender
- Identity Card Number (I.C number is unique and no duplication is allowed)
- Correspondence Address, Post Code, City, State
- Home and Office Telephone, Mobile Phone Number
- E-Mail
- Faculty / Center

8.3.3 Apply Wages Claims



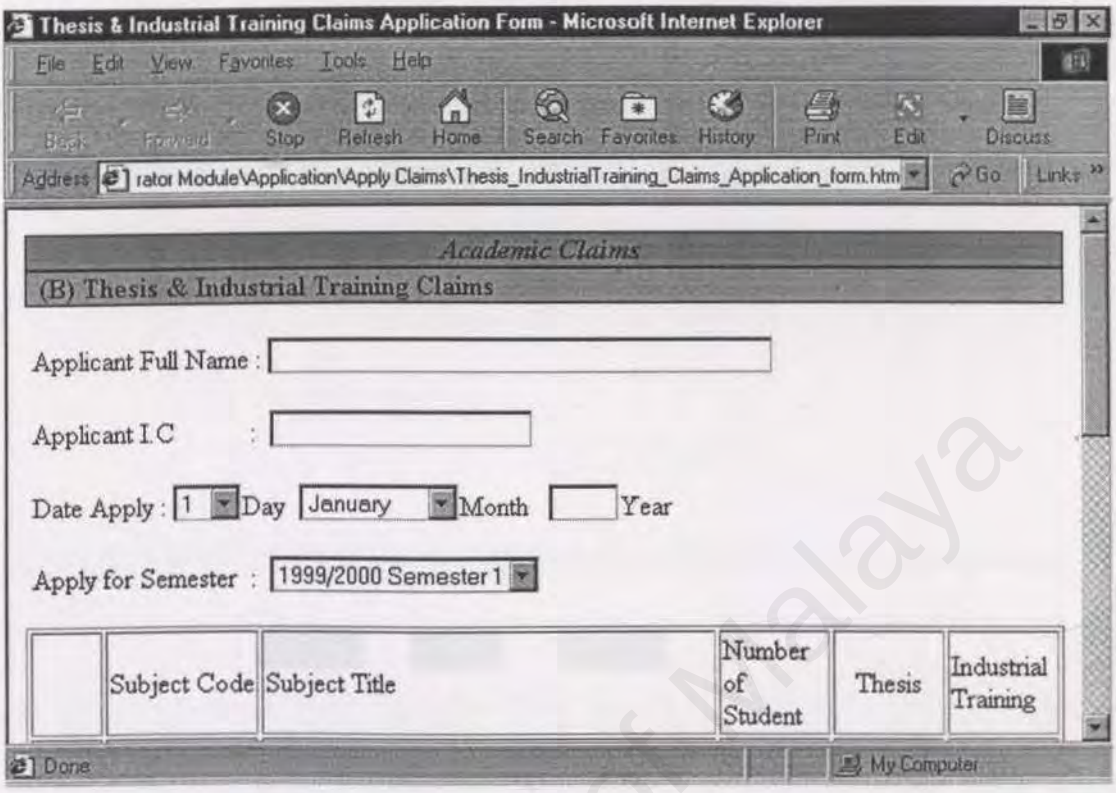
Initially, UMPJJ WCS covered 2 major categories of wages claims application as in the above figure such as the Academic Claims and Non-Academic Claims. However, due to the time and resources constraint in this thesis, I only managed to cover only the Academic Claims Application such as the Subjects, Classes, Exam Scripts Claims, Thesis and Industrial Training Claims, and the Coordinator Wages Claims. In future, I hope and wish this thesis can still carry on to cover the Non-Academic Claims such as Transportation (Public and Private) Claims, Accommodations and Lodging Claims, Food and Daily Claims, and Other Miscellaneous Claims as well.

User also can make the applications to these 3 types of claims as well.



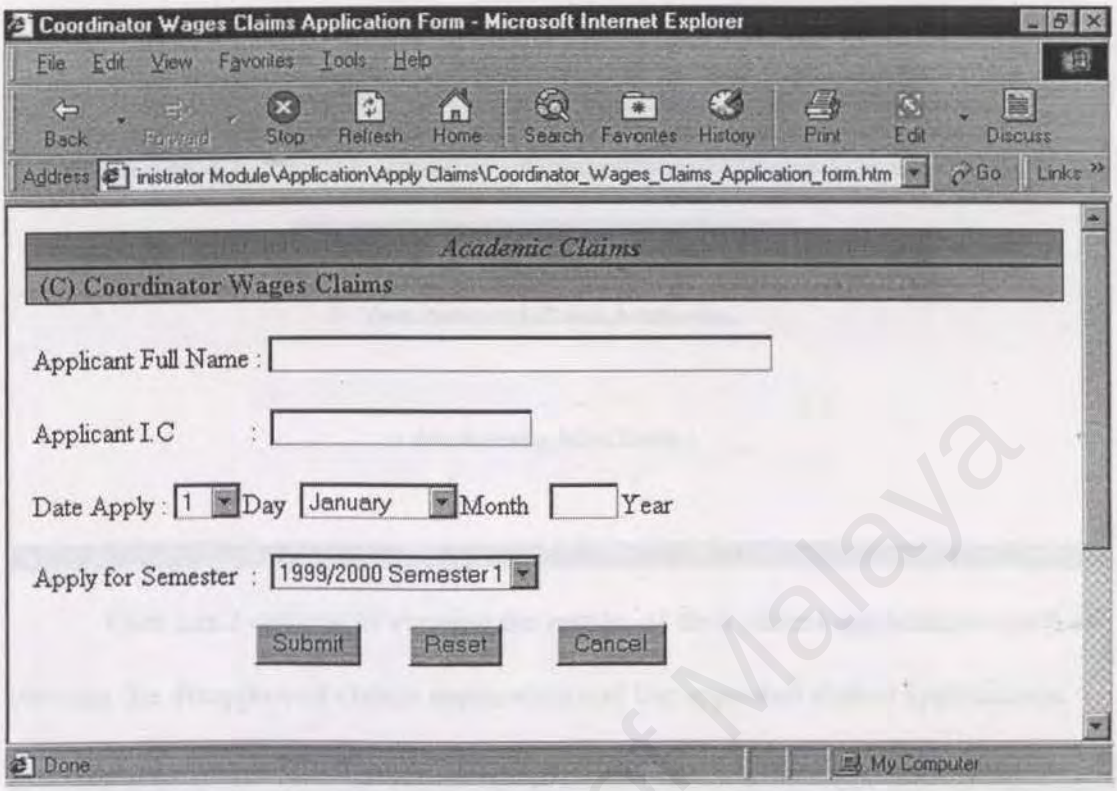
User has to enter the full name and identity card number in the application form. Then, select the respective date and semester for this application to be taken place. There is a table which applicant must enter the correct subject code and subject title in the table. Besides, applicant must determine the regarded subject class types (Lecture, Tutorial, Lab) and the amount of exam scripts that the applicant has been involved in for the respective semester final exam in UM campus.

Before the application form is submitted, please make sure that the subject "checked box" is checked for the particular subject otherwise the entered data is not submitted completely or correctly as applicant desired. Please double check the "Checked Box" again before submit the application form.



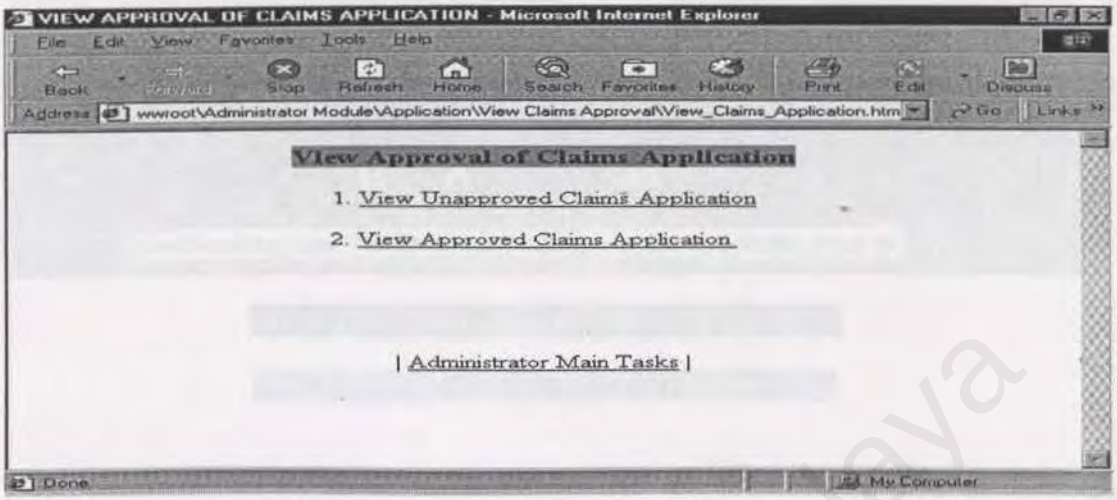
User has to enter the full name and identity card number in the application form. Then, select the respective date and semester for this application to be taken place. There is a table which applicant must enter the correct subject code and subject title in the table. Besides, applicant must determine the regarded subject types (Thesis or Industrial Training).

Before the application form is submitted, please make sure that the subject "checked box" is checked for the particular subject otherwise the entered data is not submitted completely or correctly as applicant desired. Please double check the "Checked Box" again before submit the application form.

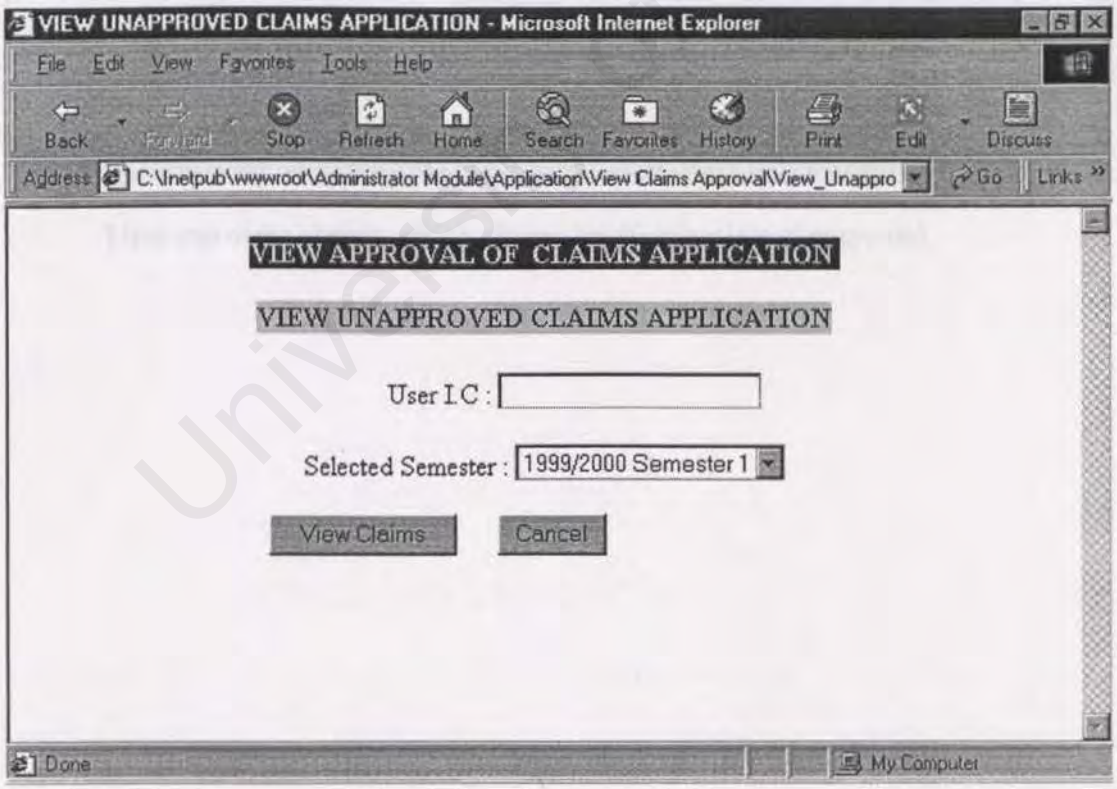


User has to enter the full name and identity card number in the application form. Then, select the respective date and semester for this application to be taken place.

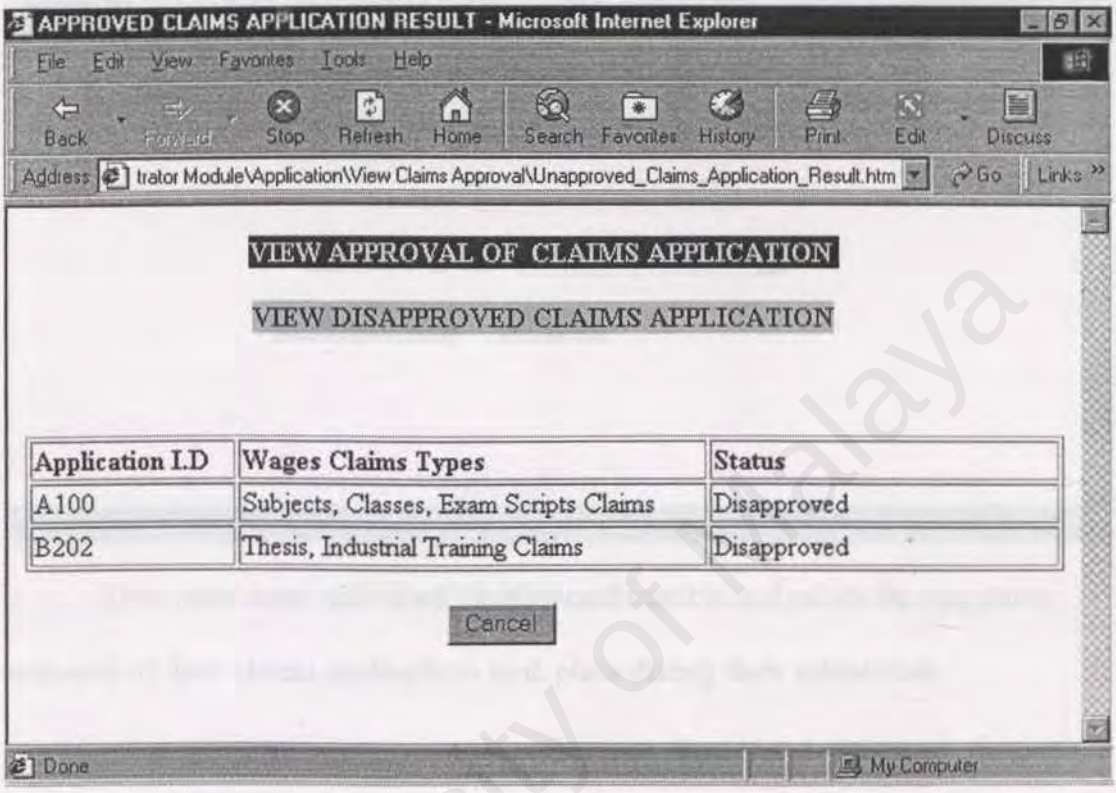
8.3.4 View Wages Claims Approval



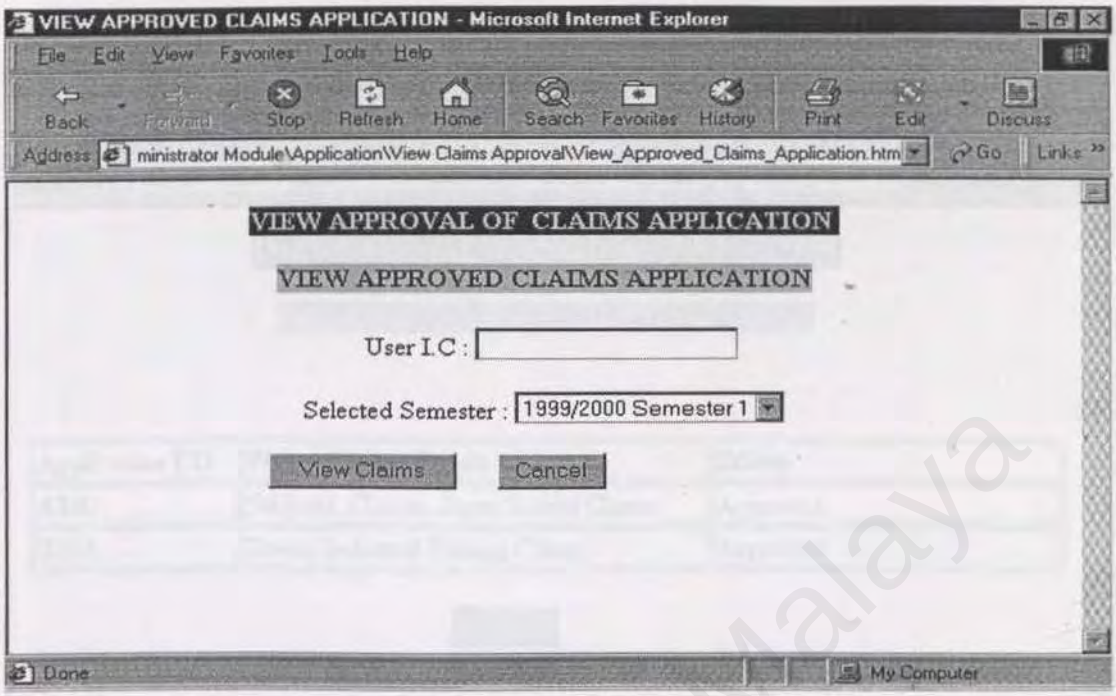
User has 2 options in viewing the results of their claims applications such as viewing the disapproved claims application and the approved claims applications.



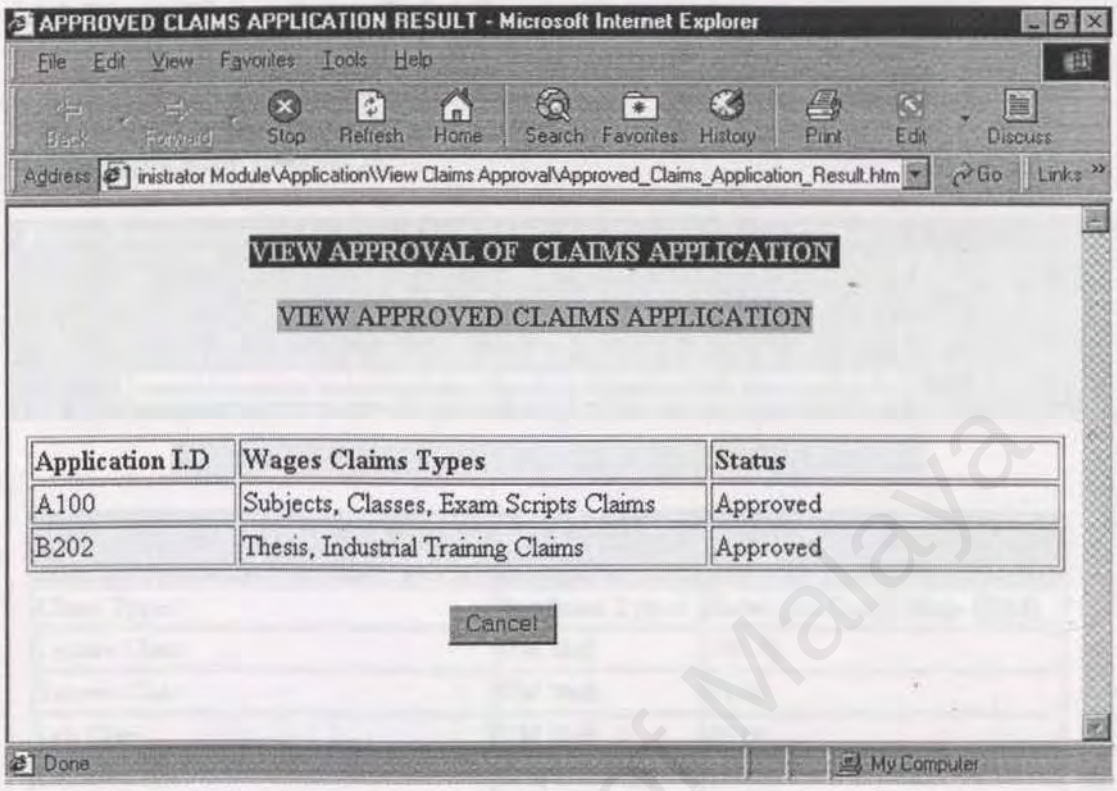
User must enter individual identity card number and select the respective semester of their claims applications took place during their submission.



User can view clearly which claims application is not approved.



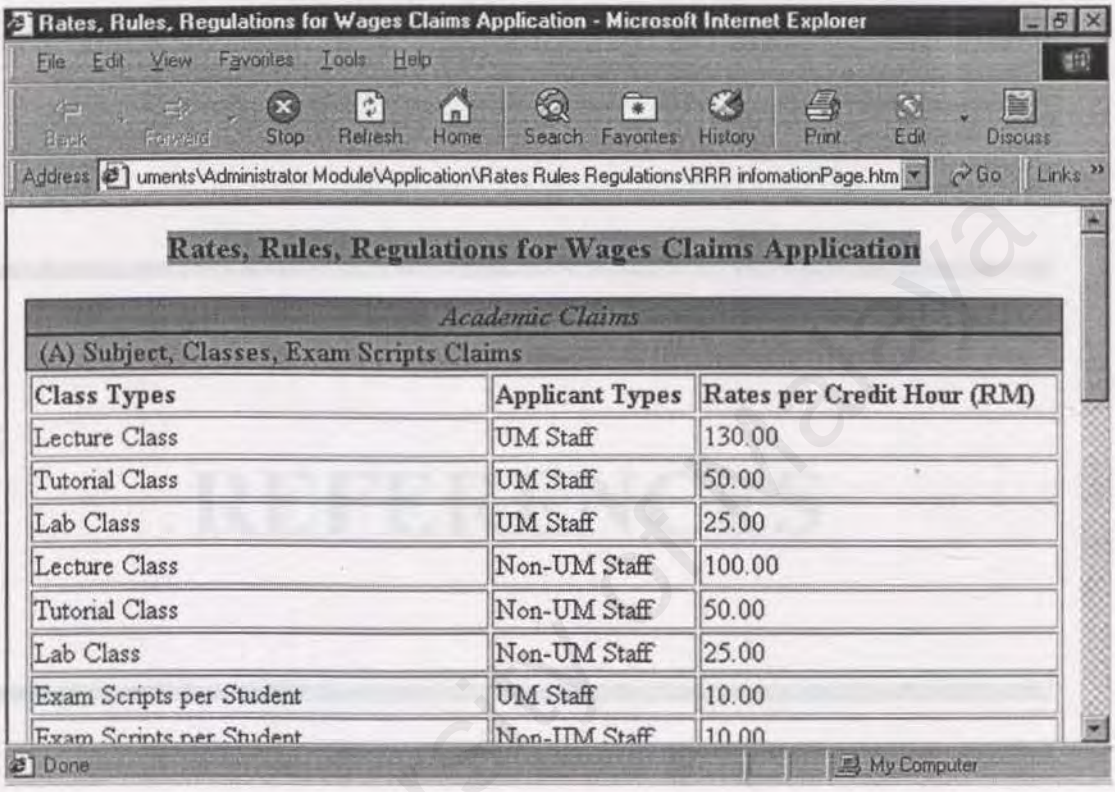
User must enter individual identity card number and select the respective semester of their claims applications took place during their submission.



User can view clearly which claims application is approved.

8.2.7 Wages Claims Rates, Rules, Regulations

User can view the current rates, rules, and regulations regarding the wages claims application in UMPJJ.



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[4] http://mcsl.mampu.gov.my
[5] http://wydoe.state.wy.us/labstd/claim.htm
[6] http://www.ctdol.state.ct.us/wgwkstnd/wcal.htm
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[30] http://www.aspdeveloper.net
[31] http://www.halcyon.com/gvr/asp.htm
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[34] http://www.agimil.net/udaynet
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[38] http://www.tarsus.com/asp/components.asp
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Glossary

ActiveX

ActiveX is a model for writing programs. ActiveX technology is used to make interactive web pages that look and behave like computer programs, rather than static pages. With ActiveX, users can ask or answer questions, use push buttons, and interact in other ways with the web page.

Browser

Short for Web Browser; it's the tool (program) that allows you to surf the web. You probably used your Web Browser to locate this page. The most popular Web Browsers right now are *Netscape Navigator* and *Internet Explorer.*

Chat Room

A place on the Internet where people go to "chat" with other people in the room. Actually there are thousands of these Chat Rooms. The rooms are usually organized by topic. For example in a Michigan Room you would expect that most of the participants in the room are probably from Michigan or a Gay room, where the participants are usually gay. When you're in a Chat Room you can view all of the conversations taking place at once on your screen. You can also get into a private chat room where only you and one or two others may talk. This can be an inexpensive way to keep up with friends and relatives who are online.

Chocolate

A crucial computer term. Chocolate is what you eat when you get frustrated with web functions such as searching for specific items, writing web pages, or just being a Newbie.

Cookie

A "cookie" is an Internet site's way of keeping track of you. It's a small program built into a web page you might visit. Typically you won't know when you are receiving cookies. Ideally a cookie could make your surfing easier by identifying you, tracking sites you visit, topics you search, and get a general feel for your preferences. This can make surfing easier, faster, more personal, and more efficient. It can also be used to collect your e-mail address for marketing (spamming) purposes. You can set your browser to warn you before you accept cookies or not accept them at all. Check your (advanced) browser settings. Keep in mind that some secure sites, such as stock trading sites, won't work if you don't accept their cookies.

Counter

A number on many web pages that will count the number of hits or count the number of times the page has been accessed. Basically, it counts the number of people that have visited that page.

Cracker

A person who breaks into a site through a computer's security. While Basically the same thing as a "Hacker", a Cracker is sometimes considered to be more malicious and destructive.

Cyberspace

Term used to describe the Internet; the term was coined by science-fiction novelist William Gibson in 1984 in *Neuromancer.*

Domain Name

The highest level name of the web site. For example, The domain name for USA Today Online is usatoday. If you type usatoday in the location area on your browser, you will be connected directly to USA Today Online. A site does not have to have its own domain name. I use geocities to host my web site and thus their domain name is included in my Internet address: http://www.geocities.com/FashionAvenue/4869/desc.html.

Download

The transfer of information from the Internet to your computer. Every time you instruct your computer system to retrieve your mail, you are downloading your mail to your computer. You may also download programs to your computer. However, be careful about downloading files or programs from a site in which you are not familiar. You could download a virus and never know it until it's too late.

E-mail

Electronic-mail. This tool is usually provided by your ISP. It allows you to send and receive mail (messages) over the Internet. Through e-mail you can write your friends, ask your ISP a technical question about your service, or even receive an Internet birthday card.

FAQ

An acronym for Frequently Asked Questions. FAQ is exactly what it sounds like: Frequently Asked Questions, with the answers of course. FAQ usually serves as a mini-help file.

FTP

An acronym for File Transfer Protocol. It's the tool you would use to transfer files through the Internet from one computer to another. For example, you would use an FTP to upload your web page from where you built it (like your computer at home) to a web site (like this one) so that all of your friends and neighbors can look at it.

Gopher

Invented at the University of Minnesota and named after its mascot, this is the direct precursor, in both concept and function, to the World Wide Web.

HTML

Hypertext Mark-up Language. HTML is not really a programming language, but a way to format text by placing marks around the text. For example HTML allows you to make a word bold or underline it. Early word processing programs used to work this way. HTML is the foundation for most web pages.

http

Hypertext Transfer Protocol. A protocol that tells computers how to communicate with each other. You will notice most web page locations begin with "http://"

Hacker

Also known as a "Cracker", a Hacker is a person who breaks into a site through a computer's security.

Hypertext

Text on a web page that links the user to another web page. The hypertext, or links will usually be a different color than the other text on the page and is usually underlined.

Hypermedia

Media (such as pictures, videos, and audio), on a web page that links the user to another web page by clicking on the media.

Host

The computer on which a web site is physically located.

IRC

An acronym for Internet Relay Chat. Worldwide real-time conferencing on the Internet, There are hundreds, maybe thousands of IRC channels, also called chat rooms. These chat rooms typically focus on specific topics, issue or commonality.

ISP

Internet Service Provider. This is your connection to the Internet. You use an ISP to connect onto the Internet every time you log on.

Internet

Originally called ARPANET after the Advanced Research Projects Agency of the U.S. Department of Defense. This electronic network connects the hosts together so that you may go from one web page to another efficiently. The electronic connection began as a government experiment in 1969 with four computers connected together over phone lines. By 1972, universities also had access to what was by then called the Internet.

Java

A programming language that developers use to create *applets*, small programs that are embedded in Web pages and that run when a user accesses the page or clicks on a certain area. If you have visited sites that play sounds, have animated figures trotting across the screen, or display scrolling text, you have already seen Java.

Keyword

A word you might use to search for a Web site. For example, searching the Web for the keyword "Dictionary" or "Terms" might help you find this site.

LOL

An acronym for Laugh Out Loud. Look for it in your e-mail, or chat rooms.

Laptop

A computer small enough to sit on your lap. The laptop computer's small size allows you to take it almost anywhere and access the Internet. Great if you travel a lot and don't want to go too long without your e-mail.

Link

A link will transport you from one Internet site to another with just a click of your mouse. Links can be text or graphic and are recognizable once you know what to look for. Text links usually will be underlined and often a different color than the rest of the text on your screen. A graphic link usually has a frame around it. For example at the bottom of this page the mailbox is a link as well as the text in the yellow boxes.

Load

Short for download and upload. If someone asks how long did the page take to load? He/She is referring to the time it takes a page to appear on your screen. If a web page is loading slow it means that it's taking a long time to fully appear on your screen. You can often scroll through a page and look at the parts that have loaded while the rest of the page continues to load. Also, you can usually click a link on the page you are loading and link to another page without waiting for the current page to fully load.

Location

An Internet address. While you are in your browser (which you are probably in now) you will see a section at the top of the page that is titled "location". If you look right now you will see that the location of this web page is http://www.geocities.com/FashionAvenue/4869/desc.html. If you type in the address of someone's web page and hit enter, your browser will take you to that page. However the address you type in the location bar must be an exact match.

Modem

Short for Modulator-demodulator devices. Modems allow computers to transmit information to one another via an ordinary telephone line.

Net

Short for Internet.

Newbie

You!

Newsgroups

Also called usenets, they are groups that often have nothing to do with news. Newsgroups are ongoing discussion groups among people on the Internet who share a mutual interest.

Online

Having access to the Internet. You are online right now. Often people will say they are online meaning they have access to the Internet and have an e-mail address, but may not necessarily be connected to the Internet at that moment.

Patience

What you need while surfing the web. Some web pages seem to take forever to fully appear on your screen.

Persistence

What you often need to learn anything, including becoming proficient on the Internet.

Protocol

A set of rules that lets computers agree how to communicate over the Internet.

Scroll

To look at the parts of the page that fall below (or above) what you see on your screen. The long bar at the far right of this screen is a scroll bar. The small square in it will allow you to scroll through the rest of this page. Just place your mouse pointer over the square, hold down the left click button on the mouse and slide the square up or down. You will see this page move. You are now scrolling.

Site

A place on the Internet. Every web page has a location where it resides which is called it's site. And, every site has an address usually beginning with "http://."

Spam (or Spamming)

The Internet version of junk mail. Spamming is sending the same message to a large number of users, usually to advertise something. E-mail address may be collected using cookies or a mailing list from a newsgroup.

Surfing

The process of "looking around" the Internet. You're doing it now.

Trojan Horse

Like the Trojan horse of mythology, Trojan horse viruses pretend to be one thing when in fact they are something else. Typically, Trojan horses take the form of a game that deletes files while the user plays.

URL

An acronym for Uniform Resource Locator. It's the address of each web site. It usually begins with "http://"

Upload

The process of transferring information from your computer to another computer through the Internet. Every time you send e-mail to someone you are uploading it.

Usenet

A collection of so-called news groups that have nothing to do with news. Usenets are ongoing discussion groups among people on the Internet who share a mutual interest.

User ID

This is the unique identifier (like your logon name) that you use to identify yourself on a computer. You probably typed your User ID (and password) when you logged onto the Internet today.

Virus

Your computer can get a virus just like your body can be invaded with a virus making you (or your computer) sick. A virus can wipe out information on your computer and create major havoc. Viruses usually originate from malicious people. You can unintentionally download virus from a web site or get it from a disk that someone has lent you. There are virus-checking programs, but there are new viruses popping up every day. So the best defense against a virus is to be very careful not to download programs or data from a site you're not familiar with.

WAIS

An acronym for Wide Area Information System which basically means lots of large databases you can search through. It was designed by WAIS Corp. as a way of accessing very large databases.

WWW

An acronym for the World Wide Web.

Web

Short for the World Wide Web.

Web Browser

The tool (program) that allows you to surf the web. You probably used your Web Browser to locate this page. The most popular Web Browsers right now are *Netscape Navigator* and *Internet Explorer.*

Web Page

Every time you are on the Internet, you are looking at a Web Page. Yes that includes this page.

World Wide Web

A full-color, multimedia database of information on the Internet. Like the name implies the World Wide Web is a universal mass of web pages connected together through links. Theoretically, if you clicked on every link on every web page you would eventually visit every corner of the world without ever leaving your computer chair. Of course you would also have to live until you were about a million years old and computers were antiquated technology.

APPENDIX

A Brief History of the Internet

The origin of the Internet in 1969 can be traced to cold war research. The United States Department of Defense Advanced Research Projects Agency (DARPA) set out to create a robust mechanism for computer-based communications. The original network was called ARPANET. Its objective was to construct a communications network able to withstand disruptions that would take place in the event of nuclear war. The network was designed to allow multiple destination paths and to enable lower-level communications software to utilise alternative paths at will. In addition, the network offered a built-in mechanism for load balancing as well as the ability to bypass inactive circuits.

Initially the Internet provided four basic network services: remote access (Telnet), file transfer (FTP), mail, and news. To promote education and research activities, access was generally free. The concept of a free public network, rather than a private, commercial one, was a clear part of the culture surrounding the network. Academics and students used the network to exchange information, to share software, and to discuss and debate issues.

During the 1970s, other academic organisations around the world began to construct similar networks to ARPANET using the same software available in the United States. The military, in particular, realised that it would need to create a more secure network than the experimental ARPANET. The military wanted to maintain its own secure telecommunications system and also maintain links to the public networks. To make this possible, an *internetting* project was initiated to link together these networks; hence the name the Internet.

An inter-networking protocol was developed to work with the original transmission control protocol. This combination of transmission control and an Internet protocol, abbreviated to TCP/IP, is the dominant standard for computer-based communications today. The benefit of the TCP/IP standard is that it is supported by virtually every computer and software manufacturer in the world. Whether the intention is to publish material or services for world-wide access or to confine them to an organisational environment, a wide choice exists in hardware and software. By enabling a rich interconnection of computing and communication environments, TCP/IP offers a simple mechanism for communicating from both present and future information systems.

By 1986, the National Science Foundation (NSF), an independent government agency established to promote science and engineering, had taken the lead role to put together a high speed backbone with a transmission rate of 1.5 Megabits per second (Mbps). It established a mechanism for regional and local commercial providers to offer access outside government and academic communities. Government subsidies helped to support the technology while demand grew. By 1989, backbone speeds were increased to 45Mbps. In April 1995, NSF support for the Internet backbone was withdrawn and the Internet is now operating using commercial telecommunications providers.

The Growth of the Internet

The level of traffic generated on the Internet has been growing rapidly. One of the most remarkable features of the Internet is the flat fee policy. In the flat-fee model, users are charged for the size of the 'pipe' or maximum rate of transmission

rather than the actual amount of data transmitted. For modem users, of course, charges may be based on connect time. While allowing users open access to any site, the Internet enables world-wide communication without the overhead of a toll system similar to the long distance telephone network now in place. The institution of long distance charges on the Internet would be impractical, since it would be impossible for users to predict the charges resulting from a given connection.

Other key factors contributing to the growth of the Internet are its:

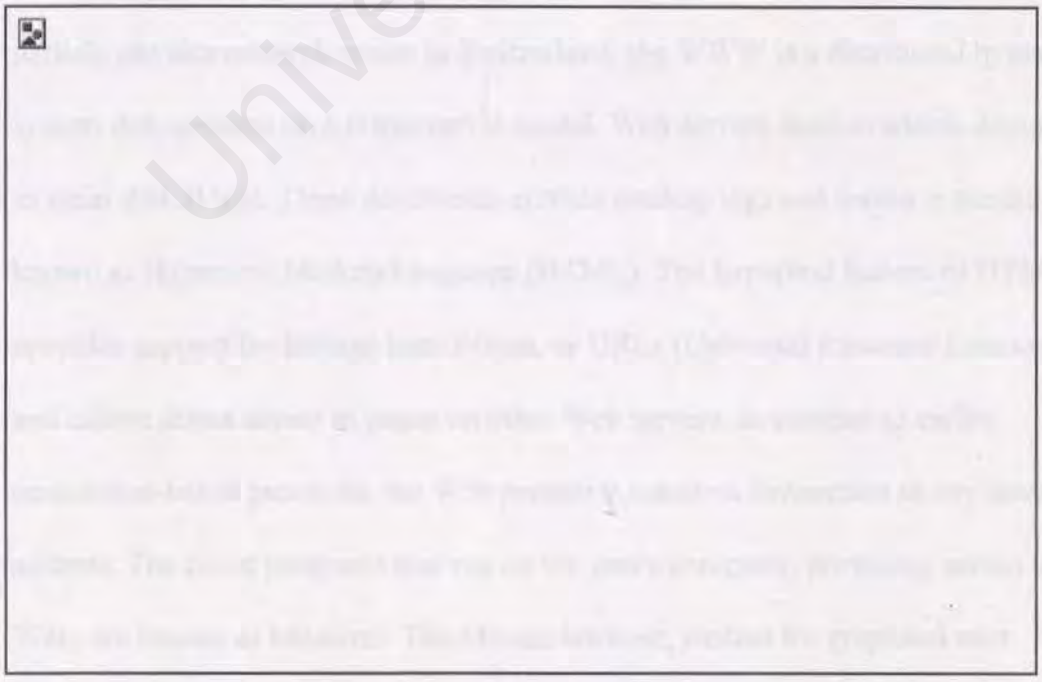
- Ability to link physically dissimilar networks;
- Role as the world's *de facto* electronic mail system;
- Use of public domain protocols (standards) that are universally supported by manufacturers;
- Growing acceptance by mainstream business and society (*.com* domain hosts established by private corporations have long surpassed *.edu* domains established by universities in the US);
- Two-way communication, whereby one can be both an originator and a consumer of information; and
- Ability to realise dramatic gains in the functionality of existing computer systems.

Surveys conducted on a regular basis show an exponential increase in the growth of Internet hosts, networks and domains (see Figure 1). A host is simply any computer with a TCP/IP address, although not all addresses have full Internet access. For

example, the three largest online service providers, America OnLine, CompuServe, and Prodigy, offer Internet access to their combined total of ten million subscribers. The number of hosts associated with their service is a relatively small number that does not reflect their large subscriber volume.

Until its discontinuance in April 1995, it was possible to document the traffic on the NSFNET backbone. Figures indicated that the amount of data moving across the backbone also grew rapidly. "Total NSFNET traffic grew from *195 million* packets in August 1988 to almost *24 billion* in November 1992, a 100-fold increase in four years. During November 1992, the network reached its first *billion-packet-a-day* mark." The last traffic measures available in April 1995, showed a monthly total of 59 billion packets. Twenty one percent of those packets were generated by the World Wide Web, making it the largest single Internet service.

FIGURE 1 - Growth in Internet Hosts, Networks and Domains



interfaces, became the prototype for many imitators, such as Netscape Navigator. This software family supports a mixture of text, sound, graphics, images, video, animation and binary (executable) files.

The information provided to users by Web servers is not limited to static files. Several methods exist to forward requests to other server processes that are able to extract information from large database systems and format it for the user. This technique permits simple transaction processing and is the foundation for electronic commerce via the Internet.

Software developers have been working to advance the capabilities of the Web by creating special viewers. For example, there are special viewers for *Postscript* documents or for executing multimedia presentations. Viewers are usually given away free by software developers, in hopes of marketing their development system. For the past two years, Sun Microsystems has been promoting an Internet development system called *Java*, that permits platform-independent software to be executed directly via the Web. More elaborate software tools, such as three-dimensional virtual reality generators, require far more bandwidth than the standard text-based Web page. With enhanced display features, the Internet is an attractive marketing medium with a wide global audience.